Draft

Santa Rosa Subregional Long-Term Wastewater Project

Environmental Impact Report
Environmental Impact Statement

July 1996

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Volume III
Chapters 4.11-4.19
Chapter 5
Appendices A-C

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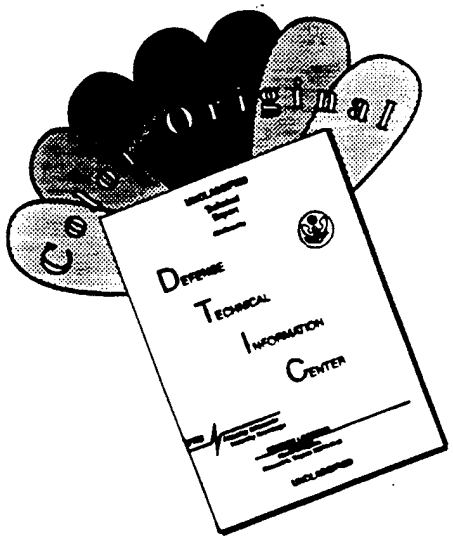

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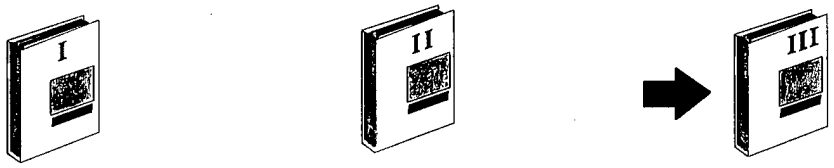
DOCUMENT STRUCTURE

You are in Volume III

The Santa Rosa Subregional Long-Term Wastewater Project Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is presented in seventeen volumes. Volumes I, II, and III contain the main body of the Draft EIR/EIS.

DRAFT EIR/EIS



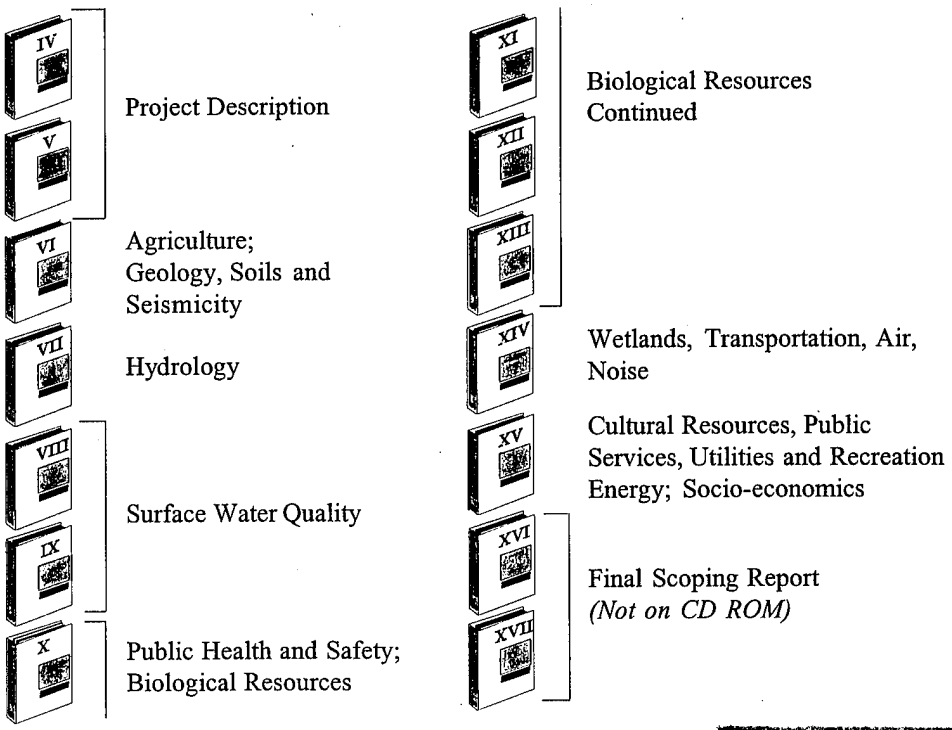
Summary and Introduction, Mitigation Program, Project Description

Impact Analysis Sections

Impact Analysis Sections Continued

APPENDICES TO THE EIR/EIS

Volumes IV through XVII contain the appendices to the EIR/EIS. The graphic below displays the organization of the volumes and topic areas contained in each.



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READING THE EIR/EIS

The document is organized to allow review at three levels of detail, depending on the reader's interest. Chapter 1 (Volume I), Introduction and Summary, provides an overview of impacts. Volumes I, II, and III combined contain the complete EIR/EIS; Volumes IV through XVII contain the technical appendices which support the Draft EIR/EIS. The summary in Volume I is not intended to replace the complete EIR/EIS which provides a thorough evaluation of the environmental impacts.

Volume I includes the Intoduction and Summary, Mitigation Program, and Project Description providing the reader with an overview of the major findings of the Draft EIR/EIS.	**Volumes II and III** include the environmental evaluation of the Project components and alternatives. The volumes also contain a discussion of the environmentally superior alternative, growth-inducing impacts, the significant and unavoidable impacts, and a glossary of terms.	**Volumes IV through XVII** contain the appendices to the EIR/EIS. The Appendices are available for use as supporting documentation for the EIR/EIS providing more extensive data on the settings and analysis.

USING THE TABLE OF CONTENTS

To assist the reader in locating information within the documents, a Table of Contents is in each volume. Tabs are used to assist the reader in locating chapters. Each chapter or appendix contains a more detailed Table of Contents to further direct the reader to the location of information. Due to the amount of information in Chapter 4 (Volumes II and III), Affected Environment and Environmental Consequences, a table of contents is provided for each of the 19 sections in this chapter.

USING THE CD ROM

In the CD ROM version of the Draft EIR/EIS, the underlined references are Hyperlinked text, which, when double clicked, will take the reader to the appropriate section in the appendix document.

HOW TO COMMENT ON THE DRAFT EIR/EIS

A discussion on how to comment on the Draft EIR/EIS is provided in Chapter 1 (Volume 1), Introduction and Summary.

ADDITIONAL ASSISTANCE

An introduction is provided at the beginning of each chapter or section of the Draft EIR/EIS contained in Volumes I, II, and III. The introduction provides information about the contents of the chapter or section.

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No supporting documents produced.

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No supporting documents produced.

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4.11 TRANSPORTATION

This section provides information regarding congestion along access roads, traffic delays, restricted access, increased traffic hazards, and damage to roadbeds resulting from construction of the Project. The section also discusses construction impacts resulting from inadequate parking for Project activities and impacts from heavy vehicles on roadways not designated as truck routes. To provide a basis for this evaluation, the setting section describes the regional roadway network and roadway segments potentially affected by Project activities. Existing peak hour and average daily traffic volume data for these segments is given. Potentially affected public transit routes are identified along with frequency of service on these routes.

IMPACTS EVALUATED IN OTHER SECTIONS

The following subjects are related to the Transportation Section, but are evaluated in other sections of this document:

- Transportation Noise. Noise increases as a result of Project traffic are evaluated in Section 4.13, Noise.
- Air Quality affected by Project traffic is evaluated in Section 4.12, Air Quality.

AFFECTED ENVIRONMENT (SETTING)

Jurisdictions potentially affected by the Project alternatives include the counties of Sonoma and Marin, the cities of Santa Rosa, Rohnert Park, Cotati, Sebastopol, and Petaluma and the Town of Windsor. Because the proposed alternatives encompass such an extensive geographic area, a number of different locations may potentially be affected throughout the Project area. The existing transportation system in the vicinity of the Project components could be directly affected by construction and operation of Project components. The existing regional transportation system is discussed in this section. Potentially affected major key roadways and reservoir access roadways in the regional transportation system are illustrated on Figures 4.11-1a, 4.11-1b, and 4.11-1c.

Existing Regional Transportation System

The regional transportation system includes the roadway network, public transit service, and bicycle and pedestrian routes. Within the Project area there are seven state and

federal highways and numerous arterial, collector, local, and rural streets. In addition, five different transit agencies provide service to local communities.

Regional Roadway Network

The regional roadway network includes roads ranging from freeways to rural roads. Outside of urban areas, most of the roadways are two-lane rural roads with relatively narrow lanes and shoulders, variable grades, and restricted opportunities for passing over much of their length. The traffic mix includes trucks and recreational and sightseeing vehicles.

The transportation network within the Project area includes six types of roadways, each of which serves a different function:

Freeways

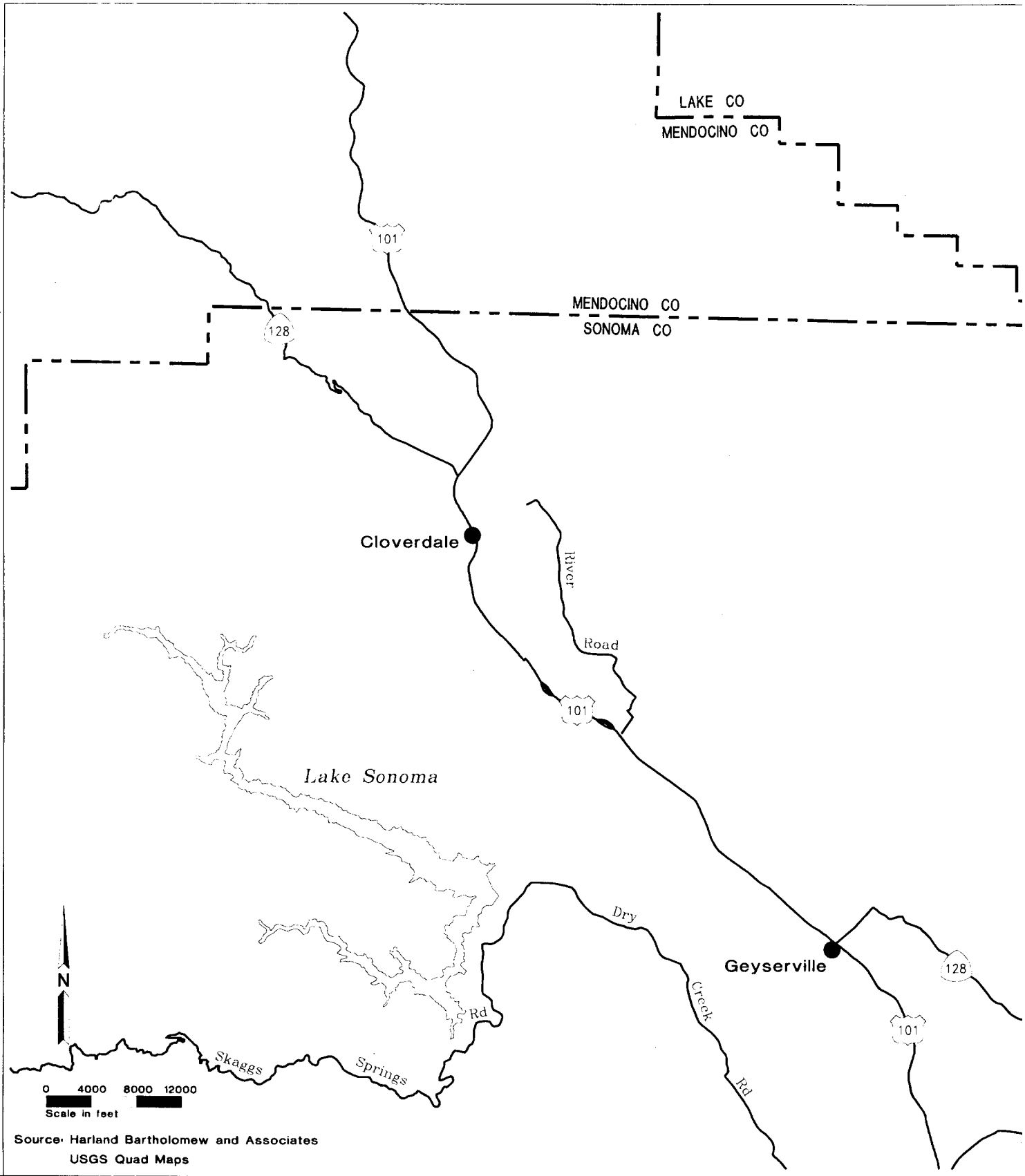
These are fed by collector and arterial streets, provide inter-city and intra-city travel, provide connections to other regional highways, and are capable of carrying heavy traffic volumes. U.S. Highway 101 serves regional and countywide travel as the major through-route for the North Coast region. It provides regional access to Mendocino County to the north and to Marin County and the San Francisco area to the south. This route is heavily used by commuters during peak travel periods. U.S. Highway 101 is a state-owned route of U.S. interest which does receive federal aid. Several improvements are being considered to U.S. Highway 101 including widening and rail options.

State Highways

These are primary routes for through traffic, commuters, and tourists. In addition, they carry the majority of local trips of any distance. State Highways 12, 37, and 121 connect Sonoma County with Napa County and are heavily congested during commute periods and due to tourism and recreational travel on weekends as well. In addition to the above routes, the Project area contains three other state highways: State Highways 1, 116, and 128, which are also congested during commute periods and on weekends.

Arterials

These are relatively high speed/high capacity roads that provide access to regional transportation facilities and serve relatively long trips. They are also medium speed/medium capacity roads for intra-community travel and provide access to the rest of the countywide highway system. Access to arterials is usually by local and collector streets, with some direct access from abutting properties.



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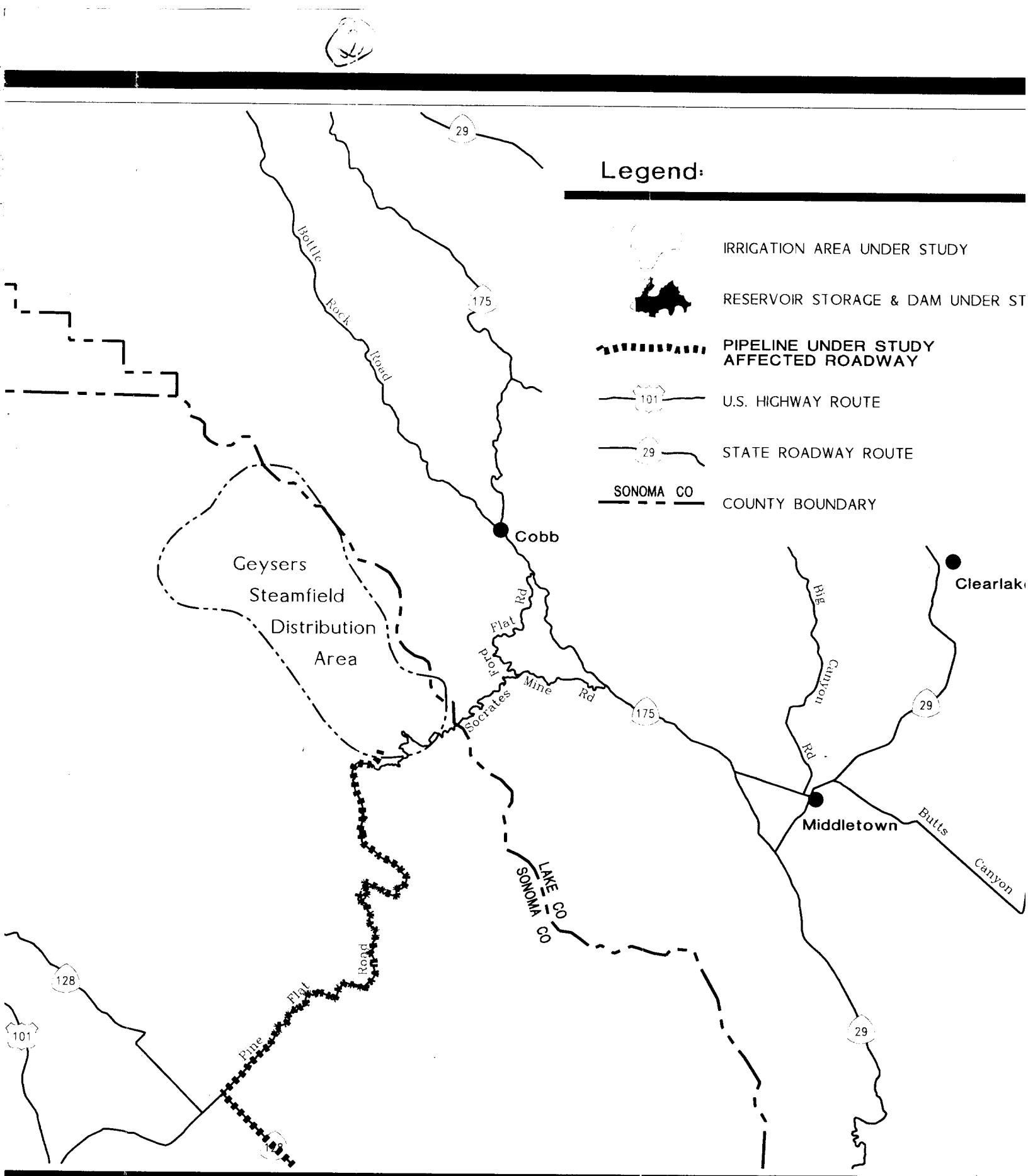

Subregional Long-Term
Wastewater Project

Figure 4

AFFECTED
ROADWAYS IN PROJECT A

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IRRIGATION AREA UNDER STUDY

RESERVOIR STORAGE & DAM UNDER STUDY

PIPELINE UNDER STUDY
AFFECTED ROADWAY

U.S. HIGHWAY ROUTE

STATE ROADWAY ROUTE

MA CO COUNTY BOUNDARY

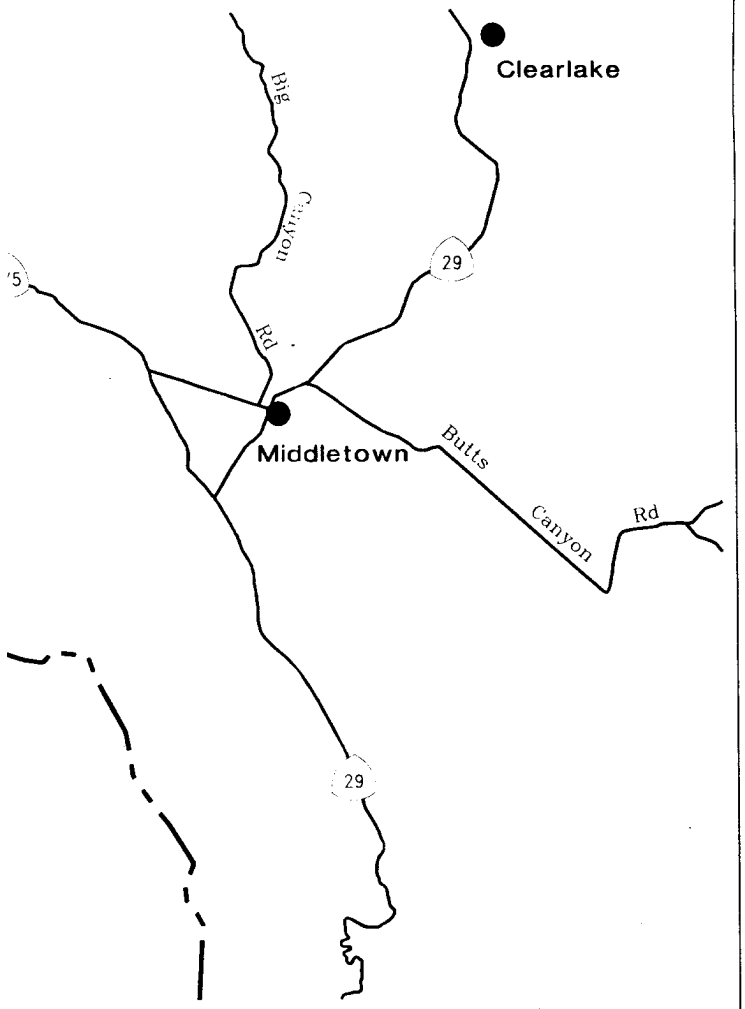

Figure 4.11-1a

AFFECTED
ROADWAYS IN PROJECT AREA

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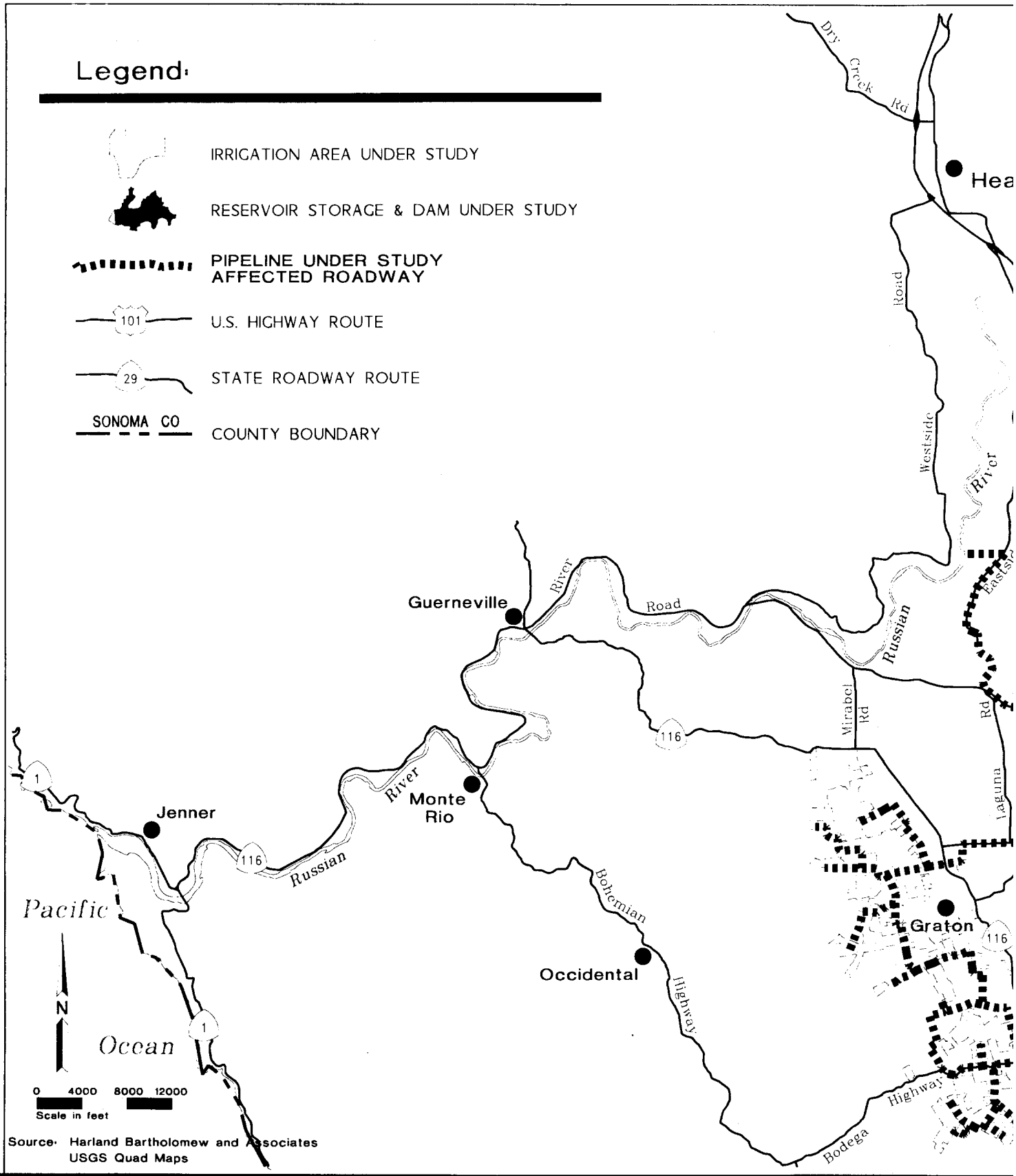

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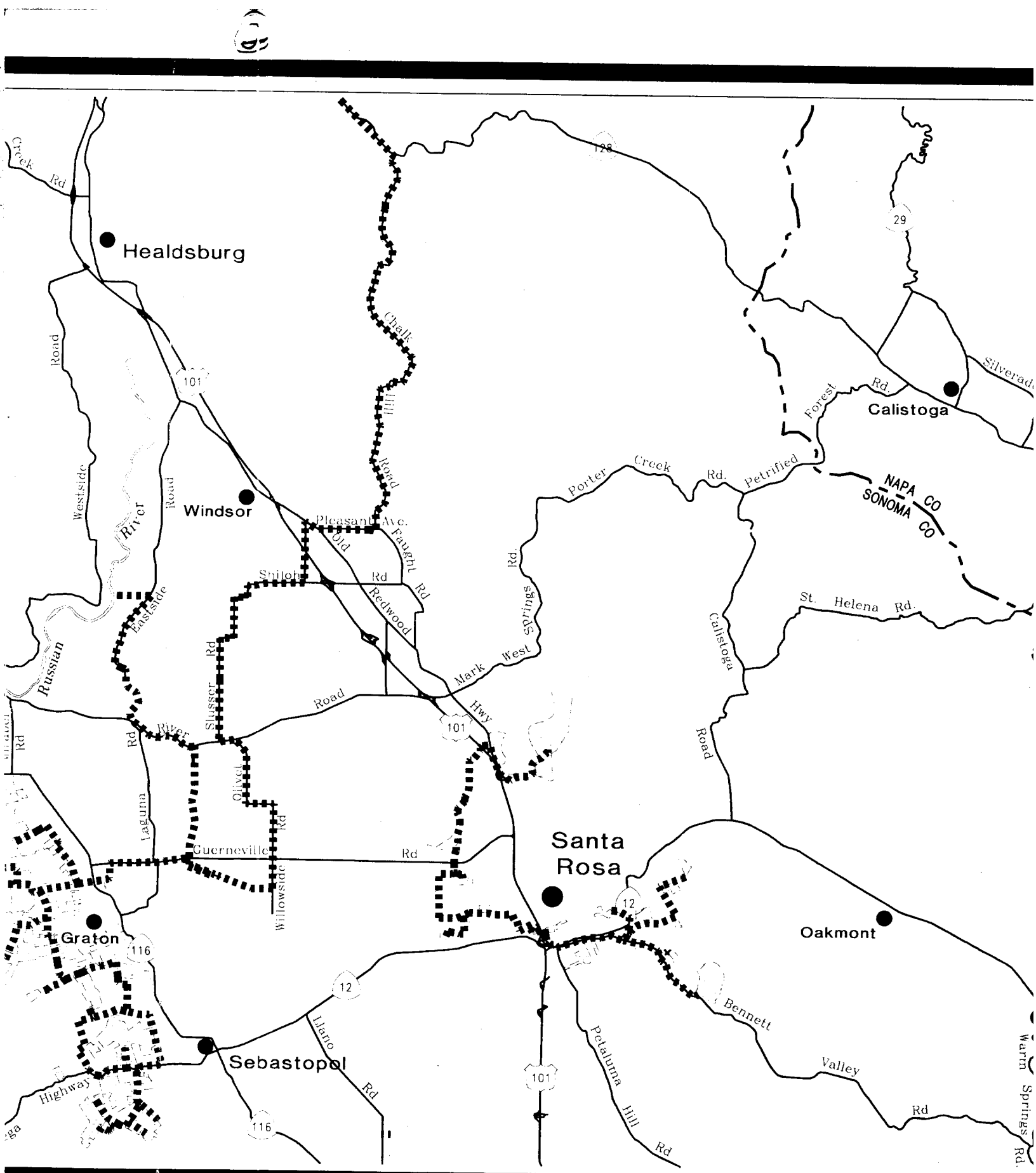

Subregional Long-Term
Wastewater Project

AFFECTED
ROADWAYS IN PROJECT

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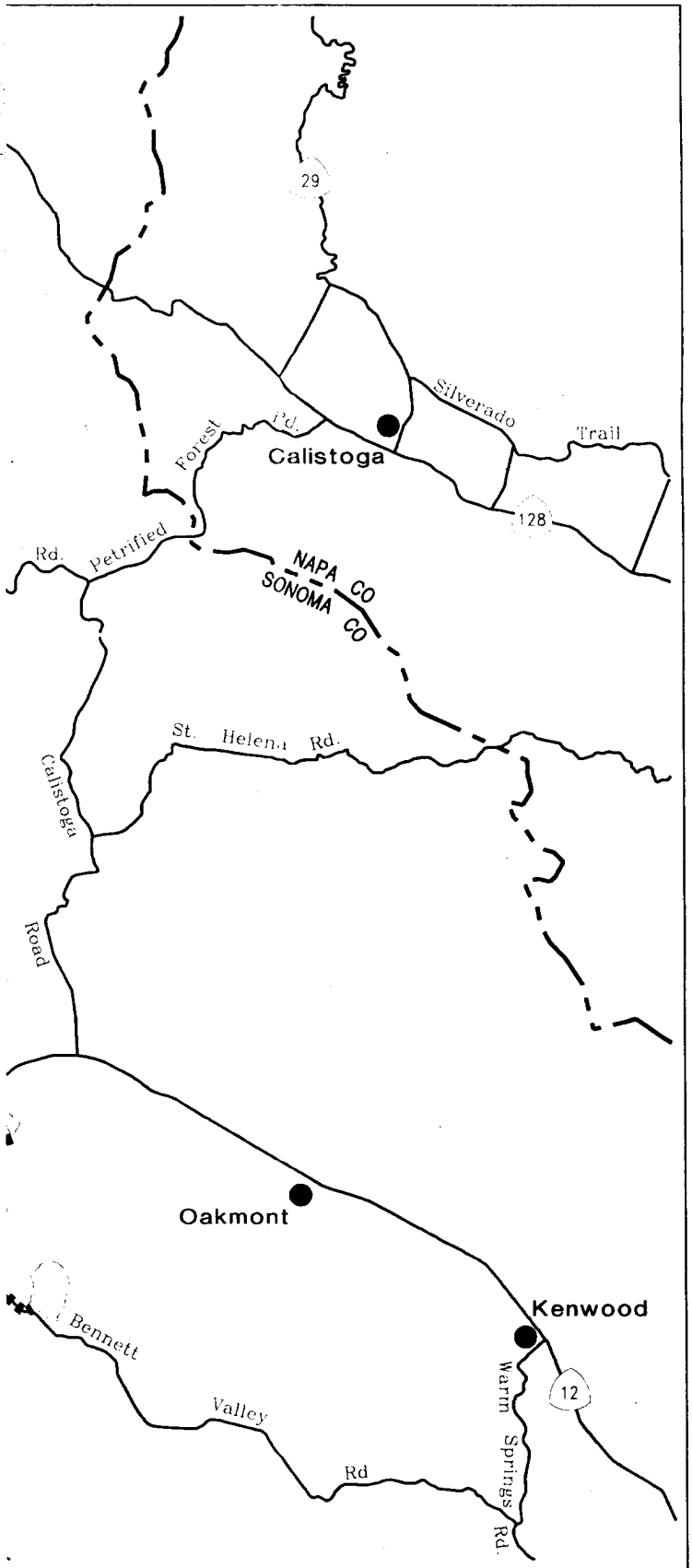
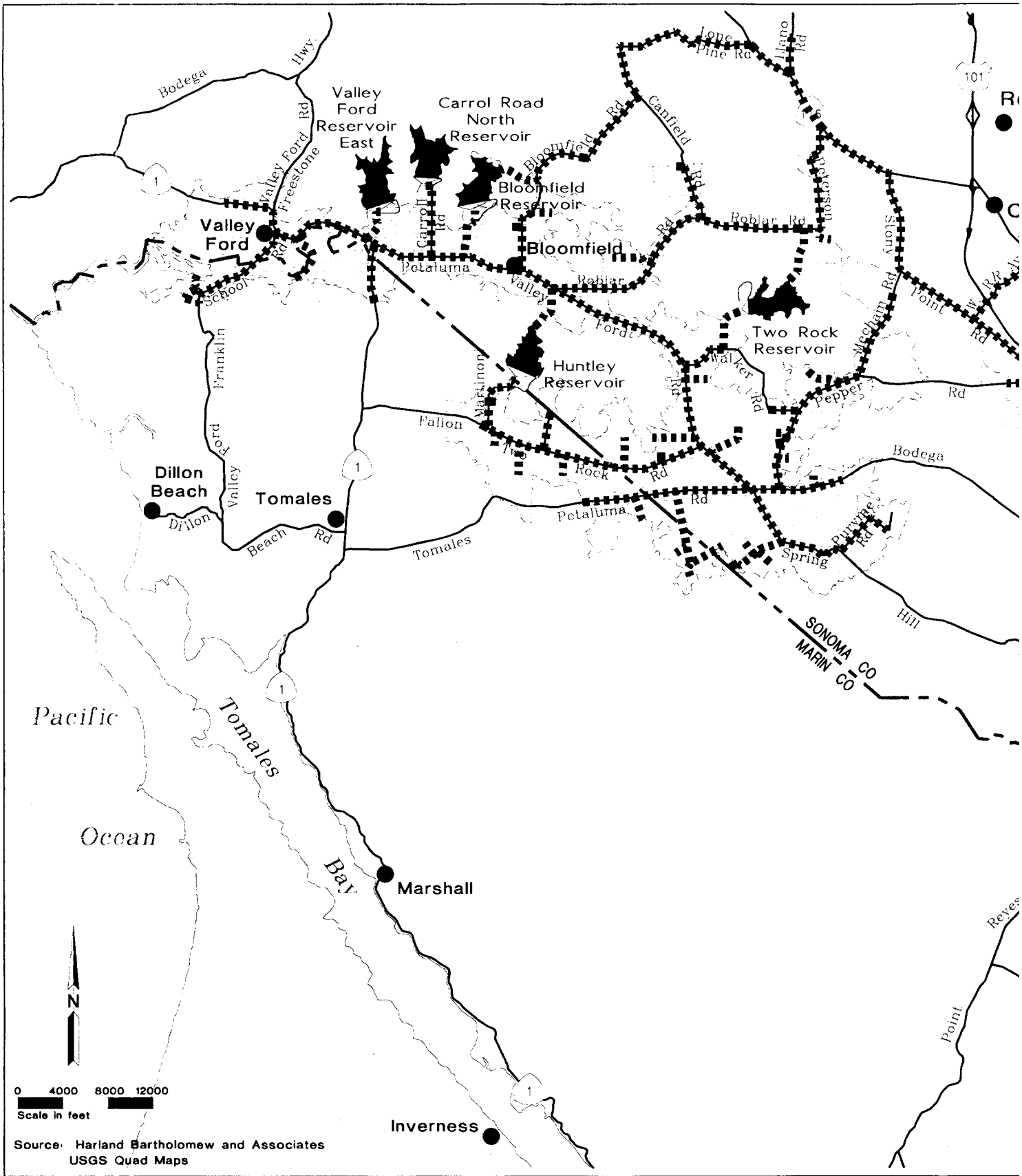


Figure 4.11-1b

AFFECTED
ROADWAYS IN PROJECT AREA



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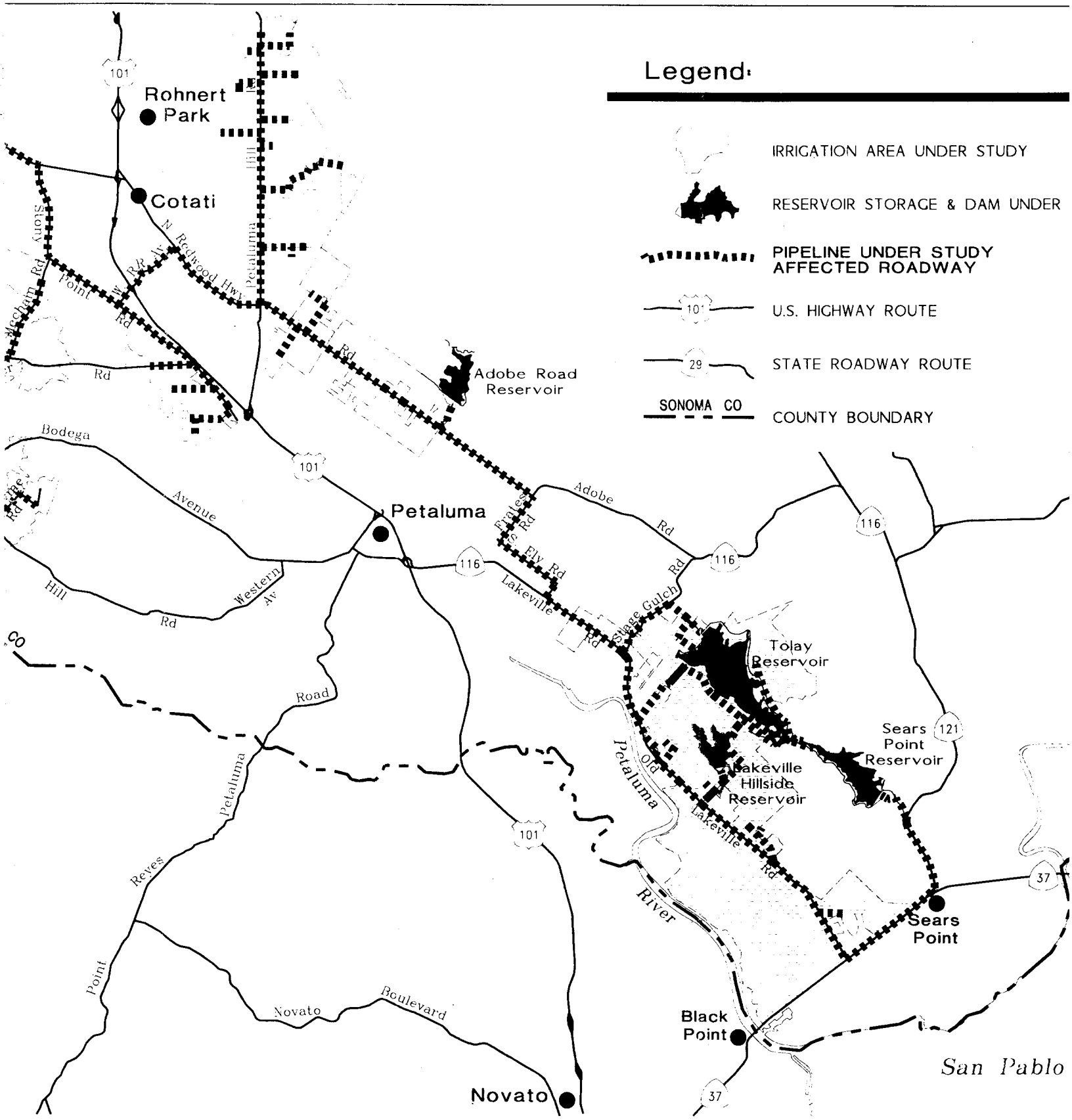

Subregional Long-Term
Wastewater Project

Figu

AFFECTED
ROADWAYS IN PROJECT

(3)

end:

IRRIGATION AREA UNDER STUDY

RESERVOIR STORAGE & DAM UNDER STUDY

PIPELINE UNDER STUDY
AFFECTED ROADWAY

U.S. HIGHWAY ROUTE

STATE ROADWAY ROUTE

IA CO COUNTY BOUNDARY

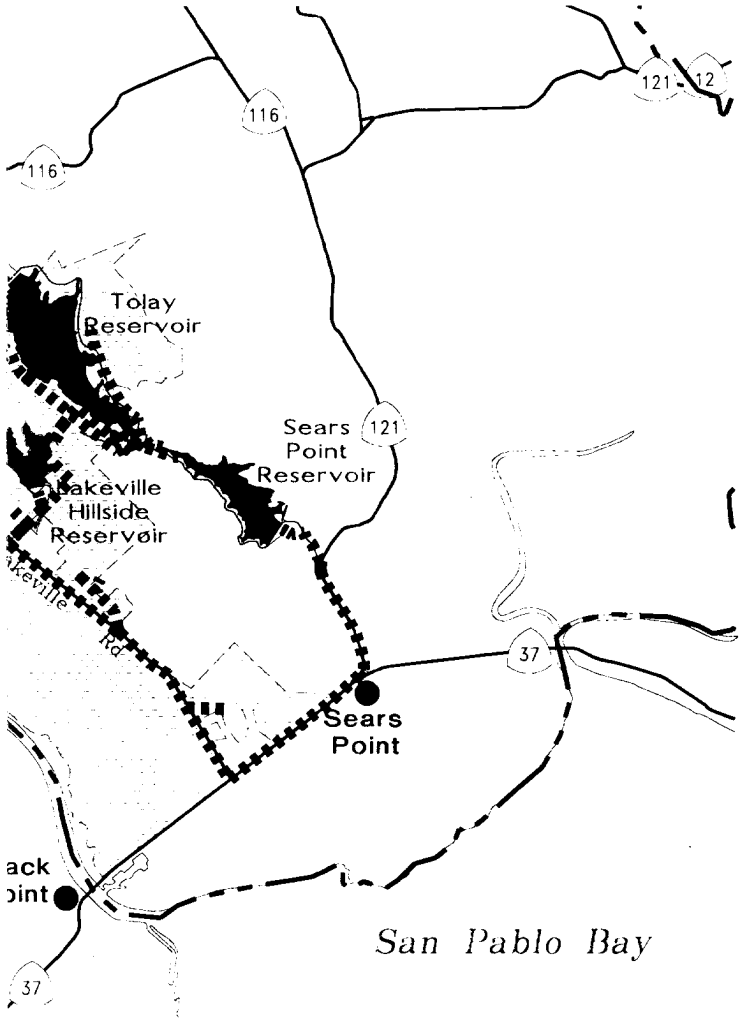

Figure 4.11-1c

AFFECTED
ROADWAYS IN PROJECT AREA

Collectors

These are relatively low speed/low volume streets, typically two lanes, for circulation within and between neighborhoods. These roads serve relatively short trips and are meant to collect trips from local streets and distribute them to the arterial network.

Local Streets

These are low speed/low volume roadways that provide direct access to abutting land uses. Driveways to individual parcels, on-street parking, and pedestrian access are allowed. Local streets are further classified as residential streets, hillside streets, or light industrial streets and are likely to be discontinuous in alignment. Many provide access to residential neighborhoods and are usually developed with curb, gutter, and sidewalk.

Rural Streets

These carry traffic to outlying districts and are generally not developed with curb, gutter, and sidewalk.

Regional and Local Roadways Included in the Transportation Analysis

All pipelines (except for those within the geysers steamfield) will be buried and will generally follow or cross public rights-of-way. Near reservoir sites and irrigation areas, some segments of the pipelines follow private access roads or "cross-country" alignments (i.e., not aligned with any road). Affected roadways within the Project area are combined (as appropriate study segments) by alternative and facility type for the purpose of this analysis. For example, the entire length of Chalk Hill Road between Highway 128 and Pleasant Avenue is considered as one study segment for Alternative 4. The resulting key affected roadway segments and reservoir access roadways included as part of the transportation analysis are listed in Table 4.11-1 by roadway, generally in geographic order from North to South.

Table 4.11-1

Affected Roadway Segments and Existing Traffic Volumes

Roadway Segment	Type	Lanes	Peak Hour			ADT
			Weekday a.m.	Weekday p.m.	Saturday Mid-day	Peak Month
Pine Flat Road north of Red Winery Road	Rural	1	24	19	19	202
Chalk Hill Road north of Spurgeon Road	Collector	2	59	75	67	766
Pleasant Avenue west of Chalk Hill Road	Collector	2	30	22	21	259
Shiloh Road between Conde Lane and Windsor Road	Arterial	2	323	394	240	4,612
Slusser Road south of Laughlin Road	Collector	2	86	69	65	1,364
River Rd./Eastside Rd. west of Slusser Rd.	Arterial	2	786	1,021	1,085	12,721
Trenton-Healdsburg Road south of Mark West Station	Collector	2	93	108	69	1,168
Eastside Road north of Mark West Station	Arterial	2	152	185	129	1,853
River Road east of Slusser Road	Arterial	2	800	1,038	1,076	12,816
Guerneville Road west of Laguna Road	Arterial	2	544	518	597	8,539
Green Valley Road west of Ross Road	Collector	2	135	194	118	2,080
Graton Road west of Sullivan Road	Arterial	2	207	212	179	2,625
Fountaingrove Parkway north of Mendocino Avenue	Arterial	4	942	960	434	11,438
Piner Road east of Coffey Lane	Arterial	4	1,283	1,969	1,322	22,244
Marlow Road north of Steele Lane	Collector	2	549	1,058	468	11,863
Stony Point south of West College Avenue	Arterial	4	1,116	1,852	1,281	20,491
West 3rd Street east of Dutton Avenue	Arterial	2	754	1,232	862	14,909
Bennett Valley Road east of Highway 12	Arterial	2	1,007	1,482	1,015	16,152
Hoen Frontage Road west of Hoen Ave.	Arterial	4	914	1,575	1,087	17,473
Lone Pine Road west of Highway 116	Collector	2	192	201	208	2,725
Bloomfield Road south of Canfield Road	Collector	2	82	112	111	1,296

Table 4.11-1

Affected Roadway Segments and Existing Traffic Volumes

Roadway Segment	Type	Lanes	Peak Hour			ADT
			Weekday a.m.	Weekday p.m.	Saturday Mid-day	Peak Month
Petaluma-Valley Ford Road west of Bloomfield Road	Arterial	2	217	337	618	4,341
Petaluma-Valley Ford Road north of Bodega Avenue	Arterial	2	230	328	574	4,371
Pepper Road south of Walker Road	Arterial	2	203	235	219	2,663
Spring Hill Road south of Bodega Avenue	Collector	2	71	89	74	806
Old Redwood Hwy. north of Railroad Ave.	Arterial	2	696	1,081	762	11,867
Petaluma Hill Rd. north of Railroad Ave.	Arterial	2	1,338	1,815	923	17,727
Petaluma Hill Road south of Crane Canyon Road	Arterial	2	886	1,508	633	12,647
Redwood Highway south of Ely Road	Arterial	4	1,226	1,702	1,080	18,929
Adobe Road south of Corona Road	Arterial	2	855	1,075	577	10,572
East Washington Street east of Ely Road	Arterial	2	463	642	610	8,220
Ely Blvd. south of Frates Road	Arterial	2	305	572	287	4,953
Lakeville Highway north of Highway 37	Arterial	4	1,065	1,636	877	16,664
Llano Road South of Highway 12	Arterial	2	177	217	NA	2,079
State Highway 1 north of Two Rock Road	Arterial/State Highway	2	NA	200	NA	1,300
State Highway 1 west of Petaluma-Valley Ford Road	Arterial/State Highway	2	NA	650	NA	4,600
State Highway 1 east of Valley Ford-Freestone Road	Arterial/State Highway	2	NA	1,100	NA	4,650
State Highway 12 along Farmers Lane	Arterial/State Highway	4	NA	2,450	NA	30,000

Table 4.11-1

Affected Roadway Segments and Existing Traffic Volumes

Roadway Segment	Type	Lanes	Peak Hour			ADT
			Weekday a.m.	Weekday p.m.	Saturday Mid-day	Peak Month
State Highway 37 east of Lakeville Highway	Arterial/State Highway	4	NA	3,350	NA	35,500
State Highway 116 east of Stony Point Road	Arterial/State Highway	2	NA	1,650	NA	18,100
State Highway 116 north of Lakeville Highway	Arterial/State Highway	2	NA	1,300	NA	15,600
State Highway 116 south of Adobe Road	Arterial/State Highway	2	NA	250	NA	3,000
State Highway 121 north of State Highway 37	Arterial/State Highway	4	NA	1,700	NA	16,300
State Highway 128 south of Pine Flat Road	Arterial/State Highway	2	NA	250	NA	2,450
Proposed Reservoir Access Roads						
Cannon Lane at Lakeville Road	Rural	2	6	7	7	70
Private Driveway off of Stage Gulch Road (SR 116) south of Adobe Road	Rural	1	1	1	1	10
Old Lakeville Road No. 3 (north) at Lakeville road	Local	2	8	10	9	95
Private Driveway off of Highway 121 at Tolay Creek	Rural	1	1	1	1	10
Access Roads (2) onto Sonoma Mountain Road	Rural	2	12	15	13	145
Private Driveway (Ielmorini Road) off of Adobe Road aligned with East Washington Street	Rural	1	1	1	1	10
Walker Road Access Road	Local	2	4	5	4	50

Table 4.11-1

Affected Roadway Segments and Existing Traffic Volumes

Roadway Segment	Type	Lanes	Peak Hour			ADT
			Weekday a.m.	Weekday p.m.	Saturday Mid-day	Peak Month
Private Driveway off of Petaluma Valley Ford Road West of Bloomfield Road	Rural	1	1	1	1	10
Carroll Road off of Petaluma Valley Ford Road	Rural	1	11	13	12	130
Private Driveway off of Highway 1 west of Petaluma Valley Ford Road	Rural	1	1	1	1	10
Martinoni Road off of Fallon Two Rock Road	Rural	1	7	8	8	85

Source: Marks Traffic Data Service Traffic Volume Sheets, 24-Hour Machine Counts, July and August, 1995. Caltrans 1994 Traffic Volumes, May, 1995, County of Sonoma Traffic Volumes, 1995.

Notes:

ADT = Average Daily Traffic

NA = Not Available

Existing Traffic Volumes

Traffic volumes can be described both in terms of average daily traffic and peak hour traffic. Average daily traffic (ADT) represents the average of the total traffic in both directions on a road segment over a 24-hour period. Peak hour traffic is the highest volume of traffic for a one-hour period. Generally, on a weekday, there are two peak hours coinciding with the morning and evening commute periods. In the Project area, peak hours are generally found between 7:00 and 9:00 a.m. and 4:00 and 6:00 p.m. A Saturday peak period is evident mid-day between 11:00 a.m. and 1:00 p.m.

Traffic counts in Sonoma County and northern Marin County vary during different seasons of the year. During the summer months, there is an increase in recreational and sightseeing activities. Therefore, in order to present a more conservative analysis, traffic volume data collected during July and August were used in assessing Project impacts. Along state highways, the peak month ADT and peak hour traffic were used for this analysis. The peak month ADT is the average daily traffic for the month of heaviest traffic flow. In addition, with the longer days, the construction related activities of the Project alternatives are likely to occur during the summer months.

Table 4.11-1 summarizes the affected roadway segment existing peak hour and average daily traffic (ADT) volumes.

Public Transit Service

Five major transit operators provide fixed-route transit services within the Project area. Each of these services is described by jurisdiction below, and the affected routes are summarized in Table 4.11-2.

Sonoma County

Golden Gate Transit connects the Santa Rosa, Sebastopol, Rohnert Park, Cotati, and Petaluma areas with Marin County and San Francisco. Mendocino Transit Authority connects the Mendocino and Sonoma Coast to Santa Rosa via Bodega Bay and Sebastopol. Sonoma County Transit provides inter-city travel within Sonoma County. Sonoma County Transit offers 21 routes which travel as far north as Cloverdale, as far west as Guerneville, as far south as Petaluma, and as far east as the City of Sonoma.

Marin County

The majority of both local and transbay (to San Francisco and western Contra Costa County) public transportation service is provided by Golden Gate Transit. The Marin County Transit District also provides local service.

City of Santa Rosa

Santa Rosa has an extensive local transit service. The City is serviced by the CityBus fleet that consists of 14 lines. Regional and inter-county commute bus service is available to Marin County and San Francisco via Golden Gate Transit.

Table 4.11-2

Affected Bus Route Service Frequencies (in minutes)

Route	A.M. Peak 7-9	Mid-Day 11-1	P.M. Peak 4-6	Saturday	Sunday
City of Santa Rosa CityBus					
2	30	30	30	60	60
3	30	30	30	60	60
5	30	30	30	60	60
6	30	30	30	60	60
7	60	60	60	60	60
8	30	30	30	60	60
9	30	30	30	60	60
11	30	30	30	60	60
12	30	30	30	60	60
City of Petaluma	No Routes Affected				
Sonoma County					
12	103	165	105	198	198
20 - East	72	104	110	226	226
20 - West	78	93	71	236	236
22 East Express	55	252	113	NS	NS
22 West Express	127	255	145	NS	NS
26 East	73	265	80	NS	NS
26 West	153	75	80	NS	NS
40 East	56	135	68	NS	NS

Table 4.11-2

Affected Bus Route Service Frequencies (in minutes)

Route	A.M. Peak 7-9	Mid-Day 11-1	P.M. Peak 4-6	Saturday	Sunday
40 West	110	165	90	NS	NS
42 North	180	100	130	NS	NS
42 South	180	110	125	NS	NS
44 North	75	126	50	182	182
44 South	62	95	62	185	185
48 North	82	130	109	190	190
48 South	120	205	84	182	182
60 North	33	54	25	77	77
60 South	32	58	33	89	89
62 North	125	NS	73	NS	NS
62 South	60	NS	one trip (LS)	NS	NS
64 North	one trip (LS)	NS	NS	NS	NS
64 South	one trip (LS)	NS	130	NS	NS
Golden Gate Transit (GGT)					
71 Southbound	49 (LS)	NS	NS	NS	NS
71 Northbound	NS	NS	36 (LS)	NS	NS
72 Southbound	19 (LS)	NS	NS	NS	NS
72 Northbound	NS	NS	one trip (LS)	NS	NS
74 Southbound	19 (LS)	NS	NS	NS	NS
74 Northbound	NS	NS	28 (LS)	NS	NS
75 Southbound	28 (LS)	NS	NS	NS	NS
75 Northbound	NS	NS	40 (LS)	NS	NS
76 Southbound	6 (LS)	NS	NS	NS	NS
76 Northbound	NS	NS	32 (LS)	NS	NS
78 Southbound	37 (LS)	NS	NS	NS	NS
78 Northbound	NS	NS	29 (LS)	NS	NS
Mendocino Transit Authority (MTA)				No routes affected	

Sources: Santa Rosa CityBus System Route Map, July 1994; Petaluma Transit Route Map and Time Schedule, May 1995; Sonoma County Transit Time Schedules, August 1995; Golden Gate Transit Bus & Ferry Transit Guide, Summer 1995 (June 11-September 2) 2nd Edition; Mendocino Transit Authority North Coast Inter City Rider and Coast Bus Time Schedules.

Notes:
NS no service
LS limited service

Sonoma County Transit connects Santa Rosa to all cities and most unincorporated communities. Transfers between routes and systems are provided in Santa Rosa at the Second Street Transit Mall.

City of Cotati

Sonoma County Transit provides inter-city travel within Sonoma County and Golden Gate Transit provides regional service.

City of Sebastopol

Sebastopol is served by three major transit services. Intra-city and inter-city transit service is provided by Sonoma County Transit with routes to Santa Rosa, the lower Russian River area, Cotati and Rohnert Park. Inter-county transit service is provided by Golden Gate Transit, which provides express routes to San Francisco. Service to Mendocino County is provided by Mendocino Transit Authority from Point Arena via Sebastopol to Santa Rosa.

City of Petaluma

Petaluma is currently served by three transit agencies: Golden Gate Transit is oriented mainly to commuters traveling to Marin County and San Francisco; Sonoma County Transit serves Santa Rosa, Sonoma, Cotati/Rohnert Park, and other destinations within Sonoma County; and intra-city transit needs are served by Petaluma Transit's minibuses.

All routes start and end at the downtown bus depot at "C" and 4th Streets. Two of Golden Gate Transit's routes and the Sonoma County Transit lines also use the downtown bus depot as do private operators.

City of Rohnert Park

Rohnert Park is currently served by two transit agencies. Golden Gate Transit is oriented mainly to commuters traveling to Marin County and San Francisco. Sonoma County Transit serves Rohnert Park and other destinations within Sonoma County. The Sonoma County Transit intra-city routes currently operate on 30-minute to one-hour headway.

In addition to the regularly scheduled routes described above, other transit services are also provided in the Project area. These include numerous demand responsive services, commercial taxi service, and other private operators.

Table 4.11-2 summarizes the service characteristics of the major bus routes that have routes along Project pipeline routes.

Bicycle and Pedestrian Facilities

The existing system of bikeways and pedestrian facilities is outlined in the General Plan for each jurisdiction. Many jurisdictions maintain a system of existing bikeways, trails, and pedestrian facilities that provide access to a number of important destinations.

Transportation Goals, Objectives, and Policies

Table 4.11-3 identifies transportation goals, objectives, and policies which provide guidance for development of Project facilities. The table also indicates which criteria in the Transportation Section are responsive to each set of policies.

Table 4.11-3

General Plan Goals, Objectives and Policies - Transportation

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Circulation and Transit Element	Goal CT-2	Provide and maintain a highway system capacity to serve projected travel demand in 2005 at acceptable levels of service	1
Sonoma County General Plan	Circulation and Transit Element	Policy CT-2k	The County may require correction of potential safety deficiencies prior to or at project approval	2,3
Sonoma County General Plan	Circulation and Transit Element	Policy CT-2v Policy CT-2x Policy CT-2y	Discourage access along parallel arterials; allow access along primary and secondary arterial where it does not interfere with traffic function of the arterial	3
Sonoma County General Plan	Circulation and Transit Element	Policy CT-2v Policy CT-2x	During peak travel periods avoid parking on parallel arterials; discourage parking on primary arterials, especially during peak periods	5

Table 4.11-3

General Plan Goals, Objectives and Policies - Transportation

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Marin Countywide Plan	Transportation Element	Objective T-1 Objective T-7 Policy T-7.1	Have a countywide transportation system that provides for the efficient movement of people and goods, and maintain the transportation system of west Marin county at a rural scale with only those road improvements that enhance safety	1,2,3,4,
Santa Rosa General Plan	Transportation and Circulation Element	Objective TCS-1a	Minimize through traffic in residential neighborhoods, avoid excessive traffic volumes and locate uses generating heavy traffic with access to arterial streets	1,2,6
Rohnert Park General Plan	Circulation Element	Principle 1	Land use decisions shall take into consideration potential traffic impacts	1-6
Cotati General Plan	Community Development Section	Policy 3.1.1	Reduce congestion on Old Redwood and Gravenstein Highways	2
Petaluma General Plan	Transportation Element	Policy 9	Land use decisions shall take into consideration potential traffic impacts	1-6
Sebastopol General Plan	Transportation Element	Policy 8	Place a higher priority on safety and pedestrian oriented design and scale, as opposed to traffic flow and speed	1,2,3
Sebastopol General Plan	Transportation Element	Policy 17 Program 17.1	Reduce through traffic on local streets and limit trucks to arterial and collector streets	6

Source: Harland Bartholomew and Associates, Inc., 1995

Notes:

1. The evaluation criteria are identified in Table 4.11-4.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

Table 4.11-4

Evaluation Criteria with Point of Significance - Transportation

Evaluation Criteria	As Measured By	Point of Significance	Justification
1. Will Project traffic cause congestion along access roads?	Percent increase in traffic along access road	Greater than 10% increase	Professional Judgment
2. Will lane closures due to Project construction cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?	a. Miles of lane closures not in compliance with Standard Transportation Procedures[1] b. Duration and extent of lane closure	Greater than 0 miles Greater than 1 month over 1 mile segment	Cities of Santa Rosa, Cotati, Petaluma, Rohnert Park, and Sebastopol Public Works Departments; Counties of Marin and Sonoma Public Works Departments; California Department of Transportation, and Professional Judgment
3. Will Project construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Number of locations where there is ingress/egress of construction equipment onto a major roadway not in accordance with regulations[1]	Greater than 0 locations	Cities of Santa Rosa, Cotati, Petaluma, Rohnert Park, and Sebastopol Public Works Departments; Counties of Marin and Sonoma Public Works Departments; California Department of Transportation
4. Will Project construction traffic damage public or private roadbeds?	Number of miles of roadway which Project does not restore to existing conditions or better	Greater than 0 miles	Cities of Santa Rosa, Cotati, Petaluma, Rohnert Park, and Sebastopol Public Works Departments; Counties of Marin and Sonoma Public Works Departments; California Department of Transportation
5. Will there be inadequate parking for Project activities?	An on-street parking	Greater than 0 vehicles	Code requirements for Sonoma County. Code requirements for Cities of Santa Rosa, Cotati, Petaluma, Rohnert Park, and Sebastopol Public Works Departments
6. Will Project construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Number of roadways traveled by Project heavy vehicles on non-designated truck routes without a Transportation Permit	Greater than 0 roadways	Cities of Santa Rosa, Cotati, Petaluma, Rohnert Park, and Sebastopol Public Works Departments; Counties of Sonoma and Marin; California Department of Transportation

Source: Harland Bartholomew & Associates, Inc., November, 1995.

Notes: 1 See Standard Traffic Control Procedures in Section 2.2.

METHODOLOGY

Traffic and circulation impacts associated with Project activities were evaluated against the criteria listed in Table 4.11-4. The affected regional roadway network, existing traffic volumes, public transit routes, and bicycle and pedestrian facilities were used as the basis for evaluation of impacts in the Project area. The regional roadway network and bicycle/pedestrian routes and standards were determined from General Plans and Congestion Management Plans for the respective jurisdictions. Existing transit service was determined from route schedules published by local and regional transit service providers. Existing traffic volumes were obtained from field observation completed during July and August, 1995, and from Sonoma and Marin Counties, local jurisdictions and Caltrans. Roadway miles affected by pipeline construction were determined from the *Alternative Projects Facilities Plans* (Parsons Engineering Science 1996). Construction impacts on traffic were estimated by the Project team engineers based on typical construction practices.

The construction of the Project alternatives can result in short-term increases in congestion associated with vehicle traffic and construction activities on the existing transportation network serving the Project area. Therefore, this evaluation focuses on construction-related transportation impacts. Temporary impacts to affected roads are assessed for the addition of worker and construction vehicles as well as construction related activities. Worker parking and construction staging areas are discussed for traffic impacts. Temporary road closures or access disruptions during pipeline construction have been identified. Detour routes will be defined as part of the Standard Transportation Procedures presented in Section 2.2. There are no permanent changes planned for the transportation network or its use after completion of construction. Therefore, Project construction impacts to the roadway system are not described utilizing the "level of service" methodology, since the Project will not generate additional traffic in the post-construction period.

Temporary lane closures on state highways, arterials, collectors, and local and rural streets were not considered significant if they will be limited to less than a month in any 1-mile section of road and alternative route/access and/or traffic control is provided.

Standard Traffic Control Procedures

The Standard Traffic Control Procedures are part of the Project measures adopted by the City and are discussed in Section 2.2. They detail typical encroachment construction permit provisions within the Project area road system rights-of-way. Elements of the Standard Traffic Control Procedures provide for: encroachment permits, transportation permits, alternative routes and detours, construction along roadways, construction across roadways, construction near schools, trenches, access, road damage, emergency vehicle

access, parking, oversize vehicles and equipment, construction hours, and ingress/egress of construction equipment onto a major roadway.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Impact: **11.1.1-6. Will the No Action Alternative impact transportation based on evaluation criteria 1 through 6?**

Analysis: *No Impact; Alternative 1.*

There is no construction associated with this component, and continued discharge and irrigation will not increase traffic impacts.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Table 4.11-5

Transportation Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.2.1. Will headworks expansion component traffic cause congestion along access roads?	Greater than 10% increase	Less than 10%	C, O&M	O
11.2.2. Will lane closures due to headworks expansion component cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?	a. Greater than 0 miles not in compliance with standard transportation procedures.	None	C	==
	b. Greater than 1 month over 1 mile segment	None	C	==
11.2.3. Will headworks expansion component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C	==

Table 4.11-5

Transportation Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.2.4. Will headworks expansion component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C	==
11.2.5. Will there be inadequate parking for headworks expansion component activities?	Any on-street parking	None	C, O&M	==
11.2.6. Will headworks expansion component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance codes:
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **11.2.1. Will headworks expansion component traffic cause congestion along access roads?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

Installation of the new influent pumps at the headworks on Llano Road will involve little, if any, heavy construction equipment and few construction personnel.

Construction traffic is estimated to be a maximum of 20 trips a day. These trips will increase daily traffic by 1 percent. This is less than 10 percent of the existing average daily traffic on Llano Road.

As noted in Chapter 3, the operation and impacts of disposing of increased sludge production are addressed in the Santa Rosa Subregional Sludge Beneficial Use Project EIR (LSA 1991).

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: 11.2.2 through 6. Will construction and operation of the headworks expansion component cause traffic impacts based on evaluation criteria 2, through 6?

Analysis: *No Impact; All Alternatives.*

No lane closures will be required for construction of the headworks expansion.

Construction traffic will enter and leave the Laguna Plant via Llano Road. Because little heavy truck traffic is involved in the construction and because of the low levels of traffic currently on Llano Road, no safety hazards will be created at the entrance to the Laguna Plant off Llano Road. The City will comply with provisions outlined in any required construction permits in accordance with governing agency regulations and specifications.

The City is required and committed to restoring any damaged access roads to existing conditions or better.

Parking for construction personnel and new employees can be easily accommodated at the Laguna Plant.

The City is required to obtain all necessary Transportation Permits to operate oversize and heavy vehicles on the public right-of-way. Transportation Permits shall be obtained from the California Department of Transportation (Caltrans) for transportation along State Highways. In addition, Transportation Permits may be required in accordance with County and governing agency regulations and specifications. The City will follow the conditions and provisions outlined in these permits.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is needed.

Urban Irrigation Component

Impact: **11.3.1-6. Will the urban irrigation component impact transportation based on evaluation criteria 1 through 6?**

Analysis: *No Impact; All Alternatives.*

There is no construction associated with the urban irrigation component. Operation and maintenance of the irrigation systems with reclaimed water will not generate more traffic than operation and maintenance of the irrigation systems using their existing source of water. Therefore, there are no traffic impacts from the urban irrigation component.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.11-6

Transportation Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.4.1. Will pipeline component traffic cause congestion along access roads?	Greater than 10% increase			
• Alt 2, 3, and 4		Greater than 10%	C	●
• Alt 5		Less than 10%	C	○
• All Alternatives		Less than 10%	O&M	○
11.4.2. Will lane closures due to pipeline component construction, cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?	a. Greater than 0 miles not in compliance with standard transportation procedures	None	C	○
• Alt 2, 3, 4, 5A	b. Greater than 1 month over 1 mile segment	Yes	C	●

Table 4.11-6

Transportation Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Alt 1, 5B		None	C	--
11.4.3. Will pipeline component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C	==
11.4.4. Will pipeline component construction traffic damage public or private roadbeds?	Greater than 0 miles			
• Geysers pipeline		None Damage if pipelines rupture	C O&M	== ●
• Bennett Valley Road and Fountaingrove Parkway pipelines		None Damage if pipelines rupture	C O&M	== ○
• All other pipelines		None None	C O&M	== ==
11.4.5. Will there be inadequate parking for pipeline component activities?	Any on-street parking	None	C O&M	== ==
11.4.6. Will pipeline component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C	==

Source: Harland Bartholomew & Associates, Inc., November, 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
-- Not Applicable

2. Level of Significance codes:
● Significant impact before and after mitigation
○ Less than significant impact; no mitigation
== No impact

Impact: **11.4.1. Will pipeline component traffic cause congestion along access roads?**

Analysis: **Construction**

Significant; Alternatives 2, 3, and 4.

Construction of pipelines will require both construction workers and heavy equipment. The major construction activities associated with installation of the pipelines that will increase congestion on access roads consist of the mobilization of construction equipment, disposal of excess excavated materials, delivery of gravel, asphalt, and water for pipeline trenches, pavement restoration, and soil compaction and dust control, deliveries of piping, and construction employees. Table 4.11-7 summarizes the daily peak activity of construction equipment and employee trips along major affected roadways and reservoir access roads where the increase in traffic is greater than 10 percent.

Table 4.11-7

Estimated Construction Traffic Impacts - Pipelines

Affected Roadway Segment	Daily Trips - Equipment Traffic	Daily Trips - Employee Traffic	Existing Daily Traffic	Percent Increase in Daily Traffic
Pine Flat Road	60	135	202	97%
Chalk Hill Road	80	45	766	16%
Pleasant Avenue	80	45	259	48%
Trenton/Healdsburg Road	80	45	1,168	11%
Spring Hill Road	80	45	806	16%
Cannon Lane	80	45	70	179%
Old Lakeville No. 3 (north)	80	45	95	132%
Sonoma Mountain Road	80	45	145	86%
Walker Road	80	45	50	250%
Carroll Road	80	45	130	96%
Martinoni Road	80	45	85	147%
Private Driveways to Reservoir Sites	80	45	10	>1,000%
Locations where Irrigation Distribution Pipeline Segments have less than 1,250 ADT	80	45	<1,250	10%

Source: Harland Bartholomew & Associates, Inc., November, 1995

Notes: ADT = Average Daily Traffic

Less than Significant; Alternative 5A.

The pipeline construction traffic associated with this alternative is less than 10 percent of the existing average daily traffic.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have a pipeline component.

Operation and Maintenance

Less than Significant; Alternatives 2, 3, 4, and 5A.

Operation of the pipelines will generate less than 10 trips per month to any area; this impact is less than a 10 percent change for all affected roadways.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: *Alternatives 2, 3, and 4.* No feasible mitigation has been identified.

Alternatives 1 and 5. No mitigation is proposed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, and 4.*

Alternative routes and/or detours will be identified where applicable to be determined through the Standard Traffic Control Procedures, described in Section 2.2 as Measures 2.2.15 to 2.2.24 adopted as part of the Project. No feasible mitigation for this impact exists along Pine Flat Road, Cannon Lane, Sonoma Mountain Road, Walker Road, Carroll Road, Martinoni Road, and the private driveways to the reservoir sites.

Impact: **11.4.2. Will lane closures due to pipeline component construction cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?**

Analysis: *Significant; Alternatives 2, 3, 4, and 5A.*

The major construction activities associated with installation of the pipelines that will cause lane closures consist of the mobilization of construction equipment; stockpiling lengths of piping along pipeline alignments; delivery of gravel, asphalt, and water for pipeline trenches; pavement restoration; soil compaction and dust control; breaking and removing pavement; excavation of pipeline trench; and installation of pipe sections.

Construction along pipeline alignments will cause partial lane closures, one-lane closure, or in the case of the geysers pipeline, closure of the whole road. The City has agreed to conduct construction in accordance with existing regulations as outlined under the Standard Traffic Control Procedures, Measures 2.2.15 through 2.2.24.

As part of the Standard Traffic Control Procedures, the City has adopted the following:

2.2.16. Emergency response vehicles will not be impeded. The City will provide advance notice to emergency service providers and coordinate alternate response routes during construction.

2.2.17. Maintain maximum number of open lanes on roadways. The City has committed to keeping at least one land of through traffic open whenever feasible.

2.2.18. Jack and bore construction of major highways. To avoid disrupting traffic and delaying commerce, the City will jack and bore pipelines under major highways, railroads, and aqueducts. All jack and bore crossings are listed in Chapter 2.

2.2.20. Access to businesses and residences. The City will notify businesses and residences in advance of scheduled construction. The city will also maintain access to businesses and residences during pipeline construction.

Temporary lane closures will occur for longer than a month on several sections of road longer than one mile (see Table 4.11-8a). Table 4.11-8b provides a breakdown of the roadway miles affected by each alternative.

The public transit routes affected by pipeline construction are summarized in Table 4.11-8c for each alternative. Lane closures, due to Project construction will cause transit delays along these transit routes. With implementation of the Standard Traffic Control Procedures, these impacts are considered to be less than significant.

Table 4.11-8a

Estimated Duration of Pipeline Construction

Affected Roadway Segment	Duration of Construction (Working Days)[1]	Number of Lanes	Existing Daily Traffic	Roadway Classification (Type)
Pine Flat Road[2]	53[2]	1	202	Rural
State Highway 128	31	2	2,450	Arterial
Chalk Hill Road	31	2	766	Collector
Pleasant Avenue	31	2	259	Collector
Shiloh Road	31	2	4,612	Arterial
Slusser Road	31	2	1,364	Collector
Laguna Road	31	2	1,993	Collector
Trenton/Healdsburg Road	36	2	1,168	Collector
Eastside Road	36	2	1,853	Arterial
Bloomfield Road	31	2	1,296	Collector
State Highway 116 east of Stony Point	31	2	18,100	Arterial
Petaluma-Valley Ford Road	46	2	4,371	Arterial
Roblar Road	31	2	1,032	Arterial
Carroll Road	31	1	130	Rural
West Railroad Avenue	31	2	1,733	Collector
Old Redwood Hwy. south of Railroad	31	4	11,120	Arterial
Stony Point north of Roblar Road	31	2	5,039	Arterial
Abobe Road	31	2	11,211	Arterial
Frates Road	31	2	8,590	Arterial
Ely Road south of Frates Road	31	2	4,953	Arterial
Hwy. 116 north of Lakeville Road	31	2	15,600	Arterial
Hwy. 116 south of Adobe Road	31	2	3,000	Arterial
Cannon Lane	31	2	70	Rural
Lakeville Road	36	2	16,664	Arterial
State Highway 37	36	4	35,500	Arterial
State Highway 121	36	4	16,300	Arterial

Source: Harland Bartholomew & Associates, Inc., 1995

Notes:

1 Lists only road segments where construction of 1 mile segment exceeds 1 month.

2 An additional 6 months time is needed for completion of reconstruction/widening/stabilization or portions of Pine Flat Road prior to pipeline construction. This time is not included in the duration of construction estimate.

Table 4.11-8b

Roadway Miles Affected

	Alternative	State Route	Arterial	Collector	Total
2A	S. Co. -Tolay Extended	2.5	43.5	30.0	76.0
2B	S. Co. -Adobe/Lakeville	2.5	43.5	30.5	76.5
2C	S. Co. -Tolay Confined	2.5	43.5	29.0	75.0
2D	S. Co. -Lakeville/Sears Point	6.0	43.5	30.5	80.0
3A	W. Co. -Two Rock	5.5	34.0	39.0	78.5
3B	W. Co. -Bloomfield	6.0	34.0	44.5	84.5
3C	W. Co. -Carroll Road	5.5	34.0	39.0	78.5
3D	W. Co. -Valley Ford	5.5	34.0	39.0	78.5
3E	W. Co. -Huntley	5.5	34.0	39.0	78.5
4	Geysers Steamfield Recharge	3.5	9.5	29.5	42.5
5A	Discharge - Russian River	0.5	10.5	5.0	16.0
5B	Discharge - Laguna	0	0	0	0

Source: Harland Bartholomew & Associates, Inc., 1995

Notes:

1. Based upon roadways potentially disrupted by construction of transmission and distribution pipelines within public rights-of-way. Miles are one-way route miles. Roadway classification is based upon local general plan and Caltrans designations.

Lane closures due to Project construction will be more problematic along State Routes, Arterials, and Collectors.

Table 4.11-7d shows the number of working days and total duration in calendar years required to install the pipeline segments (by alternative) where construction exceeds a month for a 1-mile section of road.

Table 4.11-8c

Bus Routes Affected[1]

Alternative	Golden Gate Transit	Sonoma County Transit	Santa Rosa City Bus	Other	Total Routes Affected
2A S. Co. - Tolay Extended	76, 78	20, 20E, 40 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	21
2B S. Co. - Adobe/Lakeville	76, 78	20, 20E, 40 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	21
2C S. Co. - Tolay Confined	76, 78	20, 20E, 40 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	21
2D S. Co. - Lakeville/Sears Point	76, 78, 90	20, 20E, 40 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	22
3A W. Co. - Two Rock	78	20, 20E, 26 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	20
3B W. Co. - Bloomfield	78	20, 20E, 26 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	20
3C W. Co. - Carroll Road	78	20, 20E, 26 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	20
3D W. Co. - Valley Ford	78	20, 20E, 26 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	20
3E W. Co. - Huntley	78	20, 20E, 26 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	MTA Coast Bus	20
4 Geysers Recharge	None	, 20E, 26 42, 44, 46, 48, 60, 62, 66, 64	2, 3, 5, 6, 7, 8, 9, 12	None	18
5A Discharge - Russian River	None	20E, 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	None	16
5B Discharge - Laguna	None	20E, 42, 44, 46, 48, 60, 62, 64	2, 3, 5, 6, 7, 8, 9, 12	None	16

Source: Harland Bartholomew & Associates, Inc., based upon bus route timetables/maps for the following agencies: Golden Gate Transit, June 1995; Sonoma County Transit, December 1994; Santa Rosa City Bus, July 1994; Petaluma Transit, May 1995; Sebastopol Transit Service, September 1993; MTA Coast Bus, March 1995.

Notes: 1. Bus routes operating along roadways potentially disrupted by construction of transmission and distribution pipelines within public rights-of-way.

Table 4.11-8d

Total Length of Piping and Duration of Construction

Alternative[1]	Miles	Duration of Construction (weeks[2])	Calendar Years[3]
2A	42.0	44.8	1.9
2B	36.5	35.5	1.9
2C	35.1	37.7	1.9
2D	42.1	43.7	1.9
2E	37.9	35.6	1.9
3A	24.6	25.6	1.7
3B	23.8	24.9	1.7
3C	26.1	27.4	1.7
3D	26.2	27.4	1.7
3E	20.7	20.6	1.7
3F	26.3	25.4	1.7
4	35.4	66.1	2.4
5A	7.4	36.4	1.0

Source: Parsons Engineering Science, Inc. and Harland Bartholomew and Associates, Inc., 1996

Note:

1 All Alternative 2 and 3 projects include piping for Sebastopol irrigation. It is assumed that 4 work crews will be engaged simultaneously at different locations for any of the Alternative 2 or 3 projects, 3 crews for the Alternative 4 Project, and 1 crew for the Alternative 5a Project.

2 Based on 7 working days per week and 10 hours per workday.

3 Based on 250 working days per calendar year. Time includes actual construction activity only. Alternative 4 estimate includes an additional 6 months for stabilization of portions of Pine Flat Road.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.* No feasible mitigation has been identified.

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

Impact: **11.4.3 and 6. Will construction or operation of the pipeline component have traffic impacts based on evaluation criteria 3 and 6?**

Analysis: *No Impact; All Alternatives.*

Construction of the pipelines will occur along public roadways, requiring construction equipment to enter and leave the construction zone. The City has agreed to conduct construction in accordance with existing regulations as outlined previously under the Standard Traffic Control Procedures. These regulations require the City to obtain an Encroachment Permit and Transportation Permit from the appropriate agency to minimize hazards due to construction traffic entering and leaving the construction area.

Heavy vehicles used in the construction process will travel on non-designated truck routes. However, the City has agreed to conduct construction in accordance with existing regulations as outlined previously under the Standard Traffic Control Procedures. These regulations require the City to obtain a Transportation Permit prior to using non-designated roadways; this Permit controls signage, timing, or the need for flag persons along the roadway.

The construction of the Project alternatives will result in short-term impacts to both bicycle and pedestrian facilities. There are no permanent changes planned for these facilities after completion of construction. Further, all affected facilities will be improved as a result of construction due to roadway and sidewalk resurfacing. The Standard Traffic Control Procedures presented in Section 2.2 detail specific Encroachment Permit requirements for construction within the public right-of-way, including bicycle and pedestrian facilities. Because construction will be accordance with applicable regulation and permits, no impact to pedestrian or bicycle safety has been identified.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: No mitigation is needed.

Impact: **11.4.4. Will the pipeline component cause damage to public or private roadbeds?**

Analysis: ***Operation and Maintenance***

Significant; Alternative 4.

While operation will not damage roadbeds, pipeline failure could be caused by an earthquake and could damage roads that the pipe is located

in. The geysers pipeline crosses faults on Pine Flat Road and Chalk Hill Road.

Less than Significant, Alternatives 2 and 3

Operation will not damage public roads. Potential pipe ruptures along Bennett Valley Road or Fountaingrove Parkway will probably not damage the roadbed because the pipe is only 12" in diameter and damage to the road from the earthquake will be more severe than damage from the broken pipe.

No Impact; Alternatives 1 and 5

No pipelines in Alternative 5A cross an active fault line which will subject pipelines to potential rupture.

Alternatives 1 and 5B do not have a pipeline component.

Construction

No Impact; All Alternatives.

Though heavy vehicles used in the construction process will damage Project area roadways, the City has agreed to restore all affected roadways to existing conditions or better as required under the Standard Traffic Control Procedures.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: *Alternative 4.* No feasible mitigation has been identified.

Alternatives 2, 3, and 5. No mitigation is needed.

Impact **11.4.5. Will there be inadequate parking for pipeline component activities?**

Analysis: *No Impact; All Alternatives.*

Standard Traffic Control Procedures 2.2.22, Park within Construction Easements, requires that all construction equipment and construction worker vehicles be parked within the construction easements.

Operation and maintenance parking for pipelines will be accommodated within the rights-of-way.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: No mitigation is proposed.

Storage Reservoir Component

Table 4.11-9

Transportation Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.5.1. Will storage reservoir component construction traffic cause congestion along access roads?	Greater than 10% increase			
• Alt 2 & 3		Greater than 10%	C	●
• Alt 2 & 3		Less than 10%	O&M	○
• Alt 1, 4 & 5		None	C	==
11.5.2. Will lane closures due to storage reservoir component construction, cause traffic delays, transit delays, restricted access, increased traffic hazards, and	a. Greater than 0 miles not in compliance with standard transportation procedures	None	C	==
rerouting of traffic, including emergency vehicles?	b. Greater than 1 month over 1 mile segment	None	C	==
11.5.3. Will storage reservoir component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C	==
11.5.4. Will storage reservoir component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C, O&M	==
11.5.5. Will there be inadequate parking for storage reservoir component activities?	Any in-street parking.	None	C, O&M	==
11.5.6. Will storage reservoir component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C	==

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance codes:
● Significant impact before and after mitigation
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **11.5.1. Will storage reservoir component traffic cause traffic congestion along access roads?**

Analysis: ***Construction***

Significant; Alternatives 2 and 3.

Reservoir construction will take up to 500 days (about 17 months) and will likely occur during the spring, summer, and fall periods because of the longer days and better weather. Construction traffic will consist of travel by workers to the site and transportation of equipment and construction materials onto the site. Truck trips to and from the site will also be required for import of fill. Table 4.11-10 summarizes the estimated construction traffic.

Construction workers generally travel in off-peak periods, starting work by 7:00 a.m., before the typical a.m. commuter peak hour, which generally occurs between 7:00 a.m. and 9:00 a.m., and stopping work by 3:00 p.m., before the p.m. commuter peak hour, which generally occurs between 4:00 p.m. and 6:00 p.m.. Even if two shifts were hired, employee trips will not tend to overlap peak commute periods. Thus, the work trips generated by construction workers will not impact peak hour traffic flows. However, the number of trips generated, especially the number of truck trips, will cause substantial congestion on access roads throughout the day.

The major construction activities associated with the reservoirs that will increase congestion on access roads consist of the mobilization of construction equipment, clearing of dam and reservoir area, stripping of the dam foundation area, dam foundation excavation, earthwork fill placement, tunnel construction (if necessary), construction of appurtenant structures, and construction employees. Table 4.11-10 summarizes the daily peak activity of construction equipment and employee trips along major affected roadways and reservoir access roads where the increase in traffic is greater than 10 percent.

The construction of the storage reservoirs will result in the transportation impacts associated with hauling materials. The total truck trips and total days of hauling are summarized in Table 4.11-12 for each reservoir.

Table 4.11-11 summarizes the daily peak activity of construction equipment and employee trips along haul routes where the increase in traffic is greater than 10 percent.

Table 4.11-10

Estimated Construction Traffic[1] - Reservoirs

Affected Roadway Segment	Daily Trips - Equipment Traffic	Daily Trips - Employee Traffic	Existing Daily Traffic	Percent Increase in Daily Traffic
Cannon Lane	100	230	70	Greater than 400%
Old Lakeville No. 3 (north)	100	230	95	Greater than 300%
Sonoma Mountain Road	100	230	145	Greater than 200%
Walker Road	100	230	50	Greater than 600%
Carroll Road	100	230	130	Greater than 200%
Martinoni Road	100	230	85	Greater than 300%
Private Driveways to Reservoir Sites	100	230	10	Greater than 1,000%
Fallon Two Rock Road	100	230	400	Greater than 80%
State Highway 116 south of Adobe Road	100	230	3,000	11%

Source: Harland Bartholomew & Associates, Inc. November, 1995

Notes:
1 Lists only roadway segments where impact is greater than 10%.

Table 4.11-11

Estimated Construction Traffic[1] - Haul Routes

Affected Roadway Segment	Daily Trips - Importation Traffic	Existing Daily Traffic	Percent Increase in Daily Traffic
Cannon Lane	100	70	Greater than 40%
Sonoma Mountain Road	100	145	Greater than 60%
Walker Road	100	50	200%
Carroll Road	100	130	Greater than 70%
Martinoni Road	100	85	Greater than 100%
Private Driveways to Reservoir Sites	100	10	Greater than 1,000%
Fallon Two Rock Road	100	400	20%

Source: Harland Bartholomew & Associates, Inc. November, 1995

Notes:
1 Lists only roadway segments where impact is greater than 10%.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Operation and Maintenance

Less than Significant; Alternatives 2 and 3.

Operation and maintenance of the storage reservoirs will generate fewer than 20 trips per month. These trips are less than 10 percent of the existing traffic on the primary access road.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.* No feasible mitigation has been identified.

Alternatives 1, 4, and 5. No mitigation is needed.

Table 4.11-12

Reservoir Construction Materials Importation Volumes, Haul Distance from Quarries, Truck Trips, Days of Haulage (1)

Reservoirs	Valley Ford	Carroll Road	Bloomfield	Huntley	Two Rock	Adobe Road	Lakeville	Tolay Extended	Tolay Confined	Sears Point	Assumed Quarry Source
Filter/Drain Material											
Volume (CY) (5)	144,000	123,000	189,000	180,000	98,000	180,000	47,000	96,000	430,000	100,000	San Rafael Rock
Haul Truck Trips (2)	9,800	8,200	11,267	10,667	6,533	12,000	3,133	6,533	30,000	6,667	San Rafael
Average Haul Distance (3) (5) (From Quarry)	36	35	34	32	28	23	18	20	20	16	
Riprap Rock											
Volume (CY) (5)	85,000	54,000	79,000	70,000	39,000	68,000	18,000	32,000	139,000	37,000	Syar
Haul Truck Trips (2)	5,417	4,500	6,583	5,833	3,250	6,867	1,500	2,067	11,583	3,083	Lake Herman
Average Haul Distance (3) (5) (From Quarry)	51	50	49	48	45	36	26	28	29	23	
Downstream Slope Protection Rock											
Volume (CY) (5)	27,000	24,000	33,000	32,000	18,000	33,000	7,000	12,000	56,000	14,000	Syar
Haul Truck Trips (2)	2,250	2,000	2,750	2,667	1,500	2,750	583	1,000	4,583	1,187	Lake Herman
Average Haul Distance (3) (5) (From Quarry)	51	50	49	48	45	36	26	29	29	23	
Moisture Barrier											
Volume (CY) (5)	None	None	None	None	None	None	None	None	None	190,000	San Rafael Rock
Haul Truck Trips (2)										12,667	San Rafael

Table 4.11-12

Reservoir Construction Materials Importation Volumes, Haul Distance from Quarries, Truck Trips, Days of Haulage (1)

Reservoirs	Valley Ford	Carroll Road	Bloomfield	Huntley	Two Rock	Adobe Road	Lakeville	Tolay Extended	Tolay Confined	Sears Point	Assumed Quarry Source
Average Haul Distance (3) (5) (From Quarry)										18	
Bentonite Clay											
Volume (CY) (5)	30,400	None	44,000	None	None	None	None	None	None	None	Vallejo Rail Yard
Haul Truck Trips(2)	2,027	--	2,933								
Average Haul Distance (3) (5) (From Quarry)	50	--	50								
Total Truck Trips	17,267	14,700	20,600	19,167	11,283	20,417	5,217	10,200	48,167	23,583	
Total Days of Haulage (4)	194	147	236	192	113	204	52	102	462	236	

Source: Parsons Engineering Science, Inc., 1996

(1) All Data Based on 1% Project.

(2) Truck Haul Trips Based on 15 CY/Truck for Filter/Drain Material and Moisture Barrier Material and 12 CY/Truck for Rock Materials

(3) Truck Haul Distance Based on Distance from Assumed Quarries to Reservoir Sites

(4) Working Days of Haulage Based on 100 Truck Trips per Day.

(5) Volumes of Import Materials, and Distance to Individual Quarries, Provided by Rust Environment & Infrastructure.

Impact: **11.5.2-6. Will the construction or operation of the storage reservoir component have traffic impacts based on evaluation criteria 2 through 6?**

Analysis: *No Impact; All Alternatives.*

No lane closures will be required for reservoir construction.

Construction of the storage reservoirs and associated facilities will include hauling of heavy equipment to the construction site, hauling of rock to the site, and commute trips by the construction crew. This activity will cause congestion and safety concerns at the access road intersections and interfere with local residential roadway access. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain an Encroachment Permit and Transportation Permit to regulate ingress and egress from the construction site, thus reducing any potential hazards.

There will not be any parking impacts associated with construction of the reservoirs. Sufficient land exists at each site within the designated construction zone to accommodate all parking needs during construction.

Construction or maintenance operations will result in heavy vehicles on roadways not designated or suitable as truck routes. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain a Transportation Permit prior to using non-designated roadways; this Permit controls signage, timing, and the need for flag persons along the roadway.

Heavy vehicles used in the construction process will damage Project area roadways. The City has agreed to restore all roadways, public and private, to existing conditions or better.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: No mitigation is needed.

Pump Station Component

Intermediate pump stations along the storage transmission and irrigation distribution pipelines will be constructed on parcels adjacent to public roads and connected to the pipelines in the public right-of-way. Electrical services will need to be provided to all proposed pump stations. Although most of the pump stations can be served from existing

electrical distribution lines running along public right-of-ways, new electric distribution lines and new substations will need to be constructed for some pump stations. The transportation impacts associated with pump stations are included in Table 4.11-13.

Table 4.11-13

Transportation Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.6.1. Will pump station component traffic cause congestion along access roads?	Greater than 10% increase	Less than 10%	C, O&M	○
11.6.2. Will lane closures due to pump station component construction cause traffic delays, transit delays, restricted access, increased traffic hazards, and	a. Greater than 0 miles not in compliance with standard transportation procedures	None	C	==
rerouting of traffic, including emergency vehicles?	b. Greater than 1 month over 1 mile segment	None	C	==
11.6.3. Will pump station component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C, O&M	==
11.6.4. Will pump station component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C, O&M	==
11.6.5. Will there be inadequate parking for pump station component activities?	Any on-street parking	None	C, O&M	==
11.6.6. Will pump station component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C, O&M	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance codes:
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **11.6.1. Will the pump station component cause traffic congestion along access roads?**

Analysis: *Less than Significant; Alternatives 2, 3, and 4.*

Construction of pump stations will require both construction workers and heavy equipment. The major construction activities associated with the pump stations that will increase congestion on access roads consist of the mobilization of construction equipment, construction of new electrical substations and polelines to serve some pump stations, construction of pump station buildings, installation of mechanical and electrical equipment, installation of above-grade steel storage tanks, and construction employees. Maximum construction trips will be 24 trips per day. The daily peak activity of construction equipment and employee trips along major affected roadways is not expected to increase traffic greater than 10 percent.

Operation and maintenance of the pump stations will generate less than 20 trips per month. These trips are less than 10 percent of existing traffic on the access roads.

No Impact; Alternatives 1 and 5.

Alternatives 1 and 5 do not have a new pump station component.

Mitigation: No mitigation is proposed.

Impact: **11.6.2 - 6. Will construction and operation of the pump station component have traffic impacts based on evaluation criteria 2, 3, 4, 5 and 6?**

Analysis: *No Impact; All Alternatives.*

Most pump stations are located on newly purchased small lots adjacent to public roads, and construction will not require closure of part or all of one lane of traffic. Some of the new electric distribution lines will run along a public road for several thousand feet, and construction will require closure of part or all of one lane of traffic. Construction of the Geysers pump stations and substation along Pine Flat Road will require closure of Pine Flat Road for short periods. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require access to be provided for residents and emergency vehicles and to minimize the disruption to through-traffic.

Construction of the pump stations will include hauling of heavy equipment and materials to the construction site and commute trips by the construction crew. This activity could cause safety concerns at the construction access points to the public road. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain an Encroachment Permit and Transportation Permit to regulate ingress and egress from the construction site, thus reducing any potential hazards.

Heavy vehicles used in the construction process will damage Project area roadways. The City has agreed to restore all roadways, public and private, to existing conditions or better.

Standard Traffic Control Procedures 2.2.22, Park within Construction Easements, requires that all construction equipment and construction worker vehicles be parked within the construction easements.

Heavy vehicles used in the construction process will travel on non-designated truck routes. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain a Transportation Permit prior to using non-designated roadways; this Permit controls signage, timing, and the need for flag persons along the roadway.

Alternatives 1 and 5 do not have a new pump station component.

Mitigation: No mitigation is needed.

Table 4.11-14

Transportation Impacts by Component - Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Potential Type of Impact[1]	Level of Significance[2]
11.7.1. Will agricultural irrigation component traffic cause congestion along access roads?	Greater than 10% increase	Less than 10%	C, O&M	○
11.7.2. Will lane closures due to agricultural irrigation component construction, cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?	Greater than 0 miles	None	C	==
	Greater than 1 month over 1 mile segment	None	C	==
11.7.3. Will agricultural irrigation component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C, O&M	==
11.7.4. Will agricultural component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C, O&M	==
11.7.5. Will there be inadequate parking for agricultural irrigation component activities?	Any on-street parking.	None	C, O&M	==
11.7.6. Will agricultural irrigation component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C, O&M	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:

C Construction

O&M Operation and Maintenance

2. Level of Significance codes:

○ Less than significant impact; no mitigation proposed

== No impact

Impact: **11.7.1. Will agricultural irrigation component cause traffic congestion along access roads?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

Construction of agricultural irrigation areas will require both construction workers and heavy equipment. The major construction activities associated with agricultural irrigation that will increase congestion on roads consists of the mobilization of construction equipment and construction employees. The daily peak activity of construction equipment and employee trips along major affected roadways is not expected to increase traffic greater than 10 percent. Maximum daily construction trips will be 24 trips per day.

Operation and maintenance of the agricultural irrigation component will generate a small number of additional trips. These trips are estimated to be less than 10 percent of existing traffic on the access roads.

No Impact; Alternatives 1, 4, and 5.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Impact: **11.7.2-6. Will operations and maintenance of the agricultural irrigation component have traffic impacts based on evaluation criteria 2 through 6?**

Analysis: *No Impact; All Alternatives.*

No new pipelines are required within the public right-of-way, and therefore, no lane closures are expected with the construction of agricultural irrigation areas.

Components in a typical agricultural field layout can be accommodated on the irrigated parcel.

Heavy vehicles used in the construction process could damage affected roadways. The City has agreed to restore all roadways, public and private, to existing conditions or better. No traffic hazards are expected.

Adequate construction parking can be provided on site. Parking for personnel involved in operation of irrigation systems on private farms or

ranches will be accommodated on private property, similar to existing farming activity.

Construction and operation of the agricultural irrigation systems will utilize heavy equipment in the same manner as the existing farms and ranches.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No mitigation is needed.

Geysers Steamfield Component

Table 4.11-15

Transportation Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.8.1. Will geysers steamfield component traffic cause congestion along access roads?	Greater than 10% increase	Greater than 10% Less than 10%	C O&M	● ○
11.8.2. Will lane closures due to geysers steamfield component construction, cause traffic delays, transit delays, restricted access, increased traffic hazards, and rerouting of traffic, including emergency vehicles?	a. Greater than 0 miles not in compliance with standard transportation procedures	None	C	==
	b. Greater than 1 month over 1 mile segment	None	C	==
11.8.3. Will geysers steamfield component construction traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C	==
11.8.4. Will geysers steamfield component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C, O&M	==
11.8.5. Will there be inadequate parking for geysers steamfield component activities?	Any on-street parking	None	C, O&M	==

Table 4.11-15

Transportation Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.8.6. Will geysers steamfield component construction activities result in heavy vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C, O&M	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance codes:
● Significant impact before and after mitigation
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **11.8.1. Will the Geysers steamfield component cause traffic congestion along access roads?**

Analysis: ***Construction***

Significant; Alternative 4.

Construction of the geysers steamfield component will require both construction workers and heavy equipment. The major construction activities associated with the geysers steamfield that will increase congestion on access roads are mobilization of construction equipment, construction of the geysers tank site, delivery of storage tanks, and construction employees. The daily peak activity of construction equipment and employee trips is expected to generate 195 trips per day along Pine Flat Road, greater than 10 percent of existing traffic.

No Impact; Alternatives 1, 2, 3, and 5.

Alternatives 1, 2, 3, and 5 do not have a geysers steamfield component.

Operation and Maintenance

Less than Significant; Alternative 4.

Operation and maintenance of the geysers steamfield component will generate fewer than 20 trips per month on Pine Flat Road. These trips are estimated to be less than 1 percent of existing traffic on the access roads.

No Impact; Alternatives 1, 2, 3, and 5.

Alternatives 1, 2, 3, and 5 do not have a geysers steamfield component.

Mitigation: *Alternative 4.* No feasible mitigation has been identified.

Alternatives 1, 2, 3, and 5. No mitigation is needed.

Impact: 11.8.2-6. Will construction and operation of the geysers steamfield component have traffic impacts based on evaluation criteria 2 through 6?

Analysis: *No Impact; All Alternatives.*

Some public and/or private roadways may be temporarily closed during construction. The City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require access to be provided for residents and emergency vehicles and to minimize the disruption to through-traffic.

Heavy vehicles used in the construction or operation process could damage Project area roadways. The City has agreed to restore all roadways, public and private, to existing conditions or better.

No traffic hazards are expected.

Parking for construction and operation personnel could be accommodated within the geysers area.

Heavy vehicles used in the construction process could travel on non-designated truck routes. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain a Transportation Permit prior to using non-designated roadways; this Permit controls signage, timing, and the need for flag persons along the roadway.

Alternatives 1, 2, 3, and 5 do not have a geyser steamfield component.

Mitigation: No mitigation is needed.

Discharge Component

Table 4.11-16

Transportation Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
11.9.1. Will the discharge component traffic cause congestion along access roads?	10% increase in traffic	Less than 10%	C, O&M	❍
11.9.2. Will lane closures due to discharge component construction, delay traffic, delay transit services, restrict access, increase hazards, and reroute traffic, including emergency vehicle?	a. Greater than 0 miles not in compliance with standard transportation procedures	None	C	==
	b. Greater than 1 month over 1 mile segment	None	C	==
11.9.3. Will discharge component traffic increase traffic hazards to motor vehicles, bicyclists, or pedestrians?	Greater than 0 locations	None	C	==
11.9.4. Will discharge component construction traffic damage public or private roadbeds?	Greater than 0 miles	None	C, O&M	==
11.9.5. Will there be inadequate parking for discharge component activities?	Any on-street parking	None	C, O&M	==
11.9.6. Will discharge component construction activities result in heavy construction vehicles on roadways not designated or suitable as truck routes?	Greater than 0 roadways	None	C, O&M	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:

1. Type of Impact:
   - C — Construction
   - O&M — Operation and Maintenance
2. Level of Significance:
   - ❍ — Less than significant impact; no mitigation proposed
   - == — No impact

Impact: **11.9.1. Will the discharge component cause traffic congestion along access roads?**

Analysis: *Less than Significant; All Alternatives.*

Construction of the outfall on the Russian River will require both construction workers and heavy equipment. The major construction activities associated with the outfall that will increase congestion on access roads are mobilization of construction equipment, excavation and construction of the outfall, and construction employees. The daily peak activity of construction equipment and employee trips is expected to generate less than 36 trips per day on affected roadways, less than 10%.

Operation and maintenance of discharge facilities will generate fewer than 20 trips per month. These trips are less than 10% of existing traffic on the access roads.

Mitigation: No mitigation is proposed.

Impact: **11.9.2 - 6. Will construction and operation of the discharge component have traffic impacts based on evaluation criteria 2 through 6?**

Analysis: *No Impact; All Alternatives.*

The discharge facilities to be constructed along the Russian River will be on private property and no road closures will be required.

The construction of the discharge facilities will include hauling of heavy equipment to the construction site and commute trips by the construction crew. This activity could cause congestion and safety concerns at the access road intersection and interfere with local residential roadway access. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These regulations require the City to obtain an Encroachment Permit to regulate ingress and egress from the construction site, thus reducing any potential hazards.

Heavy vehicles used in the construction or operation process could damage Project area roadways. The City has agreed to restore all roadways, public and private, to existing conditions or better.

There should not be any parking impacts associated with construction of the discharge facilities. Sufficient land exists within the designated construction zone to accommodate all parking needs during construction of the Project.

Heavy vehicles used in construction or operation could travel on non-designated truck routes. However, the City has agreed to conduct construction in accordance with existing regulations as outlined in the Standard Traffic Control Procedures. These procedures require the City to obtain a Heavy Vehicle Permit prior to using non-designated roadways; this Permit controls signage, timing, and the need for flag persons along the roadway.

Alternative 1, does not have a discharge component.

Mitigation: No mitigation is needed.

CUMULATIVE IMPACTS

There are three impacts -- either less than significant or significant -- identified in the Transportation section:

Impact: **11.1C. Will the Project plus cumulative projects cause congestion on access roads?**

Analysis: Construction of the storage reservoirs and primary transmission pipelines will occur around the year 2000; distribution pipelines and pump stations will continue to be constructed over the next 15-20 years as the buildout of the general plans requires more agricultural irrigation. Construction of the Geysers and discharge alternative will take place around the year 2000. Traffic in the Project area will continue to increase over this time period, including even the outlying areas near the storage reservoirs and agricultural irrigation areas. The point of significance for traffic congestion has been set very low at a 10 percent increase over existing traffic. Although a comprehensive cumulative traffic scenario has not been developed for every affected roadway, virtually all affected roadways have been identified as significant, and cumulative impacts will not change that determination.

Impact: **11.2C. Will the Project plus cumulative projects cause lane closures longer than 1 month over a 1-mile segment?**

Analysis: Large construction projects on the cumulative Project list which may overlap with the Long-Term Project are the storage reservoirs for

Healdsburg, Petaluma, and the Sonoma County Airport; pipelines to agricultural irrigation areas for Petaluma, Windsor, and Guerneville, and several major road and utility improvements (for example, replacement of a bridge on Chalk Hill Road, reconstruction of Adobe Road, and shoulder widening of Graton Road). The Healdsburg and Sonoma County Airport reservoirs are due to be constructed by the end of 1997, prior to the start of construction of the Long-Term Project. The pipelines to the proposed Petaluma reservoir and agricultural irrigation areas overlap Long-Term Project pipelines for 4-5 miles on Lakeville Highway, Browns Lane, South Ely Road, Frates Road, and South Adobe Road. Timing of construction of the Petaluma project is uncertain due to the controversial nature of the project, and could conceivably overlap with the Long-Term Project. Though the overlap of construction projects is extremely unlikely, if they do occur on the same roads during the same time period, the City of Santa Rosa should coordinate with the City of Petaluma so that lane closures are kept to a minimum.

Impact: **11.4C. Will the Project plus cumulative projects cause damage to public or private roadbeds?**

Analysis: The Project impact is significant or less than significant only in the case of a pipeline rupture. Such an impact is localized and temporary and not subject to cumulative impacts from other projects.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION

Table 4.11-17

Summary of Significant Impacts and Mitigation Measures

Impact	Level of Significance	Mitigation
Pipeline Component		
11.4.1. The pipeline component may cause congestion along access roads.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	No feasible mitigation has been identified.
11.4.2. Lane closures due to construction of the pipeline component construction may delay traffic, delay transit services, restrict access, increase hazards, and reroute traffic, including emergency vehicles..	Alt 2 - ● Alt 3 - ● Alt 4 - ● Alt 5A - ●	No feasible mitigation has been identified.

Table 4.11-17

Summary of Significant Impacts and Mitigation Measures

Impact	Level of Significance	Mitigation
11.4.4. The pipeline component may cause damage to public or private roadbeds.	Alt 4 - ●	No feasible mitigation has been identified.
Storage Reservoir Component		
11.5.1. The storage reservoir component may cause congestion along access roads.	Alt 2 - ● Alt 3 - ●	No feasible mitigation has been identified.
Geysers Steamfield Component		
11.8.1. Traffic from construction or the Geysers steamfield component may cause congestion along access roads.	Alt 4 - ●	No feasible mitigation has been identified.

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:

● Significant impact before and after mitigation

⊙ Significant impact before mitigation; less than significant impact after mitigation

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.11-18

Summary of Impacts by Alternative - Transportation

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	==	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	○	○	○	○	○	○	○	○	○	○	○	○
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	●	●	●	●	●	●	●	●	●	●	●	--
Storage Reservoirs	--	●	●	●	●	●	●	●	●	●	--	--	--
Pump Stations	--	○	○	○	○	○	○	○	○	○	○	--	--
Agricultural Irrigation	--	○	○	○	○	○	○	○	○	○	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	●	--	--
Discharge	--	○	○	○	○	○	○	○	○	○	○	○	○

Source: Harland Bartholomew & Associates, inc., 1996

Notes: Level of Significance Codes

-- Not applicable

== No impact

○ Less than significant impact; no mitigation proposed

● Significant impact before and after mitigation

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparer

Dan Grayuski, Harland Bartholomew & Associates, Inc.

Reviewers

Jeff Allen, DeLeuw Cather & Co.
Gary Black, Barton Aschman Associates, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Patricia I. Collins, Harland Bartholomew & Associates, Inc.
John Cummings, Ph.D. Peer Review Committee
David Ziegler, Peer Review Committee

References

HBA Team Documents

Parsons Engineering Science, Inc. 1996. *Alternative Project Facilities Plans.* (Appendix D-32).

Other References

City of Santa Rosa Department of Community Development. 1991. *City of Santa Rosa General Plan.* July. Amendments to November, 1994.

City of Sebastopol, Transportation. 1994. *General Plan.* May 31.

County of Marin. 1994. *Marin Countywide Plan, Transportation Element.* Adopted - January, 1994.

County of Sonoma, California. 1995. *County of Sonoma, Traffic Volumes.* February 7.

L.S.A. 1991. *Santa Rosa Subregional Sludge Beneficial Use Project EIR.*

Marin Congestion Management Agency. 1995. *Draft 1995 Congestion Management Program.* May.

Sonoma County Planning Department. 1989. *Sonoma County General Plan, Circulation and Transit Element.* March 23. Revisions to April 9, 1991.

Sonoma County Transportation Authority. 1993. *Sonoma County Congestion Management Program 1993 Update, Final Report.* December 7.

State of California, Department of Transportation. 1995. *1994 Traffic Volumes on State Highways.* May.

Consultation and Coordination

Persons Contacted

Eugene Benton, City of Santa Rosa Public Works Department. pers. comm. August 1995.

Mary Jo Yung, City of Santa Rosa Public Works Department. pers. comm. August 1995.

Daniel Carlson, City of Santa Rosa Utilities Department. pers. comm. May 1995.

John Cossey, Sonoma County Permit and Resource Management - Permit Division. pers. comm. July 1995

Mike Sadjadi, County of Marin, Department of Public Works. pers. comm. August 1995.

Bob Shepard, State of California, Department of Transportation, Transportation Permits. pers. comm. November 1995.

Ed Nail, State of California, Department of Transportation, Encroachment Permits. pers. comm. May 1995.

Sue Kelly, City of Sebastopol, Public Works Department. pers. comm. August 1995.

Ed Walker, Sonoma County Department of Public Works. pers. comm. August 1995.

Melinda Grosch, Sonoma County Transportation Authority. pers. comm. August 1995.

Correspondence

Parsons Engineering Science, Inc. 1995a. *Construction Related Impacts on Transportation Corridors Memorandum.* July 5. (Appendix N-1).

Parsons Engineering Science, Inc. 1995b. *Construction Impacts Memorandum.* August 6. (Appendix N-3).

Parsons Engineering Science, Inc. 1995c. *Construction Impacts Memorandum.* August 7. (Appendix N-4).

Parsons Engineering Science, Inc. 1995d. *Construction Related Impacts on Transportation Corridors and Air Quality Memorandum.* October 27. (Appendix N-6).

Parsons Engineering Science, Inc. 1995e. *Time to Install Pipelines Memorandum.* November 16. (Appendix N-7).

Parsons Engineering Science, Inc. 1995f. *Truck Trips to Import Materials for Dam Construction.* December 5. (Appendix N-9).

John Cossy, Engineering Technician III, Sonoma County Permit and Resource Management - Permit Division, Permit Number 18471, July, 1995.

Eugene Benton, Deputy Director & City Traffic Engineer, City of Santa Rosa Public Works Department, Meeting, August, 1995.

Andy Placido, Principal, Marks Traffic Data Service, Traffic Data Collection, July, 1995.

Mietek Mieczko, Principal, Marks Traffic Data Service, Traffic Data Collection, August, 1995.

Bob Shepard, State of California, Department of Transportation, Meeting, November, 1995.

Parsons Engineering Science, Inc., Response to Comments on Construction Related Impacts on Transportation Corridors Memorandum, July 31, 1995.

Parsons Engineering Science, Inc., Response to Questions Regarding Construction Activities for Pipelines, November 14, 1995.

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4.12 AIR QUALITY

This section discusses the Project's potential to generate emissions that exceed threshold levels, screening trigger levels, and risk assessment thresholds. The potential for creation of odors and violations of air quality permits for the geysers operation is also discussed. Background information on air quality regulations and ambient air quality standards is presented to provide a context for a discussion of existing air quality in the Project area. Topography and meteorology are discussed because they affect local air quality. Existing emissions at the Laguna Plant and at the geysers are summarized.

IMPACTS EVALUATED IN OTHER SECTIONS

All impacts relating to air quality are discussed in this section.

AFFECTED ENVIRONMENT (SETTING)

Regulatory Context

Pursuant to the Federal Clean Air Act of 1970 and subsequent revisions, the U.S. Environmental Protection Agency (EPA) established ambient air pollutant concentration standards and maximum allowable emission rates for certain individual sources of air pollutants. Air quality is controlled through the attainment of ambient standards and enforcement of emission limits. A system also was set up in which EPA made each state responsible for attaining air quality standards within its borders. Under the state programs, individual facilities generally are required to obtain permits to construct new or modified facilities and to operate such facilities. Specific emission limits for various equipment and facility types need to be met.

National Ambient Air Quality Standards have been established for six air pollutants: ozone, carbon monoxide, particulate matter less than ten microns in diameter (also referred to as PM_{10}), nitrogen oxides, lead, and sulfur dioxide. These six air pollutants are termed "criteria" pollutants because the standards established for them were based upon documented human health criteria. Primary standards for air pollutants were established to protect public health, while secondary standards were established to protect the public welfare by preventing impairment of visibility and damage to vegetation and property. Annual average standards are never to be exceeded. Short-term standards (e.g., 1-hour and 24-hour averages) are not to be exceeded more than once a year. The 1977 Amendments to the Clean Air Act required that each state identify areas within its borders that did not meet the national ambient air quality standards and develop and obtain EPA approval of a State Implementation Plan that demonstrates how the state will attain national ambient air quality standards.

Major amendments to the Clean Air Act were signed into law on November 15, 1990. These amendments prescribe new planning requirements and attainment deadlines for

areas that do not attain national ambient air quality standards. Procedures and guidelines for conforming with the 1990 Clean Air Act Amendments are continually being prepared and updated by the EPA. The 1990 amendments also directed the EPA to set standards for air toxins and require certain industries to significantly reduce emissions of controlled toxic pollutants. This information is presented in Title 40 of the Code of Federal Regulations.

The California Air Resources Board (the Air Board) coordinates and oversees the activities of California's many single-county and multi-county unified Air Pollution Control Districts and Air Quality Management Districts. The Air Board and the various Air Quality Districts operate numerous air quality monitoring stations throughout the state. Data collected at those stations are used to classify areas and air basins as "attainment" or "nonattainment" for each criteria air pollutant based on whether the ambient air quality standards have been achieved. The Air Board is responsible for incorporating local nonattainment plans into the State Implementation Plan. The Air Board also regulates the amount of pollutants that can be emitted by new motor vehicles sold in California.

The Air Board also has established state ambient air quality standards, many of which are more stringent than the corresponding national ambient air quality standards. In addition to the six criteria pollutants regulated by the Federal Clean Air Act, the Air Board has also established state standards for hydrogen sulfide, sulfates, and vinyl chloride.

An area is designated to be in nonattainment for a certain pollutant if violations of the applicable standard have occurred in each of the last three years. One violation per year contributes to state designation as nonattainment; federal designation occurs with two or more violations per year.

The California Clean Air Act, which became effective on January 1, 1989, provides a planning framework for attainment of state ambient air quality standards. Local Air Quality Districts in violation of state ambient air quality standards are required to prepare plans for attaining the state standards. The California Clean Air Act provides for the classification of nonattainment air basins into three classes: moderate, serious, and severe. For each class, the California Clean Air Act specifies attainment strategies that must be adopted. For all classes, attainment plans are required to demonstrate a five percent per year reduction in the emissions of nonattainment pollutants or their precursors, unless the Air Board determines that all feasible measures are being employed. Typically, the Air Board makes modifications to these strategies as appropriate to also meet federal requirements.

The California legislature, when it passed the California Clean Air Act, recognized that particulate matter (PM_{10}) attainment was not easily obtained and set requirements that were less strict than for other pollutants. The California Clean Air Act did require the Air Board to produce a report regarding the prospect of achieving the state ambient air quality standard for particulate matter (PM_{10}). The Air Board recommended that certain actions be taken, but did not impose a planning process to require attainment by a certain date.

The Project area includes most of the southern portion of Sonoma County, from the geysers in the north to Sears Point in the south and a small part of northern Marin County. Most of the Project lies in southern Sonoma County, which is part of the San Francisco Bay Area Air Basin. The San Francisco Bay Area Air Basin includes the counties of Napa, Sonoma, Solano, Marin, Contra Costa, San Francisco, Alameda, Santa Clara, and San Mateo and is under the jurisdiction of the Bay Area Air Quality Management District. The northern portion of Sonoma County (primarily north of Healdsburg) lies within the North Coast Air Basin. The geysers steamfield, and a portion of the pipeline leading to it, are the only Project components within the North Coast Air Basin. This portion of Sonoma County is under the jurisdiction of the Northern Sonoma County Air Pollution Control District. Table 4.12-1 shows the attainment/nonattainment status of Sonoma County for the various criteria pollutants. The majority of the Project area has been designated as nonattainment for ozone and particulate matter (PM_{10}) on the state level. The San Francisco Bay Area Air Basin is currently in nonattainment for carbon monoxide on the federal level; however, no violations of the 8-hour average standard have occurred since 1991. The Bay Area Air Quality Management District has applied to EPA for redesignation to attainment status for carbon monoxide.

Table 4.12-1

Sonoma County Designations

Pollutant	San Francisco Bay Area Air Basin		North Coast Air Basin	
	State	Federal	State	Federal
Ozone	N	A	A	A
Carbon Monoxide	A	N	A	A
Nitrogen Dioxide	A	A	A	A
Sulfur Dioxide	A	A	A	A
Particulate Matter (PM_{10})	N	U	N	U
Sulfates	A	NA	A	NA
Lead	A	NA	A	NA
Hydrogen Sulfide	U	NA	A/U[1]	NA
Visibility Reducing Particles	U	NA	U	NA

Source: Bay Area Air Quality Management District, Improving Air Quality Through Local Plans and Programs, October, 1994 and telephone conversation with Shawn Connelly with the Northern Sonoma Air Pollution Control District, July 18, 1995

Notes:
A - attainment
N - nonattainment
U - unclassified
NA - not applicable (no standard for this pollutant)
1 Geyser Geothermal Area - A, Remainder of northern Sonoma County - Unclassified

Effects of Non-Attainment Constituents

Ozone is considered to be the main constituent of smog. Complex photochemical reactions between reactive organic gases and nitrogen oxides in the presence of sunlight produce ozone. Major sources of reactive organic gases and nitrogen oxides in the Project air basins are motor vehicles and stationary source combustion processes. Direct effects of ozone include aggravation of respiratory diseases, eye irritation, visibility reduction and vegetation damage.

Particulate matter (PM_{10})of all sizes may be made up of several types of particles, including dust, smoke, ash, mist, and fumes. Sources of particulate matter include combustion of fuels, agricultural practices, construction activities, road dust, industrial processes, along with natural sources such as wind-blown dust. The majority of particulate matter generated in the Project area is caused by kicking up of road dust by tires and wind blown dust. Extended exposure to particulates can cause and aggravate respiratory diseases and severely limit visibility.

Carbon monoxide is a product of incomplete combustion of fossil fuels. The largest source of carbon monoxide is motor vehicles. Emissions are highest when vehicles are idling or traveling at slow speeds. Other sources are utility and industrial fuel combustion, forest fires, and open burning. Exposure to high levels of carbon monoxide can cause headaches and dizziness. It can also aggravate cardiovascular disease.

Plans to Reach Attainment

In 1994, the Bay Area Air Quality Management District updated the Bay Area Clean Air Plan as required by the California Clean Air Act. The Clean Air Plan contains specific measures to reduce ozone and carbon monoxide air pollution in an attempt to reach attainment of standards for these pollutants (The area was redesignated as an attainment area for carbon monoxide in November 1994 on the state level and redesignation on the federal level is expected in 1996 or 1997). Although the Clean Air Plan does not yet directly address the problem of particulate matter (PM_{10}), the measures taken by the plan to reduce ozone and carbon monoxide will, in turn, reduce the factors contributing to particulate matter. The Clean Air Plan aims to reduce ozone and carbon monoxide emissions by implementation of control measures which will provide an overall reduction in emissions from permitted sources and by implementation of transportation control measures which will provide an overall reduction in the use of single-passenger commuter vehicles and consequent air pollution from motor vehicles on the highways. The Bay Area Air Quality Management District's goal is to obtain state ozone standard attainment by 1997. Maintenance Plans have been developed to show how the Bay Area will maintain attainment of federal ambient air quality standards.

Since the portion of the North Coast Air Basin under the jurisdiction of the Northern Sonoma Air Pollution Control District is in attainment for all air pollutants, except the state standard for particulate matter (PM_{10}), no specific planning has been required.

Factors Affecting Local Air Quality

The primary factors affecting local air quality are the location of air pollutant sources and the amount of pollutants emitted, but topographical and meteorological conditions are also important. Atmospheric conditions such as wind speed, wind direction and air temperature gradients interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. Another important factor is the Pacific Ocean, which moderates temperatures and helps create consistent wind gradients.

Topography and Meteorology

Topography

From an airshed perspective, much of the Project pipelines and irrigation area lies primarily within two valleys (Santa Rosa and Petaluma). The Santa Rosa Plain covers the northern portion of the Project (from the City of Cotati to the geysers), while the southern portion of the Project (West and South County Alternatives) lies within the Petaluma Valley. These valleys are bordered on the east side by the Sonoma Mountains. On the west side, there are a series of low hills followed to the south by lowlands, called the Petaluma Gap. Many of the proposed reservoirs will be located in the low hill areas.

Temperature

Vertical temperature gradients influence the stability of the atmosphere and vertical mixing of air pollutants. A temperature inversion, which is a layer of warm air above a cooler layer of air, acts as a nearly impenetrable lid. Inversions severely limit vertical mixing of the atmosphere and thus decrease the vertical dilution of near-surface air pollutant emissions. The strongest inversions in the Project area occur during the fall, significantly contributing to high ozone and other air pollutant concentration levels.

As a result of these inversions, emissions in the Petaluma Valley are more likely to stay in the west and south county areas during the summer and fall months. The Santa Rosa Plain, which is farther inland and is less affected by the ocean, is more likely to have inversions and higher pollutant levels in the fall and winter months.

Horizontal temperature gradients create wind flows that disperse air pollutants. Horizontal temperature gradients are greater near the coast due to differential heating between land and water surfaces. This effect is diminished inland in proportion to the distance from a large body of water (e.g., the Pacific Ocean and

San Pablo Bay). The Petaluma Valley portion of the Project area can experience fairly large horizontal temperature gradients as a result of the Petaluma Gap, even though it is not a coastal location. Horizontal temperature gradients are less severe in the Project area located in the Santa Rosa Plain because of the diminishing effects of the ocean on sites farther inland. Therefore, the Santa Rosa Plain has the potential for higher pollutant levels than the Petaluma Valley.

Temperature can also play an important role in the production of pollutants. Motor vehicles and equipment run less efficiently and produce more pollutants when temperatures are lower. Ozone is produced when hydrocarbons and nitrogen oxides react in the presence of sunlight and warm temperatures. Based on temperature, the Cotati Valley portion of the Project area has a higher pollution potential than the Petaluma Valley portion because it has warmer summer and colder winter temperatures.

In general, the Project area temperatures range from 50-85 degrees Fahrenheit in the summer and 35-65 degrees Fahrenheit in the winter, depending on the time of day (Bay Area Air Quality Management District 1994).

Precipitation

When precipitation occurs, air pollutants can be washed out of the atmosphere. In the absence of precipitation, long periods of dry weather aggravate the problem of wind blown dust, resulting in generation of particulate matter (PM_{10}).

Precipitation data from the Santa Rosa and Petaluma monitoring stations show that the rainy season primarily occurs between November and March. The months with the heaviest precipitation levels are January and December. Very little rainfall is observed during the rest of the year. The annual average precipitation for the Petaluma area is approximately 24 inches. The annual average rainfall for the Santa Rosa area is approximately 30 inches. The Santa Rosa area receives more rainfall because of its proximity to the Sonoma Mountains (Bay Area Air Quality Management District 1994).

Wind

Light winds limit the dilution of air pollutants as they disperse downwind from their source. Air pollutants can accumulate, especially in sheltered valleys, when light winds combine with reversals of wind direction between daytime and nighttime air flows, or when calm conditions persist for extended periods.

Wind patterns in the Project area are strongly influenced by the topography. As marine air travels eastward through the Petaluma Gap, it splits into two directions - one northward towards Santa Rosa and one southward towards San Pablo Bay. As a result, the predominant wind direction in Petaluma is from the northwest, while the predominant wind direction in Santa Rosa is from the south or southwest.

The annual average wind speed in Petaluma is 7 mph, while the annual average is slightly lower in Santa Rosa at 5 mph (Bay Area Air Quality Management District 1994). The fastest winds generally occur during the spring and summer months when horizontal temperature gradients are the greatest between coastal and inland areas.

Existing Air Quality

The Air Board compiles ambient air quality data from monitoring stations in the state. As noted previously, the study area has some portions of its land under the jurisdiction of the Northern Sonoma Air Pollution Control District, while the majority of the area is under the jurisdiction of the Bay Area Air Quality Management District. The Bay Area Air Quality Management District operates a monitoring station in Santa Rosa that collects most gaseous and particulate pollutants. This station, however, does not monitor for particulate matter (PM_{10}). The Bay Area Air Quality Management District also operates an ozone monitoring station in Sonoma. The Northern Sonoma Air Pollution Control District only monitors for particulate matter within Sonoma County at sites located at Guerneville, Healdsburg, and Cloverdale. The Healdsburg site lies within the northern portion of the Project area.

Exceedence of the most stringent standard and the maximum concentration for monitored pollutants in the Project area are summarized in Table 4.12-2. Most of the available data come from the station located in Santa Rosa. Data from this station for regional pollutants such as ozone are representative of the whole Project area. It is likely that the levels of localized pollutants, such as carbon monoxide, in the Project area are reduced from the levels measured at the Santa Rosa station because the station is located in downtown Santa Rosa. All pollutants monitored at the Santa Rosa station were below the applicable federal and state standards. However, PM_{10} levels monitored at the Healdsburg station show exceedences of state standards. The federal standards for PM_{10} were not exceeded.

Existing Emissions at the Laguna Plant

Existing air emissions from the Laguna Plant come primarily from operation of the internal combustion engines and two of the processes (the liquid and solid process flows). Table 4.12-3 summarizes emissions from the plant.

The Laguna Plant currently has three internal combustion engines. The primary emissions from the internal combustion engines include carbon monoxide, nitrogen oxides, hydrocarbons, and various hazardous air pollutants (primarily volatile organic compounds). As a worst-case estimate, it was assumed that all three engines will operate 24 hours per day, 7 days per week, and 52 weeks per year.

Emissions projections from the liquid process flow were based on quarterly sampling data taken during 1990-1993 and the Bay Area Sewage Toxics Emissions Model Version

3.0. Emissions from solid process flows were based on a December 1990 AB 2588 emission inventory report (City of Santa Rosa 1990).

In addition to air quality emissions, potential odors are an item of concern at the Laguna Plant. The Laguna Plant has an existing odor control program. Influent to the plant is prechlorinated, and ferrous chloride is also added to reduce odors. Exhaust air from the sludge treatment buildings is scrubbed prior to release to the atmosphere. The odor complaint history for the Laguna Plant was examined for the last five years (1990-1994). A total of 23 complaints were received by the Laguna Plant. The majority of the complaints were received in 1990. The odors which led to about half the complaints were found not to be caused by the Laguna Plant. In cases where the odors were caused by the Laguna Plant, corrective actions were taken to eliminate the odor.

Existing Air Quality at the Geysers

Air quality at the geysers is influenced by activities performed by several different companies. The steamfields primarily emit hydrogen sulfide, particulates, and organic gases. The Northern Sonoma Air Pollution Control District places allowable limits on each unit that emits pollutants at the geysers on a case-by-case basis. The most regulated pollutant is hydrogen sulfide. Emissions typically range from 50 to 80 percent of the allowable limits. In April 1995, there were no permit violations, and no exceedences of ambient air quality standards at the geysers based on monitoring results (Northern Sonoma Air Pollution Control District, pers. comm. July 18, 1995).

Table 4.12-2

Number of Ambient Air Quality Standard Exceedences and 1990-1993 Maximums at Monitoring Stations within the Project Area[1]

Pollutant	Units	Averaging Time	Air Quality Standards		1990		1991		1992		1993	
			State	Federal	Exceedence[2]	Max. Value[3]	Exceedence[2]	Max. Value[3]	Exceedence[2]	Max. Value[3]	Exceedence[2]	Max. Value[3]
Ozone	ppm	1-hour	0.09	0.12	0	0.07	0	0.09	0	0.08	0	0.08
Carbon Monoxide	ppm	1-hour	20	35	0	7.0	0	6.0	0	6.0	0	6.0
		8-hour	9	9	0	5.1	0	4.0	0	4.0	0	3.8
Nitrogen Dioxide	ppm	1-hour	0.25	—[4]	0	0.09	0	0.09[5]	0	0.10	0	0.09[5]
		Annual	—	0.053	NA[6]	0.014	NA	0.014[5]	NA	0.015	0	0.016[5]
Particulate matter (PM_{10})	$\mu g/m^3$	1-hour	50	150	2	57	3	72	0	42	0	43
		Annual Geometric Mean	30	—	NA	16.9	NA	19.1[5]	NA	16.9[5]	NA	16.1[5]
		Annual Arithmetic Mean	—	50	NA	20.5	NA	22.9[5]	NA	18.9[5]	NA	18.2[5]
Sulfates	$\mu g/m^3$	24-hour	25	—	0	6.0	0	6.8	0	6.3	0	10.6
Lead	$\mu g/m^3$	30-day	1.5	—	0	0.04	0	0.03	0	0.02	0	0.12
		Quarter	—	1.5	0	0.03	0	0.02	0	0.01	0	0.05

Source: California Air Resources Board, California Air Quality Data, 1990-1993

Notes:

1. Ozone, carbon monoxide, nitrogen dioxide, sulfates, and lead were monitored at the Santa Rosa - Fifth Street Station. PM_{10} was monitored at the Healdsburg-Matheson Street Station.
2. Number of exceedences of the most stringent standard.
3. Maximum concentration measured during the year.
4. — indicates that no ambient air quality standard has been established.
5. Data represented are valid, but incomplete in that an insufficient number of valid data points were collected to meet EPA and/or CARB criteria for representativeness.
6. NA = Not Applicable

Table 4.12-3

Estimated Existing Air Pollutant Emissions from Operation of the Laguna Plant

Pollutant/Organic Compound	Liquid Process Flow[1]		Solid Process Flow[2]		Internal Combustion Engines[3]		Total	
	(lb/day)	(lb/yr)	(lb/day)	(lb/yr)	(lb/day)	(lb/yr)	(lb/day)	(lb/yr)
Criteria Pollutants								
Nitrogen Oxides	--	--	--	--	362.0	132130.0	362.0	132130.0
Carbon Monoxide	--	--	--	--	1125.0	410625.0	1125.0	410625.0
Hydrocarbons	--	--	--	--	144.0	52560.0	144.0	52560.0
Hazardous Air Pollutants								
Acetaldehyde	--	--	--	--	0.0013	0.5	0.0013	0.5
Acetone	0.3002	109.6	--	--	0.0000	--	0.3002	109.6
Acrolein	--	--	--	--	0.0009	0.3	0.0009	0.3
Benzene	0.0190	6.9	0.0003	0.1	0.0421	15.4	0.0614	22.4
Dichlorobenzene	0.0488	17.8	--	--	--	--	0.0488	17.8
Ethylbenzene	0.0271	9.9	--	--	--	--	0.0271	9.9
Formaldehyde	--	--	--	--	0.0187	6.8	0.0187	6.8
Perchloroethylene	0.5511	201.2	--	--	--	--	0.5511	201.2
Styrene	--	--	--	--	0.0151	5.5	0.0151	21.6
Toluene	0.1152	42.1	0.0014	0.5	0.0538	19.6	0.1704	62.2
Trichloroethene	0.0577	21.1	--	--	--	--	0.0577	21.1
Xylene	0.1937	70.7	0.0016	0.6	0.0190	6.9	0.2143	78.2
Methylene Chloride	0.3274	119.5	0.0500	18.3	0.0256	9.3	0.4030	147.1
1,1,1-Trichloroethane	0.2155	78.7	0.0003	0.1	--	--	0.2158	78.8

Source: Parsons Engineering Science, Inc., 1996

Notes
1. Source of information is Quarterly sampling from January 1990 through 1993 (CH2M Hill 1993)
2. Emissions are a total of AB 2588 report Source Test Data (City of Santa Rosa 1990)
3. Source of information is Permit Application Package to BAAQMD for Authority to Construct the Laguna Advanced Treatment Upgrade Project (CH2M Hill, 1993)
- Not tested for or detected

Air Quality Goals, Objectives, and Policies

Table 4.12-4 identifies goals, objectives, and policies which provide guidance for development in relation to air quality in the Project area. The table also indicates which criteria in the Air Quality Section are responsive to each set of policies.

Table 4.12-4

General Plan Goals, Objectives, and Policies - Air Quality

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Resource Conservation Element	Goal RC-13 Objective RC-13.1 Objective RC-13.2 Policy RC-13d	Preserve and maintain the projected county air quality and minimize air pollution	1-6
Marin Countywide Plan	Environmental Quality Element	Policy EQ-2.75 Program EQ-2.76b Program EQ-2.78a	The County shall adhere to the Federal or State air quality standards, whichever are more stringent, for management of locally generated pollutants, and shall require projects which generate high levels of pollutants to incorporate mitigation in the Project design	1-6
Santa Rosa General Plan	Open Space and Conservation Element	Goal OSC-10 Objective OSC-10a	Continue to meet federal and state standards for air quality and, where possible, maintain air quality superior to those standards	1-6
Petaluma General Plan	Community Health and Safety Element	Objective (n)	Maintain or improve Petaluma's air quality	1-6
Sebastopol General Plan	Conservation, Open Space and Parks Element	Goal 7 Policy 18 Policy 19	Protect and improve air quality by cooperating in implementation of the regional Clean Air Plan and enforcement of air quality standards	1-6
Windsor General Plan	Environmental Resources Element	Policy G.1 Policy G.1.1	Comply with state and federal ambient air quality standards	1-6

Source: Harland Bartholomew and Associates, Inc., 1995

Notes:
1. The evaluation criteria can be found on Table 4.12-5.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

The criteria identified in Table 4.12-5 are used to determine whether the impact of the Project on air quality will be significant. These criteria are based on local rules and regulations and are more stringent, when converted to an annual basis, than de minimis threshold levels specified in the Final Clean Air Act Conformity Rule dated November 30, 1993 (EPA 1993).

Table 4.12-5

Evaluation Criteria with Point of Significance - Air Quality

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will construction of the Project generate emissions that exceed threshold levels?	Emissions of Hydrocarbons, Nitrogen Oxides, Sulfur Dioxide, and Particulates Carbon Monoxide Particulates	Greater than 150 pounds/day for each pollutant Greater than 550 pounds/day Greater than 15 tons/year	Bay Area Air Quality Management District Guidelines for Assessing Impacts of Projects and Plans Northern Sonoma Air Pollution Control District Rules and Regulations
2. Will Project emissions cumulatively exceed allowable limits?	Emissions of Organic Compounds, Nitrogen Oxides, Sulfur Dioxide, Carbon Monoxide, and Particulates	Greater than 10 pounds/day for each pollutant	Bay Area Air Quality Management District Regulation 2 Rule 2 Section 301.2
3. Will Project toxic emissions exceed screening trigger levels?	Emissions of Carcinogens Benzene Dichlorobenzene Perchloroethylene Methylene Chloride Non Carcinogens Ethylbenzene Toluene Xylene 1,1,1-Trichloroethane	 Greater than 6.7 lbs/yr Greater than 68 lbs/yr Greater than 33 lbs/yr Greater than 190 lbs/yr Greater than 193,000 lbs/yr Greater than 38,600 lbs/yr Greater than 57,900 lbs/yr Greater than 61,800 lbs/yr	Bay Area Air Quality Management District Risk Management Policy
4. Will Project toxic emissions exceed risk assessment thresholds?	Cancer risk	Greater than one in a million	Bay Area Air Quality Management District Risk Management Policy

Table 4.12-5

Evaluation Criteria with Point of Significance - Air Quality

Evaluation Criteria	As Measured by	Point of Significance	Justification
5. Will the Project cause potential odors?	Complaints	Greater than ten odor complaints in a 90 day period	Bay Area Air Quality Management District Regulation 7
6. Will the Project cause permit/monitoring violations at the geysers?	Violations	Greater than 0 violations	Northern Sonoma Air Pollution Control District Rules and Regulations

Source: Parsons Engineering Science, Inc. 1996

METHODOLOGY

Headworks Expansion

Expansion of the headworks will increase capacity at the Laguna Plant, allowing the Laguna Plant to operate at an average dry weather flow of 21 mgd, an increase from the existing capacity of 18 mgd. Increases in air quality related emissions will result from the higher liquid and solid process flows. The buildout flow rate without water conservation is 27 mgd. Water conservation reduces the flow rate to 21 mgd, but the same quantity of solids will be treated at the plant as without conservation, i.e., 27 mgd (CH2M Hill 1995). Thus, emissions from liquid process flow were based on 21 mgd, and emissions from solid process flow were based on 27 mgd. Emissions from the liquid process flow were estimated by the Bay Area Sewage Toxics Emissions Model Version 3.0. The model estimates pathway losses through volatilization, sorption, and biodegradation. The solid process flow emissions for 21 mgd are presented in the Permit Application Package to the Bay Area Air Quality Management District for Authority to Construct the Laguna Advanced Treatment Upgrade Project (CH2M Hill 1993). A factor of 27/21 or 1.29 was applied to the results presented in those reports to account for water conservation.

Currently the internal combustion engines operate blowers, which supply air to the aeration basins. After the Advanced Treatment Upgrade Project, the internal combustion engines will be used to run the generator in the Cogeneration Building, which will be used to power the Laguna Plant. Emissions from the internal combustion engines for the Advanced Treatment Upgrade Project were calculated as part of the Permit Application Package to the Bay Area Air Quality Management District for authority to construct (CH2M Hill 1993). There will be some additional air quality emissions generated by the internal combustion engines in order to power the larger capacity pumps that will be installed at the headworks as part of the Long-Term Wastewater Project. However, the

engines will not operate under the Project at levels above the permitted levels specified for the Upgrade Project.

Construction Activities

Air quality related emissions were estimated for several construction related components. These items included dust emissions from wind erosion of exposed soil surfaces, material handling, grading, and entrained and re-entrained dust due to vehicle travel over paved and unpaved roadways, as well as combustion engine emissions from construction equipment and vehicles used to transport material and employees. Typical construction scenarios were developed including the amount of area worked per day, amount of materials handled, number of miles traveled by trucks, and equipment usage.

Emission factors for dust generating activities were calculated using various equations presented in the *Control of Open Fugitive Dust Sources* (EPA 1992) and *Compilation of Air Pollutant Emission Factor, Volume I: Stationary Point and Area Sources* (EPA 1995). The emissions factors are applied to usage units such as vehicle miles traveled, area cleared or exposed, and tons of material handled.

Construction equipment exhaust emissions from fuel combustion were estimated using emission factors presented in EPA's *Nonroad Engine and Vehicle Emission Study* (EPA 1991). These emission factors require information on type of equipment, equipment horsepower and operational hours. Exhaust emission factors for heavy-duty trucks and passenger vehicles used to transport materials and workers to the site were calculated using the California Air Resources Board EMFAC7F mobile source emission factor model. These emission factors are on a per mile basis, are based on travel speed, and were applied to round trip travel distances to the Project site.

Details of the assumptions used, emission factor calculations, and emissions calculations related to construction operations are provided in Appendix O-1.

Odors

The discussion of possible odor complaints in the future due to expanded Laguna Plant operations was based on an evaluation of the history of past odor complaints and the potential of the Project to have additional complaints, measured by the number and type of controls incorporated into the Project to limit emission of odorous compounds.

Environmental Consequences (Impacts) and Recommended Mitigation

No Action (No Project) Alternative

Impact: **12.1.1-6. Will the No Action Alternative impact air quality based on evaluation criteria 1 through 6?**

Analysis: *No Impact; Alternative 1.*

The no action alternative will have no air quality impacts.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Table 4.12-6 provides a summary of air quality impacts associated with the headworks expansion.

The expansion of the Laguna Plant headworks will result in the increase of air quality emissions from liquid and solid process flows only. There will be no change in the operation or emissions of the internal combustion engines, because the engines are part of the Advanced Treatment Upgrade Project, not the Long-Term Project (see Initial Study for Laguna Subregional Wastewater Treatment Plant - Advanced Treatment Upgrade [City of Santa Rosa, 1994]). A table showing the compounds that have an increase in emissions compared to existing conditions including the upgrade Project is provided in Appendix 0-6. Most of the increases are due to increased throughput at the aeration basins.

Table 4.12-6

Air Quality Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance		Impact	Type of Impact[1]	Level of Significance[2]
12.2.1. Will construction of the headworks expansion component generate emissions that exceed threshold levels?	Daily Particulates	Greater than 150 lbs/day	0 lbs	C	==
	Annual Particulates	Greater than 15 tons/year	0 tons	C	==
	Daily Hydrocarbons	Greater than 150 lbs/day	0 lbs	C	==
	Daily Nitrogen Oxides	Greater than 150 lbs/day	0 lbs	C	==
	Daily Sulfur Dioxides	Greater than 150 lbs/day	0 lbs	C	==
	Daily Carbon Monoxides	Greater than 550 lbs/day	0 lbs	C	==
12.2.2. Will headworks expansion component emissions cumulatively exceed allowable limits?	Organic Compounds	Greater than 10 lbs/day	1.2 pounds	O&M	O

Table 4.12-6

Air Quality Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance		Impact	Type of Impact[1]	Level of Significance[2]
	Nitrogen Oxides	Greater than 10 lbs/day	0 pounds	O&M	○
	Sulfur Monoxide	Greater than 10 lbs/day	0 pounds	O&M	○
	Carbon Monoxide	Greater than 10 lbs/day	0 pounds	O&M	○
	Particulates (PM_{10})	Greater than 10 lbs/day	0 pounds	O&M	○
12.2.3. Will headworks expansion component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels				
	Benzene	Greater than 6.7 lbs/yr	3 pounds		○
	Dichlorobenzene	Greater than 68 lbs/yr	5 pounds		○
	Perchloroethylene	Greater than 33 lbs/yr	105 pounds		⊙[3]
	Methylene chloride	Greater than 190 lbs/yr	182		○
	Ethylbenzene	Greater than 193,000 lbs/yr	3 pounds		○
	Toluene	Greater than 38,600 lb/yr	14		○
	Xylene	Greater than 57,900 lbs/yr	20		○
	1,1,1 - Trichloroethane	Greater than 61,800	40		○
12.2.4. Will headworks expansion component toxic emissions exceed risk assessment thresholds?	Cancer risk	Greater than 1/million	0.37/ million	O&M	○

Table 4.12-6

Air Quality Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
12.2.5. Will the headworks expansion component cause potential odors?	Greater than 10 complaints/ 90-day period	Possible odors from sludge	O&M	●
12.2.6. Will the headworks expansion component cause permit/monitoring violations at the geysers?	Greater than 0 violations	--	--	--

Source: Parsons Engineering Science, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
-- Not Applicable

2. Level of Significance:
○ Less than significant impact; no mitigation proposed
● Significant impact before and after mitigation
⊙ Significant impact before mitigation; less than significant impact after mitigation
== No impact)

3. If a compound exceeds trigger levels significance is determined by an evaluation of cancer risk (criterion 4).

Impact: **12.2.1. Will the headworks expansion component exceed emissions threshold levels?**

Analysis: *No Impact; All Alternatives.*

Because no grading or other soil and material handling is required for this component, no construction-related emissions are expected. Therefore, the construction phase has no emissions.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is needed.

Impact: **12.2.2. Will the headworks expansion component cumulatively exceed allowable emission limits?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The Project will not exceed the significance criteria of 10 pounds/day of volatile organic compounds, nitrogen oxides, carbon monoxide, sulfur dioxide, or particulate matter. This impact is less than significant.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: 12.2.3. Will the headworks expansion component exceed/trigger toxic emissions levels?

Analysis: *Significant; Alternatives 2, 3, 4, and 5.*

The increase in perchloroethylene, a toxic compound, exceeds its screening trigger level for carcinogenic effects. A screening level health risk assessment was performed to determine if this increase will lead to a cancer risk of greater than one in a million (refer to impact 12.2.4). The results show that it does not lead to cancer risk of greater than one in a million and is therefore not a significant impact (CH2M Hill 1995).

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: 12.2.4. Will the headworks expansion component exceed the cancer risk toxic emissions threshold?

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The risk screening analysis shows that toxic emissions from the Project will not exceed a cancer risk of greater than one in one million.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: 12.2.5. Will the headworks expansion component cause odors?

Analysis: *Significant; Alternatives 2, 3, 4, and 5.*

This expansion will lead to more throughput and consequently the potential for an increase in the amount of odorous emissions. The current odor control program at the plant appears to be adequate. There have been relatively few complaints over the last five years. Once an odor complaint is received by the plant, the complaint is investigated by plant personnel. If the odor causing substance is found to be related to plant operation, corrective measures are taken. It is not expected that an increase in plant capacity will create a significant increase in off-site odors based on the odor history of the plant.

Expansion of the headworks will lead to an increase in production of sludge at the Laguna Plant. Impacts of expanded sludge handling facilities

were evaluated in the Santa Rosa Subregional Sludge Beneficial Use Project EIR (LSA Associates, Inc. 1991). The EIR concluded that potential odors were the only unavoidable adverse impact associated with the sludge Project. Despite the inclusion of mitigation measures it was concluded that there was a potential for odors associated with both composting and land application. Although it is uncertain whether odor impacts will exceed the points of significance established in the criteria for this environmental document, because the previous EIR found this impact to be significant, even with mitigation, it is reported here as significant. Measures to minimize odors are included in Chapter 2, Measure 2.2.26, Odor Control for Sludge Handling.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No feasible mitigation has been identified.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, 4, and 5.*

The previous EIR concluded that mitigation will reduce the potential for odors but that a significant potential for odor will still exist.

Impact: 12.2.6. Will the headworks expansion component cause permit/monitoring violations at the geysers?

Analysis: Does not apply.

Mitigation: Does not apply.

Urban Irrigation Component

Impact: 12.3.1-6. Will the urban irrigation component impact air quality based on evaluation criteria 1 through 6?

Analysis: *No Impact; All Alternatives.*

The urban irrigation component consists of existing irrigation systems where existing water supplies will be replaced with reclaimed water. No construction is proposed. Inorganic and organic chemicals in the reclaimed water have been measured between 1988 and 1995 by the City of Santa Rosa. The potential impacts to people from these chemicals have been covered both in the Public Health and Safety section of this document and in the human health risk assessment prepared for this Project (Human Health Risks from Chemical and Biological Components of Reclaimed Water). It was concluded that some inhalation from spray irrigation is possible, but this route will be orders of magnitude lower than exposure to domestic water via the same route because of decreased exposure duration and because volatile organic chemicals will dissipate outdoors. In

addition, some types of irrigation, such as drip, present essentially no exposure.

Based on experience with existing operations, minor odors associated with the start of irrigation each spring will not be expected to result in more than 10 odor complaints in a 90-day period. This component will have minimal or no impacts on air quality.

Alternative 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.12-7

Air Quality Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance		Impact		Type of Impact[1]	Level of Significance[2]
12.4.1. Will construction of the pipeline component generate emissions that exceed threshold levels?	Daily Particulates	Greater than 150 lbs/day	Alternatives 2 & 3	208 lbs	C	⊙
			Alternative 4	132 lbs	C	○
			Alternative 5A	44 lbs	C	○
	Annual Particulates	Greater than 15 tons/year	Alternative 2	25 tons	C	●
			Alternative 3	18 tons	C	⊙
			Alternative 4	17 tons	C	⊙
			Alternative 5A	9 tons	C	○
	Daily Hydrocarbons	Greater than 150 lbs/day	Alternatives 2 & 3	15 lbs	C	○
			Alternative 4	12 lbs	C	○
			Alternative 5A	4 lbs	C	○
	Daily Nitrogen Oxides	Greater than 150 lbs/day	Alternatives 2 & 3	164 lbs	C	⊙
			Alternative 4	124 lbs	C	○
			Alternative 5A	42 lbs	C	○
	Daily Sulfur Dioxides	Greater than 150 lbs/day	Alternatives 2 & 3	15 lbs	C	○
			Alternative 4	11 lbs	C	○
			Alternative 5A	4 lbs	C	○

Table 4.12-7

Air Quality Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
	Daily Carbon Monoxide Greater than 550 lbs/day	Alternatives 2 & 3 92 lbs	C	○
		Alternative 4 70 lbs	C	○
		Alternative 5A 23 lbs	C	○
12.4.2. Will the pipeline component emissions cumulatively exceed allowable limits?	All Criteria Pollutants	0 lbs	O&M	==
12.4.3. Will pipeline component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels	0 lbs/yr	O&M	==
12.4.4. Will pipeline component toxic emissions exceed risk assessment thresholds?	Cancer risk Greater than 1/million	No Risk	O&M	==
12.4.5. Will the pipeline component cause odors?	Greater than 10 complaints/ 90-day period	Less than 10	O&M	==
12.4.6. Will the pipeline component cause permit/monitoring violations at the geysers?	Greater than 0 violations	--	--	--

Source: Parsons Engineering Science, Inc., 1996

Notes:

1. Type of Impact:
   - C Construction
   - O&M Operation and Maintenance
   - -- Not Applicable

2. Level of Significance codes:
   - ● Significant impact before and after mitigation
   - ⊙ Significant impact before mitigation; less than significant impact after mitigation
   - ○ Less than significant impact; no mitigation proposed
   - == No impact

Impact: **12.4.1. Will the pipeline component exceed emission threshold levels?**

Analysis: *Significant; Alternatives 2, 3, and 4.*

The installation of pipelines will generate air pollutants in two ways: fugitive dust and combustion emissions. Fugitive dust is emitted during such construction activities as grading, trenching, material handling, and truck travel over unpaved and paved roadways, as well as wind erosion over construction areas. Combustion emissions will be generated by heavy-duty construction equipment and from trucks transporting materials to and from the site. Emissions were calculated using the emission factors described in the methodology as well as assumptions related to a typical construction day. Comparing pipeline construction emissions to significance criteria indicates that generation of particulate matter will be a significant air quality impact on a daily and annual basis for Alternatives 2 and 3 and on an annual basis for Alternative 4. Alternatives 2 and 3 also have significant nitrogen oxides impacts.

Less than Significant; Alternative 5A.

Emissions of all constituents are below threshold levels.

No Impact; Alternatives 1 and 5B.

Alternative 1 and 5B do not have a pipeline component.

Mitigation: *Alternatives 2, 3, and 4.*

2.4.10 Vehicle and Equipment Exhaust Control Program.

2.4.11 Dust Control Program.

Alternatives 1 and 5. No mitigation is proposed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 3 and 4.*

Significant after Mitigation; Alternative 2.

The impacts regarding daily particulates and nitrogen oxides will be reduced to a level below significance. Impacts for Alternative 3 and 4 regarding annual particulates will be reduced to a level below significance. Annual particulate impacts for Alternative 2 will remain significant.

Impact: **12.4.2-6. Will the pipeline component degrade air quality based on evaluation criteria 2, 3, 4, 5, and 6?**

Analysis: *No Impact; All Alternatives.*

The pipelines are underground, and their operation does not produce measurable air emissions or odors. Emissions from occasional releases at valves along the pipeline will be inconsequential. Therefore, there are no air quality impacts from operation of the pipelines.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: No mitigation is needed.

Storage Reservoir Component

Table 4.12-8

Air Quality Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance		Impact		Type of Impact[1]	Level of Significance[2]
12.5.1. Will the construction of the storage reservoir component generate emissions that exceed threshold levels?	Daily Particulates	Greater than 150 lbs/day	Tolay Extended	2,340 lbs	C	●
			Adobe/Lakeville	1,314 lbs	C	●
			Tolay Confined	1,256 lbs	C	●
			Lakeville/Sears Point	1,544 lbs	C	●
			Two Rock	863 lbs	C	●
			Bloomfield	790 lbs	C	●
			Carroll Road	899 lbs	C	●
			Valley Ford	899 lbs	C	●
			Huntley	732 lbs	C	●
	Annual Particulates	Greater than 15 tons/year	Tolay Extended	268 tons		●
			Adobe/Lakeville	144 tons	C	●
			Tolay Confined	145 tons	C	●
			Lakeville/Sears Point	171 tons	C	●
			Two Rock	107 tons	C	●
			Bloomfield	85 tons	C	●
			Carroll Road	96 tons	C	●
			Valley Ford	97 tons	C	●
			Huntley	79 tons	C	●

Table 4.12-8

Air Quality Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance		Impact		Type of Impact[1]	Level of Significance[2]
	Daily Hydrocarbons	Greater than 150 lbs/day	105 lbs		C	○
	Daily Nitrogen Oxides	Greater than 150 lbs/day	Tolay Extended and Confined	1,413 lbs	C	●
			Adobe/Lakeville and Lakeville/Sears Point	1,958 lbs	C	●
			Alternative 3	1,069 lbs	C	●
	Daily Sulfur Dioxides	Greater than 150 lbs/day	Tolay Extended and Confined	134 lbs	C	○
			Adobe/Lakeville and Lakeville/Sears Point	175 lbs	C	⊙
			Alternative 3	87 lbs	C	○
	Daily Carbon Monoxide	Greater than 550 lbs/day	Tolay Extended and Confined	521 lbs	C	○
			Adobe/Lakeville and Lakeville/Sears Point	791 lbs	C	●
			Alternative 3	467 lbs	C	○
12.5.2. Will the storage reservoir component emissions cumulatively exceed allowable limits?	All Criteria Pollutants		0 lbs		O&M	==

Table 4.12-8

Air Quality Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
12.5.3. Will storage reservoir component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels	0 lbs/day	O&M	==
12.5.4. Will storage reservoir component toxic emissions exceed risk assessment thresholds?	Cancer risk Greater than 1/million	No Risk	O&M	==
12.5.5. Will the storage reservoir component cause odors?	Greater than 10 complaints/ 90-day period	Less than 0	O&M	○
12.5.6. Will the storage reservoir component cause permit/monitoring violations at the geysers?	Greater than 0 violations	--	--	--

Source: Parsons Engineering Science, Inc., 1996

Notes:

1. Type of Impact:
   - C — Construction
   - O&M — Operation and Maintenance
   - -- — Not Applicable
2. Level of Significance codes:
   - ● — Significant impact before and after mitigation
   - ⊙ — Significant impact before mitigation; less than significant impact after mitigation
   - ○ — Less than significant impact; no mitigation proposed
   - == — No impact

Impact: **12.5.1. Will the storage reservoir component exceed threshold emissions levels?**

Analysis: *Significant; Alternatives 2 and 3.*

As with construction of transmission pipelines, construction of the storage reservoirs will generate dust and combustion-related emissions from heavy-duty equipment and vehicles entering and leaving the Project site. For several criteria pollutants all Alternative 3 reservoirs had similar impacts and the highest value among them was presented in Table 4.12-8. Comparing the emissions estimates to the daily significance criteria, the results of the analysis show that construction of each of the reservoirs will have significant impacts from dust generation and nitrogen oxide emissions from construction equipment and vehicle trips related to the Project. In addition, subalternatives that have two reservoirs proposed (Alternatives 2B and 2D) will have significant sulfur dioxide and carbon monoxide impacts. Mitigation measures will reduce sulfur dioxide emissions to less than significant levels.

No Impact; Alternatives 1, 4 and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.4.10 Vehicle and Equipment Exhaust Control Program

2.4.11 Dust Control Program.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2 and 3.*

The above mitigation measures, which are described in Chapter 2, will reduce impacts regarding sulfur dioxide to less than significant levels. Other impacts remain significant even with mitigation.

Impact: **12.5.2-4, 6. Will the storage reservoir component degrade air quality based on evaluation criteria 2, 3, 4, and 6?**

Analysis: *No Impact; All Alternatives.*

Operation of the storage reservoirs does not produce air emissions. Therefore, there are no air quality impacts associated with operation of the reservoirs.

Alternatives 1, 4 and 5 do not have a storage reservoir component.

Mitigation: No mitigation is needed.

Impact: 12.5.5. Will the storage reservoir component cause odors?

Analysis: *Less than Significant; Alternatives 2 and 3.*

Draining of the reservoirs may lead to possible odors. However, similar activities have been performed at the Delta and Meadowlane ponds with relatively few complaints in the past. It is thus highly unlikely that these activities will lead to 10 complaints in a 90-day period.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: No mitigation is proposed.

Pump Station Component

Table 4.12-9

Air Quality Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance		Impact	Type of Impact[1]	Level of Significance[2]
12.6.1: Will construction of the pump station component generate emissions that exceed threshold levels?	Daily Particulates	Greater than 150 lbs/day	22 lbs	C	O
	Annual Particulates	Greater than 15 tons/year	0.2 tons	C	O
	Daily Hydrocarbons	Greater than 150 lbs/day	7 lbs	C	O
	Daily Nitrogen Oxides	Greater than 150 lbs/day	95 lbs	C	O
	Daily Sulfur Dioxides	Greater than 150 lbs/day	10 lbs	C	O
	Daily Carbon Monoxide	Greater than 550 lbs/day	32 lbs	C	O

Table 4.12-9

Air Quality Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
12.6.2. Will pump station component emissions cumulatively exceed allowable limits?	All Criteria Pollutants	0 lbs	O&M	==
12.6.3. Will pump station component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels	0 lbs	O&M	==
12.6.4. Will pump station component toxic emissions exceed risk assessment thresholds?	Cancer risk Greater than 1/million	No Risk	O&M	==
12.6.5. Will the pump station component cause potential odors?	Greater than 10 complaints/ 90-day period	0	O&M	==
12.6.6. Will the pump station component cause permit/monitoring violations at the geysers?	Greater than 0 violations	--	--	--

Source: Parsons Engineering Science, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
-- Not Applicable

2. Level of Significance codes:
O Less than significant impact; no mitigation proposed
== No impact

Impact: **12.6.1. Will the pump station component exceed emissions threshold levels?**

Analysis: *Less than Significant; Alternatives 2, 3, and 4.*

Construction of the pump stations will require some grading of the area and will create some additional vehicle trips bringing materials and workmen to the site. These activities are not expected to have a significant impact on air quality. The values in the table represent the highest amount of emissions calculated for any of the subalternatives.

No Impact; Alternatives 1 and 5.

These alternatives do not have a pump station component.

Mitigation: No mitigation is proposed.

Impact: **12.6.2-6. Will the pump station component degrade air quality based on evaluation criteria 2, 3, 4, 5, and 6?**

Analysis: *No Impact; All Alternatives*

Because pumps are operated by electricity (not internal combustion engines), operation of the pump stations does not produce air emissions. Therefore, there are no air quality impacts from operation of pumps.

Alternatives 1 and 5 do not have a pump station component.

Mitigation: No mitigation is needed.

Agricultural Irrigation Component

Impact: **12.7.1-6. Will the agricultural irrigation component impact air quality based on evaluation criteria 1 through 6?**

Analysis: *No Impact; All Alternatives.*

The agricultural irrigation component includes the irrigation system on individual properties and operation as defined in the Irrigation Management Guidelines. Some construction will occur on private property as individuals hook themselves up to the public pipelines. Since specific details are not available regarding level of effort and schedule, emissions from these activities were not calculated. It is expected that activities will be at a much lower effort and less frequent than for Project pipeline construction. As a result, emissions are expected to be well below significance criteria. Inorganic and organic chemicals in the reclaimed water have been measured between 1988 and 1995 by the City of Santa Rosa. The potential impacts to people from these chemicals are addressed both in the Public Health and Safety section of this document and in the human health risk assessment prepared for this Project (*Human*

Health Risks from Chemical and Biological Components of Reclaimed Water). It was concluded that some inhalation from spray irrigation is possible, but this exposure will be orders of magnitude lower than exposure to domestic water via the same route because of decreased exposure duration and because volatile organic chemicals (and also odors) will dissipate quickly outdoors. In addition, some types of irrigation, such as drip, present essentially no exposure. Therefore, operation of the agricultural irrigation component will have no impacts on air quality. Operation of winter irrigation for the implementation of the contingency plan will have the same impacts as summer irrigation.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No mitigation is needed.

Geysers Steamfield Component

Table 4.12-10

Air Quality Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance		Impact	Type of Impact[1]	Level of Significance[2]
12.8.1. Will construction of the geysers steamfield component generate emissions that exceed threshold levels?	Daily Particulates	Greater than 150 lbs/day	111 lbs	C	○
	Annual Particulates	Greater than 15 tons/year	4 tons	C	○
	Daily Hydrocarbons	Greater than 150 lbs/day	27 lbs	C	○
	Daily Nitrogen Oxides	Greater than 150 lbs/day	224 lbs	C	●
	Daily Sulfur Dioxides	Greater than 150 lbs/day	15 lbs	C	○
	Daily Carbon Monoxides	Greater than 550 lbs/day	120 lbs	C	○
12.8.2. Will geysers steamfield component emissions cumulatively exceed allowable limits?	All Criteria Pollutants		0 lbs	O&M	==
12.8.3. Will geysers steamfield component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels		0 lbs	O&M	==
12.8.4. Will geysers steamfield component toxic emissions exceed risk assessment thresholds?	Cancer risk	Greater than 1/million	No risk	O&M	==

Table 4.12-10

Air Quality Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
12.8.5. Will the geysers steamfield component cause potential odors?	Greater than 10 complaints/ 90-day period	0	O&M	==
12.8.6. Will the geysers steamfield component cause permit/monitoring violations at the geysers?	Greater than 0 violations	0	O&M	==

Source: Parsons Engineering Science, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance codes:
● Significant impact before and after mitigation
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **12.8.1. Will the geysers steamfield component exceed emissions threshold levels?**

Analysis: *Significant; Alternative 4.*

Construction of the distribution pipelines, installation of the storage tanks, and grading to create a flat surface area for the storage tanks will generate dust and equipment exhaust emissions. The amount of nitrogen oxide emissions will exceed the significance criteria and is considered a significant impact. All other air pollutants amount are below applicable significance criteria.

No Impact; Alternative 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: *Alternative 4.*

2.4.10 Vehicle and Equipment Exhaust Control Program.

Alternative 1, 2, 3, and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternative 4.*

The above mitigation measure will not reduce impacts regarding nitrogen oxide to a level below significance.

Impact: **12.8.2-6. Will the geysers steamfield component degrade air quality based on evaluation criteria 2 through 6?**

Analysis: *No Impact; All Alternatives.*

Operation of the storage tanks and distribution pipelines will not produce air emissions. Therefore, there will be no air quality impacts from operation of these facilities.

Alternative 4, the Geysers Recharge, involves injecting water into wells that will feed into the geysers-Calistoga geothermal reservoir. This additional water will extend the life of the steamfields, but will not result in modification of typical operations. Therefore, it is expected that the air quality related emissions at the geysers will not increase from current levels. The Northern Sonoma Air Pollution Control District does not consider existing or potential future emissions at the geysers to be significant (i.e., violate permitting/monitoring requirements), based on existing monitoring results at various facilities at the geysers. When the Northern Sonoma Air Pollution Control District did their attainment planning for the future, they assumed that the geysers will continue to operate at current levels indefinitely into the future.

Alternatives 1, 2, 3, and 5 do not have a geyser steamfield component.

Mitigation: No mitigation is needed.

Discharge Component

Table 4.12-11

Air Quality Impacts by Component - Discharge

Evaluation Criteria	Point of Significance		Impact	Type of Impact[1]	Level of Significance[2]
12.9.1. Will construction of the discharge component generate emissions that exceed threshold levels (for Alternative 5A only)?	Daily Particulates	Greater than 150 lbs/day	22 lbs	C	O
	Annual Particulates	Greater than 15 tons/year	0.01 tons	C	O
	Daily Hydrocarbons	Greater than 150 lbs/day	7 lbs	C	O
	Daily Nitrogen Oxides	Greater than 150 lbs/day	95 lbs	C	O
	Daily Sulfur Dioxides	Greater than 150 lbs/day	10 lbs	C	O
	Daily Carbon Monoxide	Greater than 550 lbs/day	32 lbs	C	O

Table 4.12-11

Air Quality Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
12.9.2. Will discharge component emissions cumulatively exceed allowable limits?	All Criteria Pollutants	0 lbs	O&M	==
		0 lbs	O&M-CP	==
12.9.3. Will discharge component toxic emissions exceed screening trigger levels? A risk screening analysis would then have to be performed.	Greater than screening trigger levels	0 lbs	O&M	==
		0 lbs	O&M-CP	==
12.9.4. Will discharge component toxic emissions exceed risk assessment thresholds?	Cancer risk Greater than 1/million	No risk	O&M	==
		No risk	O&M-CP	==
12.9.5. Will the discharge component cause potential odors?	Greater than 10 complaints/ 90-day period	0	O&M	==
		0	O&M-CP	==
12.9.6. Will the discharge component cause permit/monitoring violations at the geysers?	Greater than 0 violations	--	--	--

Source: Parsons Engineering Science, Inc., 1996

Notes:

1. Type of Impact:
   - C — Construction
   - O&M — Operation and Maintenance
   - O&M-CP — Operation and Maintenance - Contingency Plan
   - -- — Not Applicable
2. Level of Significance codes:
   - O — Less than significant impact; no mitigation proposed
   - == — No impact

Impact: **12.9.1. Will the discharge component construction exceed emission threshold levels?**

Analysis: *Less than Significant; Alternative 5A.*

It was assumed that construction of the outfall structure will be similar to construction of a pump station. Construction activities are not expected to have a significant impact on air quality.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

Alternative 5B does not include any construction activities.

Alternatives 1, 2, 3, and 4 do not have a new discharge outfall.

Mitigation: No mitigation is proposed.

Impact: **12.9.2-6. Will the discharge component degrade air quality based on evaluation criteria 2 through 6?**

Analysis: *No Impact; All Alternatives.*

Discharge does not produce emissions. Therefore there are no air quality impacts.

Mitigation: No mitigation is needed.

CUMULATIVE IMPACTS

There are three impacts -- either significant or less than significant after mitigation -- identified in the Air Quality section:

Impact: **12.1C. Will the Project plus cumulative projects generate emissions that exceed threshold levels?**

Analysis: Construction activities for pipelines (Alternatives 2, 3, and 4) and reservoirs (Alternatives 2 and 3) result in significant construction-period emissions of daily and annual particulates, nitrogen oxides, sulfur oxides, and carbon monoxide. Mitigation measures can reduce impacts to less than significant for pipeline construction for all emissions except annual particulate levels associated with the Alternative 2 pipelines and nitrogen oxide emissions associated with the geysers pipeline. Impacts for reservoir construction are less mitigable, and will be significant even with mitigation for daily and annual particulates and daily nitrogen oxides at all reservoirs, and for daily carbon monoxide for Alternatives 2B and 2D.

Impact: **12.2C. Will the Project plus cumulative projects emissions exceed allowable levels?**

Analysis: Threshold levels for construction emission are established by the Bay Air Quality Management District on a per project basis, and are based on regional goals for control of emissions. Thus, other projects will need to be evaluated on an individual basis. While the threshold for construction emissions is not applicable to cumulative analysis, it is certainly possible that two or more construction projects could be occurring simultaneously in the Project area, and will contribute to the total load of construction emissions. For example, the reservoirs for a South County Alternative and the proposed Petaluma reclaimed water storage reservoir could be constructed at the same time.

Impact: **12.3 and 4C. Will the Project plus cumulative projects toxic emissions exceed screening trigger levels or risk assessment thresholds?**

Analysis: The headworks expansion will generate perchloroethylene emissions that exceed the screening trigger level, however further risk assessment analysis showed that the cancer risk will be less than the threshold of one in a million.

There are no foreseeable projects in the vicinity of the Laguna Treatment Plant that will contribute additional emissions of perchloroethylene in the Project vicinity. Emissions will only be produced by industrial or commercial uses.

Impact: **12.5C. Will the Project plus cumulative projects cause potential odors?**

Analysis: Increased sludge production from expansion of the headworks was previously determined to be significant in the evaluation of the Santa Rosa Subregional Sludge Beneficial Use Project EIR. No other new odor sources in the vicinity of the Laguna Treatment Plant have been identified.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Table 4.12-12

Summary of Significant Impacts and Mitigation Measures - Air Quality

Impact	Level of Significance	Mitigation Measure
Headworks Expansion		
12.2.3. The headworks expansion component may exceed/trigger toxic emissions levels.	Alt 2 - ⊙ Alt. 3 - ⊙ Alt. 4 - ⊙ Alt. 5 - ⊙	A screening level health risk assessment determined perchloroethylene levels will be less than significant.
12.2.5. The headworks expansion component may cause odors.	Alt 2 - ● Alt. 3 - ● Alt. 4 - ● Alt. 5 - ●	No feasible mitigation has been identified.
Pipeline Component		
12.4.1. The pipeline component may exceed emission threshold levels.	Alt 2 - ● Alt 3 - ⊙ Alt 4 - ⊙	2.4.11 Dust Control Program
Storage Reservoir Component		
12.5.1. The storage reservoir component may exceed emission threshold levels.	Alt 2 - ● Alt 3 - ●	2.4.10 Vehicle and Equipment Exhaust Control Program 2.4.11 Dust Control Program
Geysers Steamfield Component		
12.8.1. The geysers steamfield component may exceed emission threshold levels.	Alt 4 - ●	2.4.10 Vehicle and Equipment Exhaust Control Program

Source: Parsons Engineering Science, Inc. 1996

Notes:

⊙ Significant impact before mitigation; less than significant impact after mitigation

● Significant impact before and after mitigation

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.12-13

Summary of Impacts by Alternative - Air Quality

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	==	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	●	●	●	●	●	●	●	●	●	●	●	●
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	●	●	●	●	⊙	⊙	⊙	⊙	⊙	⊙	○	--
Storage Reservoirs	--	●	●	●	●	●	●	●	●	●	--	--	--
Pump Stations	--	○	○	○	○	○	○	○	○	○	○	--	--
Agricultural Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	●	--	--
Discharge	--	==	==	==	==	==	==	==	==	==	==	○	==

Source: Parsons Engineering Science, Inc., 1995

Notes: Level of Significance Codes

-- Not applicable

== No impact

○ Less than significant impact; no mitigation proposed

⊙ Significant impact; less than significant after mitigation

● Significant impact before and after mitigation

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Ivy Edmonds, Parsons Engineering Science, Inc.

Reviewers

Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Doug Cook, Parsons Engineering Science, Inc.
Claire Chapin, Parsons Engineering Science, Inc.
John Cummings, Ph.D., Peer Review Committee
David Ziegler, Peer Review Committee

References

HBA Team Documents

Parsons Engineering Science, Inc. *Human Health Risks from Chemical and Biological Components of Reclaimed Water.* (Appendix J-3)

Other References

Bay Area Air Quality Management District. 1995, *Bay Area Air Quality Management District Rules and Regulations, Regulation 2 Rule 2.* June 7.

Bay Area Air Quality Management District. 1994. *Improving Air Quality Through Local Plans and Programs.* October.

Bay Area Air Quality Management District. 1994. *Bay Area Air Quality Management District Risk Management Policy Memorandum with May 25, 1994 Updated Screening Levels.*

Bay Area Air Quality Management District. 1985. *Guidelines for Assessing Impacts of Projects and Plans.* November.

California Air Resources Board. 1990-1993. *California Air Quality Data.*

CH2M Hill. 1995. Memorandum from Carol Abramson on Modeling Results, December 7.

CH2M Hill. 1993. *Permit Application Package To The Bay Area Air Quality Management District For Authority To Construct The Laguna Advanced Treatment Upgrade Project.* November.

City of Santa Rosa. 1994. *Initial Study for Laguna Subregional Wastewater Treatment Plan-Advances Treatment Upgrade*. February.

City of Santa Rosa. 1990. *AB 2588 Emission Inventory Report to the Bay Area Air Quality Management District*. December.

EPA. 1995. *Compilation of Air Pollution Emission Factors, Volume I: Stationary Point and Area Sources* AP-42, 5th edition. U.S. Environmental Protection Agency, Research Triangle Park, NC. January.

EPA. 1993. *Federal Register, 40 Code of Federal Regulations* Parts 6, 51, and 93. November 30.

EPA. 1992. *Control of Open Fugitive Dust Sources*. September.

EPA. 1991. *Nonroad Engine and Vehicle Emission Study - Report*, U.S. November.

LSA Associates, Inc. 1991. *Santa Rosa Subregional Sludge Beneficial Use Project EIR*. February.

Consultation And Coordination

Persons Contacted

Carol Abramson, CH2M Hill
Sean Connolly, Northern Sonoma Air Pollution Control District
Barbara Lee, Northern Sonoma Air Pollution Control District
Randy Frazier, Bay Area Air Quality Management District
Scott Lutz, Bay Area Air Quality Management District
Scott Stinebaugh, Laguna Plant
Doug Hackley, UNOCAL
Ed Vogue, UNOCAL
Wade Eakle, U.S. Army Corps of Engineers

Correspondence

Memorandums from Rich Maurer on construction scenarios, July 5, July 31, August 6, August 7, 1995, October 27, and November 4.

Memorandum from Stan Kline at Rust Environment & Infrastructure, September 28, 1995.

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4.13 NOISE

This section discusses the Project's potential to expose the public to high noise levels due to construction, construction traffic operation and maintenance. To allow an understanding of the impact analysis, the setting section provides information on noise concepts and the existing noise environment. State and local noise policies are discussed as a basis for significance criteria.

IMPACTS EVALUATED IN OTHER SECTIONS

All impacts relating to noise are discussed in this section.

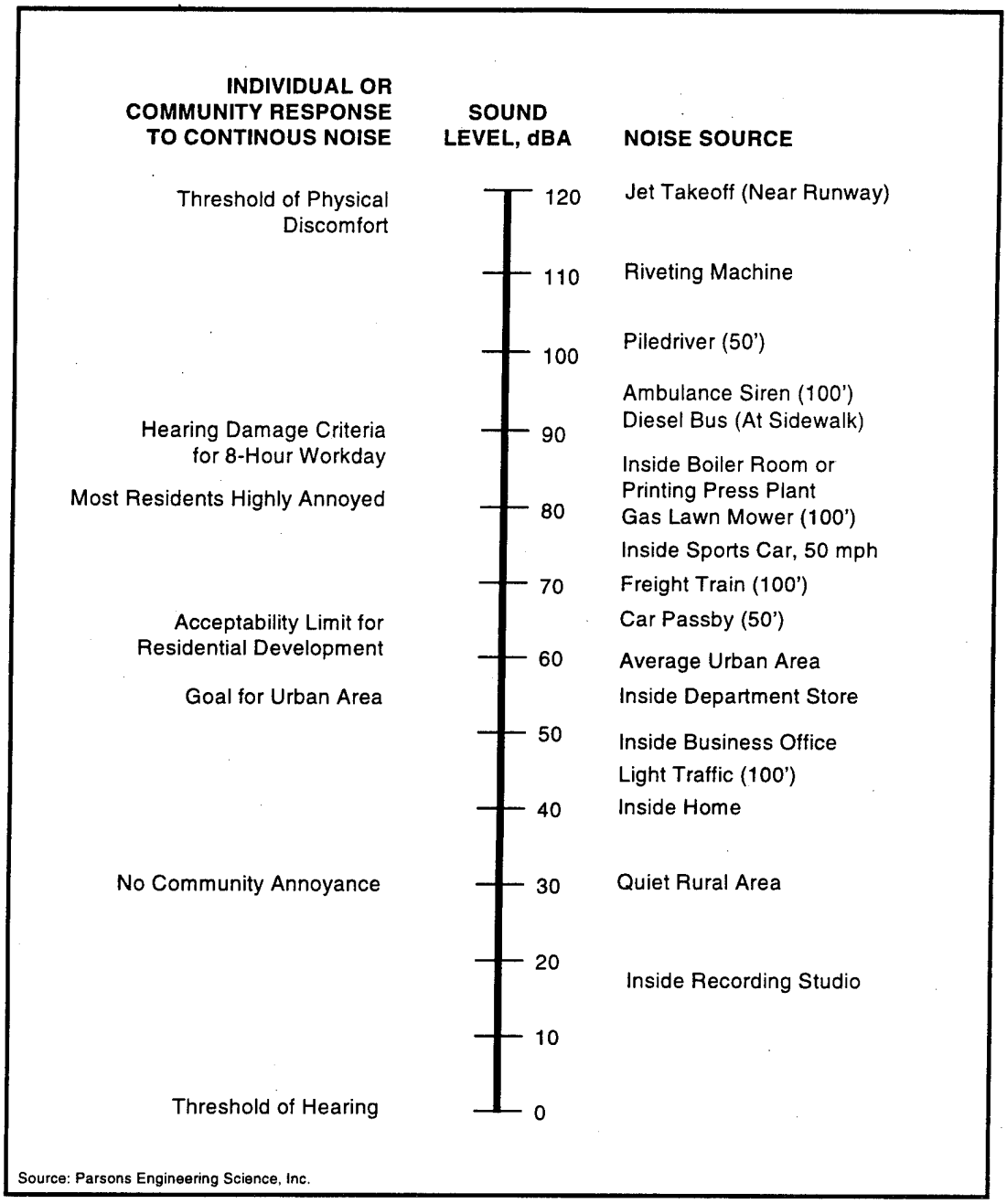
AFFECTED ENVIRONMENT (SETTING)

Noise is most often defined as unwanted sound. Sound levels can be easily measured; however, the variability is subjective and physical response to sound complicates the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as "loudness" or "noisiness." Physically, sound pressure magnitude is measured and quantified using a logarithmic ratio of pressures. The scale gives the level of sound in decibels (dB).

Noise Terminology

Different sounds have different frequency content. When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute (ANSI 1983). The A-weighted noise level has been found to correlate well with people's judgments of the noisiness of different sounds and has been used for many years as a measure of community noise. Figure 4.13-1 illustrates typical A-weighted sound pressure levels for various sound sources and responses of people to these levels.

When sound levels are measured at distinct intervals over a period of time, they indicate the statistical distribution of the overall sound level in a community during that period. The most common nomenclature associated with such measurements is the energy equivalent sound level (L_{eq}). L_{eq} is a single-number noise descriptor representing the average sound level in a real environment, where the actual noise level varies with time.



Source: Parsons Engineering Science, Inc.

While the A-weighted scale is often used to quantify the sound level of an individual event and is related to subjective response, the degree of annoyance and other response effects depend on a number of factors such as magnitude of the sound level in relation to the background, or ambient sound level; duration of the sound event; repetitiveness of event occurrences; and time of day the event occurs.

Several methods have been devised to relate noise exposure over time to community response. The U.S. Environmental Protection Agency (EPA) developed the Day-Night Average sound level (L_{dn}) as the rating method to describe long-term annoyance from environmental noise. L_{dn} is similar to a 24-hour L_{eq} A-weighted level, but with a 10 dB penalty for nighttime (10 p.m. to 7 a.m.) sound levels to account for the increased annoyance that is generally felt during normal sleep hours.

The Community Noise Equivalent Level (CNEL) has been adopted by the California Aviation Department for airport noise impact studies and by the State of California for environmental noise monitoring purposes. CNEL is similar to the A-weighted L_{eq}, but includes a 5 dB penalty during the evening hours (7 p.m. to 10 p.m.), while nighttime hours (10 p.m. to 7 a.m.) are penalized 10 dB. For outdoor noise, the Day-Night Average Sound Level (L_{dn}) noise descriptor is usually 0.5 to 1 dB less than the CNEL in a given environment.

Construction Noise

Construction noise has its greatest effect on sensitive noise receptors, also known as noise sensitive land uses. The Sonoma County General Plan defines these uses as residences, schools, churches, rest homes, and long-term medical or mental care facilities. Table 4.13-1 presents an inventory of existing residential dwelling units, vacant parcels, and other sensitive receptors along pipeline routes throughout the Project area. Although not defined as sensitive receptors, parks and other recreational areas have been included in Table 4.13-1. Parks and recreational areas have been included in the inventory because the quality of the recreational activity can be greatly affected by noise.

Table 4.13-1

Sensitive Noise Receptors along Pipeline Routes

Pipeline	Approximate Number of Residential Dwelling Units	Vacant Parcels	Other Sensitive Receptors
Bennett Valley Irrigation	3,200	0	Lincoln Elementary School Burbank School Matanzas Elementary School Village Elementary School Bennett Valley School Montgomery High School Slater Junior High School Christ Church Latter Day Saints Church First Baptist Church Immanuel Baptist Church Veterans Memorial Building Jacob Park De Meo Park Julliard Park Doyle Park Howarth Park Bennett Valley Commands Park & Golf Course Jockey Club
Fountaingrove Irrigation	1,100	0	Kaiser Permanente Hospital Helen Lehman Elementary School Hilliard Comstock Junior High School Bethal Church Ellis Retirement Home Finley Community Center Finley Park Jennings Park Fountaingrove Golf Course
Adobe Road Irrigation and Reservoirs	500	12	Penngrove School Old Adobe School Waugh School Building Penngrove Community Church Adobe Christian Center Church Penngrove Community Club Petaluma Adobe State Historical Monument

Table 4.13-1

Sensitive Noise Receptors along Pipeline Routes

Pipeline	Approximate Number of Residential Dwelling Units	Vacant Parcels	Other Sensitive Receptors
Petaluma Hill Road/ Rohnert Park Irrigation	130	22	Sonoma State University Church of Christ- Petaluma Hill Road California Greens Family Golf Course
Lakeville Irrigation	90	28	Adobe Creek Golf Club
North Petaluma Valley Irrigation	50	19	KOA Campground
West County Irrigation and Reservoirs	850	98	Gravenstein Union School Mount Vernon School Durham School Two Rock Union School Two Rock Presbyterian Church Church of Christ - Roblar Road Emma Hershey Memorial Park U.S. Coast Guard Station - Two Rock
Sebastopol Irrigation	1,020	161	Apple Blossom School Pleasant Hill School Spring Hill School Willow Wood School Graton Church
Geysers Pipeline	1,055	62	Mattie Washburn School Olivet School Willowside Park Windsor Golf Course

Source: Harland Bartholomew & Associates, Inc., 1996

Existing Noise Environment

The noise environment within the study area varies significantly due to the large geographic area and various outdoor environments. Most of the Project components such as reservoirs, transmission pipelines, and pump stations are located in rural areas. The existing ambient noise environment in the study area is comprised of contributions from surface traffic on local streets and highways, aircraft flyovers from local airports, trains on various railroad tracks, and other individual activities in the area.

Table 4.13-2

Summary of Estimated Existing Ambient Noise Levels near Pump Stations

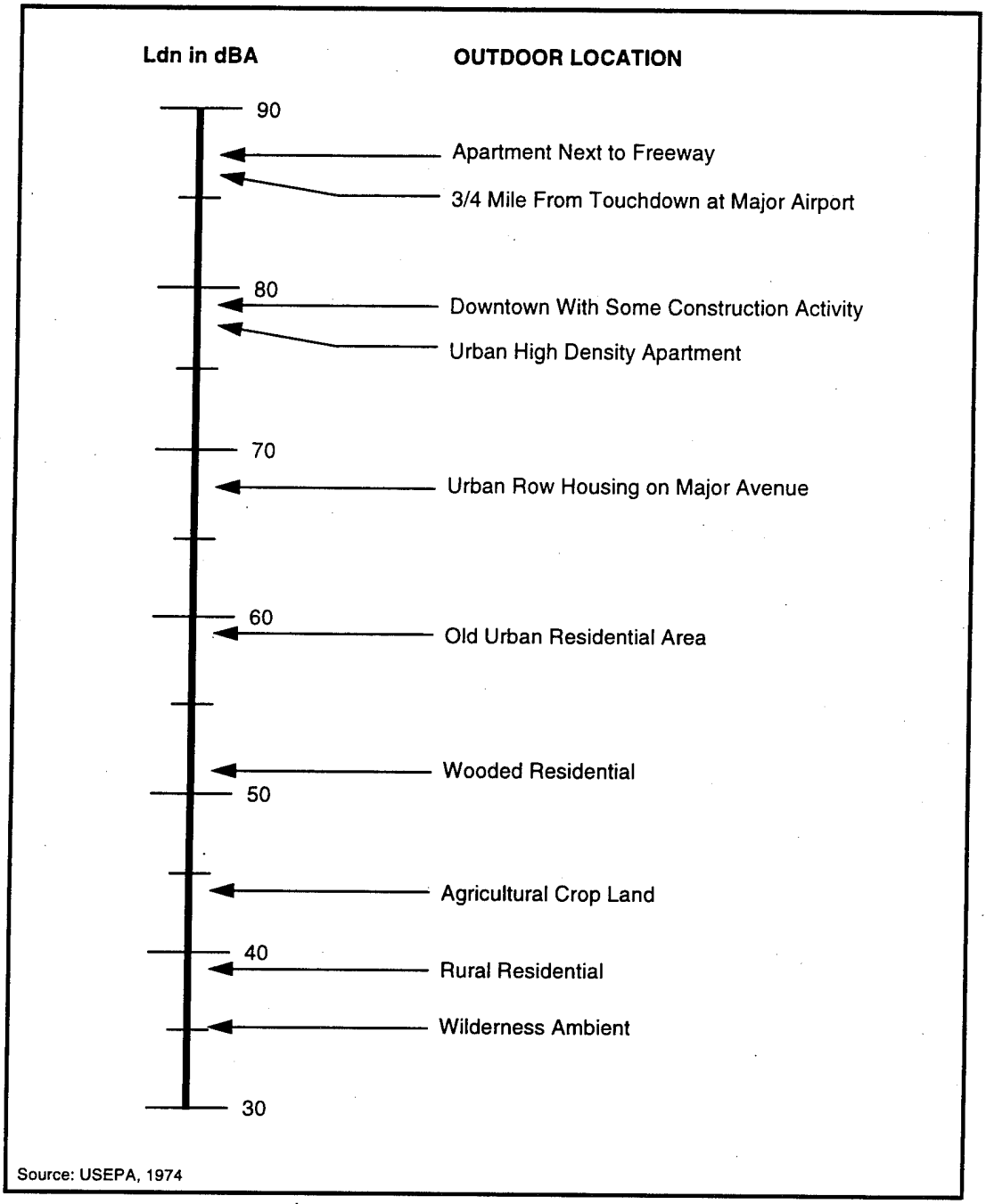
Pump Station	Nearest Sensitive Receptor, feet	Noise Sources	Ambient Noise Levels, L_{dn}	Jurisdiction	Notes
S - Meadowlane Ponds	2,000	Local surface traffic, the Laguna wastewater treatment plant, and other urban activities	50 - 60	Santa Rosa	The upper noise level range would be for receptors near major streets. Sparsely populated.
TASW - Tolay Backdam T - Tolay Dam AR - Adobe Road Dam TR - Two Rock Dam B - Bloomfield Dam VF - Valley Ford Dam CR - Carroll Road Dam G3 & G4 - on Pine Flat Road	Greater than 3,000	Traffic in the surrounding areas	35 - 45	Sonoma Co.	Located in a remote areas, no nearby residences.
TCSW - Tolay Confined Backdam	1,400	Local surface traffic	45 - 55	Sonoma Co.	The upper noise level range would be for receptors near local streets. Sparsely populated.
ARSW - Adobe Road Stormwater Dam	900	Local surface traffic	45 - 55	Sonoma Co.	The upper noise level range would be for receptors near local streets. Sparsely populated.
SP - Sears Point Dam	1,700	Local surface traffic	45 - 55	Sonoma Co.	The upper noise level range would be for receptors near local streets. Sparsely populated.
H - Huntley Dam	600	Local surface traffic	45 - 55	Sonoma Co.	The upper noise level range would be for receptors near local streets. Sparsely populated.
SEB & G1 - Delta Pond	Greater than 3,000	Traffic in the surrounding areas	35 - 45	Sonoma Co.	Located in a open areas, no nearby residences.

Table 4.13-2

Summary of Estimated Existing Ambient Noise Levels near Pump Stations

Pump Station	Nearest Sensitive Receptor, feet	Noise Sources	Ambient Noise Levels, L_{dn}	Jurisdiction	Notes
FGS & BVS - West College Pond	300	Local surface traffic, the Santa Rosa West College treatment plant, and other urban activities	50 - 60	Santa Rosa	The upper noise level range would be for receptors near major streets. Mostly residential to the south and the treatment plant to the north.
FGB - Redwood Hwy North of Fountaingrove Parkway	400	Local surface traffic	50 - 60	Santa Rosa	The upper noise level range would be for receptors near local streets. Sparsely populated.
BVB - Sonoma County Fair Ground	500	Local surface traffic	50 - 65	Santa Rosa	The upper noise level range would be for receptors near major streets. Mostly residential to the north and open spaces to the north.
G2 - Hwy 128 at Pine Flat Road	300	Local surface traffic	45 - 55	Sonoma Co.	The upper noise level range would be for receptors near local streets. Sparsely populated.
SBPS-2, SBPS-3, SBPS-7 through SBPS-12	300	Local surface traffic	45 - 65	Sonoma Co.	The upper noise level range would be for receptors near local streets.
WBPS-1 through WBPS-16	200	Local surface traffic	45 - 65	Sonoma Co.	The upper noise level range would be for receptors near local streets.
LBPS-1 through LBPS-4	400	Local surface traffic	45 - 65	Sonoma Co.	The upper noise level range would be for receptors near local streets.

Source: Parsons Engineering Science, Inc., 1996



Source: USEPA, 1974

The study area varies greatly in population density and accordingly in noise level. The noise levels are highest near transportation corridors and populated areas since primary noise sources are human related. The existing ambient noise in the study area has not been measured for the purposes of this study. Typical noise levels in similar environmental settings were used in estimating the existing ambient noise (U.S. EPA 1974). Figure 4.13-2 depicts typical noise levels in terms of L_{dn} for various outdoor environments. The estimated existing noise environment in the study area varies from an L_{dn} of approximately 35 dBA in remote rural areas to an L_{dn} of 65 dBA in an urban area with high density housing. Table 4.13-3 summarizes the existing noise setting in the vicinity of the pump stations. Because each of the reservoirs has a pump station located adjacent to it, Table 4.13-3 also represents the ambient noise levels at the reservoirs during the irrigation season.

Regulatory Context

This section identifies the local ordinances and other regulations and guidelines which comprise the regulatory context for noise. General plan policies related to the noise environment are identified in the next section titled "Noise Goals, Policies, and Objectives."

Marin County

The Marin County Noise Element does not quantify a noise standard for new development. It states that *"It is unlawful for any person to make, continue, or cause to be made or continued, any loud, unnecessary or unusual noise which either annoys, disturbs, injures or endangers the comfort, repose, health or peace of others"* (County of Marin 1994).

The Marin Countywide Plan Noise Element specifies noise standards for various land uses (County of Marin 1994). Residential, public, and institutional land uses should not be subjected to noise levels above 60 dBA L_{dn}. In commercial areas, the acceptable noise level is 65 dBA. In industrial and agricultural areas, the acceptable noise level is 70 dBA. Residential land uses within agricultural areas, including, for example, a family's home on a dairy ranch, are considered residential uses for noise level classification purpose. The County has also adopted separate standards for stationary noise sources such as mechanical equipment, quarries, kennels, or industrial facilities. The noise standards establish benchmarks for allowable noise levels in residential areas and for other noise-sensitive land uses. These standards will be applicable to new stationary noise sources proposed near existing residential areas or noise-sensitive land uses. Table 4.13-3 shows the standards for stationary noise sources.

Table 4.13-3

Marin County Allowable Noise Exposure From Stationary Noise Sources

	Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
Hourly, L_{eq}, dBA	50	45
Maximum Noise Level, dBA	70	65
Maximum Noise Level, dBA (Impulsive Noise)	65	60

Source: County of Marin, Marin Countywide Plan Noise Element, 1994

Sonoma County

The Sonoma County General Plan states that the "*noise level resulting from new sources and ambient noise shall not exceed the standards in Table 4.13-5 as measured at the exterior property line of any affected residential land uses.*" These standards also apply to other sensitive receptors such as schools, hospitals, rest homes, and long-term medical or mental care facilities. To implement the Noise Element, Sonoma County requires special permit review procedures to be established for projects that involve significant noise level generation, or that are located in noise impacted areas.

Table 4.13-4

Sonoma County Noise Level Performance Standards

Category	Cumulative Duration of Noise Event in Any 1-Hour Period	Maximum Exterior Noise Level Standards, dBA	
		Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
1	30-60 minutes	50	45
2	15-30 minutes	55	50
3	5-15 minutes	60	55
4	1-5 minutes	65	60
5	0-1 minutes	70	65

Source: County of Sonoma, Sonoma County General Plan Noise Element, 1989 revised 1991

City of Santa Rosa

The noise standards used by the City of Santa Rosa include the Land Use Compatibility Standards for Community Noise Environment, State of California Noise Insulation Standards (California Code of Regulations, Title 24, Part 2), and applicable standards in the City's Noise Ordinance. Figure 4.13-3 shows the recommended noise levels associated with various land uses. The Noise Element of the City's General Plan includes the following policies:

- Apply a comprehensive program of noise prevention, using existing standards and procedures; and
- Cooperate with pertinent City of Santa Rosa, County of Sonoma, and State of California agencies, as well as private entities, to reduce noise from significant sources.

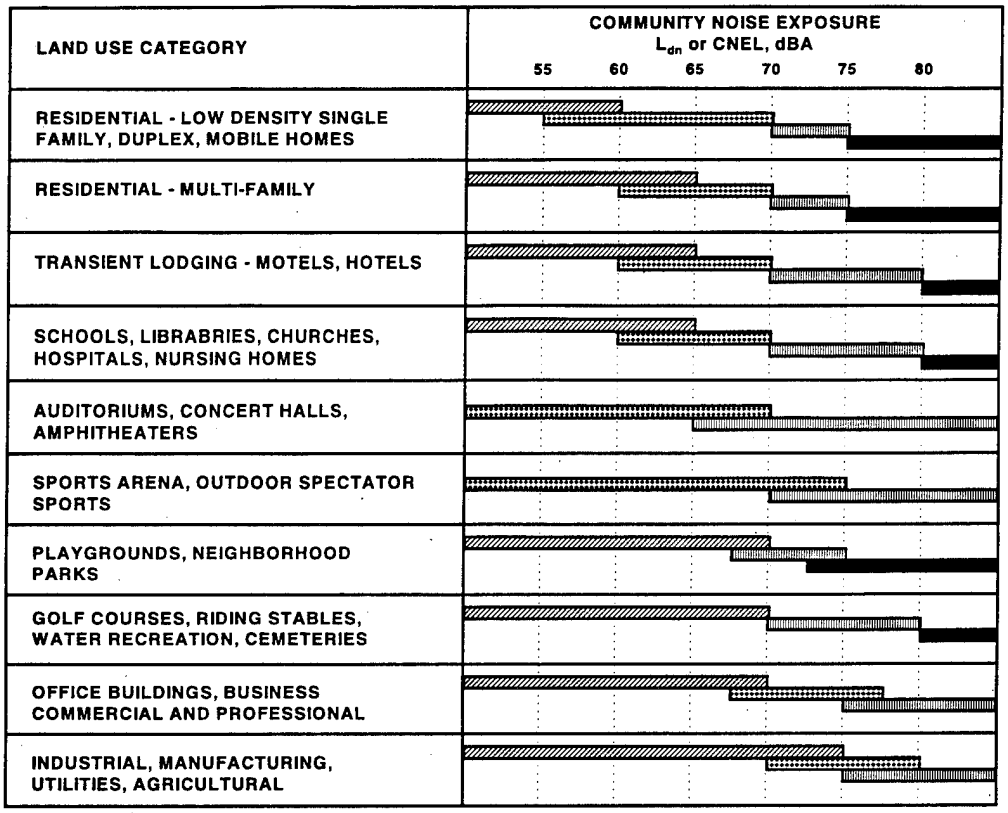
The City of Santa Rosa Municipal Code, Chapter 17-16, Ordinance No. 17-16.20 states that "*It is unlawful for any person to operate any machinery, equipment, pump, fan, air-conditioning apparatus or similar mechanical device in any manner so as to create any noise which would cause the noise level at the property line of any property to exceed the ambient base noise level by more than five decibels*" (Santa Rosa, 1989). Table 4.13-5 presents the City's ambient base noise levels.

Table 4.13-5

City of Santa Rosa Municipal Code Ambient Base Noise Levels

Zone	Daytime Level (dBA)	Evening Level (dBA)	Nighttime Level (dBA)
Single-family Residential	55	50	45
Multi-family Residential	55	55	50
Office and Commercial	60	60	55
Intensive Commercial	65	65	55
Industrial	70	70	70

Source: City of Santa Rosa, City of Santa Rosa Municipal Code 17-16.030, 1989



INTERPRETATION

NORMALLY ACCEPTABLE

Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE

New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE

New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE

New construction or development should generally not be undertaken.

Source: Adapted from California State Dept. of Health Services,1990

City of Sebastopol

The City of Sebastopol General Plan does not contain a noise standard (City of Sebastopol 1994). It contains an objective (Objective N1): "to establish noise standards which protect public health, welfare, and safety, and which enhance the rural residential atmosphere of Sebastopol." Policy N1.1 states that the noise standards "will take into consideration" the recommendations of the State Department of Health and the Environmental Protection Agency. The Noise Hazards discussion in the General Plan recognizes that indoor sound levels should be 45 dBA and the outdoor sound level should not exceed 55 dBA.

City of Petaluma

The City of Petaluma has a noise ordinance. Noise standards set by the State of California for land use categories, Figure 4.13-3, define acceptable conditions for use in Petaluma. Outdoor and indoor noise standards are used to review new proposals and to delineate areas already exposed to high noise levels. For single- and multi-family residential buildings noise must be mitigated to provide an interior L_{dn} of 45 dBA. An L_{dn} of 60 dBA is established as the reasonable noise level for exterior use areas.

Construction Noise Limits

The City of Santa Rosa does not have quantitative noise limits for construction activities. However, the City limits construction activities to between the hours of 7 a.m. and 10 p.m. seven days a week. Any activity not in compliance with any provision of the Noise Ordinance will require a special condition permit.

The policy of the Marin County Noise Element is to minimize impacts from excessive noise due to construction activity. During all phases of construction, measures should be taken to minimize the exposure of neighboring properties to excessive noise from construction-related activity. The Community Development Agency reserves the right to set hours for construction-related activities involving the use of machinery, power tools, or hammering. The type of construction, site location and noise sensitivity of nearby land uses will determine the hours of construction.

The cities of Rohnert Park, Cotati, Sebastopol, Petaluma, and the County of Sonoma also do not have noise limits for construction activities. The State's Office of Noise Control *Model Community Noise Control Ordinance* includes noise limits for construction activities. Table 4.13-6 presents the construction noise limits recommended by the State's Office of Noise Control, which will be used as Project criteria for the construction noise study.

Table 4.13-6

Maximum Noise Limits for Construction and Stationary Equipment, L_{eq}

Time	Single-Family Residential	Multi-Family Residential	Mixed-Residential & Commercial
Daily, except Sundays and Legal Holidays, 7 a.m. to 7 p.m.	60 dBA	65 dBA	70 dBA
Daily, 7 p.m. to 7 a.m. and all day Sunday and Legal Holidays	50 dBA	55 dBA	60 dBA

Source: California Department of Health, Office of Noise Control, Mode Community Noise Control Ordinance, 1977

Airblast Limits

The construction of proposed reservoirs will require blasting for rock quarrying. Airblast is an impulsive sound generated by an explosive blast and resulting fragmentation and movement. There are three possible adverse effects of airblast: (1) damage to structures, (2) human health risk, and (3) human annoyance. To assess these adverse effects from airblasts, the air overpressures caused by the blast must be estimated.

Hearing damage from a single airblast has been shown to occur starting at peak overpressures of 178 dB, for single instance occurrences (Hirsch 1968). However, this level will not normally occur outside the restricted safety region of a blast area. Therefore, hearing damage criteria will not be addressed in this study, since it is assumed that there will be no unprotected humans within the restricted safety region of a blast site.

Studies have shown that building damage to glass and other fragile structural members is improbable when the peak overpressure of an airblast is below 140 dB (true-peak), although claims of damage may begin to occur at levels starting at 130 dB (Siskind et al. 1980).

The most likely impact from airblast is human annoyance. A "moderate" risk of human annoyance resulting in complaints will potentially occur when the peak overpressure is between 110 and 125 dB. The risk becomes "high" when the peak overpressure is between 125 and 140 dB (Schomer 1973).

It is recommended that airblast limits be applied to airblast noise associated with this Project, since the state and local criteria do not adequately address this type of noise. The recommended criterion for building damage due to airblast is 130 dB at building structures and the recommended criterion for annoyance due to airblast

noise is 110 dB at an occupied property line, below which there is a low risk of human complaint.

State Noise Policies

The State of California has compatibility guidelines for different land uses (California 1976). For each land use, the level of acceptability of the noise environment is dependent upon the activity that is conducted and the type of building construction (for indoor activities). Figure 4.13-3 illustrates the State of California land use compatibility standards for community noise environment. The land use compatibility guidelines are applicable for both CNEL and L_{dn}.

The California Department of Transportation (Caltrans) has established noise standards for traffic noise on highways. When these standards or Noise Abatement Criteria (NAC) are approached or exceeded, noise impacts occur. The Noise Abatement Criteria for most sensitive receptors (including parks, residences, schools, churches, libraries, and hospitals) are an L_{eq} of 67 dBA at areas with outdoor activities and an L_{eq} of 52 dBA at the interior of schools and residences (Caltrans 1987). Even though these standards only apply to state routes, they can be used as guidelines for a city street noise impact study.

Noise Goals, Objectives, and Policies

Table 4.13-7 identifies goals, objectives, and policies which provide guidance for development in relation to the noise environment in the Project area. The table also indicates which criteria in the Noise Section are responsive to each set of policies. No facilities are located in Rohnert Park or Cotati.

Table 4.13-7

General Plan Goals, Objectives, and Policies - Noise

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Noise Element	Goal NE-1 Objective NE-1.3 Policy NE-1a Policy NE-1c Policy NE-1f	Protect people from the harmful effects of exposure to excessive noise and achieve an environment in which people and land uses may function without impairment from noise by protecting the present noise environment and preventing intrusion of new noise sources which will substantially alter the noise environment	1.2

Table 4.13-7

General Plan Goals, Objectives, and Policies - Noise

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Noise Element	Goal NE-2 Objective NE-2.1	Confine the noise impacts from transportation facilities to the smallest feasible land area and design and manage such facilities to produce the lowest feasible noise levels and impacts on noise sensitive land uses	3
Marin Countywide Plan	Noise Element	Objective N-2 Policy N-2.1	Ensure that new development does not significantly increase noise levels within existing areas and ensure that noise from new development does not exceed County guidelines	2
Marin Countywide Plan	Noise Element	Policy N-2.4	During all phases of construction, measures should be taken to minimize the exposure of neighboring properties to excessive noise levels	1,3
Santa Rosa General Plan	Noise Element	Goal N-1	Reduce nuisance noise from stationary and moving sources to protect the health and comfort of people in Santa Rosa and require mitigation where necessary to meet stipulated noise standards	1.2.3
Petaluma General Plan	Community Health and Safety Element	Objective (m)	Minimize the amount of noise that future development creates and the amount of noise to which the community is exposed by strictly enforcing the noise standards and requiring mitigation measures to produce noise compatible land uses	1,2,3
Sebastopol General Plan	Safety Element	Policy 4 Policy 5	Protect existing noise environment in residential areas and reduce vehicular noise in residential areas	1,2,3

Table 4.13-7

General Plan Goals, Objectives, and Policies - Noise

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Windsor General Plan	Public Health and Safety Element	Policy D.1 Policy D.1.1 Policy D.1.2	Encourage new development to be planned and designed to minimize noise impacts on noise sensitive areas, minimize noise interference from outside sources and maintain the ambient sound environment as much as possible	2
Windsor General Plan	Public Health and Safety Element	Policy D.2.4	Seek to restrict construction in a manner that allows for efficient construction mobilization and activities, while also protecting noise sensitive uses	1,3

Source: Harland Bartholomew & Associates, Inc., 1995

1. The evaluation criteria are in 4.13.8.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

State and local governments have established noise guidelines and policies for the purpose of protecting citizens from various adverse physiological, psychological, and sociological effects associated with noise. The appropriate criteria for different cities are described in the previous section.

In addition to being concerned about the absolute noise level that might occur when a new noise source is introduced into an area, it is also important to consider the change from the existing noise environment. If the existing noise environment is quite low and the new noise source greatly increases the noise exposure (even though a criterion level might not be exceeded), an impact may be perceived by the listener.

Changes in noise levels greater than 5 dBA are readily noticeable and will be considered a significant increase, while changes less than 3 dBA are generally not discernible to most people. Complaints may certainly be expected if the difference reaches 10 dBA or more. Therefore, the point of significance is set when noise levels increase by 5 dB or greater, even though they still fall within the local noise criteria.

The operation of Project components such as pump stations, reservoirs, and pipelines will be continuous over a 24-hour period, as the nighttime noise limits for residential areas

were used for the evaluation criteria, to represent the worst-case noise impacts. Sensitive receptors can be assumed to be residences.

Table 4.13-8

Evaluation Criteria with Point of Significance - Noise

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will construction of the Project expose the public to high noise levels?	Projected noise levels at property line or "yard" line	Greater than L_{eq} of 60 dBA	California Office of Noise Control recommended construction noise limits
2. Will operation and maintenance of the Project expose the public to high noise levels?	Projected noise levels at property line or "yard" line	a. Greater than L_{eq} of 45 dBA, OR Greater than L_{eq} of 50 dBA b. Greater than 5 dBA increase in noise, L_{eq}	General Plan of Sonoma County and Noise Element of Marin County City of Santa Rosa Municipal Code An increase of 5 dBA or more will be readily noticeable.
3. Will construction of the Project cause high noise levels from construction traffic?	Projected traffic volume due to construction	Greater than 10 % increase in traffic volume	A 10 % increase in traffic volume will increase the noise by less than 1 dBA, which normally will not be noticeable.

Source: Parsons Engineering Science, Inc., 1996

METHODOLOGY

Noise Calculations

Outdoor sound transmission is influenced by three types of natural effects: distance effects, atmospheric effects, and terrain effects. For point sources, sound levels drop off with distance in accordance with the "inverse square law", which yields a 6 dB sound level reduction for each doubling of the distance from the source. A sound source can be treated as a "point source" when the distance from the source is large compared to the dimensions of the source.

In addition to the drop in noise levels as distance increases, noise also drops due to the atmospheric absorption and losses due to a barrier. Atmospheric absorption is dependent upon temperature and relative humidity. A barrier is a solid structure that intercepts the direct sound path from a source. It provides a reduction in sound level within its "shadow zone." A barrier can be a hill, earth berm, a wall, or a building. The noise analysis for this study is conservative because atmospheric absorption and barrier noise reduction were not considered in the calculation.

Construction Noise

Noise impacts from construction activity of the Project are a function of the noise generated by construction equipment, the location and sensitivity of nearby land uses, and the timing and duration of the noise-generating activities. Noise levels within and adjacent to the Project construction areas will increase during the construction period. Construction will not cause long-term impacts since it will be temporary and limited to 7 a.m. - 7 p.m.

The primary noise from the construction activities will be generated by vehicles and equipment involved in site clearing and grading, foundation preparation, facility construction, and finish work. Representative sound levels for most common types of construction equipment and usage factors (U.S. Army CERL 1978 and U.S. EPA 1971) were used to estimate construction noise levels. The usage factors represent the percentage of time that the equipment will be operating at full speed. Table 4.13-9 provides the noise data which are used in the assessment of construction noise during various stages of construction activities.

Table 4.13-9

Typical Construction Equipment Noise Levels

Equipment	Noise Levels at 50 Feet, (dBA)
Backhoe	85
Compactor	89
Concrete Truck	88
Crane	83
Dozer	80
Dump Truck Export	91
Dump Truck Import	91
Excavator	85
Flat Bed Truck	80
Front End Loader	85
Generator	78
Grader	85
Paver	89
Pick Up Truck	70
Ripper	80
Scraper	85
Water Truck	87

Table 4.13-9

Typical Construction Equipment Noise Levels

Equipment	Noise Levels at 50 Feet, (dBA)
Welding Machine	74
Worker Vehicles	70

Source: U.S. Army Construction Engineering Research Laboratory, Construction Site Noise Control Cost-Benefit Estimating Procedures, 1978. U.S. Environmental Protection Agency, Noise from Construction Equipment and Operation, Building Equipment, and Home Appliances, 1971.

Vibration

There are no established criteria for vibration due to construction, and aside from the potential for blasting at the Two Rock and Adobe Road reservoir sites, construction methods are not expected to generate substantial vibrations. Blasting is discussed in the section on reservoir construction impacts. Time-of-day restrictions, which are part of the mitigation program for noise, will also address any minor vibration impacts. Therefore, vibration is not discussed further in the impact analysis.

Pump Station Operation Noise

The noise generated by equipment operations at the pump stations has been predicted using noise measurements conducted at existing pump stations located at the Delta Ponds and the Denner Ranch. The existing Delta Pond pump station is an enclosed pump station containing two 350 HP and one 75 HP pumps. At the Denner Ranch pump station, there were three pumps, two 150 HP and one 75 HP, located in an outdoor environment. Both pumps were operating during the measurement. At the Delta Pond pump station, the measured noise levels range from 72 to 88 dBA at a distance of 15 feet from the enclosed pump station. The noise ranges represent the noise levels surrounding the pump station. The upper noise levels are due to an opening, for ventilation, on one side of the building wall. At the Denner Ranch pump station, the measured noise levels were 78 to 71 dBA at distances of 15 and 50 feet, respectively.

In calculating the noise generated by the pump stations, the measured noise data were adjusted to reflect the differences in pump power rating. The estimated noise levels for the indoor pump station represent the worst-case scenario, that is the noise at the side of the pump building with the ventilation openings. At the side with no openings, the noise due to the pumps will be approximately 16 dBA lower. The booster and main

distribution pump stations will be operated on a 24-hour basis during the irrigation season.

Noise due to pump stations was calculated at the nearest existing sensitive receptor as well as nearest future sensitive receptor. The nearest future sensitive receptor was assumed to be located at the property line of the pump stations. With the exception of the pump stations for reservoirs, the pump noise at future sensitive receptors was calculated for a distance of 10 feet from the pump stations. This is the minimum required distance from the future building structure to the property line per County zoning code. For the reservoirs, the pump noise at future sensitive receptors was calculated at the construction limit line.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Impact: **13.1.1-3. Will the No Action Alternative impact noise based on evaluation criteria 1 through 3?**

Analysis: *No Impact; Alternative 1.*

The No Action Alternative will not have any noise impacts as it involves no construction.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Table 4.13-10

Noise Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.2.1. Will construction of the headworks expansion component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA	Less than L_{eq} of 60 dBA	C	❍

Table 4.13-10

Noise Impacts by Component - Headworks Expansion

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.2.2. Will operation of the headworks expansion component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co. Greater than L_{eq} of 50 dBA Santa Rosa	Less than L_{eq} of 45 dBA	O&M	○
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Less than a 5 dBA increase in L_{eq}	O&M	○
13.2.3. Will construction of the headworks expansion component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume	Less than 10% increase	C	○

Source: Parsons Engineering Science, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
○ Less than significant impact; no mitigation proposed

Impact: **13.2.1. Will construction of the headworks expansion component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The new influent pumps will be located inside an existing facility at the Laguna Plant. With the exception of removing and replacing the existing pump systems, there will not be any new construction. The closest sensitive receptor, a dwelling, is about 1,100 feet to the north across Llano Road. Construction equipment, required for the removal and installation of the pump system, will be a small crane and delivery trucks. Construction noise impacts at the nearest sensitive receptor are expected to be less than significant.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: **13.2.2. Will operation of the headworks expansion component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

Because the new influent pumps will be located in an enclosed underground facility and the closest sensitive receptor is about 1,100 feet away, operation noise impacts are expected to be less than significant.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Impact: **13.2.3. Will construction of the headworks expansion component cause high noise levels from construction traffic?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The daily traffic volume associated with construction of the Laguna Plant headworks expansion will include worker vehicles traveling to and from the Project site. The increase in traffic volume on local streets will be less than 10 percent. Therefore, the noise generated by the construction traffic will not produce significant noise impacts, considering the existing traffic volumes.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Urban Irrigation Component

Impact: **13.3.1-3. Will the urban irrigation component impact noise based on evaluation criteria 1 through 3?**

Analysis: *No Impact; All Alternatives.*

Irrigation facilities used in this component already exist; no new construction is necessary. Also, use of reclaimed water rather than the existing water supply in the irrigation systems will not increase noise levels over those currently experienced. There will be no construction or operation noise impacts.

Alternatives 1, 4 and 5, do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.13-11

Noise Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.4.1. Will construction of the pipeline component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA	96 dBA	C	●
13.4.2. Will operation of the pipeline component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co. Greater than L_{eq} of 50 dBA Santa Rosa	Less that L_{eq} of 45 dBA	O&M	○
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Less than 5 dBA increase in L_{eq}	O&M	○
13.4.3. Will construction of the pipeline component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume	Up to 1,250 %	C	●

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
○ Less than significant impact; no mitigation proposed
● Significant impact before and after mitigation

Impact: 13.4.1. Will construction of the pipeline component expose the public to high noise levels?

Analysis: *Significant. Alternatives 2, 3, 4, and 5A.*

Table 4.13-12 presents the quantity of the equipment and its usage factors for various stages of construction for the pipelines. The usage factors represent the percentage of time that the equipment will be operating at full speed. In addition, the analysis assumes that all equipment will be operating simultaneously to represent a worst-case scenario. The highest

level of construction noise is expected to be generated during the excavation stage. An L_{eq} as high as 90 dBA at 50 feet from the center of construction activity will be generated during specific periods of heavy excavation. During other stages of construction, the L_{eq} will be lower and will vary depending on the amount of activity and the types of equipment in use.

There are residences located approximately 25 feet away from the pipeline construction routes. These receptors will experience an L_{eq} as high as 96 dBA from construction activities. Noise levels at 50 feet away from construction will be 90 dBA. This will exceed the noise criteria, and significant noise impacts will occur. At a distance of 1,600 feet or greater, the construction noise is expected to be below 60 dBA, the construction noise criterion.

Even though pipeline construction extends over many miles, the noise impacts due to pipeline construction will be short-term. The pipeline construction is anticipated to proceed at a pace of approximately 160 linear feet per day. Therefore, a worst-case noise impact for the nearest sensitive receptor will be exposure to the construction noise of 96 dBA for approximately one construction day. Based on the construction pace of 160 feet per day, a typical noise impact for receptors that are located along the pipeline routes will be between 74 and 96 dBA over a one-week period.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.*

2.4.9. Construction Noise Control Measures

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

The construction noise impacts will be reduced substantially with implementation of both the equipment noise control and administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the construction noise impacts nearby sensitive receptors; however, it will not reduce these to a less than significant level.

Table 4.13-12

Estimated Construction Noise Levels for Pipelines

Equipment	Quantity	Construction Usage Factors[1]			
		Clearing	Excavation	Rough	Finish
Backhoe	1	4%	40%	0%	16%
Compactor	1	0%	30%	0%	30%
Crane	1	0%	0%	16%	0%
Dump Truck Export	1	16%	16%	0%	16%
Dump Truck Import	1	16%	16%	0%	0%
Excavator	1	0%	10%	0%	0%
Flat Bed Truck	1	16%	16%	40%	16%
Front End Loader	1	16%	16%	0%	4%
Generator	1	40%	40%	0%	2%
Paver	1	0%	0%	0%	12%
Pick Up Truck	1	16%	16%	40%	16%
Ripper	1	4%	40%	0%	16%
Water Truck	1	26%	26%	0%	0%
Welding Machine	2	0%	0%	30%	0%
Worker Vehicles	20	16%	16%	40%	16%
L_{eq} at 50 feet from construction site		**88 dBA**	**90 dBA**	**80 dBA**	**88 dBA**

Source: U.S. Army Construction Engineering Research Laboratory, Construction Site Noise Control Cost-Benefit Estimating Procedures, 1978. U.S. Environmental Protection Agency, Noise from Construction Equipment and Operation, Building Equipment, and Home Appliances, 1971

Note:
1. Usage factors represent the percentage of time the equipment will be operating at full speed

Impact: **13.4.2. Will operation of the pipeline component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5A.*

During the operation of the pipelines, the potential for noise exists due to pressurized water flow in the pipelines. Generally, noise is caused by high velocity water turbulence, water surge or thrust, and water hammering. The pipeline systems will be buried three feet below the ground surface

along their routes, which will provide a natural noise barrier. The operation of pipelines will not produce significant noise impacts.

There will be air relief valves located periodically along the geysers pipeline from Pump Station G2 to G4. There are no sensitive receptors near the relief valve locations. The relief valves will not produce significant noise impacts. At the G2, G3, and G4 pump stations, there will be a surge tank located outside of the pump building to allow draining of the pipeline in the event of a failure. Noise will be produced due to the water surge into the tank and air relief valves. Since the surge tank will be located behind the pump station building, which will serve as a noise barrier, and the water surge will only occur on an emergency basis, significant noise impacts due to the surge tank will not occur.

No Impact; Alternatives 1 and 5B.

These alternatives have no pipeline component.

Mitigation: No mitigation is proposed.

Impact: **13.4.3. Will construction of the pipeline component cause high noise levels from construction traffic?**

Analysis: *Significant; Alternatives 2, 3, 4, and 5A.*

The daily traffic volume associated with construction of the pipelines will include worker vehicles traveling to and from the Project site. The traffic volume on local public streets will be increased by up to 250 percent. The increase in traffic volume will translate to a noise increase of approximately 5 dBA. For the private driveways approaching the reservoir sites, the increase in construction traffic will be approximately 1,250 percent. The noise due to this increase in traffic volume will be approximately 11 dBA. Therefore, significant noise impacts will be expected from construction of the pipelines.

The noise impacts due to pipeline construction will be short-term. The pipeline construction will typically last for 31 days for a 1-mile segment.

No Impact; Alternative 1 and 5B.

These alternatives have no pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.*

2.4.9. Construction Noise Control Measures

Alternative 1 and 5B. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

The construction noise impacts due to traffic will be reduced through the administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the traffic noise at nearby sensitive receptors; however, it will not be reduced to a level of less than significant.

Storage Reservoir Component

Table 4.13-13

Noise Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.5.1. Will construction of the storage reservoir component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA			
• Tolay Extended		62 dBA	C	⊙
• Adobe Road		Air blast criteria may be exceeded 55 dBA or less	C	●
• Tolay Confined		62 dBA	C	⊙
• Lakeville Hillside		68 dBA	C	●
• Sears Point		60 dBA	C	●
• Two Rock		Air blast criteria may be exceeded 55 dBA or less	C	●
• Bloomfield		55 dBA or less	C	○
• Carroll Road		55 dBA or less	C	○
• Valley Ford		55 dBA or less	C	○
• Huntley		69 dBA	C	●

Table 4.13-13

Noise Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.5.2. Will operation of the storage reservoir component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma Co. Greater than L_{eq} of 50 dBA Santa Rosa	None	O&M	==
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	None	O&M	==
13.5.3. Will construction of the storage reservoir component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume	Up to 1,250 %	C	●

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
● Significant impact before and after mitigation
⊙ Significant impact before mitigation; less than significant impact after mitigation
❍ Less than significant impact; no mitigation proposed
== No Impact

Impact: **13.5.1. Will construction of the storage reservoir component expose the public to high noise levels?**

Analysis: *Significant; Alternatives 2, 3A, and 3E.*

Tolay Extended, Adobe Road, Tolay Confined, Lakeville Hillside, Sears Point, Two Rock, Huntley. Construction noise at the reservoirs will result in significant impacts. The greatest impact is projected to occur at Huntley where estimated construction noise exceeds the noise criteria by up to 9 dBA. At the Two Rock and Adobe Road sites, the recommended airblast criteria may be exceeded which will result in significant impacts.

The number of equipment pieces listed in Table 4.13-14 is for a typical reservoir including Valley Ford, Carroll Road, Bloomfield, Huntley, Two Rock, Adobe Road, and Sears Point. The Tolay Reservoir is larger in magnitude and spread out more with multiple structures. Even though larger, construction noise for the Tolay Reservoir will be similar to that of other reservoirs mentioned above, because the construction equipment will be spread out over a wider area. Even though the Lakeville Hillside reservoir is significantly smaller, the construction noise for the Lakeville Hillside reservoir will not be significantly lower. However, the construction duration will be significantly shorter.

The highest level of construction noise is expected to be generated during the excavation stage. An L_{eq} as high as 91 dBA at 50 feet from the center of construction activity will be generated during specific periods of heavy excavation. During other stages of construction, the L_{eq} will be lower and will vary depending on the amount of activity and the types of equipment in use. Table 4.13-15 summarizes the construction noise impacts for the reservoirs.

Construction of the reservoir at the Two Rock and Adobe Road sites will require blasting for a rock quarry. Blasting noise is dependent on several factors: (1) the type of explosive material and method of detonation; (2) the amount or weight of explosive material; (3) the type of rock and earth material to be blasted; and (4) the depth in which the charge is placed in the ground. Because of the variability of these factors, and the fact that detailed information regarding the blasting is not available, it is not possible to precisely assess blast noise impacts. Depending on the blast-charge weight, it is possible that the recommended airblast criteria may be exceeded at the Two Rock and Adobe Road sites.

Table 4.13-14

Estimated Construction Noise Levels for Reservoirs

Equipment	Quantity	Construction Usage Factors[1]			
		Clearing	Excavation	Rough	Finish
Backhoe	3	4%	40%	0%	16%
Compactor	3	0%	30%	0%	0%
Dozer	5	4%	40%	0%	16%
Dump Truck Export	1	16%	16%	0%	16%
Dump Truck Import	5	16%	16%	0%	0%
Grader	2	40%	40%	0%	2%
Scraper	8	4%	40%	0%	16%
Water Truck	3	26%	26%	0%	0%

Table 4.13-14

Estimated Construction Noise Levels for Reservoirs

Equipment	Quantity	Construction Usage Factors[1]			
		Clearing	Excavation	Rough	Finish
Worker Vehicles	20	16%	16%	40%	16%
L_{eq} at 50 feet from construction site		**89 dBA**	**91 dBA**	**90 dBA**	**88 dBA**

Source: U.S. Army Construction Engineering Research Laboratory, Construction Site Noise Control Cost-Benefit Estimating Procedures, 1978. U.S. Environmental Protection Agency, Noise from Construction Equipment and Operation, Building Equipment, and Home Appliances, 1971

Note:
1. Usage factors represent the percentage of time the equipment will be operating at full speed

Table 4.13-15

Summary of Construction Noise Impacts for Storage Reservoirs

Storage Reservoir	Distance to Nearest Sensitive Receptor, feet	Construction Noise Levels, L_{eq} (dBA)[1]		Jurisdiction
		at 50 feet	at Nearest Sensitive Receptor	
Tolay Extended	1,400	91	62	Sonoma County
Adobe Road	> 3,000	91	55 or less	Sonoma County
Tolay Confined	1,400	91	62	Sonoma County
Lakeville Hillside	700	91	68	Sonoma County
Sears Point	1,700	91	60	Sonoma County
Two Rock	> 3,000	91	55 or less	Sonoma County
Bloomfield	> 3,000	91	55 or less	Sonoma County
Carroll Road	> 3,000	91	55 or less	Sonoma County
Valley Ford	> 3,000	91	55 or less	Sonoma County
Huntley	600	91	69	Sonoma County

Source: Parsons Engineering Science, Inc. 1996

Note:
1. Excluding blast noise

Less than Significant; Alternatives 3B, 3C, and 3D.

Bloomfield, Carroll Road, Valley Ford. At these reservoirs, the nearest sensitive receptor is located more than 3,000 feet from the construction site, and the estimated construction noise levels are below the noise criteria. Construction noise impacts at the nearest sensitive receptor are expected to be less than significant.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2, 3A, and 3E.*

2.4.9. Construction Noise Control Measures

Alternatives 3B, 3C, and 3D. No mitigation is proposed.

Alternatives 1, 4, and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3A, and 3E.*

The construction noise impacts will be reduced substantially with implementation of both the equipment noise control and administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the construction noise impacts at nearby sensitive receptors; however, at most reservoir sites it will not be reduced to a level of less than significant.

Impact: **13.5.2. Will operation of the storage reservoir component expose the public to high noise levels?**

Analysis: *No Impact; All Alternatives.*

With the exception of pump stations that will be required to distribute stored water from the reservoirs to the irrigation areas and in some cases handle the volume of runoff water and divert it around the reservoirs, there will not be any mechanical noise sources associated with the operation of the reservoirs. No significant noise impacts will be expected from the reservoir component. Noise associated with the pump stations at each of the reservoirs is discussed under the pump station component.

Alternatives 1, 4, and 5, do not have a storage reservoir component.

Mitigation: No mitigation is needed.

Impact: **13.5.3. Will construction of the storage reservoir component cause high noise levels from traffic?**

Analysis: *Significant; Alternatives 2 and 3.*

The daily traffic volume associated with construction of the reservoirs includes 100 truck trips per day for hauling material from each reservoir to available quarries and 230 trips for workers traveling to and from the Project site. The traffic volume on local streets will be increased by up to 700 percent. The increase in traffic volume will translate to a noise increase of approximately 8 dBA. For the private driveways approaching the reservoir sites, the increase in construction traffic will be approximately 1,250 percent. The increase in noise due to this increase in traffic volume will be approximately 11 dBA. Therefore, significant noise impacts will be expected from the traffic generated by construction of the reservoirs.

No Impact; Alternatives 1, 4 and 5.

These alternatives have no storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.4.9. Construction Noise Control Measures.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2 and 3.*

The construction noise impacts due to traffic will be reduced substantially through administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the traffic noise at nearby sensitive receptors; however, it will not be reduced to a level of less than significant.

Pump Station Component

Pump stations are scattered within Sonoma County, Marin County, and the City of Santa Rosa. There will not be any pump stations in the Cities of Rohnert Park, Sebastopol, Cotati, or Petaluma. The Alternative Projects Facilities Plan illustrates the location of the proposed pump stations; the capacity and features of these stations are listed in Appendix D-32.

Table 4.13-16

Noise Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.6.1. Will construction of the pump station component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA			
• All South County alternatives		50-71 dBA	C	●
• All West County alternatives		50-75 dBA	C	●
• Geysers Recharge Alternative		37-71 dBA	C	●
13.6.2. Will operation of the pump station component expose the public to high noise levels?				
• Alternative 2 (including Sebastopol)	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	62-99 dBA	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 3A	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	69-94 dBA	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 3B	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	56-94 dBA	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●

Table 4.13-16

Noise Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 3C	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	69-94 dBA	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 3D	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	64-94 dBA	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 3E	a. Greater than or equal to L_{eq} of 45 dBA Sonoma & Marin Co.	59-94 dBA	O&M	●
	Greater than or equal to L_{eq} of 50 dBA Santa Rosa	81-92 dBA	O&M	●
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●
• Alternative 4	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co.	89-101 dBA increase in noise	O&M	●
	Greater than L_{eq} of 50 dBA Santa Rosa	None		==
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Greater than 5 dBA increase in noise	O&M	●

Table 4.13-16

Noise Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.6.3. Will construction of the pump station component cause high noise levels from construction traffic?	Greater than 10% increase in traffic volume	< 10% increase	C	○

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
● Significant impact before and after mitigation
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **13.6.1. Will construction of the pump station component expose the public to high noise levels?**

Analysis: *Significant; Alternatives 2, 3, and 4.*

Table 4.13-17 presents the quantity of the equipment and its usage factors for various stages of construction for the pump stations. The highest level of construction noise is expected to be generated during the excavation stage. An L_{eq} as high as 87 dBA at 50 feet from the center of construction activity will be generated during specific periods of heavy excavation. During other stages of construction, the L_{eq} will be lower and will vary depending on the amount of activity and the types of equipment in use.

Table 4.13-17

Estimated Construction Noise Levels for Pump Stations

Equipment	Quantity	Construction Usage Factors[1]			
		Clearing	Excavation	Rough	Finish
Backhoe	1	4%	40%	0%	16%
Compactor	1	30%	30%	0%	0%
Concrete Truck	1	0%	0%	4%	0%
Crane	1	0%	0%	8%	4%

Table 4.13-17

Estimated Construction Noise Levels for Pump Stations

Equipment	Quantity	Construction Usage Factors[1]			
		Clearing	Excavation	Rough	Finish
Dozer	1	4%	40%	0%	16%
Dump Truck Export	1	16%	16%	0%	16%
Dump Truck Import	1	16%	16%	0%	0%
Excavator	1	0%	10%	0%	0%
Flat Bed Truck	1	16%	16%	40%	16%
Front End Loader	1	4%	40%	0%	16%
Generator	1	40%	40%	0%	2%
Paver	1	0%	0%	0%	12%
Pick Up Truck	1	16%	16%	40%	16%
Water Truck	1	26%	26%	0%	0%
Welding Machine	2	0%	0%	30%	0%
Worker Vehicles	20	16%	16%	40%	16%
L_{eq} at 50' from construction site, dBA		**84**	**87**	**82**	**82**

Source: U.S. Army Construction Engineering Research Laboratory, Construction Site Noise Control Cost-Benefit Estimating Procedures, 1978. U.S. Environmental Protection Agency, Noise from Construction Equipment and Operation, Building Equipment, and Home Appliances, 1971. Parsons Engineering Science, Inc. 1996

Notes:
1. Usage factors represent the percentage of time the equipment will be operating at full speed

Table 4.13-18

Summary of Construction Noise Impacts for Pump Stations

Pump Station	Distance to Nearest Sensitive Receptor, feet	Construction Noise Levels, L_{eq} (dBA)		Jurisdiction
		at 50 feet	at Nearest Sensitive Receptor	
S - Meadowlane Ponds	2,000	87	55	Santa Rosa
TASW - Tolay A Backdam	Greater than 3,000	87	51 or less	Sonoma Co.
TCSW - Tolay C Backdam	1,400	87	58	Sonoma Co.

Table 4.13-18

Summary of Construction Noise Impacts for Pump Stations

Pump Station	Distance to Nearest Sensitive Receptor, feet	Construction Noise Levels, L_{eq} (dBA) at 50 feet	Construction Noise Levels, L_{eq} (dBA) at Nearest Sensitive Receptor	Jurisdiction
ARSW - Adobe Road Stormwater	900	87	62	Sonoma Co.
T - Tolay Dam	Greater than 3,000	87	51 or less	Sonoma Co.
SP - Sears Point Dam	1,700	87	56	Sonoma Co.
L - Lakeville Dam	700	87	64	Sonoma Co.
AR - Adobe Road Dam	Greater than 3,000	87	51 or less	Sonoma Co.
TR - Two Rock Dam	Greater than 3,000	87	51 or less	Sonoma Co.
B - Bloomfield Dam	Greater than 3,000	87	51 or less	Sonoma Co.
CR - Carroll Road Dam	Greater than 3,000	87	51 or less	Sonoma Co.
VF - Valley Ford Dam	Greater than 3,000	87	51 or less	Sonoma Co.
H - Huntley Dam	600	87	65	Sonoma Co.
ASR-2 - Petaluma. Hill Rd at Rohnert Park Expressway	Greater than 1,000	87	61 or less	Sonoma Co.
SEB - Delta Pond	Greater than 3,000	87	51 or less	Sonoma Co.
FGS & BVS - West College Ponds	300	87	71	Santa Rosa
FGB - Redwood Hwy. North at Fountaingrove Parkway	400	87	69	Santa Rosa
BVB - Sonoma County Fairground	500	87	67	Santa Rosa
G1 - Delta Pond	Greater than 3,000	87	51 or less	Sonoma Co.
G2 - Hwy 128 at Pine Flat Road	300	87	71	Sonoma Co.
G3 & G4 - Pine Flat Rd.	Greater than 15,000	87	37 or less	Sonoma Co.
SBPS-2 - Petaluma Hill Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
SBPS-3 - Petaluma Hill Rd.	600	87	65	Sonoma Co.
SBPS-7 - Petaluma Hill Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
SBPS-8 - Petaluma Hill Rd.	500	87	67	Sonoma Co.
SBPS-9 - E. Railroad Ave.	Greater than 1,000	87	61 or less	Sonoma Co.
SBPS-10 - Adobe Road	300	87	71	Sonoma Co.
SBPS-11 - Adobe Road	Greater than 1,000	87	61 or less	Sonoma Co.
SBPS-12 - Lakeville Road	600	87	65	Sonoma Co.
WBPS-1 - Martinoni Road	Greater than 1,000	87	61 or less	Marin Co.

Table 4.13-18

Summary of Construction Noise Impacts for Pump Stations

Pump Station	Distance to Nearest Sensitive Receptor, feet	Construction Noise Levels, L_{eq} (dBA) at 50 feet	Construction Noise Levels, L_{eq} (dBA) at Nearest Sensitive Receptor	Jurisdiction
WBPS-3 - Seavey Road	400	87	69	Sonoma Co.
WBPS-4 - Spring Hill Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
WBPS-5 - Pepper Road	Greater than 1,000	87	61 or less	Sonoma Co.
WBPS-6 - Valley Ford Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
WBPS-7 - Canfield Road	200	87	75	Sonoma Co.
WBPS-8 - Valley Ford Rd.	700	87	64	Sonoma Co.
WBPS-9 - Valley Ford Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
WBPS-10 - Bloomfield Rd.	300	87	71	Sonoma Co.
WBPS-11 - Carroll Road	600	87	65	Sonoma Co.
WBPS-12 - Hwy 1	Greater than 1,000	87	61 or less	Marin Co.
WBPS-13 - Valley Ford Rd,	Greater than 1,000	87	61 or less	Sonoma Co.
WBPS-16 - Meachum Rd.	Greater than 1,000	87	61 or less	Sonoma Co.
LBPS-1 - Green Valley	Greater than 1,000	87	61 or less	Sonoma Co.
LBPS-2 - Graton Road	500	87	67	Sonoma Co.
LBPS-3 - Bodega Hwy.	400	87	69	Sonoma Co.
LBPS-4 - Burnside Road	Greater than 1,000	87	61 or less	Sonoma Co.

Source: Parsons Engineering Science, Inc., 1996

No Impact; Alternatives 1 and 5.

These alternatives have no new pump station component.

Mitigation: *Alternatives 2, 3, and 4.*

2.4.9. Construction Noise Control Measures

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, and 4.*

The construction noise impacts will be reduced substantially with implementation of both the equipment noise control and administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the construction noise impacts at nearby sensitive receptors; however, it will not be reduced to a level of less than significant.

Impact: **13.6.2. Will operation of the pump station component expose the public to high noise levels?**

Analysis: *Significant; Alternatives 2, 3, and 4.*

Table 4.13-19 presents the results of the analysis for noise impacts associated with operation of the pump stations before implementation of mitigation. Also shown in Table 4.13-19 is the distance from the pumps at which pump noise will be less than 45 dBA. During the irrigation season (typically May through October) pumps are assumed to operate 24 hours a day. During the winter months, the pump station at the Laguna Plant will be operating to send reclaimed water to reservoirs; during the winter, pump stations serving the irrigation areas will only be used when the contingency winter irrigation program is operating.

No Impact; Alternatives 1 and 5.

These alternatives have no new pump station component.

Mitigation: *Alternatives 2, 3, and 4.*

2.3.17. Pump Station Noise Control

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, and 4.*

The noise generated during operation of the pump stations will be greatly reduced through implementation of this measure. Pump noise will be reduced using various combinations of techniques such as a noise barrier between the pump station and sensitive receptors, fully enclosed underground facility for the pump stations, pump station lay out so that ventilation and door will be facing away from the sensitive receptors, acoustical louvers for the building air ventilation openings, and low noise motor for the pump systems. These noise control features can reduce noise levels up to 20 to 30 dBA, if facilities are placed underground, with

additional noise reduction features decreasing noise by 3 to 15 dBA. Noise reduction for each mitigation feature is discussed in Measure 2.3.17. Implementation of the noise control measure will significantly reduce the operational noise impacts at the existing sensitive receptors. However, significant noise impacts will still occur, even after mitigation measures are applied.

Impact: **13.6.3. Will construction of the pump station component cause high noise levels from construction traffic?**

Analysis: *Less than Significant; Alternatives 2, 3, and 4.*

The daily traffic volume associated with construction of the pump stations will include worker vehicles traveling to and from the Project site. The increase in traffic volume on local streets will be less than 10 percent. Therefore, the noise generated by the construction traffic will be less than significant.

No Impact; Alternatives 1 and 5.

These alternatives have no new pump station component.

Mitigation: *Alternatives 2, 3, and 4.* No mitigation is proposed.

Alternatives 1 and 5. No mitigation is needed.

Table 4.13-19

Estimated Noise Impacts from Operation of Pump Stations
(Before Mitigation)

Pump Station	System Data		Distance to Nearest Sensitive Receptor		Pump Noise Level at Nearest Sensitive Receptor		Noise Criteria[3]	Distance at Which Pump Noise Would be Less than 45 dBA (ft)
	No.[1]	Size (HP[2])	Existing (ft)	Potential Future (ft)	Existing, L_{eq} (dBA)	Potential Future, L_{eq} (dBA)	L_{eq} (dBA)	
S - Meadowlane Ponds[4]	3	750	2,000	10	50	92	50	Greater than 4,000
TASW - Tolay Extended Backdam	2	400	Greater than 3,000	375	42 or less	62	45	Greater than 2,500
TCSW - Tolay Confined Backdam	2	1,000	1,400	500	53	64	45	Greater than 4,000
ARSW - Adobe Road Stormwater	2	550	900	250	54	67	45	Greater than 2,700
T - Tolay Dam	4	750	Greater than 3,000	125	47 or less	88	45	Greater than 4,100
SP - Sears Point Dam	4	900	1,700	200	54	75	45	Greater than 4,500
L - Lakeville Dam	3	215	700	125	54	73	45	Greater than 2,100
AR - Adobe Road Dam	4	325	Greater than 3,000	125	44 or less	76	45	Greater than 2,900
TR - Two Rock Dam	3	160	Greater than 3,000	125	39 or less	72	45	Greater than 1,700
B - Bloomfield Dam	3	340	Greater than 3,000	875	43 or less	56	45	Greater than 2,700

Table 4.13-19

Estimated Noise Impacts from Operation of Pump Stations
(Before Mitigation)

Pump Station	System Data		Distance to Nearest Sensitive Receptor		Pump Noise Level at Nearest Sensitive Receptor		Noise Criteria[3]	Distance at Which Pump Noise Would be Less than 45 dBA (ft)
	No.[1]	Size (HP[2])	Existing (ft)	Potential Future (ft)	Existing, L_{eq} (dBA)	Potential Future, L_{eq} (dBA)	L_{eq} (dBA)	
CR - Carroll Road Dam	3	340	Greater than 3,000	125	43 or less	75	45	Greater than 2,700
VF - Valley Ford Dam	3	400	Greater than 3,000	375	43 or less	64	45	Greater than 2,700
H - Huntley Dam	3	300	600	625	57	59	45	Greater than 2,500
ASR-2 - Petaluma Hill Rd at Rohnert Park Expressway	2	140	Greater than 1,000	10	47 or less	87	45	Greater than 1,300
SEB - Delta Pond[4]	3	400	Greater than 3,000	10	43 or less	90	45	Greater than 2,700
FGS - West College Ponds[4]	1	150	300	10	58	85	50	Greater than 1,500
BVS - West College Ponds[4]	1	350	300	10	54	81	50	Greater than 1,000
FGB - Redwood Hwy. North of Fountaingrove Parkway	1	125	400	10	52	83	50	Greater than 1,000
BVB - Sonoma County Fairground	1	75	500	10	47	81	50	Greater than 700
G1 Delta Pond[4]	3	900	Greater than 3,000	10	42 or less	89	45	Greater than 2,500

Table 4.13-19

Estimated Noise Impacts from Operation of Pump Stations
(Before Mitigation)

Pump Station	System Data		Distance to Nearest Sensitive Receptor		Pump Noise Level at Nearest Sensitive Receptor		Noise Criteria[3]	Distance at Which Pump Noise Would be Less than 45 dBA (ft)
	No.[1]	Size (HP[2])	Existing (ft)	Potential Future (ft)	Existing, L_{eq} (dBA)	Potential Future, L_{eq} (dBA)	L_{eq} (dBA)	
G2 - Hwy 128 at Pine Flat Road	4	1,500	300	10	71	100	45	Greater than 5,700
G3 - Pine Flat Road	4	1,250	Greater than 15,000	10	36 or less	99	45	Greater than 5,700
G4 - Pine Flat Road	4	1,750	Greater than 20,000	10	35 or less	101	45	Greater than 6,400
SBPS-2 - Petaluma Hill Road	1	40	Greater than 1,000	10	39 or less	78	45	Greater than 500
SBPS-3 - Petaluma Hill Road	1	60	600	10	45	80	45	Greater than 600
SBPS-7 - Petaluma Hill Road	4	225	Greater than 1,000	10	52 or less	91	45	Greater than 2,500
SBPS-8 - Petaluma Hill Road	1	130	500	10	50	83	45	Greater than 1,000
SBPS-9 - E. Railroad Ave.	1	25	Greater than 1,000	10	37 or less	76	45	Greater than 400
SBPS-10 - Adobe Road	5	900	300	10	70	99	45	Greater than 5,100
SBPS-11 - Adobe Road	3	40	Greater than 1,000	10	43 or less	83	45	Greater than 800
SBPS-12 - Lakeville Road	3	500	600	10	59	94	45	Greater than 3,000

Table 4.13-19

Estimated Noise Impacts from Operation of Pump Stations
(Before Mitigation)

Pump Station	System Data		Distance to Nearest Sensitive Receptor		Pump Noise Level at Nearest Sensitive Receptor		Noise Criteria[3]	Distance at Which Pump Noise Would be Less than 45 dBA (ft)
	No.[1]	Size (HP[2])	Existing (ft)	Potential Future (ft)	Existing, L_{eq} (dBA)	Potential Future, L_{eq} (dBA)	L_{eq} (dBA)	
WBPS-1 - Martinoni Road	1	5	Greater than 1,000	10	30 or less	69	45	Greater than 200
WBPS-3 - Seavey Road	1	15	400	10	42	74	45	Greater than 300
WBPS-4 - Spring Hill Road	1	110	Greater than 1,000	10	43 or less	83	45	Greater than 800
WBPS-5 - Pepper Road	3	475	Greater than 1,000	10	54 or less	94	45	Greater than 3,000
WBPS-6 - Valley Ford Road	1	20	Greater than 1,000	10	36 or less	75	45	Greater than 400
WBPS-7 - Canfield Road	1	40	200	10	53	78	45	Greater than 500
WBPS-8 - Valley Ford Road	1	10	700	10	36	72	45	Greater than 300
WBPS-9 - Valley Ford Road	1	1	Greater than 1,000	10	23 or less	62	45	Greater than 100
WBPS-10 - Bloomfield Road	1	50	300	10	50	79	45	Greater than 600
WBPS-11 - Carroll Road	1	10	600	10	39	72	45	Greater than 300
WBPS-12 - Hwy 1	1	5	Greater than 1,000	10	30 or less	69	45	Greater than 200

Table 4.13-19

Estimated Noise Impacts from Operation of Pump Stations (Before Mitigation)

Pump Station	System Data		Distance to Nearest Sensitive Receptor		Pump Noise Level at Nearest Sensitive Receptor		Noise Criteria[3]	Distance at Which Pump Noise Would be Less than 45 dBA (ft)
	No.[1]	Size (HP[2])	Existing (ft)	Potential Future (ft)	Existing, L_{eq} (dBA)	Potential Future, L_{eq} (dBA)	L_{eq} (dBA)	
WBPS-13 - Valley Ford Road	1	140	Greater than 1,000	10	44 or less	84	45	Greater than 1000
WBPS-16 - Meachum Road	1	20	Greater than 1,000	10	36 or less	75	45	Greater than 400
LBPS-1 - Green Valley	1	5	Greater than 1,000	10	30 or less	69	45	Greater than 200
LBPS-2 - Graton Road	2	175	500	10	54	88	45	Greater than 1,500
LBPS-3 - Bodega Highway	1	35	400	10	46	78	45	Greater than 500
LBPS-4 - Burnside Road	1	35	Greater than 1,000	10	38 or less	78	45	Greater than 500

Source: Parsons Engineering Science, Inc. 1996

Notes:
1. Number of pumps; does not includes standby pump systems
2. Horsepower
3. Lowest noise criteria applicable to affected sensitive receptors
4. Pumps are located outdoors

Agricultural Irrigation Component

Table 4.13-20

Noise Impacts by Component- Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.7.1. Will construction of the agricultural irrigation component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA	90 dBA	C	●
13.7.2. Will operation of the agricultural irrigation component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma & Marin Co. Greater than L_{eq} of 50 dBA Santa Rosa	Less than L_{eq} of 45 dBA	O&M	○
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Less than L_{eq} of 5 dBA increase	O&M	○
13.7.3. Will construction of the agricultural irrigation component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume	Less than 10 % increase	C	○

Source: Parsons Engineering Science, Inc., 1995

Notes:

1. Type of Impact:
   - C — Construction
   - O&M — Operation and Maintenance
   - O&M-CP — Operation & Maintenance - Contingency Plan
2. Level of Significance:
   - ○ — Less than significant impact; no mitigation proposed
   - ● — Significant impact before and after mitigation

Impact: **13.7.1. Will construction of the agricultural irrigation component expose the public to high noise levels?**

Analysis: *Significant; Alternatives 2 and 3.*

The agricultural irrigation component includes installation of pipe from public rights-of-way to undivided parcels receiving irrigation water.

The noise generated by the construction of this part of agricultural irrigation component will be similar to that of pipeline construction. The highest level of construction noise is expected to be generated during the

excavation stage. An L_{eq} as high as 90 dBA at 50 feet from the center of the construction activity will be generated during specific periods of heavy excavation. During other stages of construction, the L_{eq} will be lower and will vary depending on the amount of activity and the types of equipment in use. The specific location of the local distribution system pipelines has not been determined. Therefore, noise impacts at specific sensitive receptors were not analyzed. However, construction noise will be significant if a sensitive receptor is located within 1,600 feet of the construction site.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: *Alternatives 2 and 3.*

2.4.9. Construction Noise Control Measures

Alternatives 1, 4, and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2 and 3.*

The construction noise impacts will be reduced substantially with implementation of both the equipment noise control and administrative measures specified in the Construction Measures Section of this document. Application of the construction noise control measures will reduce the construction noise impacts at nearby sensitive receptors; however, it will not be reduced to a level of less than significant.

Impact: **13.7.2. Will operation of the agricultural irrigation component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

The operation of the agricultural irrigation component will include operation of small pumps (50 hp or less), pipelines, and drip, or spray irrigation system. Impacts of pipelines are similar to those described under the pipeline component. The pumps will be located on the private property of irrigation users, and have thus not been sited at this time. Impacts will be essentially the same as discussed above for pump stations. Please refer to the discussion of pump stations for impacts and mitigation measures. The pipelines and sprinklers used for agricultural irrigation will not produce significant noise impacts. This applies to winter irrigation under the Contingency Plan as well.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Impact: **13.7.3. Will construction of the agricultural irrigation component cause high noise levels from construction traffic?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

The daily traffic volume associated with construction of the agricultural irrigation component will include worker vehicles traveling to and from the Project site. The increase in traffic volume on local streets will be less than 10 percent. Therefore, the noise generated by the construction traffic will be less than significant.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Geysers Steamfield Component

Table 4.13-21

Noise Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.8.1. Will construction of the geysers steamfield component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA	Less than 60 L_{eq} of 60 (dBA)	C	O
13.8.2. Will operation of the geysers steamfield component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma & Marin County Greater than L_{eq} of 50 dBA Santa Rosa	Less than an L_{eq} of 45 dBA	O&M	O
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Less than 5 dBA increase in L_{eq}	O&M	O

Table 4.13-21

Noise Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.8.3. Will construction of the geysers steamfield component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume	Less than 10 % increase	C	●

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
○ Less than significant impact; no mitigation proposed
● Significant impact before and after mitigation

Impact: **13.8.1. Will construction of the geysers steamfield component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternative 4.*

The nearest sensitive receptor to the holding tanks for the geyser steamfield is several miles away. Therefore, the construction of the holding tanks is not expected to produce significant noise impacts. Construction of the pipelines within the geysers reserve is within an industrial area with no sensitive receptors.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: No mitigation is proposed.

Impact: **13.8.2. Will operation of the geysers steamfield component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternative 4.*

Flow of reclaimed water into the pipes within the geysers reserve is via gravity; "injection" of water into the geothermal wells is also via gravity. There will not be any mechanical noise sources associated with the operation of the geysers steamfield component. There may be some water turbulence as the holding tanks operate.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: No mitigation is proposed.

Impact: **13.8.3. Will construction of the geysers steamfield component cause high noise levels from construction traffic?**

Analysis: *Significant; Alternative 4.*

The daily traffic volume associated with construction of the geysers steamfield component will include worker vehicles traveling to and from the site. The increase in traffic volume on Pine Flat Road will be greater than 10 percent. Therefore, the noise generated by the construction traffic will be significant.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: *Alternative 4.* No feasible mitigation has been identified.

Alternatives 1, 2, 3, and 5. No mitigation is needed.

Discharge Component

Table 4.13-22

Noise Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.9.1. Will construction of the discharge component expose the public to high noise levels?	Greater than L_{eq} of 60 dBA			
• Russian River		Less than an L_{eq} of 60 dBA	C	O
• Laguna		None	C	==

Table 4.13-22

Noise Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
13.9.2. Will operation of the discharge component expose the public to high noise levels?	a. Greater than L_{eq} of 45 dBA Sonoma & Marin County	Less than an L_{eq} of 45 dBA	O&M	○
	Greater than L_{eq} of 50 dBA Santa Rosa		O&M	○
	b. Greater than or equal to 5 dBA increase in noise, L_{eq}	Less than a 5 dBA increase in L_{eq}		
13.9.3. Will construction of the discharge component cause high noise levels from construction traffic?	Greater than 10 % increase in traffic volume			
• Russian River		Less than 10% increase	C	○
• Laguna		None	C	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
○ Less than significant impact; no mitigation proposed
== No impact

Impact: **13.9.1. Will construction of the discharge component expose the public to high noise levels?**

Analysis: *Less than Significant; Alternative 5A.*

The nearest sensitive receptor to the discharge outfall location is approximately 1,800 feet away on the west side of the river. On the east side of the river, the nearest sensitive receptor is approximately 2,600 feet away. The noise generated by construction activities is estimated to be 87 dBA at a distance of 50 feet during the heaviest construction period. At the sensitive receptor distances of 1,800 and 2,600 feet way, the noise due to construction activities will be less than 60 dBA. Therefore, noise impacts due to construction will be less than significant.

No Impact. Alternatives 1, 2, 3, 4, and 5B.

No construction is required for discharge at the Laguna.

Mitigation: No mitigation is proposed.

Impact: **13.9.2. Will operation of the discharge component expose the public to high noise levels?**

Analysis: *Less than Significant; All Alternatives*

There will be noise generated by the water leaving the discharge pipeline into the Russian River and Laguna de Santa Rosa. However, there are no nearby sensitive receptors in the vicinity of the discharge. Therefore, the operation of the discharge component will not produce significant noise impacts.

Mitigation: No mitigation is proposed.

Impact: **13.9.3. Will construction of the discharge component cause high noise levels from construction traffic?**

Analysis: *Less than Significant; Alternative 5A.*

The daily traffic volume associated with construction of the discharge outfall will include worker vehicles traveling to and from the site. The increase in traffic volume on local streets will be less than 10 percent. Therefore, the noise generated by the construction traffic will be less than significant.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

No construction is required for discharge at the Laguna.

Mitigation: No mitigation is proposed.

CUMULATIVE IMPACTS

There are three impacts -- all significant -- identified in the Noise section:

Impact: **13.1C. Will the Project plus cumulative projects expose the public to high noise levels?**

Analysis: *Alternatives 2, 3, 4, and 5A.*

While already significant, construction noise impacts could be exacerbated even further if construction either overlaps with, or is closely followed by other construction projects. Construction of the City of Petaluma reclaimed water storage reservoir and pipelines could increase

construction noise levels in the South County area or could extend the length of time that high noise levels are experienced at particular sites. This may be of particular concern where pipelines from the Petaluma and Subregional projects are being built in the same streets, such as Lakeville Highway. These impacts may be reduced somewhat by coordination of the two construction contracts (it may be possible to install both pipelines at the same time). Mitigation for noise impacts is already in place, and there are no additional feasible measures that could be implemented to lessen noise impacts.

Impact: **13.2C. Will the Project plus cumulative projects expose the public to high noise levels?**

Analysis: *Alternatives 2, 3, and 4.*

Noise from pump stations will contribute to the overall increase in noise levels in the Project area. As population in the area increases, and more intensive land uses occur in the Project area, the existing quiet character of many areas will unavoidably change. New pump stations for the Petaluma reclamation project and for the proposed Healdsburg reservoir will increase noise levels in their vicinity. A variety of noise attenuation features are proposed to be included in pump stations for the Project, and there are no additional feasible measures that could be imposed to lessen cumulative effects.

Impact: **13.3C. Will the Project plus cumulative projects cause high noise levels from construction traffic?**

Analysis: *Alternatives 2, 3, 4, and 5A.*

Noise from construction traffic. Construction of all new pipelines (Alternatives 2, 3, 4, and 5A) and reservoirs (Alternatives 2 and 3) will generate significant noise from traffic. This will contribute to the cumulative traffic noise in the Project area, but impacts will be limited to the construction period. Mitigation for construction traffic is included in the Project, and there is no further feasible mitigation that could lessen cumulative impacts.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION

Table 4.13-23

Summary of Significant Impacts and Mitigation Measures - Noise

Impact	Level of Significance[1]	Mitigation Measure
Pipelines		
13.4.1. Construction of pipeline component may expose the public to high noise levels.	Alt 2 - ● Alt 3 - ● Alt 4 - ● Alt 5A - ●	2.4.9. Construction Noise Control Measures
13.4.3. Construction of the pipeline component may cause high noise levels from the construction traffic.	Alt 2 - ● Alt 3 - ● Alt 4 - ● Alt 5A - ●	2.4.9. Construction Noise Control Measures
Storage Reservoirs		
13.5.1. Construction of the storage reservoir component may expose the public to high noise levels.	Alt 2A - ⊙ Alt 2B - ● Alt 2C - ⊙ Alt 2D - ● Alt 3A - ● Alt 3E - ●	2.4.9. Construction Noise Control Measures
13.5.3. Construction of the storage reservoir component may cause high noise levels from the construction traffic.	Alt 2 - ● Alt 3 - ●	2.4.9. Construction Noise Control Measures
Pump Stations		
13.6.1. Construction of the pump station component may expose the public to high noise levels.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.4.9. Construction Noise Control Measures
13.6.2. Operation of the pump station component may expose the public to high noise levels.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.3.17. Incorporate Noise Control Measures into the Final Design of the Pump Station.
Agricultural Irrigation		
13.7.1. Construction of the agricultural irrigation component may expose the public to high noise levels.	Alt 2 - ● Alt 3 - ●	2.4.9. Construction Noise Control Measures

Table 4.13-23

Summary of Significant Impacts and Mitigation Measures - Noise

Impact	Level of Significance[1]	Mitigation Measure
Geysers Steamfield		
13.8.3. Construction of the geysers steamfield component may cause high noise levels from construction traffic.	Alt 4 - ●	No feasible mitigation has been identified.

Source: Parsons Engineering Science, Inc., 1996

Notes: Level of significance:

● Significant impact before and after mitigation

⊙ Significant impact before mitigation; less than significant impact after mitigation

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.13-24

Summary of Impacts by Alternative - Noise

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	==	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	O	O	O	O	O	O	O	O	O	O	O	O
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	●	●	●	●	●	●	●	●	●	●	●	--
Storage Reservoirs	--	●	●	●	●	●	●	●	●	●	--	--	--
Pump Stations	--	●	●	●	●	●	●	●	●	●	●	--	--
Agricultural Irrigation	--	●	●	●	●	●	●	●	●	●	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	●	--	--
Discharge	--	O	O	O	O	O	O	O	O	O	O	O	O

Source: Parsons Engineering Science, Inc., 1996

Notes: Level of Significance Codes

-- Not applicable

== No impact

O Less than significant impact; no mitigation proposed

● Significant impact before and after mitigation

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Sean Bui, Parsons Engineering Science, Inc.
Areg Gharabegian, P.E., Parsons Engineering Science, Inc.
Lidano Boccia, Parsons Engineering Science, Inc.

Reviewers

Marlund Hale, Ph.D., P.E., Parsons Engineering Science, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Patricia I. Collins, Harland Bartholomew & Associates, Inc.
John Cummings, Ph.D., Peer Review Committee
David Ziegler, Peer Review Committee

References

HBA Team Documents

None

Other References

American National Standards Institute. 1983. *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983. New York, NY.

California Department of Health. 1976. *Guidelines for Preparation and Content of Noise Elements of the General Plan.*

California Department of Transportation. 1987. *Highway Design Manual, Chapter 1100, Highway Traffic Noise Abatement.* January.

U.S. Army Construction Engineering Research Laboratory. 1978. *Construction Site Noise Control Cost-Benefit Estimating Procedures, Interim Report* N-36. January.

California Department of Health, Office of Noise Control. 1977. *Model Community Noise Control Ordinance.* April.

Hirsch, F.G. 1968. *Effects of Overpressure on the Ear - A Review.* Annals of the New York Academy of Science, V. 151, Part 1, 147-162.

County of Marin. 1994. *The Marin Countywide Plan-Noise Element.* January.

City of Petaluma. 1993. *Petaluma General Plan, 1987-2005.* March.

City of Santa Rosa. 1989. *City of Santa Rosa Municipal Code.* Chapter 17-16. August.

Schomer, P.D. 1973. *Predicting Community Response to Blast Noise, Technical Report (TR) E-17/AD773690.* U.S. Army Construction Engineering Research Laboratory.

Siskind, D.E., V.J. Stachura, M.S. Stagg, and J.W. Kopp. 1980. *Structure Response and Damage Produced by Airblast from Surface Mining*, Bureau of Mines Bull. 8485.

County of Sonoma. 1989 revised 1991. *Sonoma County General Plan.*

U.S. Environmental Protection Agency. 1971. *Noise from Construction Equipment and Operation, Building Equipment, and Home Appliances, NTID 300.1.* December.

U.S. Environmental Protection Agency. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, 550/9-74-004.* March.

Consultation and Coordination

Persons Contacted

None

Correspondence

None

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4.14 VISUAL RESOURCES

This section discusses the Project impacts on visual resources related to visual contrast, view obstruction, or loss of view. The section also addresses degradation in visual quality resulting from loss or alteration of a specific scenic resource (such as mature stands of native trees) or introduction of a new source of high intensity light or glare. To provide a basis for this evaluation, the setting section describes the regional landscape character and the existing visual conditions of the Project area broken down into landscape units. Potentially sensitive viewpoints are identified, along with scenic routes and other resources designated in local general plans.

IMPACTS EVALUATED IN OTHER SECTIONS

The following items are related to the Visual Resource Section but are evaluated in other sections of this document:

- Growth Inducement. Visual impacts may occur due to development in the Project area. The issue of growth inducement resulting from the Project is addressed in the Section 5.3, NEPA/CEQA Required Sections of this document.
- Historic Sites and Structures. Construction of Project facilities including dams and pipelines could impact the visual quality of historic sites and landscapes. Impacts of the proposed Project facilities on historic resources are discussed in Section 4.15, Cultural Resources and Paleontology.
- Recreational Activities. Project facilities may impact the visual qualities associated with recreational activities. Impacts on recreational activities from the Project are addressed in Section 4.16, Public Services, Utilities, and Recreation.

AFFECTED ENVIRONMENT (SETTING)

The following section provides a general discussion of the regional landscape character of the Project area, addresses the applicable plans and policies governing preservation of visual resources, and provides a description of the existing visual conditions of the study area broken down into landscape units. The landscape units represent distinct areas defined by topographic conditions (ridgelines, valleys), landscape conditions, and community boundaries. The baseline conditions were assessed based on review of Project maps and aerial photos, viewshed modeling, and a detailed site reconnaissance. Viewshed modeling was performed through the ArcInfo Geographic Information System computer program. The site reconnaissance included photography of all reservoir sites, pipeline routes, and pump station sites from sensitive viewpoints. Detailed photo logs were prepared to document the locations of the sensitive viewpoints.

Regional Landscape Character

The Project area is located within Sonoma and Marin counties, which contain a diversity of landscape types. The general topographic trend of the Coastal mountains is north-northwest to south-southeast with broad valley corridors running between the major ranges. The study area extends from the northern shores of San Pablo Bay in the south into the steeply-sloping mountainous terrain of the geysers geothermal area in the north. The western borders of the study area are characterized by lower, more rolling hills and valleys of Marin and Sonoma counties.

The central part of the Project area is composed of the agricultural plains which flank the Petaluma River and Laguna de Santa Rosa drainages. These landscapes also contain the main concentrations of urban and suburban land uses. The area is surrounded by scenic countryside which is viewed extensively by residents and visitors to the Wine Country region. As stated in the Sonoma County General Plan, "Coastal bluffs, vineyards, San Pablo Bay, the Laguna de Santa Rosa and other landscapes are of special importance to the quality of life of County residents and the tourists and agricultural economy." The Project area includes each of these areas, except coastal bluffs.

Locally Designated Scenic Resources

The following are scenic resources which are specifically designated by local jurisdictions and which may be affected by Project facilities. Local policies which are related to these resources are identified in Table 4.14-1.

Sonoma County

The Open Space Element of the Sonoma County General Plan designates specific scenic resources divided into three categories:

Community Separators

Rural lands designated as Community Separators are intended to provide visual relief between identifiable cities and communities. These lands are not necessarily scenic in their own right, but impose development restrictions to function as buffers to prevent continuous, corridor-style urbanization patterns. Project facilities may affect the following designated Community Separators:

- Petaluma/Rohnert Park (1,200 acres)
- Rohnert Park/Santa Rosa (1,700 acres)
- Santa Rosa/Sebastopol (1,400 acres)
- Windsor/Larkfield/Santa Rosa (2,000 acres)

Scenic Landscape Units

Scenic Landscape Units are intended to preserve land considered as a scenic resource. The scenic qualities of these lands influence the quality of life of residents and are important to tourism and the agricultural economy. These lands are largely open space and provide visual relief from urban densities and have little capacity to absorb very much development without significant visual impact. The list of potentially affected scenic landscape units which occur within the Project area is provided below in the section titled Sensitivity of Potentially Affected Visual Resources.

Scenic Corridors

These are designated roadways which pass through scenic areas, typically orchards, forest-covered hills, rolling dairy lands, and valleys planted in vineyards. These policies are intended to preserve these scenic roadside landscapes through compatible land-uses, setback restrictions, signage restrictions, and vegetation protection.

Marin County

The Huntley Reservoir site is visible from Marin County, and agricultural irrigation areas and pipelines are proposed within the County. There are no specific scenic resources designated by the Marin Countywide Plan in the vicinity of Project facilities, although ridgelines and grassy and wooded hillsides of upland areas have been identified by the Marin Countywide Plan as resources of concern within the inland rural portions of the County.

Santa Rosa

None of the reservoir sites are located within the planning jurisdictional boundaries of Santa Rosa, but pipelines, urban irrigation areas, and pump stations are. The City of Santa Rosa General Plan, Policy UD-3, states that views of undeveloped ridges and hillsides are to be maintained; however, any potential views of the reservoirs and ancillary facilities outside Santa Rosa will be minute elements in the distant background viewed at a distance of six miles or greater.

Designated scenic roads in the City potentially affected by the Project are Fountaingrove Parkway, Highway 12 and Bennett Valley Road.

Sebastopol

There are no specific scenic resources designated in the Sebastopol General Plan although the scenic views of the Laguna de Santa Rosa, Atascadero Creek, and the hills to the west of Sebastopol are identified as general areas of concern.

Petaluma

Most of the visual resources addressed in the Petaluma General Plan involve development within the City that could interfere with view corridors to the Sonoma Mountains, Petaluma River, and western hills. However, the Petaluma General Plan does designate Scenic Routes outside the Petaluma urban limit line, which the city intends to address through the County project referral process. Designated routes potentially affected by the Project are:

- Lakeville Highway
- Adobe Road
- Sonoma Mountain Road
- Stage Gulch Road
- Petaluma Hill Road
- Spring Hill Road
- Stony Point Road
- Bodega Avenue (Petaluma-Valley Ford Road)

Windsor

The Town of Windsor General Plan designates Scenic Corridors, which are rural lanes or scenic roads that enhance the visual experience and lead to recreation areas or that exhibit unusual natural or man-made features of interest. Designated routes potentially affected by Project facilities are:

- Conde Lane
- Pleasant Avenue
- Chalk Hill Road

Sonoma County Coastal Plan

Recommendations based on the Coastal Act regulate development and protect scenic views along the coastline. Agricultural irrigation areas, pump stations and pipelines west of Valley Ford in the Americano Creek watershed are located within the Sonoma County Coastal Zone. No other Project facilities are located within the coastal zones and the jurisdiction of the Sonoma County Coastal Plan.

Visual Resources Goals, Objectives, and Policies

Table 4.14-1 identifies goals, objectives, and policies which provide guidance for development in relation to visual resources in the Project area. The table also indicates which criteria in the Visual Resources Section are responsive to each set of policies.

Table 4.14-1

General Plan Goals, Objectives, and Policies - Visual Resources

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Open Space Element	Goal OS-1 Objective OS-1.1 Objective OS-1.2 Objective OS-1.4 Policy OS-1b Policy OS-1c Policy OS-1e	Preserve the visual identities of communities by maintaining open space as community separators between cities and communities and within the community separators: retain a rural character; preserve existing specimen trees and tree stands; and preserving natural landforms.	1
Sonoma County General Plan	Open Space Element	Goal OS-2 Objective OS-2.1 Policy OS-2b Policy OS-2e	Retain the largely open, scenic character of important scenic landscape units by retaining a rural character and requiring that new development retain existing vegetation and natural landforms.	2
Sonoma County General Plan	Open Space Element	Goal OS-3 Objective OS-3.1 Policy OS-3c Policy OS-3h	By designating specific scenic corridors, preserve roadside landscapes which have a visual quality; establish rural scenic corridor setbacks; minimize removal of vegetation; and require revegetation for public works projects.	3,4
Marin Countywide Plan	Environmental Quality Element	Policy EQ-3.11	Visual qualities and the view potential of the natural and built environment shall be considered in any project or operation review; tree-cutting and damage shall be avoided wherever possible.	5,6
Santa Rosa General Plan	Urban Design Element	Goal UD-3 Objective UD-3a	Maintain views of undeveloped ridges and hillsides, and protect natural land forms and vegetation of the hills.	5,6

Table 4.14-1

General Plan Goals, Objectives, and Policies - Visual Resources

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Santa Rosa General Plan	Safety Element	Goal TCS-4 Objective S-6a	Give residents and visitors the opportunity to enjoy the beauty of Santa Rosa's natural setting by identifying and maintaining scenic roads, through appropriate setbacks, protection of view corridors and landscaping.	3
Petaluma General Plan	Community Character Element	Objective (b)	Preserve the rural backdrop and maintain views of important natural features including the Sonoma Mountains, Petaluma River and the western hills.	2,5,6
Petaluma General Plan	Open Space, Conservation and Energy Element	Objective (c) Policy 9	Protect and enhance scenic routes to historic areas and major recreation areas, and apply scenic route policies through the County project referral process.	3
Sebastopol General Plan	Community Identity Element	Goal 13 Policy 40	Preserve and enhance scenic views of the Laguna de Santa Rosa, Atascadero Creek, the hills to the west of Sebastopol and other natural resources within the city's planning and referral area.	2,5,6
Windsor General Plan	Environmental Resources Element	Policy I.1 Policy I.1.1 Policy I.1.3	Recognize and preserve significant views along scenic corridors, with development which is harmonious with the natural viewshed and preserves views of the surrounding foothills along rural lanes.	3
Windsor General Plan	Environmental Resources Element	Policy I.2 Policy I.2.1 Policy I.2.3 Policy 1.2.6	Preserve the significant landforms surrounding the community.	1,2,5,6

Source: Harland Bartholomew and Associates, Inc., 1995

1 The evaluation criteria are in Table 4.14-2.

Caltrans Scenic Resources and State Scenic Highways

Within the Project area, portions of three highways are formally designated as scenic highways by the state:

- Highway 116 between Highway 1 and the junction of Highway 12;
- Highway 12 east of Santa Rosa and the junction of Highway 121; and
- Highway 1.

Most of the state highways within the Project area are eligible for designation as scenic highways according to Caltrans criteria, indicating that visual quality along these highway corridors is generally high.

Sensitivity of Potentially Affected Visual Resources

The following situations are considered to provide sensitive viewing opportunities within the Project area:

- Parks and designated passive recreation areas (e.g., hiking trails and nature interpretation facilities);
- Rural residential areas close to proposed Project facilities, particularly where homes are sited and designed to take advantage of scenic views;
- Scenic highways and scenic corridors recognized for their visual character, and major travel routes which carry significant volumes of recreational (sight-seeing) traffic, including:
  - Highway 101
  - Highway 128
  - Highway 1
  - Highway 37
  - Highway 12 east and west of Santa Rosa
  - Eastside Road west of Windsor
  - Highway 116, east and west of Highway 101
  - Bennett Valley Road
  - Other local roads identified as scenic corridors in the Sonoma County General Plan or City General Plans listed in Table 4.14-5
- Communities, higher density residential areas, and other major public use areas, such as:
  - Windsor

  - Santa Rosa
  - Sebastopol
  - Petaluma
  - Valley Ford
  - Bloomfield
  - Penngrove

- Scenic Landscape Units which are areas designated or zoned for protection of rural or natural scenic qualities, including community separator areas:
  - Alexander Valley
  - Hills east of Windsor
  - Laguna de Santa Rosa lowlands and hills between Forestville, Sebastopol, and Meacham Hill
  - Bennett Valley
  - Atascadero Creek west of Sebastopol
  - Sonoma Mountain east of Petaluma
  - South Sonoma Mountain

Existing Visual Conditions

The following subsections provide a more detailed assessment of existing conditions in each of the general landscape units potentially affected by Project components. The scenic landscape units identified by the Sonoma County General Plan represent more specific areas within the general landscape units described below. For each landscape unit, the existing visual character and important scenic features are described. Approximate viewing distances are described as follows:

- Foreground - 0-2,000 feet
- Near Middleground - 2,000 feet - 1 mile
- Middleground - 1-3 miles
- Background - 3+ miles

Santa Rosa Plain

This area includes the gently sloping plains east of the Laguna de Santa Rosa floodplain. It includes the communities of Santa Rosa, Rohnert Park, and Cotati. Landscape types include both high density and lower density urban and suburban development, agricultural lands (irrigated grazing, pasture land, and row crops) with low-level rural densities, and more natural areas of wetlands and riparian forest along the Laguna de Santa Rosa. In open areas, extensive views can be obtained of Sonoma Mountain to the east and to the less distinct hills and ridges of the coastal ranges to the west. The Highway 101 corridor forms a major linear feature and development corridor through the area.

This landscape unit contains the existing Laguna Plant southwest of Santa Rosa. The facility has a utilitarian appearance which contrasts with the rural landscape surroundings, due to its large scale and industrial building materials. However, the scale of the existing pump station buildings is smaller and generally compatible with that of other structures in the area Perimeter landscaping around the site and along the road screens much of the treatment plant from off-site areas.

The Windsor area is considered a subset of the northern Santa Rosa Plain. The area is characterized by low hills and views are fairly open. Agriculture, scattered natural vegetation, and small communities are found throughout the area.

Pipeline routes within this unit generally follow the roadways with ample right-of-way through open agricultural land, with some adjoining residential areas and mixed vegetation (including oak trees in some areas) within the right-of-way. Proposed pump station sites are adjacent to public rights-of-way, and are located either in urban settings within the City of Santa Rosa, or at existing reclamation system sites (Delta Pond and the Laguna Plant).

A 115 kV powerline (supported on wooden poles, 60-70 feet high), is proposed to follow an existing easement along the Laguna de Santa Rosa between the Highway 116/Highway 101 interchange and Pump Station "S" at the Laguna Treatment Plant.

A 115 kV overhead powerline is also proposed to run 3600 feet in an easterly direction along Railroad Avenue near Cotati, then 1000 feet in a southerly direction along Petaluma Hill Road to power Pump Station SBPS-10.

Petaluma River Valley

This area is a diverse landscape of rolling and gently sloping terrain enclosing the Petaluma River, centered on the City of Petaluma. Considerable urban and suburban development has occurred both on the flatter valley floor and the rolling terrain north of Petaluma. Extensive rural residential development is intermixed with agricultural landscapes further from the City boundaries. Long distance views of surrounding hills can be obtained in open areas and from high points within the area. The downtown area of Petaluma is distinctive with its well-preserved Victorian architecture and adjacent homes located on the hill above the town center. The Petaluma River is a strong visual feature seen from its banks or higher elevations, particularly towards the south where it winds through extensive wetlands as it approaches San Pablo Bay.

Pipeline routes in this unit follow road rights-of-way which are narrow in places, pass near homes, and contain many mature trees. Pump station sites are also located along these rights-of-way. Specifically, the long straight stretches of

Lakeville Road, located at the base of Sonoma Mountain is distinctive for the avenues of mature eucalyptus trees.

Sonoma Mountain

Sonoma Mountain forms a dominant visual feature and enclosing element for the Santa Rosa Plain and Petaluma River valley. Steeply sloping and in places rising to 1,400 feet, it provides a distinctive skyline and backdrop to the urban setting of Santa Rosa, with strong vegetation patterns (oak woodland and grass) in places. Further south, in the Lakeville Area, it become less rugged and rises to lower elevations, characterized by open grassland with occasional distinctive patterns of riparian woodland and planted shelterbelts. The topography is varied, with many hidden valleys contained within the range of hills. From vantage points in the hills, commanding views over the Petaluma River, Santa Rosa Plain, and more distant coastal hills can be obtained. The area is largely undeveloped, with occasional ranches and sparsely distributed local roads; grazing is the predominant visible land use.

Pipeline routes in general follow narrow County roads through steep open grazing land or wider rights-of-way along major travel routes.

Three proposed reservoir sites occur within this landscape unit:

Adobe Road Reservoir Site

This reservoir site occupies a relatively narrow valley at the foot of Sonoma Mountain where they meet the Petaluma Valley floor, about 4 miles northeast from the Petaluma City center. The valley contains natural riparian vegetation and steep grassy slopes, with a small number of agricultural buildings within the proposed footprint of the reservoir. The valley pinches off at its outlet to the Petaluma Valley; this, together with screening by existing trees near the valley mouth, prevents views from penetrating up the valley from the Petaluma Valley area.

Potentially sensitive viewpoints include:

- Farmhouse near the valley mouth northeast of Adobe Road (foreground);
- Adobe Road in the vicinity of the valley mouth (near middleground), which is a County designated scenic corridor;
- Sonoma Mountain Road where it approaches higher elevations north of the reservoir site (foreground) and other small local roads in the hills nearby;
- Washington Street in Petaluma, which provides axial middleground and background views northeast towards the site;

- Skyranch Airport (a public viewpoint) with middleground views towards the valley mouth from the south;
- General views from open areas within Petaluma and north of Petaluma, in middleground and background, (e.g., County Fairgrounds and various parks);
- City Park on the hill, and homes on the hill above downtown and Petaluma; and
- Highway 101 at a distance of 2 miles or more (middleground and background).

A 12 kV overhead electrical service line is proposed to extend from Sonoma Mountain Road to the pump station at the north end of the proposed reservoir. Electrical service to the pump station located on the south end of the reservoir will be provided underground.

Tolay (Extended and Confined) Reservoir Site

This site occupies a broad, flat valley basin within the surrounding hills of Sonoma Mountain. The valley slopes gently up to the adjoining rolling hills, but narrows toward its outlet on Tolay Creek in the south. The site is characterized by fields and grassland, with a mixture of extensive grassland and evergreen woodland on the surrounding hills. A few small farm buildings occur within the site. The area is seen from the following key viewpoints:

- A small number of private homes/ranches on both valley sides; and
- A stretch of Stage Gulch Road (Highway 116) northwest of the site, with open near-middleground views along the Tolay Creek valley. This is a County designated scenic corridor.

A 12 kV overhead electrical service line is proposed to run along an existing access road extending from Stage Gulch Road to the proposed Tolay A pump station located at the northeast end of the reservoir site. The road crosses a gently sloping valley basin that is visually open. A 12 kV line will also be constructed from the easterly end of Cannon Lane to Pump Station "T" at the southeast end of the reservoir site. Views at this location are limited from any public viewpoint.

Lakeville Hillside Reservoir Site

This site occupies a narrow, moderately sloping valley on the west facing flank of the southern part of Sonoma Mountain where terrain is gently rolling. The valley is tucked away from most views, screened by topography. The valley bottom contains some native riparian (willows) vegetation and scattered eucalyptus trees

associated with its historic agricultural use. The area is mainly grassland used for grazing. It is seen from the following viewpoints:

- Private homes and farm buildings on the gentle hillsides to the south (in foreground);
- Old Lakeville Highway, No.2 which affords glimpses of the site (in near-middleground) between the eucalyptus trees alongside the road; and
- Lakeville Highway, a County designated scenic corridor, which has very limited views of the site due to rising intervening topography and the eucalyptus rows along Old Lakeville Highway No. 2.

Electrical service to the proposed pump station at the Lakeville Hillside dam will be provided by a short underground line from an existing overhead line on the site.

Sears Point/Bay Flats Area

The southern tip of Sonoma Mountain forms the edge of the bay flats area, which is itself part of the extensive San Pablo Bay landscape. The expansive flat lands of the bay shore are characterized by wetlands and flat adjoining agricultural lands and pasture. The expanses are dissected and edged by the sinuous waterways of the Napa Sloughs and Sonoma Creek and by linear features such as levees and roadways built on fill through the marshland. The hills to the north provide a backdrop of moderately sloping grassy terrain, with a few trees clustered at lower elevations and in riparian corridors. Extensive panoramic views are obtained westward to the hills of Marin County across the Petaluma River and northward towards the hills above the City of Sonoma.

Sears Point Reservoir Site

The Sears Point reservoir site at the southern tip of Sonoma Mountain, and occupies the valley of Tolay Creek where it broadens out to meet the edge of the bay flats. The valley is largely open, with some native riparian vegetation along the creek and a few clusters of eucalyptus trees. Low hillocks near the mouth of the valley partly close it off from views to the east. The site is potentially within the influence of the following sensitive viewpoints:

- Sears Point Raceway, a well-known destination for racing enthusiasts and visitors, located on the south facing hillside approximately one mile to the south of the site (middleground views);
- Highway 121, a County designated scenic corridor which carries significant tourist traffic between Sears Point and the City of Sonoma and which provides limited open views toward the site in near middleground;

- The Roche Winery which is located atop a small hill with panoramic views east of Highway 121, about 1 mile from the reservoir site; and
- Highway 37, a County designated scenic corridor which supports high traffic volumes between Vallejo and the Highway 101 corridor. It provides open middleground and background views westward toward the site across the wetlands of Tubbs Island.

The farm/private house located immediately to the east of the site in the Tolay Creek valley is screened from the site itself by an intervening low ridge.

Pipeline routes are located along roadway right-of-way primarily through open agricultural land.

A 115 kV overhead electrical service route is proposed to run 9500 feet along Highway 121 from Highway 37 to the proposed Pump Station "SP" at the Sears Point reservoir site Currently, an overhead utility line mounted on 40-foot-high wooden poles runs along the west side of the Highway.

Bennett Valley

This landscape unit is formed by a small valley enclosed by the Sonoma Mountains on three sides and transitions from the urban area of east Santa Rosa to a suburban landscape type in the northern part of the Valley. This gives way to open agricultural and grazing land in the south, with steep valley sides sustaining grassland and native woodland. Bennett Mountain forms a scenic backdrop for views from Bennett Valley Road.

Pipelines in this unit are part of the proposed urban irrigation system. They will follow the network of County roads, with right-of-way varying from narrow to wide. Some of the older local roads are narrow, with many turns, roadside banks, and mature oak trees or shelterbelts along the fenceline.

Sebastopol Area

West of the Santa Rosa Plain, the low hills around Sebastopol provide a diverse, heavily treed landscape characterized by numerous scattered residences in a rural setting of orchards and small lots. Landscape characteristics are created by a rich mosaic of small-scale landscapes including roadside trees, fruit trees, wooded areas, scattered oaks within fields, and residential landscapes with relatively few long-distance panoramas.

Pipelines in this unit will follow the network of County roads, with right-of-way varying from narrow to wide. Some of the older local roads are narrow, with

many turns, roadside banks, and mature oak trees or shelterbelts along the fenceline.

Western Hills

To the west of Sebastopol and Forestville and extending to the Marin County coastline, lie open rolling hills which provide diverse scenic landscapes. While generally less rugged than the higher Sonoma Mountain, they provide varied views of east-west valleys, open sweeping ridges, and largely undeveloped pastoral landscapes. The valleys of Estero Americano, Stemple Creek, and Salmon Creek are separated by high rolling terrain with numerous side valleys. The broader valleys contain some agriculture and are distinctive for the prominent long shelterbelts of eucalyptus and cypress trees. The area is seen by significant numbers of recreational visitors and sight-seers traveling to coastal destinations on day trips and vacations. The area contains several very small communities and scattered rural housing at very low densities.

Pipeline routes in this area follow along narrow country roads, some of which contain or are bordered by mature shelterbelts. Other routes follow sloping, narrow roads through valleys and over hills, with narrow rights-of-way and steep adjoining banks. Some pipeline routes follow wide County roads such as Petaluma-Valley Ford Road.

Two Rock Reservoir Site

This site occupies a steep-sided valley which is largely hidden from public view amid the undeveloped hills approximately five miles west of the Highway 101 corridor. The site consists of open grassy valleysides with some wooded vegetation in the valley bottom and east-facing slopes. The valley opens through a narrow gap between steep spurs onto a broader, flat valley which is tributary to Stemple Creek. The principal viewpoints potentially affected include:

- Walker Road, a country road which passes less than a mile from the site.
- Valley Ford Highway, a County designated scenic corridor. The reservoir site can be seen in middleground views; and
- A small number of private homes/ranches near Walker Road downstream of the site and at the southeast corner of the site.

A 277/480 kV electrical line, supported on wooden poles, 40-45 feet high, is proposed to run adjacent to Hall Road which leads to the Two Rock Reservoir site from Walker Road. An existing overhead powerline extends part way along this road. Some scattered trees and high shrubs are found along the road.

Bloomfield Reservoir Site

This site occupies a side valley off the Americano Creek Valley, immediately to the south of English Hill. The valley itself consists of moderately sloping open grassland, with occasional clumps of eucalyptus trees as visual features. Seen in views up the valley from the south, the steep hillsides of English Hill dominate the landscape, with their distinctive pattern of riparian woodland in the steep gullies on the south facing slopes, and ridgeline trees along the crest of the hill. A few homes are on the south side of the ridgeline trees with commanding views of the scenic low coastal hill country and valleys. Man-made developments that are visible in the area are primarily scattered farm buildings and rural residences, associated with the pastoral land uses of the area.

Potentially sensitive viewpoints in this area include:

- A few homes on English Hill which overlook the reservoir site in near middleground;
- A few scattered farms/rural residences at the mouth of the side valley and in the Americano Creek Valley, in near middleground and middleground;
- Petaluma-Valley Ford Road, which is a County designated scenic corridor, providing near-middleground views at right angles to the direction of travel;
- The Bloomfield cemetery in near-middleground on a low hilltop west of the town; and
- Other local roads in the immediate area, notably Jones Road, which may provide some focal views northward towards the site in middleground.

The community of Bloomfield, less than a mile to the southeast of the site, is not within view due to topographic screening. The site is also not visible from Highway 1, which enters the Americano Creek Valley about 1.5 miles to the west.

A 12 kV electrical service line, mounted on wooden poles, 40-45 foot high, is proposed to run adjacent to the existing road which extends to the Bloomfield Reservoir site. This road passes through open agricultural/pasture land.

Carroll Road Reservoir Site

This site occupies another side valley off the Americano Creek Valley, south of English Hill and immediately to the west of the Bloomfield site. The reservoir site is set back further from the Americano Creek Valley than the Bloomfield site. The side valley itself consists of moderately sloping open grassland, with occasional clumps of eucalyptus trees. The valley splits into two areas at its upper reaches, with the steep open hillsides of English Hill providing strong visual

enclosure to the north. The ridgeline is relatively devoid of trees at this point, with a few trees and homes visible on the crest. These homes provide commanding views of the scenic coastal hill country and valleys within this landscape type. Other man-made developments that are visible in the area are primarily scattered farm buildings and rural residences, associated with the pastoral land uses of the area.

Potentially sensitive viewpoints in this area include:

- A few homes on English Hill which overlook the reservoir site in near middleground. There are no open public views from Burnside Road along the crest of the hill;
- A few scattered farms/rural residences along Carroll Road within the side valley in foreground and in the Americano Creek Valley, in middleground;
- The Petaluma-Valley Ford Road, which is a County designated scenic corridor, provides middleground views at the right angles to the direction of travel; and
- Highway 1, which is a State Scenic Highway and one of the major north-south recreational travel routes in California. The northbound stretch approaching Americano Creek provides open views toward English Hill, although the actual valley bottom at the site in middleground is shielded by low intervening topography.

Electrical service to the proposed pump station at the Carroll Road dam will be provided by a short underground line from an existing overhead line on the site.

Valley Ford Reservoir Site

This site occupies another side valley off the Americano Creek Valley, southwest of English Hill and immediately to the west of the Carroll Road site. The reservoir site is closer to the Americano Creek Valley than either the Carroll Road or Bloomfield sites. The side valley itself consists of moderately sloping open grassland, with occasional clumps of eucalyptus trees and some riparian growth in the higher drainages. The site lies between two southward projecting spurs that extend from the long low mass of English Hill, which provides visual enclosure to the north. The ridgeline is relatively devoid of trees at this point, with a few trees visible on the crest. Man-made developments that are visible in the area are primarily scattered farm buildings and rural residences, associated with the pastoral land uses of the area. One farmstead occupies the site near the base of English Hill, and a small overhead utility line is prominent in the valley bottom.

Sensitive viewpoints in this area include:

- The farms/private residence within the side valley and a few others in foreground to middleground in the Americano Creek Valley;
- The Petaluma-Valley Ford Road, which is a County designated scenic corridor, providing foreground and near-middleground views up the side valley, particularly in the westbound direction;
- Highway 1 (a State Scenic Highway), where the northbound stretch approaching Americano Creek provides continuous open focal views into the side valley at middleground to foreground viewing distances, making this reservoir site the most visible of all of the West County sites to large numbers of recreational travelers; and
- Homes and viewlots at the west end of English Hill. This site is farthest from these sensitive locations, and only the higher east-facing elevations of the side valley are visible from English Hill.

The site is screened from the Valley Ford community and other stretches of Highway 1 by topography.

Electrical service to the proposed pump station at the Valley Ford dam will be provided by a short underground line from an existing overhead line on the site.

Huntley Reservoir Site

This site occupies a small side valley off the Stemple Creek drainage, close to the Marin County border. The valley is bounded by moderately sloping hillsides with open grassland. The heads of the valley are marked by a dense belt of eucalyptus trees on the skyline. A small local road runs along the valley, and provides access to a few rural residences on the valley sides. The principal viewpoints potentially affected include:

- Private residences within the immediate foreground of the valley;
- Local traffic along Martinoni road;
- Local and recreational traffic along:
  - Fallon-Two Rock Road and Tomales-Petaluma Road along Stemple Creek in Marin County (with brief middleground views at a wide angle to the direction of travel); and
  - Points along the Tomales-Petaluma Road and Twin Bridge Road in focal views up the valley to the north in middleground;
- Scattered rural residences at middleground viewing distances along the Stemple Creek Valley.

Electrical service to the proposed pump station at the Huntley dam will be provided by a short underground line from an existing overhead line on the site.

Russian River Area

The Russian River Valley in the Project area provides distinctly different visual resources than other landscape types, due to the dominance of the larger river channel with its flat floodplain, steep, wooded enclosing slopes, and sinuous corridor. The valley broadens out and becomes less distinct upstream towards Healdsburg. The communities within the Valley provide distinctive urban features associated with the tourist industry in the region. The Eastside Road along the Russian River passes through oak woodland in which the right-of-way is quite narrow. A variety of views are obtained from travelers moving along the corridor as it twists and turns through coastal range hills. The River is also a popular recreational resource for "floaters" who will have views from the River.

The pipeline routes follow some narrow roads through heavily wooded terrain, with oaks and mixed evergreen trees close to the paved access roadway.

Alexander Valley

The Alexander Valley is identified as a Scenic Landscape Unit in the County General Plan. It forms a large distinctive landscape type comprised of a broad flattish valley floor with intensive agricultural uses, notably vineyards, surrounded by rugged hills with a rich mosaic of woodland, scrub, and grassland vegetation types. There is considerable agricultural development associated with wineries, farms, and rural residences. Highway 101 and Highway 128 are County designated scenic corridors. The area sustains a high volume of tourist traffic and recreational sight-seeing associated with the wine industry and the area's scenic qualities. The bridge over Sausal Creek provides a distinct feature and focal point, with an open panorama of the Mayacmas Mountains.

The geysers pipeline route follows wide rights-of-way along the valley floor through agricultural land; some mature oak tree clumps occur adjacent to the right-of-way.

Mayacmas Mountains/Geysers Area

The Mayacmas Mountains are in a landscape unit of high, rugged, and steeply dissected mountain ranges and valleys to the north of the Project area. Rising to above 3,000 feet, they form the high background ridges to much of the lower landscapes already described to the southwest. The steep slopes reveal different vegetation patterns, depending on aspect and elevation, with complex mosaics of darker colored scrub, evergreen forests and open grassland. Much of the area is sparsely populated with little evidence of man-made features.

The geysers area itself forms a unique component where man-made development of the geothermal fields has introduced several large power plants with highly visible steam plumes under some conditions and extensive networks of roads, powerlines, and pipelines on steep terrain. Road scars and vegetation clearings can be very prominent in these landscapes, depending upon the visual absorption capability of the natural vegetation patterns.

The southwest facing slopes of the mountains and higher ridgelines are widely visible from the Alexander Valley and other locations at considerable distances (middleground and background). There are few roads and viewing opportunities within the mountains themselves, other than the occasional narrow winding public roads such as Geysers Road, which is well to the north of the proposed pipeline route. The roads provide diverse short distance views to surrounding mountainsides, and extensive panoramas of the lower landscapes from overlooks.

The geysers pipeline route follows a narrow, winding road (Pine Flat Road) through steeply sloping valleys and across rugged dissected hillsides, with thick vegetation in the valley bottoms and chaparral elsewhere.

A 12 kV overhead electrical line is proposed to run along Pine Flat Road to pump stations G-2, G-3, and G-4. The overhead power line alignment, mounted on 40-45 foot high wooden poles, begins in a flat orchard area and then proceeds along narrow Pine Flat Road as it winds up rugged, dissected hillsides covered with chaparral vegetation.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

The visual impact evaluation criteria are presented in Table 4.14-2. These criteria are drawn primarily from local, State, and Federal agency policies and procedures, adapted where necessary to reflect CEQA requirements.

Table 4.14-2

Evaluation Criteria with Point of Significance - Visual Resources

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will the Project be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?	a. Level of visual contrast (change in form, line, color, texture, scale of landscape)	a. Strong visual contrast[1]	Sonoma County General Plan Caltrans Scenic Resource Inventory
	b. View obstruction (loss of view)	b. Obstruction in viewed area[2] from foreground[3] or middleground[3]	
	c. Degradation in visual quality	c. Loss or alteration of a[4] specific scenic resource	
2. Will the Project be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?	a. Level of visual contrast (change in form, line, color, texture, scale of landscape)	a. Strong visual contrast[1]	Sonoma County General Plan Caltrans Scenic Resource Inventory
	b. Amount of view obstruction (loss of view)	b. Obstruction in viewed area[2] from foreground[3] or middleground[3]	
	c. Degradation in visual quality	c. Loss or alteration of a[4] specific scenic resource	
3. Will the Project be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?	a. Level of visual contrast (change in form, line, color, texture, scale of landscape)	a. Strong visual contrast[1]	Sonoma County General Plan and City General Plan Caltrans Scenic Resource Inventory
	b. Amount of view obstruction (loss of view)	b. Obstruction in viewed area[2] from foreground[3] or middleground[3]	
	c. Degradation in visual quality	c. Loss or alteration of a[4] specific scenic resource	

Table 4.14-2

Evaluation Criteria with Point of Significance - Visual Resources

Evaluation Criteria	As Measured by	Point of Significance	Justification
4. Will the Project be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?	Proximity of Project facilities to setback line	Less than 200 feet	Sonoma County General Plan
5. Will the Project cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area[6], or other public use area[7]?	a. Level of visual contrast (change in form, line, color, texture, scale of landscape)	a. Strong visual contrast[1]	Principles of visual management (e.g., Caltrans Environmental Procedures, US Forest Service Visual Management System, Federal Highway Administration Visual Impact Assessment Manual, and Bureau of Land Management Visual Resource Management System)
	b. Amount of view obstruction (loss of view)	b. Obstruction in viewed area[2] from foreground[3] or middleground[3]	
	c. Degradation in visual quality	c. Loss or alteration of a[4] specific scenic resource	
6. Will the Project may cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?	a. Level of visual contrast (change in form, line, color, texture, scale of landscape)	a. Strong visual contrast[1]	Principles of visual management (e.g., US Forest Service Visual Management System, Federal Highway Administration Visual Impact Assessment Manual, and Bureau of Land Management Visual Resource Management System)
	b. Amount of view obstruction (loss of view)	b. Obstruction in viewed area[2] from foreground[3] or middleground[3]	
	c. Degradation in visual quality	c. Loss or alteration of a[4] specific scenic resource	

Table 4.14-2

Evaluation Criteria with Point of Significance - Visual Resources

Evaluation Criteria	As Measured by	Point of Significance	Justification
7. Will the Project create a new light source?	High intensity light or glare towards private residences	Greater than 0 residences affected	California Environmental Quality Act Case Law

Source: Dames & Moore, 1995

1 Strong Visual Contrast - (one or more of the following) regraded land forms are flat with little to no contour: line of major ridgeline is altered and not consistent with surrounding ridgelines or minor ridgelines are eliminated; inconsistent color with adjacent landscape character; elimination of landscape texture created by exposed soil or removal of vegetation; form of project grossly exceeds scale of natural land forms.

2 Viewed area defined as area of landscape (i.e., everything except sky) as shown in a photograph from the closest sensitive viewpoint, taken with a normal (50 mm) lens.

3 Foreground: 0-1/2 mile; Middleground: 1/2-3 miles

4 Specific Scenic Resource - (one or more of the following) landscape component that creates striking feature; Landform - steep (>60%) undulating/dissected slopes, distinctive rock outcrops, or pronounced ridgelines; Water - major bodies of water that provide reflective qualities and irregular shorelines, or major/permanent streams/rivers with diversity of meanders, flows, rapids, rock outcrops, or river-banks; Vegetation - mature stands of native or cultural species (oaks and eucalyptus) in natural groves or distinct planted patterns (i.e. eucalyptus along roads or as planted wind breaks); Man-made development - historic structures.

5 High volume travelways: State highways and 2-lane County highways serving direct connections with settlements named on the USGS quad maps;

6 Recreation use areas: Designated recreation sites, parks, trails, or other areas managed for public recreation.

7 Public use area: Downtown areas, cemeteries, community centers, attracting the public on a daily or regular basis.

For most evaluation criteria (1-3 and 5-6), visual impact significance is measured by three criteria: changes in visual contrast, amount of view obstruction, and degradation in visual quality. Visual contrast is significant if it is strong as a result of regraded landforms, alteration or elimination of ridgelines, and changes introduced by the Project which result in landscape colors, textures, and scale of visual components which are inconsistent with the natural surroundings. View obstruction is considered significant if foreground or middleground views of the viewed area seen from sensitive viewing areas are obstructed by the Project. Degraded visual quality is considered significant if the Project severely alters or displaces specific scenic resources composed of striking landform features, aesthetic water bodies, mature stands of native/cultural trees (historic hedgerows, etc.), or historic structures. More detailed definitions of strong visual contrasts and specific scenic resources are provided in the footnotes to Table 4.14-2. Visual impacts are considered to be significant overall if any one of the three measures of significance is identified.

METHODOLOGY

Visual impacts are generally assessed by estimating the amount of visual changes introduced by Project components, the degree to which visual changes may be visible to

surrounding viewer groups, and the general sensitivity of viewer groups to landscape alterations. Visual changes are usually measured by three factors: the amount of visual contrast that Project components create (changes to form, line, color, texture, and scale in the landscape), the amount of view obstruction (loss of view) that occurs, and degradation of specific scenic resources (removal of scenic tree groves, etc.).

General visibility of Project components was based on computerized viewshed analysis and field checks to specific areas of potential visual sensitivity (e.g., residential areas, community and county parks, scenic highways). Visibility mapping was conducted by importing USGS 1:250,000 Digital Elevation Model data into a computerized Geographic Information System (GIS). The computer then performed line-of-sight calculations to determine the extent to which intervening topography will block views of the reservoir dam, water surface, or pump station from surrounding areas. Viewshed mapping assumes that potential views are determined by topography only; no localized site conditions such as vegetation or buildings which could block specific views are calculated. In the analysis, visibility was considered for up to a 5-mile radius of the reservoir site ("background" viewing distance).

Based upon visibility mapping and potentially sensitive viewpoints identified in field investigations and discussed in the setting, the analysis was narrowed down to a few key viewpoints where computer modeling and/or visual simulation techniques will be employed. The models and simulations were used to assist in estimating the extent and scale of landscape alterations, including the possible elimination of scenic resources. In general, residents and travelers along scenic highways are considered to be the most sensitive to visual changes since view frequency is high, view durations are long, and viewers have high expectations of scenic quality.

Environmental Consequences (Impacts) and Mitigation Measures

No Action (No Project) Alternative

Impact: **14.1.1-7. Will the No Action Alternative impact visual resources based on evaluation criteria 1 through 7?**

Analysis: *No Impact*; *Alternative 1.*

The No Action Alternative will involve no construction or new facilities and therefore will have no visual impacts.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Impact: **14.2.1-7. Will the headworks expansion component impact visual resources based on evaluation criteria 1 through 7?**

Analysis: *No Impact; All Alternatives.*

The headworks expansion consists of installation of new pumps within an existing building. There will be no change in the visual environment.

Mitigation: No mitigation is needed.

Urban Irrigation Component

Impact: 14.4.1-7. Will the urban irrigation component impact visual resources based on evaluation criteria 1 through 7?

Analysis: *No Impact. All Alternatives.*

The urban irrigation component consists of using reclaimed water in existing irrigation systems; this change in water source for the irrigation has no visual impact.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.14-3

Visual Resource Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.4.1. Will the pipeline component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?				
• Pipeline segments listed in Table 4.14-4	Strong visual contrast	Strong	C	⊙
• All other pipelines		None	C, P	=
• All pipelines	Permanent View Obstruction	None	C, P	=
• All pipelines	Loss or alteration of a specific scenic resource	None	C, P	=
14.4.2. Will the pipeline component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?				
• Pipeline segments listed in Table 4.14-4	Strong visual contrast	Strong	C, P	⊙

Table 4.14-3

Visual Resource Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• All other pipelines		None	C, P	=
• All pipelines	Permanent View Obstruction	None	C, P	=
• All pipelines	Loss or alteration of a specific scenic resource	None	C, P	=
14.4.3. Will the pipeline component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?				
• Pipeline segments listed in Table 4.14-5	Strong visual contrast	Strong	C, P	⊙
• All other pipelines		None	C, P	=
• All pipelines	Permanent View Obstruction	None		
• Lakeville Highway (S. of Browns Lane); Chalk Hill Road (between Pleasant Lane and Hwy 128); Petaluma Valley Ford Road (west of Roblar Road)	Loss or alteration of a specific scenic resource	Loss of Mature Stands of Trees	C, P	⊙
• All other pipeline segments		None	C, P	=
14.4.4. Will the pipeline component be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?	Less than 20 feet	None	P	=
14.4.5. Will the pipeline component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?				
• Geysers pipeline along Pine Flat Road	Strong visual contrast	Strong	C, P	●
• Pipeline segments listed in Table 4.14-5		None	C, P	=
• All other pipelines		Strong	C, P	⊙
• All pipelines	Permanent View Obstruction	None	C, P	=

Table 4.14-3

Visual Resource Impacts by Component - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Trenton Healdsburg Road; Eastside Rd. (N. of River Road)	Loss or alteration of a specific scenic resource	Loss of Mature Stands of Trees	C, P	⊙
• Other pipeline segments listed in Table 4.14-5		None	C, P	=
14.4.6. Will the pipeline component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?				
• Pipeline segments listed in Table 4.14-5.	Strong visual contrast	Strong	C, P	⊙
• All other pipelines		None	C, P	=
• All pipelines	Permanent Visual Obstruction	None	C, P	=
• All pipelines	Loss or alteration of a specific scenic resource	None	C, P	=
14.4.7. Will the pipeline component create a new light source?	Greater than 0 residential units affected	None	C, P	=

Source: Harland Bartholomew and Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
P Permanent

2. Level of Significance:
● Significant impact before and after mitigation
⊙ Significant impact before mitigation; less than significant impact after mitigation
○ Less than significant impact; no mitigation proposed
= No impact

Impact: **14.4.1. Will the pipeline component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separators?**

Analysis: *Significant. Alternatives 2, 3, and 4.*

Portions of pipeline routes, as shown in Table 4.14-4 are located within or adjacent to community separators, as defined in the Sonoma County General Plan. Construction activities along these routes will involve removal of vegetation, grading and trenching of the landscape edge within the public right-of-way. This will result in a bare, scarred appearance in

strong contrast to the existing vegetated edge and pastoral visual character within the community separators.

Table 4.14-4

Pipeline Segments Located in Community Separators and Scenic Landscape Units

Pipeline Segment	From	To
Community Separators		
Santa Rosa-Windsor Community Separator		
Pleasant Avenue	Pool Creek	Chalk Hill Road
Petaluma-Rohnert Park Community Separator		
Stony Point Road	West Sierra Avenue	Orchard Lane
West Railroad Avenue	Stony Point Road	Birch Avenue
Adobe Road	Jacobsen Lane	Hardin Lane
Scenic Landscape Units		
Estero Americano		
Highway 1	Freestone-Valley Ford Road	west of Freestone-Valley Ford Road
Alexander Valley		
Highway 128	north of Chalk Hill Road	Pine Flat Road
Pine Flat Road	Highway 128	Sausal Creek
Russian River		
Eastside Road	Trenton-Healdsburg Road	Ballard Road
Trenton Healdsburg Road	River Road	Eastside Road
Mark West Creek		
Slusser Road	River Road	Steele Ranch Road
Graton		
Ross Road	Ross Station Road	south of Ross Station Road
Santa Rosa Plain		
Direct Discharge Pipeline	Delta Pond	River Road (cross country alignment)
Geysers Pipeline	Delta Pond	Guerneville Road (cross country alignment and via Willowside Road)
Olivet Road	Piner Road	River Road
Atascadero Creek		

Table 4.14-4

Pipeline Segments Located in Community Separators and Scenic Landscape Units

Pipeline Segment	From	To
Barlow Lane	Mill Station Road	Occidental Road
Mill Station Road	Barlow Lane	Ferguson Road
Watertrough Road	Burnside Road	
Burnside Road	Watertrough Road	Gold Ridge Road
Gold Ridge Road	Ramondo Drive	Koblike Drive
Washoe Creek		
Stony Point Road	Roblar Road	West Sierra Avenue
Copeland Creek		
Roberts Road	east of Petaluma Hill	Pressley Road
Lichau Road	Roberts Road	east of Roberts Road
Adobe Road/Sonoma Mountain		
Adobe Road	Jacobsen Lane	Frates Road
Lakeville Highway		
Ely Road	north of Brown's Lane	Brown's Lane
Lakeville Highway	north of Stage Gulch Road	Highway 37

Source: Harland Bartholomew & Associates, Inc. 1996

Because the pipelines will be located underground, there will be no permanent obstruction of views. Along all pipeline routes as part of the Project, construction scars will be revegetated and landforms along the routes will be restored and blended with the natural landforms. These measures, as described in Section 7.2, will neutralize the visual effects of construction resulting in no permanent impact.

No other specific scenic resources which will be impacted by pipeline construction have been identified within the community separators, scenic landscape units and scenic corridors.

No Impact; Alternatives 1 and 5.

Alternative 5A does not have any pipelines located in a community separator.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: *Alternatives 2, 3, and 4.*

2.3.10 Limit Construction Disturbance.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 2, 3, and 4.*

This measure will minimize construction disturbance of the landscape edge and therefore reduce impacts due to visual contrast.

Impact: **14.4.2, 3 and 6. Will the pipeline component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from Public Viewpoints; with Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors; and with foreground view from one or more private residences?**

Analysis: *Significant. Alternatives 2,3, 4, and 5A.*

Portions of pipeline routes, as shown in Table 4.14-4 and Table 4.14-5 are located within or adjacent to designated Scenic Landscape Units and along Scenic Corridors. Construction activities along all of these routes will involve removal of vegetation, grading and trenching of the landscape edge within the public right-of-way. This will result in a bare, scarred appearance in strong contrast to the existing vegetated edge and pastoral visual character within the scenic landscape units. Construction activities will also result in a strong visual contrast with both the rural and urban landscape edges within the right-of-way along the Scenic Corridors. Because these landscape edges are immediately adjacent to private residences along the pipeline routes, they will have a significant impact on foreground views from these residences.

Table 4.14-5

Pipeline Segments Along Designated Scenic Corridors

Corridor Type/Route Segment	From	To
State Scenic Corridors		
Highway 1	south of Petaluma-Valley Ford Road	west of Freestone-Valley Ford Road
Highway 116	Guerneville Road	Green Valley Road
Sonoma County Scenic Corridors		
Highway 1	Sonoma-Marin County Line	west of Freestone-Valley Ford Road
Highway 128	Chalk Hill Road	Pine Flat Road
Chalk Hill Road	Pleasant Avenue	Highway 128
River Road	west of Slusser Road	Trenton-Healdsburg Road
River Road	Olivet Road	Slusser Road
Green Valley Road	Highway 116	Bowes Road
Highway 116	Guerneville Road	Green Valley Road
Petaluma Hill Road	Tevis Way	Adobe Road
Crane Canyon Road	Petaluma Hill Road	Inverness Avenue
Guerneville Road	Laguna de Santa Rosa	Highway 116
Occidental Road	Barlow Road	Coffee Lane
Bodega Highway	Ragle Road	Ferguson Road
Highway 116	Lone Pine Road	South Stony Point Road
Petaluma-Valley Ford Road	Spring Hill Road	Highway 1
Bodega Avenue	Middle Two Rock Road	Spring Hill Road
Adobe Road	Jacobsen Lane	Frates Road
Lakeville Highway	Browns Lane	Highway 37
Highway 37	Lakeville Highway	Highway 121
Highway 121	Highway 37	Tolay Creek
Stage Gulch Road	Lakeville Highway	Tolay Creek
River Road	Olivet Road	Slusser Road
Santa Rosa Scenic Roads		
Fountaingrove Parkway	Old Redwood Highway	Fountaingrove Golf Course
Bennett Valley Road	Farmers Lane	Bennett Valley Golf Course
Petaluma Scenic Routes		
Lakeville Highway	Browns Lane	Old Lakeville Highway No. 2
Adobe Road	Petaluma Hill Road	Frates Road

Table 4.14-5

Pipeline Segments Along Designated Scenic Corridors

Corridor Type/Route Segment	From	To
Petaluma Hill Road	Roberts Road	Adobe Road
Spring Hill Road	Petaluma Valley Ford Road	Purvine Road
Stony Point Road	Meacham Road	Orchard Lane
Bodega Avenue (Petaluma-Valley Ford Road)	Middle Two Rock Road	Pepper Road
Windsor Scenic Corridors		
Conde Lane	Shiloh Road	Highway 101
Pleasant Avenue	east of Pool Creek	Chalk Hill Road
Chalk Hill Road	Pleasant Avenue	Brooks Creek

Source: Harland Bartholomew & Associates, Inc. 1996

Because the pipelines will be located underground, there will be no permanent obstruction of views. Along all pipeline routes as part of the Project, construction scars will be revegetated and landforms along the routes will be restored and blended with the natural landforms. These measures will neutralize the visual effects of construction resulting in no permanent impact.

On three of the pipeline routes--Lakeville Highway south of Browns Lane, Petaluma-Valley Ford Road west of Roblar Road, and Chalk Hill Road between Pleasant Lane and Highway 128--specific scenic resources that could be impacted by pipeline construction have been identified. These consist of mature stands of eucalyptus lining portions of Lakeville Highway and Petaluma-Valley Ford Road, and overstory vegetation creating a visual canopy along Chalk Hill Road. Along these segments, however, the pipeline alignment will be adjusted within the right of way to avoid impacting these resources. No other specific scenic resources which will be impacted by pipeline construction have been identified within the scenic landscape units and scenic corridors.

No Impact; Alternative 1 and 5B.

These alternatives do not have a pipeline component.

Mitigation: *Alternatives 2, 3, and 4.*

2.3.9. Adjust Pipeline Alignments.

Alternatives 2, 3, 4, and 5A.

2.3.10. Limit Construction Disturbance

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 2, 3, 4, and 5A.*

These measures will avoid the disturbance of the specific scenic resources and will minimize construction disturbance and therefore avoids impacts on these scenic resources and reduces impacts due to visual contrast.

Impact: **14.4.4 and 7. Will the pipeline component impact visual resources based on evaluation criteria 4 and 7?**

Analysis: *No Impact; All Alternatives.*

All pipelines will be constructed underground. They will not conflict with the 20-foot setback along Sonoma County scenic corridors, however, since they are underground structures, they are not considered a permanent building or structure. No new light source will be created by the pipelines.

Mitigation: No mitigation is needed.

Impact: **14.4.5. Will the pipeline component be inconsistent with foreground or middleground views from high volume travelways?**

Analysis: *Significant. Alternatives 2,3, 4, and 5A.*

The pipeline routes which are not located along Scenic Corridors are located along City or County Roads which are considered high volume travelways according to Evaluation Criterion 5. Construction activities along all of these routes will involve removal of vegetation, grading and trenching of the landscape edge within the public right-of-way. This will result in a strong visual contrast with both the rural and urban landscape edges within the right-of-way along these pipeline routes

Because the pipelines will be located underground, there will be no permanent obstruction of views. Along all pipeline routes as part of the Project, construction scars will be revegetated and landforms along the routes will be restored and blended with the natural landforms. These measures will neutralize the visual effects of construction resulting in no permanent impact except on Pine Flat Road. Along Pine Flat Road, from Red Winery Road to the geysers steamfield, construction of the geysers pipeline will require widening and reconstruction of the existing narrow roadway within the existing right-of-way. This will result in extensive grading with cut and fill along major portions of the pipeline route, and will introduce a strong visual contrast with the surrounding natural landscape, due to the widened roadway and side slopes.

On two of the pipeline routes for Alternative 5A--Trenton-Healdsburg Road and Eastside Road north of River Road--specific scenic resources that could be impacted by pipeline construction have been identified. These consist of overstory vegetation creating a visual canopy along both Trenton-Healdsburg Road and Eastside Road. Along these segments, however, the pipeline alignment will be adjusted within the right of way to avoid impacting these resources. No other specific scenic resources which will be impacted by pipeline construction have been identified.

No Impact; Alternative 1 and 5B.

These alternatives do not have a pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.*

2.3.9. Adjust Pipeline Alignments.

2.3.10. Limit Construction Disturbance

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 2, 3, and 5A.*

Significant after Mitigation; Alternative 4.

Measure 2.3.9 will avoid the disturbance of the specific scenic resources and therefore avoids impacts on these scenic resources. Measure 2.3.10 will reduce impacts on the landscape edge due to visual contrast.

No mitigation is available to reduce the impacts along Pine Flat Road to a level less than significant.

Storage Reservoir Components

Table 4.14-6

Visual Resource Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.5.1. Will the storage reservoir component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?	Strong visual contrast	None	C, P	=

Table 4.14-6

Visual Resource Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.5.2. Will the storage reservoir component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?				
• Adobe Road Reservoir	Strong visual contrast	Strong	C, P	⊙
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	Loss	C, P	⊙
• All other reservoirs	Strong visual contrast	None	C, P	=
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.5.3. Will the storage reservoir component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?				
• Tolay Extended and Confined	Strong visual contrast	Slight	C, P	○
	Permanent Visual Obstruction	Permanent Obstruction	C, P	●

Table 4.14-6

Visual Resource Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
	Loss or alteration of a specific scenic resource	None	C, P	=
• Adobe Road, Sears Point, Valley Ford Reservoir	Strong visual contrast	Strong	C, P	○
	Permanent Visual Obstruction	Permanent Obstruction	C, P	●
	Loss or alteration of a specific scenic resource	Loss	C, P	●
• Bloomfield, Carroll Road	Strong visual contract	Strong	C, P	●
• Lakeville Hillside, Two Rock, Huntley	Strong visual contrast	None	C, P	=
	Permanent Visual Obstruction	None	C, P	
	Loss or alteration of a specific scenic resource	None	C, P	=
14.5.4. Will the storage reservoir component be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?	Less than 20 feet	None	C, P	=
14.5.5. Will the storage reservoir component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?				
• Adobe Road, Bloomfield, Huntley	Strong visual contrast	Strong	C, P	⊙

Table 4.14-6

Visual Resource Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
• Sears Point	Strong visual contrast	Strong	C, P	⊙
	Permanent Visual Obstruction	Permanent Obstruction	C, P	●
	Loss or alteration of a specific scenic resource	Loss	C, P	●
• All other reservoirs	Strong visual contrast	None	C, P	=
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.5.6. Will the storage reservoir component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?				
• Tolay Extended, Adobe Road, Tolay Confined, Sears Point, Two Rock and Valley Ford	Strong visual contrast	Strong	C, P	⊙
	Permanent Visual Obstruction	Permanent Obstruction	C, P	●
	Loss or alteration of a specific scenic resource	None	C, P	=

Table 4.14-6

Visual Resource Impacts by Component - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Lakeville Hillside and Huntley	Strong visual contrast	Strong	C, P	⊙
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
• Bloomfield, Carroll Road	Strong visual contrast	Strong	C, P	●
	Permanent Visual Obstruction	Permanent Obstruction	C, P	●
	Loss or alteration of a specific scenic resource	Loss	C, P	●
14.5.7. Will the storage reservoir component create a new light source?	Greater than 0 residences affected	None	C, P	=

Source: Harland Bartholomew and Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
P Permanent

2. Level of Significance:
● Significant impact before and after mitigation
⊙ Significant impact before mitigation; less than significant impact after mitigation
○ Less than significant impact; no mitigation proposed
= No Impact

Construction of the storage reservoirs and associated facilities will visually change the landform, spatial form, and colors of all the sites being considered. During construction, visual contrast will be introduced by several construction activities:

- Clearing of vegetation and removal of tree stumps and roots at dam and reservoir areas
- Stripping of dam foundation and on-site borrow areas
- Dam foundation excavation and on-site borrow area excavation

- Construction of appurtenant structures and ancillary facilities such as spillway, inlet/outlet conduits, diversion channels, pipelines, access roads, fencing.

Incised into one of the two adjoining hillsides, a concrete-lined diversion channel will divert water around the end of the dam to the base of the reservoir at the Tolay Extended and Confined, Adobe Road and Sears Point reservoirs. Broken stone to stabilize the earth surface will be used at the base of spillways. A paved service road will be constructed to lead up to each dam site.

The main visual focus of the reservoir will be the earthen dams which block off rural valleys and anchor into adjoining hillsides. Dam heights range from 80 to over 200 feet. The face of each dam will be a geometric, non-undulating slope, and the dam ridgeline will be flat. During and immediately after construction prior to revegetation, the exposed soil face of the dam will introduce visual contrast compared to the surrounding landscape. Newly graded slopes will be left barren to revegetate naturally, ultimately supporting grass cover to control erosion. During the summer, grassy slopes will have a brown and dry appearance, and during the winter, the slopes will be green. No trees or shrubs are proposed for the dam face due to concerns of invasive roots that will undermine the structural integrity of the dam.

Where sensitive viewpoints provide elevated views of the reservoir surface, for example, at English Hill, there is potential for significant impacts from the visual contrast as water levels fluctuate during different times of the year. From September through October, the reservoirs will be emptying, and during December through January, the reservoirs will be filling. During some periods, the reservoir will look dry.

To determine which visually sensitive areas and sections of roads will have potential views of the reservoirs (embankment or water surface), a computerized viewshed analysis was conducted to map general visibility on a wide-area basis. Visibility mapping, presented in Figures 4.14-1 through 4.14-9, was used in assessing visual impacts and in the selection of key viewpoints for computer models/simulations (Figures 4.14-10 through 4.14-18). All reservoir figures are placed at the end of the storage reservoir component discussion. Additional information regarding how visibility mapping was conducted is found in the Methodology section.

Impact: **14.5.1, 4 and 7. Will the storage reservoir component impact visual resources based on evaluation criteria 1, 4, and 7?**

Analysis: *No Impact; All Alternatives.*

All the reservoir sites are located outside designated Community Separator areas delineated in the Sonoma County General Plan. All the reservoirs, diversion channels, and other appurtenant facilities are well outside the 20-foot setback criterion.

Low intensity lights may be used to illuminate the pump house areas for operation and maintenance, but the lights will be located too far away from highway or residential viewers to pose appreciable visual impacts. Lights will only be turned on by personnel when needed, they will not be on continuously or automatically.

Mitigation: No mitigation is needed.

Impact: **14.5.2. Will the storage reservoir component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?**

Analysis: *Significant; Alternative 2B.*

The Adobe Road reservoir is located within a designated Sonoma County Scenic Landscape Unit. Computerized viewshed mapping indicates potential widespread visibility from Petaluma located 1-3 miles to the south (middleground view range), but view obstruction from public viewpoints will be minimal. Strong visual contrast from the dam face and crest, and scenic resource loss of mature trees will occur.

No Impact. Alternatives 1, 2A, 2C, 2D, 3, 4, and 5.

The Tolay Extended and Confined reservoirs are located just outside a Scenic Landscape Unit. However, within a three-mile radius, visibility is confined to Stage Gulch Road and overlooking higher topography which surrounds the reservoir. Strong contrasts or view blockage will not be expected from sensitive viewpoints within the scenic landscape unit.

The Lakeville Hillside site is located within a designated County Scenic Landscape Unit. However, computerized viewshed mapping indicates that visibility within three miles will not result in strong visual contrast or view blockage from the foreground or middleground, and visibility from upland areas to the south will be from a background view range.

The Sears Point site is on the border of a designated Scenic Landscape Unit, but since it is surrounded by designated scenic lands, the site will be considered as within the unit. Visibility is generally limited to a cone extending to the southeast across Tubbs Island, the Naval Reservation, and San Pablo Bay. As a distant background element from most widespread locations, the visual impacts posed by the site will not result in strong visual contrast from foreground or middleground views.

Two Rock, Bloomfield, Carroll Road, Valley Ford, and Huntley reservoirs are located outside designated Scenic Landscape Unit areas delineated in the Sonoma County General Plan.

Alternatives 1, 4, and 5 do not have a reservoir component.

Mitigation: *Alternative 2B.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

2.4.7. Establish Tree Screening.

2.4.8. Revegetate Face of Reservoir Dam.

Alternatives 1, 2A, 2C, 2D, 3, 4, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 2B.*

These measures will reduce the visual contrast of the dam face by introducing vegetation consisting of grasses on the dam face, and thereby maintaining a consistent color and texture with the surrounding hills. Planting of trees and other vegetation to screen other high contrast visual elements such as concrete diversion channels, energy dissipation structures and roadways, as well as the points at which the dam joins the adjacent hillsides, will also blend the dam with the surrounding land forms.

Impact: **14.5.3. Will the storage reservoir component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?**

Analysis: *Significant; Alternatives 2, 3B, 3C, 3D.*

Tolay Extended and Confined (Alternatives 2A and 2C). Views of the reservoir along a designated scenic corridor are limited to a 1.5-mile section of Stage Gulch Road. From this location, the dam is viewed at a range of .75 miles (middleground). Some visual contrast will be evident, although the dam appears as an extension of an existing ridgeline. Specific resource loss is not considered significant since the mosaic of trees is located in highland areas behind the middleground ridge/dam. From a few view locations views up the valley will be obstructed, although most views will be at right angles to the direction of travel and will occupy less than 15 percent of the principal views. Even though the surface area of this reservoir is large, there will be no views of the stored water from Stage Gulch Road.

Adobe Road. (Alternative 2B). Reservoir can be seen for short distances (up to .5 mile) along Old Adobe Road (scenic corridor in Sonoma County and Petaluma General Plans) and Sonoma Mountain Road (scenic corridor in Petaluma General Plan). Although corridor exposure is limited, views to the dam will be in the foreground (less than .5 mile) with strong visual contrast due to the rock face of the dam, view obstruction of the background ridge line, and scenic resource loss of mature groves of trees on the site (see Figure 14.4-2. Note that the weather conditions mask full views of the scenic background ridgeline).

The Lakeville Hillside reservoir is discussed below under No Impact.

Sears Point. (Alternative 2D). The main dam will be clearly visible from a designated scenic corridor, Highway 121 (Sonoma County General Plan). Visual contrast will be strong, the view up a scenic valley will be obstructed, and a specific scenic resource consisting of several groupings of mature trees on the site will be lost. The view range will also be fairly close (.75 mile from the selected viewpoint). The saddle dams will be much less contrasting due to their relatively subtle effect on the skyline seen from the highway.

Bloomfield. (Alternative 3B). Visibility of the dam will exist for a .75 mile section along Petaluma Valley Ford Road, a designated Sonoma County scenic corridor to the south at a distance of .75 mile. The dam will be a dominant landscape element due to its strong contrast, view obstruction and scale. The reservoir dam will reduce views of scenic resources consisting of trees and the undulating landform of the slopes of English Hill as seen from the scenic corridor (see Figure 14.4-6).

Carroll Road. (Alternative 3C). The visual impact is similar to Bloomfield, although the dam will be viewed from a farther distance of 1.25 miles (middleground), resulting in somewhat reduced scale and view obstruction.

Valley Ford. (Alternative 3D). Construction of the reservoir at this location will introduce significant visual impacts to Highway 1, a state designated Scenic Highway and Petaluma-Valley Ford Road, a County designated Scenic Corridor. The dam is fully visible to viewers traveling north on Highway 1 and west on Petaluma-Valley Ford Road, though screened by topography, as well as by foreground elements (e.g., trees, water tank closer to the road), from most viewers traveling west to east. Because the hill on the east side of the dam is recessed, little screening is provided to viewers traveling west. The dam is relatively close to the highway (.5 to .75 miles) and will be visible for an estimated highway distance of up to 3 miles. The dam will exhibit strong visual contrast and will obscure ridgelines in the background (see Figure 14.14-8). Specific scenic resources consisting of views of the inundated valley containing trees and dissected landforms will be eliminated.

No Impact; Alternatives 1, 3A, 3E, 4 and 5.

Two Rock. (Alternative 3A). Based on computerized viewshed mapping and field observation, it is estimated that the dam will not be seen from Valley Ford Highway, a County designated Scenic Corridor. It is possible that minor effects of vegetation clearing at the periphery of the Project may be just visible, but these are not expected to introduce significant visual contrasts.

Huntley. (Alternative 3E). The dam will not be visible from any designated scenic corridor.

The Lakeville Hillside site (Alternatives 2B and 2D) will have no impact on scenic corridors. Views of the reservoir site from Lakeville Highway, a designated scenic corridor, are screened by topography to the north of Old Lakeville Highway No. 3 and by foreground elements between Lakeville Highway and Old Lakeville Highway No. 3. However, because this site is paired with the Adobe Road and Sears Point sites (Alternative 2B and 2D respectively), the overall impact for both alternatives will be significant

Alternatives 1, 4 and 5 do not have a storage reservoir component.

Mitigation: *Alternative 2, 3B, 3C, 3D.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

2.4.7. Establish Tree Screening.

2.4.8. Vegetate Face of Reservoir Dam.

Alternatives 1, 3A, 3E, 4 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternative 2, 3B, 3C, and 3D.*

These measures will reduce the visual contrast of the dam face by introducing vegetation consisting of grasses on the dam face, and thereby maintaining a consistent color and texture with the surrounding hills. Planting of trees and other vegetation to screen other high contrast visual elements such as concrete diversion channels, energy dissipation structures and roadways, as well as the points at which the dam joins the adjacent hillsides, will also blend the dam with the surrounding land forms.

However, no mitigation is available to reduce the impact on visual contrast for the Bloomfield and Carroll Road sites related to views of the reservoir bottom from English Hill. There is no mitigation available to reduce the impacts on visual obstruction for any site to less than significant.

Mitigation measures intended to reduce view obstruction or replace a degraded/eliminated visual resource are not available. Typically, the dam will block views up a scenic valley containing interesting landform and trees. Another condition that cannot be mitigated is an elevated viewpoint that overlooks a scenic valley that will be inundated. Because the water level may fluctuate and the edge conditions may be unsightly, the presence of the reservoir does not constitute replacing a scenic resource of equal value.

Impact: **14.5.5. Will the storage reservoir component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?**

Analysis: *Significant; Alternatives 2B, 2D, 3B and 3E.*

Adobe Road. (Alternative 2B). In addition to Adobe Road which is a designated scenic corridor, the reservoir will potentially be seen from many streets throughout Petaluma including Washington Street which is directly aligned with the reservoir (although vegetation along Adobe Road does provide some visual screening). Many public use areas, including the Petaluma Airport, are within the 3-mile view radius of the reservoir. The potential visibility of the dam poses significant impacts due to the strong visual contrast.

The Lakeville Hillside reservoir is discussed below under No Impact.

Sears Point. (Alternative 2D). Within the immediate area of Sears Point, public use areas include the Roche Winery from which the reservoir site is visible. People visiting the Sears Point Raceway will also be able to see the dam. Visual contrast, view obstruction of the valley and loss of scenic resources consisting of groups of mature trees are all considered significant.

Bloomfield. (Alternative 3B). Bloomfield cemetery located about 1 mile away to the southeast is anticipated to have views of the dam resulting in significant impacts due to the strong visual contrast of the dam face.

Huntley. (Alternative 3E). The dam will be visible along a short .25 mile section of Fallon Two Rock Road. Viewing distance will be from a range of 1 mile (middleground). Visual contrast will be strong, but view obstruction will be limited for travelers other than viewers along Martinoni Road which serves local residents. There are no recreation or public use areas within the middleground view range.

No Impact. Alternatives 1, 2A, 2C, 3A, 3C, 3D, 4, and 5.

Tolay Extended and Confined. (Alternatives 2A and 2C). The reservoir site is surrounded by hills which greatly limit the extent of visibility. There are no high volume travelways (other than scenic corridors), recreation, or public use areas within the middleground view range.

Two Rock. (Alternative 3A). The dam and reservoir have limited visibility except from the tops of surrounding hills. There are no high volume travelways, recreation or public use areas within the middleground view range.

Carroll Road. (Alternative 3C). There are no other high-volume travelways (other than scenic corridors), recreation, or public use areas within the middleground view range.

Valley Ford. (Alternative 3D). There are no high volume travelways (other than scenic corridors), recreation or public use areas within the middleground view range.

In addition, the Lakeville Hillside site (Alternatives 2B and 2D) will have no impact under this criterion. Views of the reservoir site are extremely limited with the only public views from the little used Old Lakeville Highway. There are no other recreation or public use areas within the area of visibility. However, because this site is paired with the Adobe Road and Sears Point sites (Alternative 2B and 2D respectively), the overall impact for both alternatives will be significant

Alternatives 1, 4 and 5 do not have a storage reservoir component.

Mitigation: *Alternatives 2B, 2D, 3B and 3E.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

2.4.7. Establish Tree Screening.

2.4.8. Revegetate Face of Reservoir Dam.

Alternatives 1, 2A, 2C, 3A, 3C, 3D, 4, and 5. No mitigation is needed.

After Mitigation: *Significant; Alternative 2D.*

Less than Significant after Mitigation; 2B, 3B, and 3E.

These measures will reduce the visual contrast of the dam face by introducing vegetation consisting of grasses on the dam face, and thereby maintaining a consistent color and texture with the surrounding hills. Planting of trees and other vegetation to screen other high contrast visual elements such as concrete diversion channels, energy dissipation structures and roadways, as well as the points at which the dam joins the adjacent hillsides, will also blend the dam with the surrounding land forms.

No mitigation is available to reduce impacts on view obstruction for the Sears Point site (Alternative 2D) to less than significant. Mitigation measures intended to reduce view obstruction are not available. The dam will block views from the Roche Winery up a scenic valley containing interesting landform and trees.

Impact: **14.5.6. Will the storage reservoir component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?**

Analysis: *Significant; Alternatives 2 and 3.*

Tolay Extended and Confined. (Alternatives 2A and 2C). Several residences have views of the dam or overlooking views of the water surface in the middleground view range, which creates strong visual contrast. Limited views of the back dam and saddle also exist at private residences in middleground.

Adobe Road. (Alternative 2B). Residences along Adobe Road will have views of the main dam, while residences above the site on Sonoma Mountain Road will have views overlooking the water surface and bottom of the reservoir, all of which will create strong visual contrast. The northern back dam also will be visible from one residence, while the east side Saddle dam will not be visible.

Lakeville Hillside. (Alternatives 2B and 2D). The dam will be viewed by residences to the south in the foreground (.5 mile) that are located near Lakeville Highway. There will be no residences in the hills closely surrounding the reservoir that will have overlooking views.

Sears Point. (Alternative 2D). Private residences in the hills north and northeast of the site that will overlook the reservoir from a viewing range of .5 to .75 miles. The main dam will not be visible from the nearby farmhouse to the east, due to topography. The saddle dams may be partly visible on the skyline from this residence, but with low contrast after the construction period.

Two Rock. (Alternative 3A). A residence located off Walker Road will have views of the dam at a view range of .75 miles creating strong visual contrast and obstructing views up the valley.

Bloomfield. (Alternative 3B). Residences on two properties are located in the valley leading up to the reservoir site and will have views of the dam. In addition, residential views exist along Bloomfield and Jones Road which are all located within 1.25 miles of the dam. Overlooking residences located on English Hill, approximately 0.5 miles to the north, will also have views of the reservoir site and observe exposed soil when the water level in the reservoir is down.

Carroll Road. (Alternative 3C). Several residences are located in the valley leading up to the reservoir site, with views of the dam at close viewing range (.25 to .5 miles) with strong visual contrast, view blockage, and loss of scenic features. Overlooking residences located on English Hill, approximately 0.5 miles to the northeast, will also have views of the reservoir site and observe exposed soil when the water level in the reservoir is down.

Valley Ford. (Alternative 3D). For residences located adjacent to Petaluma-Valley Ford Road near the reservoir and in the hills south of the

highway, the dam will pose significant visual impacts due to the close viewing range (.5 to 1 miles), creating strong visual contrast in the foreground views, as well as obstruction of views up the valley.

Huntley. (Alternative 3E). A residence is located approximately .75 miles southwest of the reservoir from which the dam will be visible, creating strong visual contrast and obstructing views. Views from other residences in the foreground or close middleground will be screened by topography. There will be limited visibility of the saddle dam on the ridgeline east of the reservoir, seen from homes in the valley adjoining but this will be in the middleground view, and therefore not significant. Potential views from elevated residences in the far middleground located to the south also will not be significant.

No Impact; Alternatives 1, 4 and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

2.4.7. Establish Tree Screening.

2.4.8. Revegetate Face of Reservoir Dam.

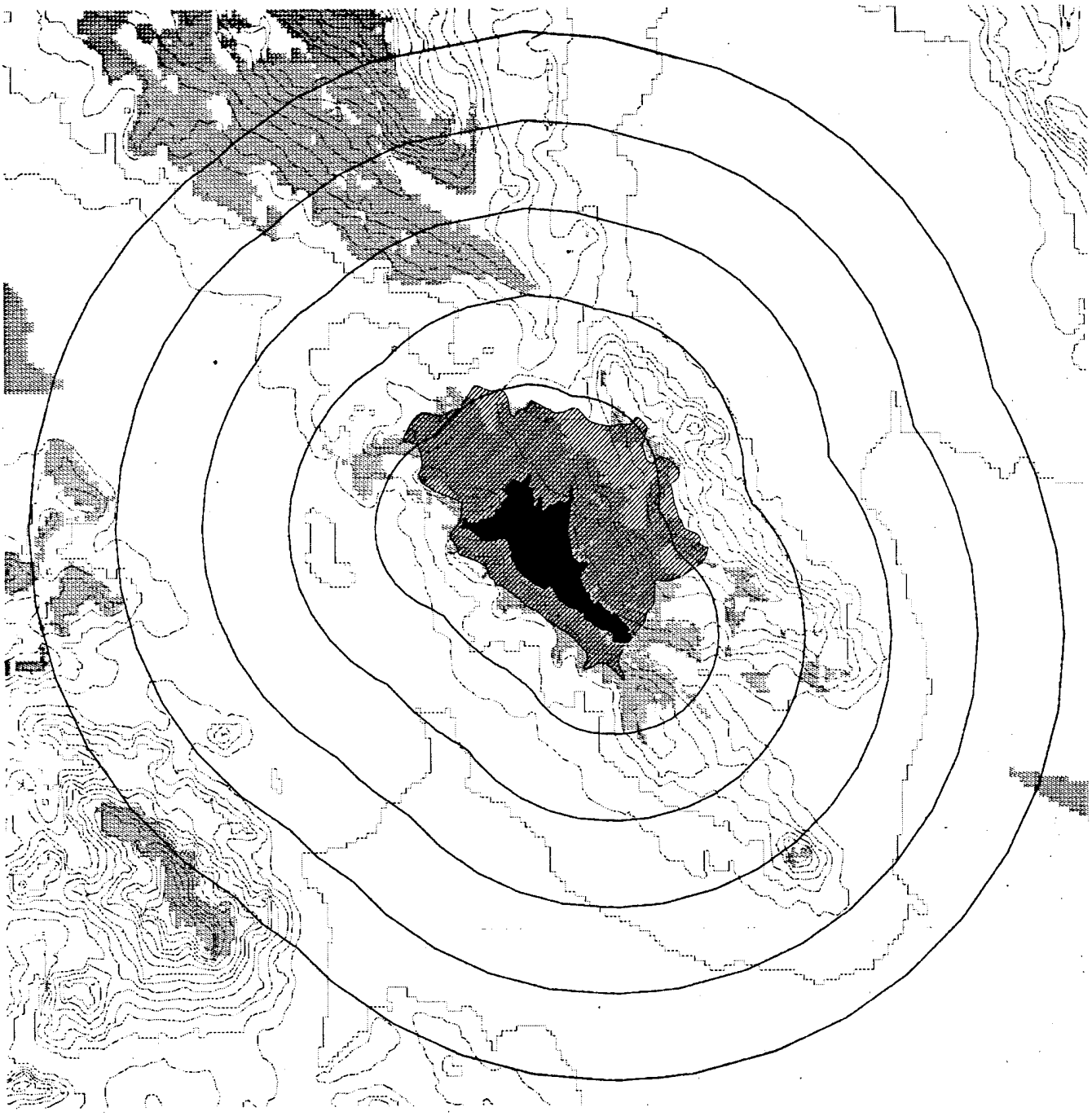
Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Significant; Alternatives 2A, 2B, 2C, 2D, 3A, 3B, 3C and 3D.*

Less than Significant; Alternative 3E.

For all alternatives these measures will reduce the visual contrast of the dam face by introducing vegetation consisting of grasses on the dam face, and thereby maintaining a consistent color and texture with the surrounding hills. Planting of trees and other vegetation to screen other high contrast visual elements such as concrete diversion channels, energy dissipation structures and roadways, as well as the points at which the dam joins the adjacent hillsides, will also blend the dam with the surrounding land forms.

Provision of dense vegetative screening on the affected residential properties to create an opaque all season visual block could be undertaken, and will result in a more aesthetically pleasing view by obscuring view of the dam face. However, this will not mitigate the obstruction of existing views.



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30 meter contours calculated by Arc/Info using USGS 1:250,000 DEM data.

Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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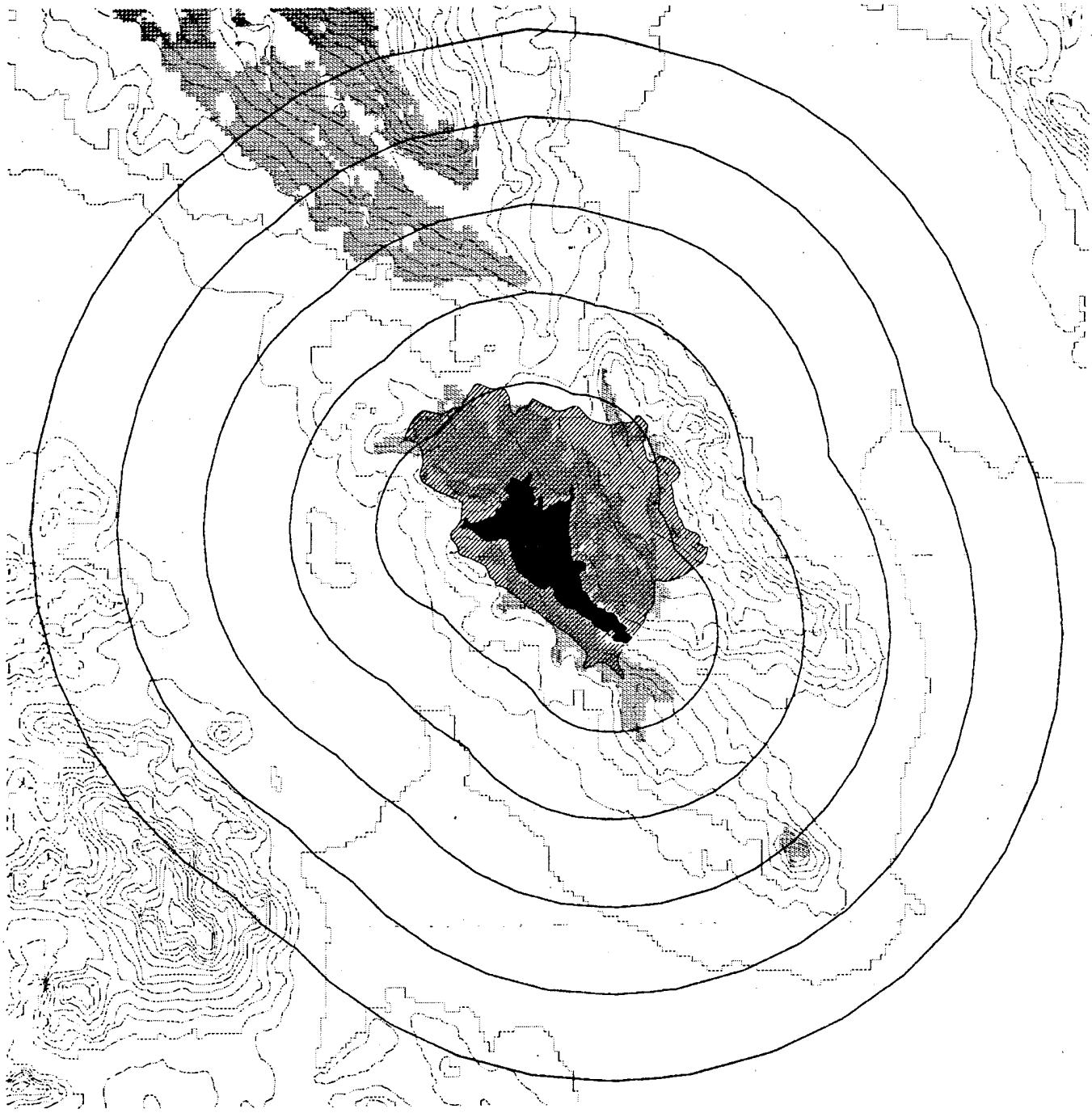
VISIBILITY MAPPING Figure 4.14-1a
VIEW FROM RESERVOIR
TOLAY EXTENDED RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- **Reservoir**
- **Watershed Boundary**
- **Areas Having Visibility**
- **Reservoir Buffering 1 Mile Increments**

source: Dames & Moore

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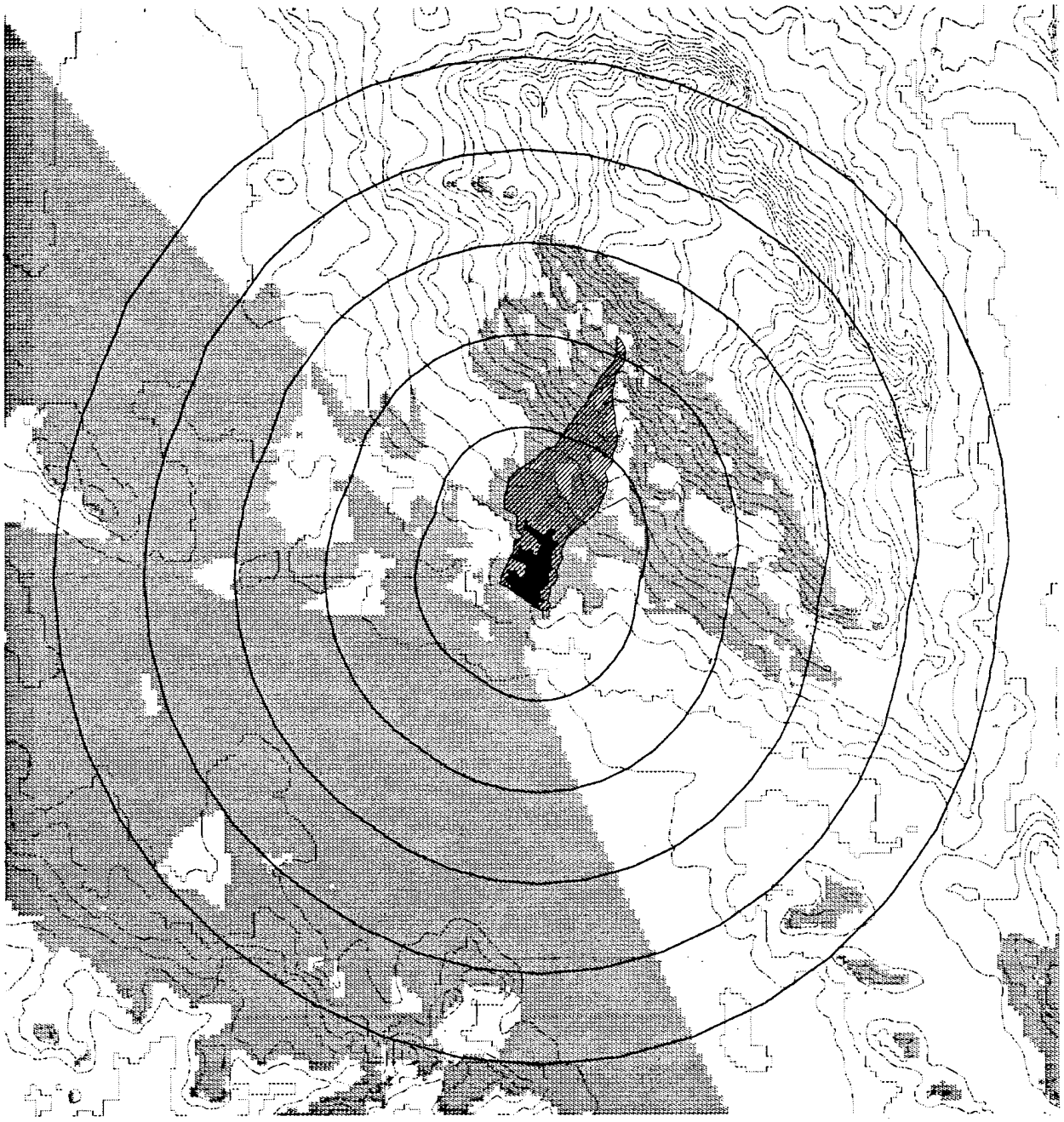
VISIBILITY MAPPING **Figure 4.14-1b**
VIEW FROM DAM
TOLAY EXTENDED RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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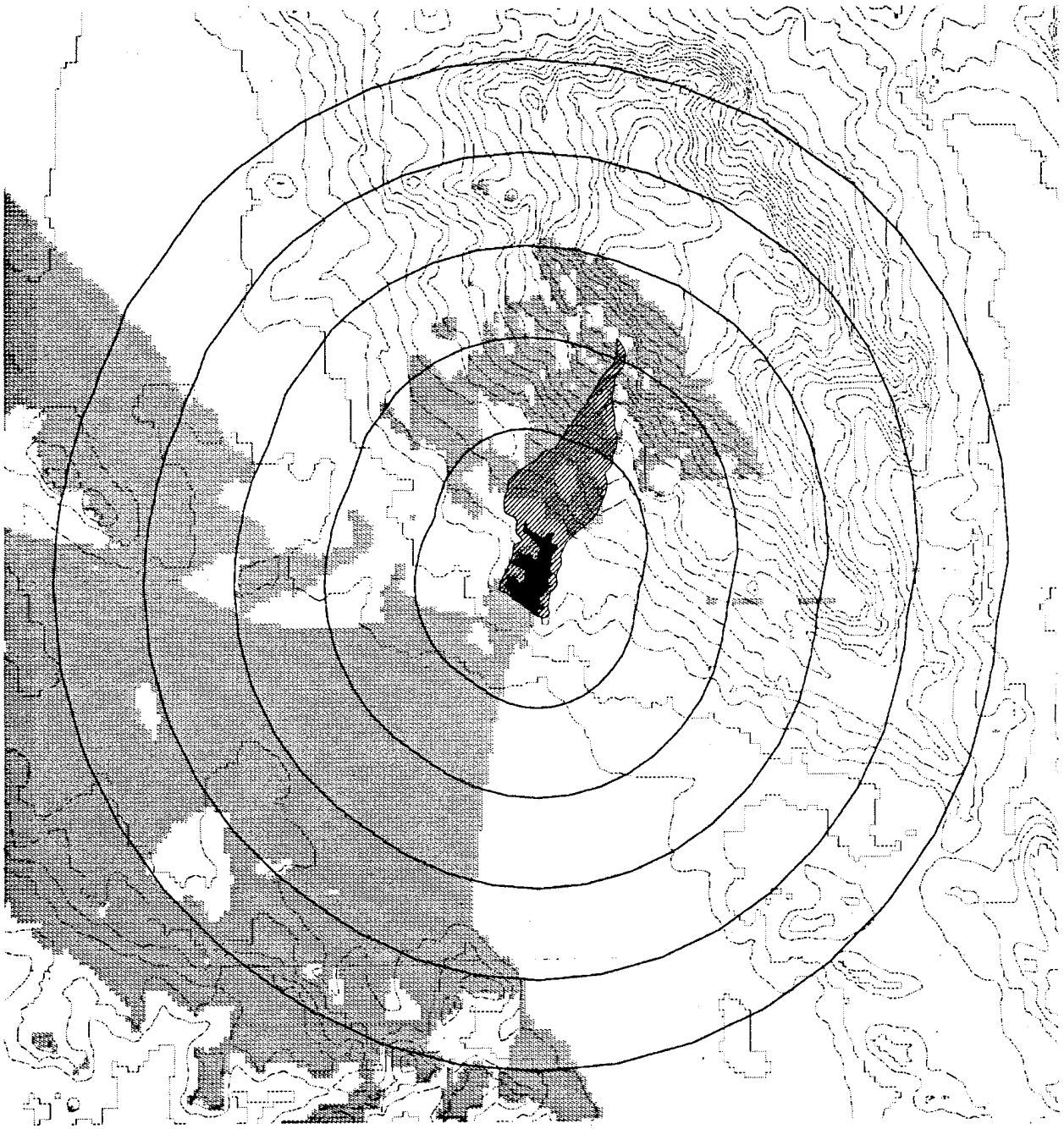
VISIBILITY MAPPING **Figure 4.14-2a**
VIEW FROM RESERVOIR
ADOBE ROAD RESERVOIR



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30 meter contours calculated by Arc/Info using USGS 1:250,000 DEM data.

Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile increments

source: Dames & Moore

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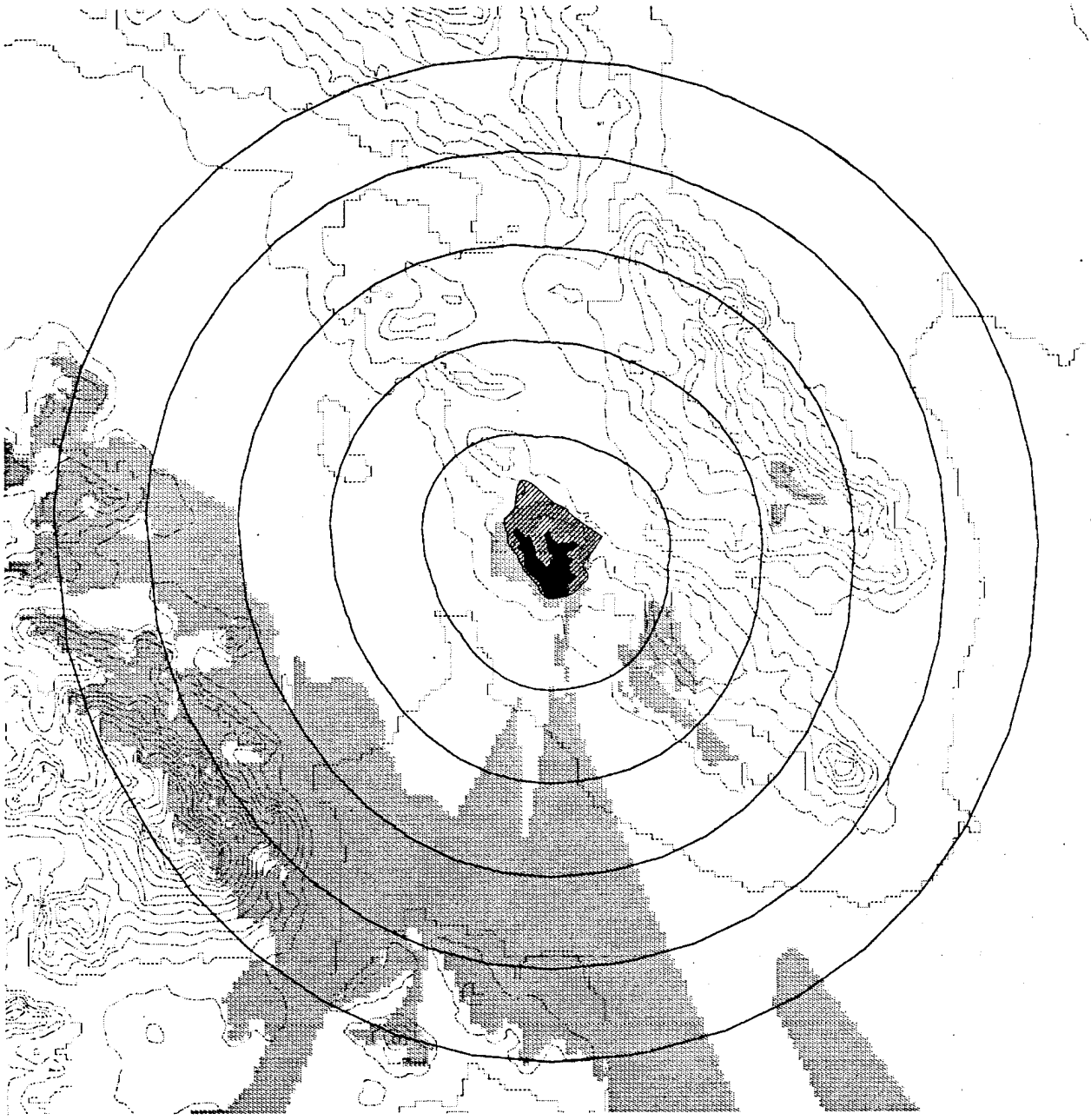
VISIBILITY MAPPING
VIEW FROM DAM
ADOBE ROAD RESERVOIR

Figure 4.14-2b



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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VISIBILITY MAPPING Figure 4.14-3a
VIEW FROM RESERVOIR
LAKEVILLE HILLSIDE RESERVOIR

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scale: 1"=10,000'

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Viewshedscalculated by Arch/Info using USGS 1:250,000 DEM data.

30 meter contours calculated by Arc/Info using USGS 1:250,000 DEM data.

Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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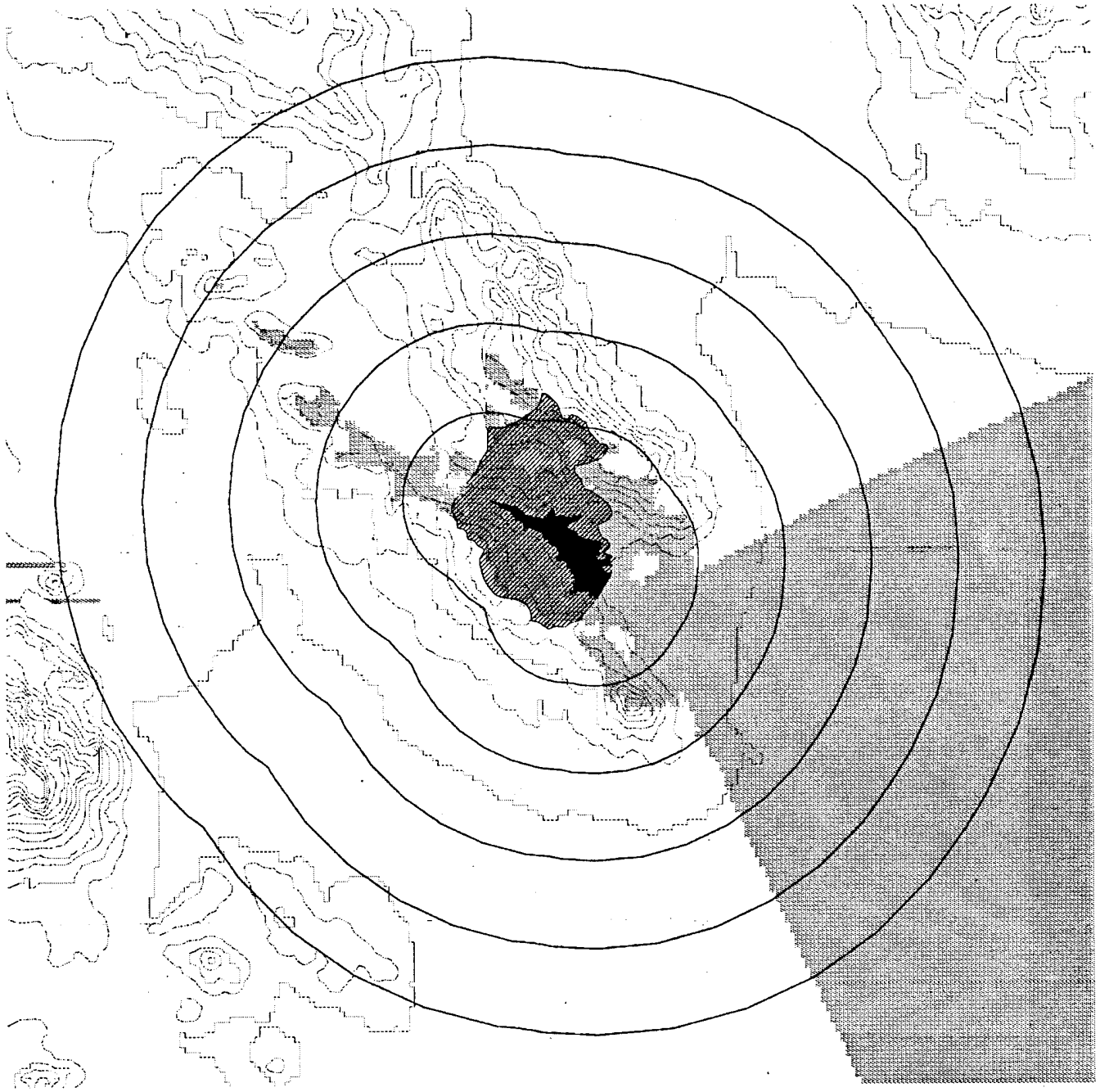
VISIBILITY MAPPING **Figure 4.14-3b**
VIEW FROM DAM
LAKEVILLE HILLSIDE RESERVOIR



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Roads and streams from USGS, 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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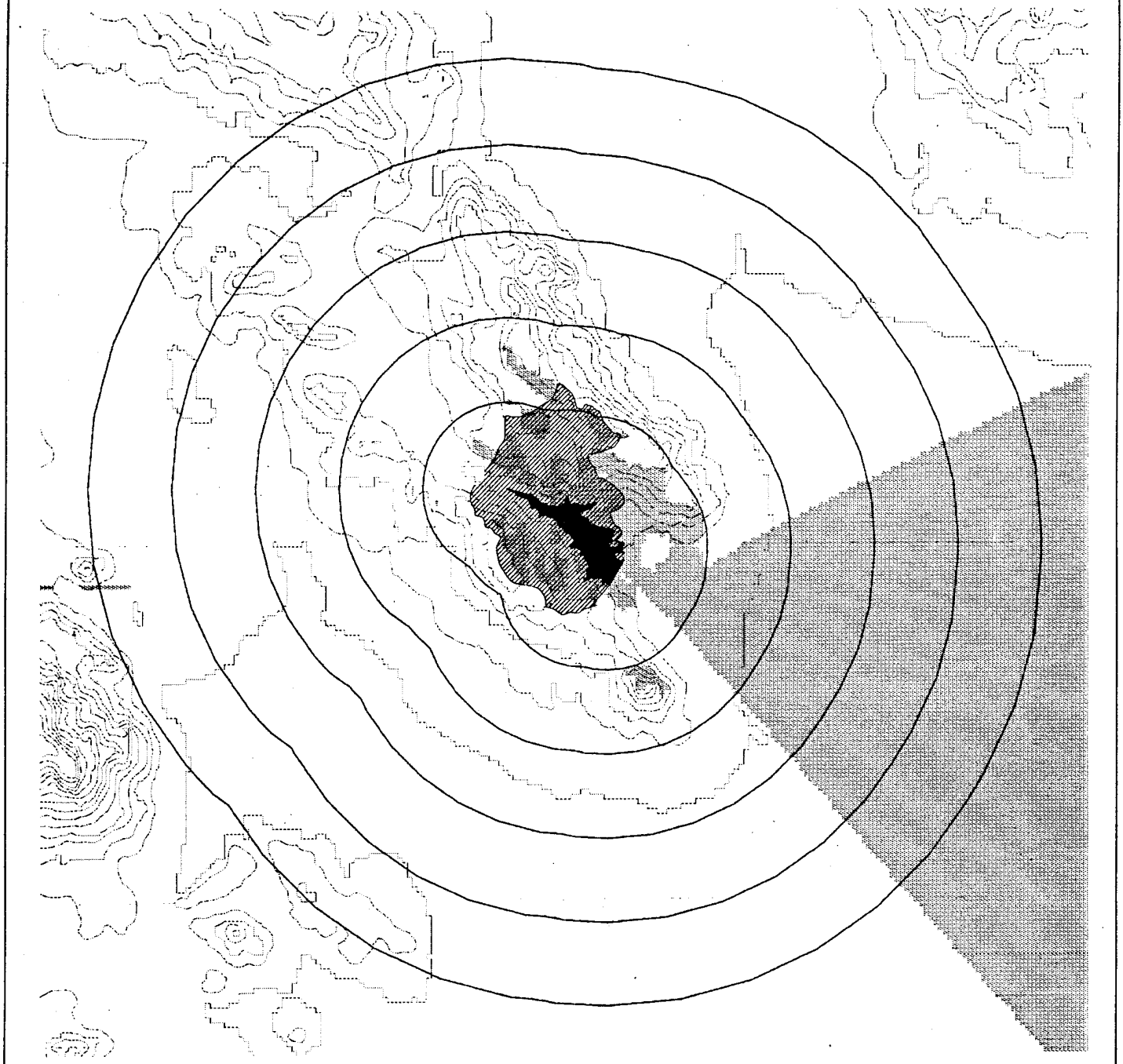
VISIBILITY MAPPING Figure 4.14-4a
VIEW FROM RESERVOIR
SEARS POINT RESERVOIR



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30 meter contours calculated by Arc/Info using USGS 1:250,000 DEM data.

Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile increments

source: Dames & Moore

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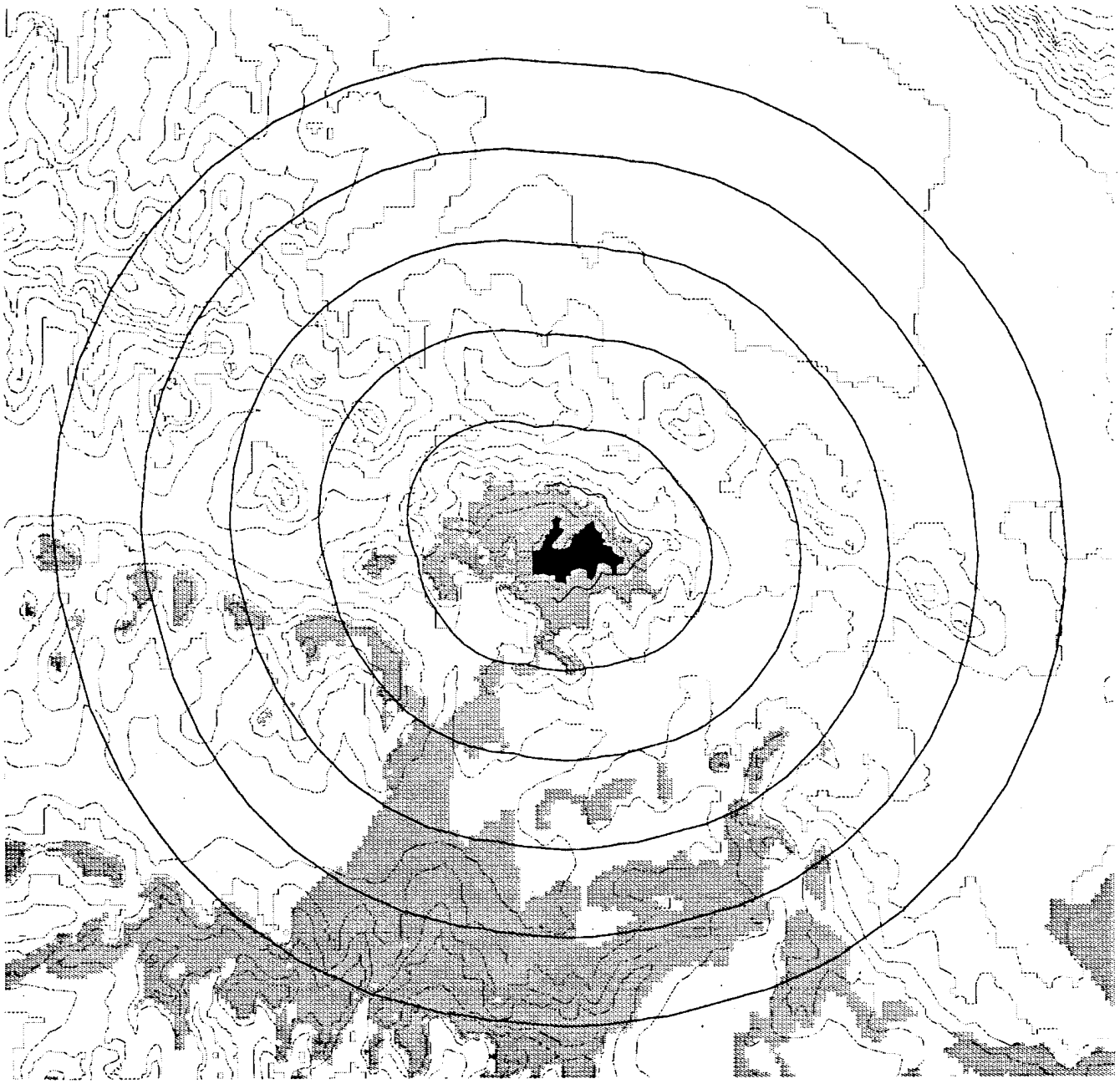
VISIBILITY MAPPING
VIEW FROM DAM
SEARS POINT RESERVOIR

Figure 4.14-4b



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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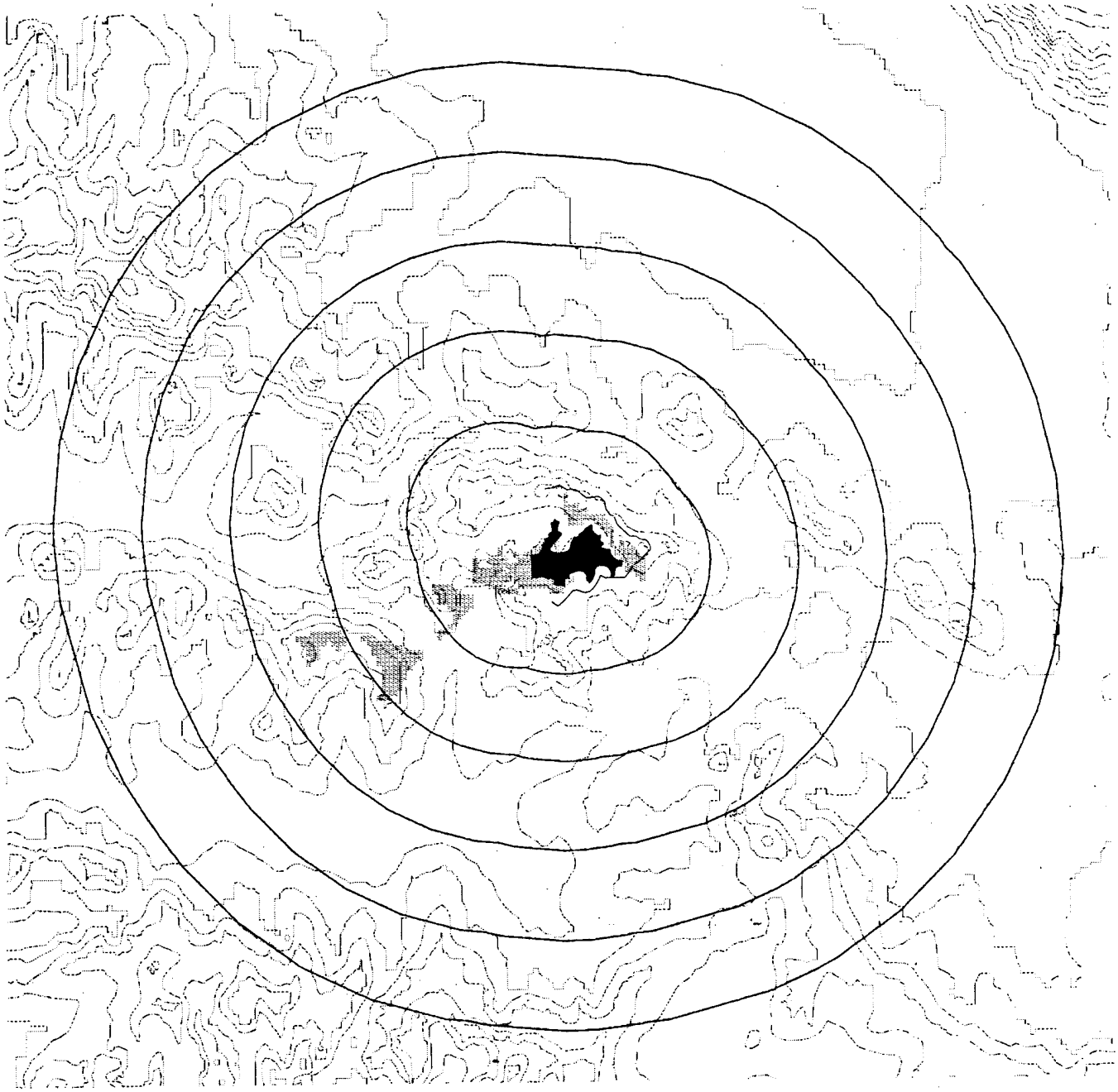
VISIBILITY MAPPING Figure 4.14-5a
VIEW FROM RESERVOIR
TWO ROCK RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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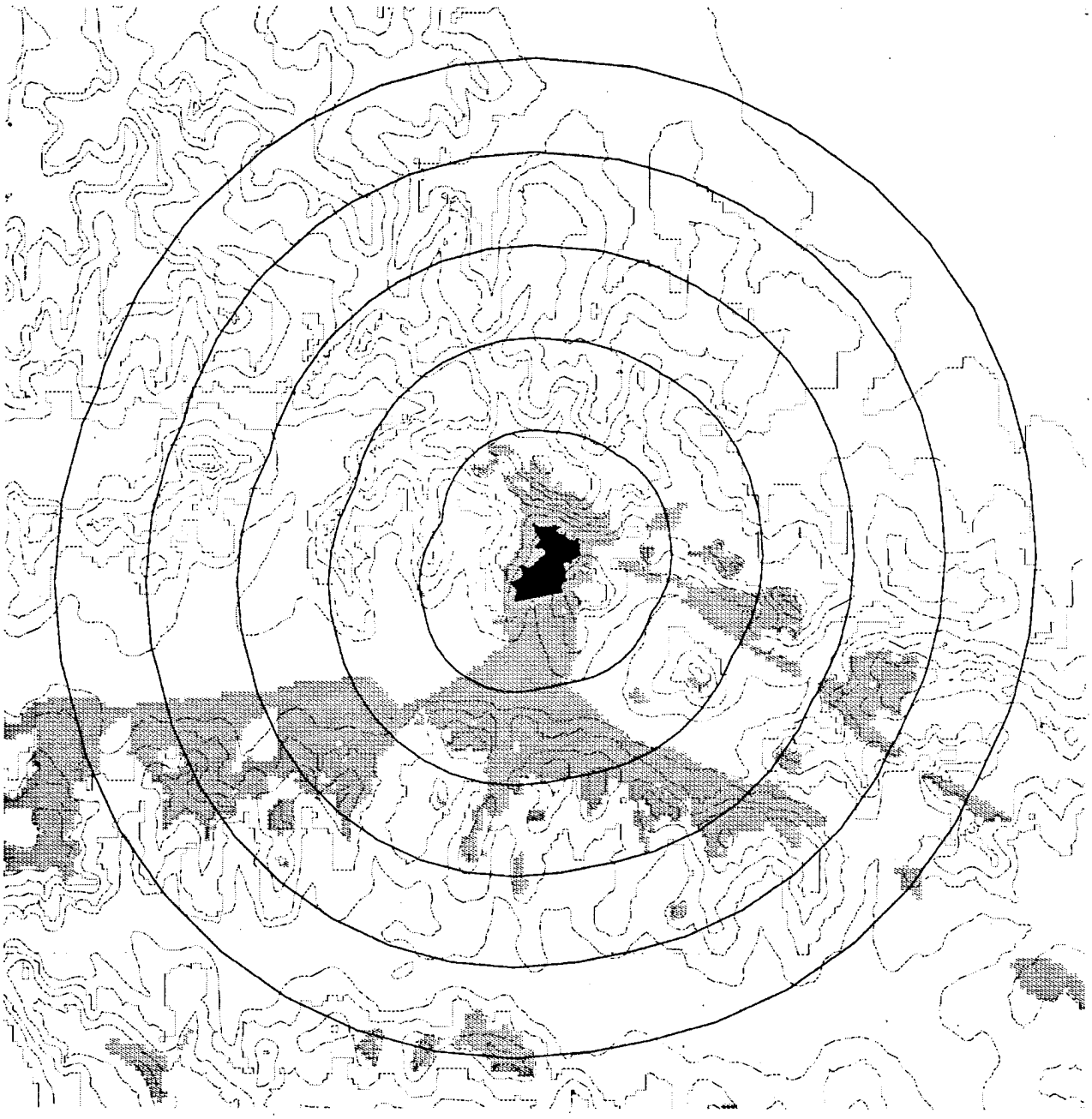
VISIBILITY MAPPING **Figure 4.14-5b**
VIEW FROM DAM
TWO ROCK RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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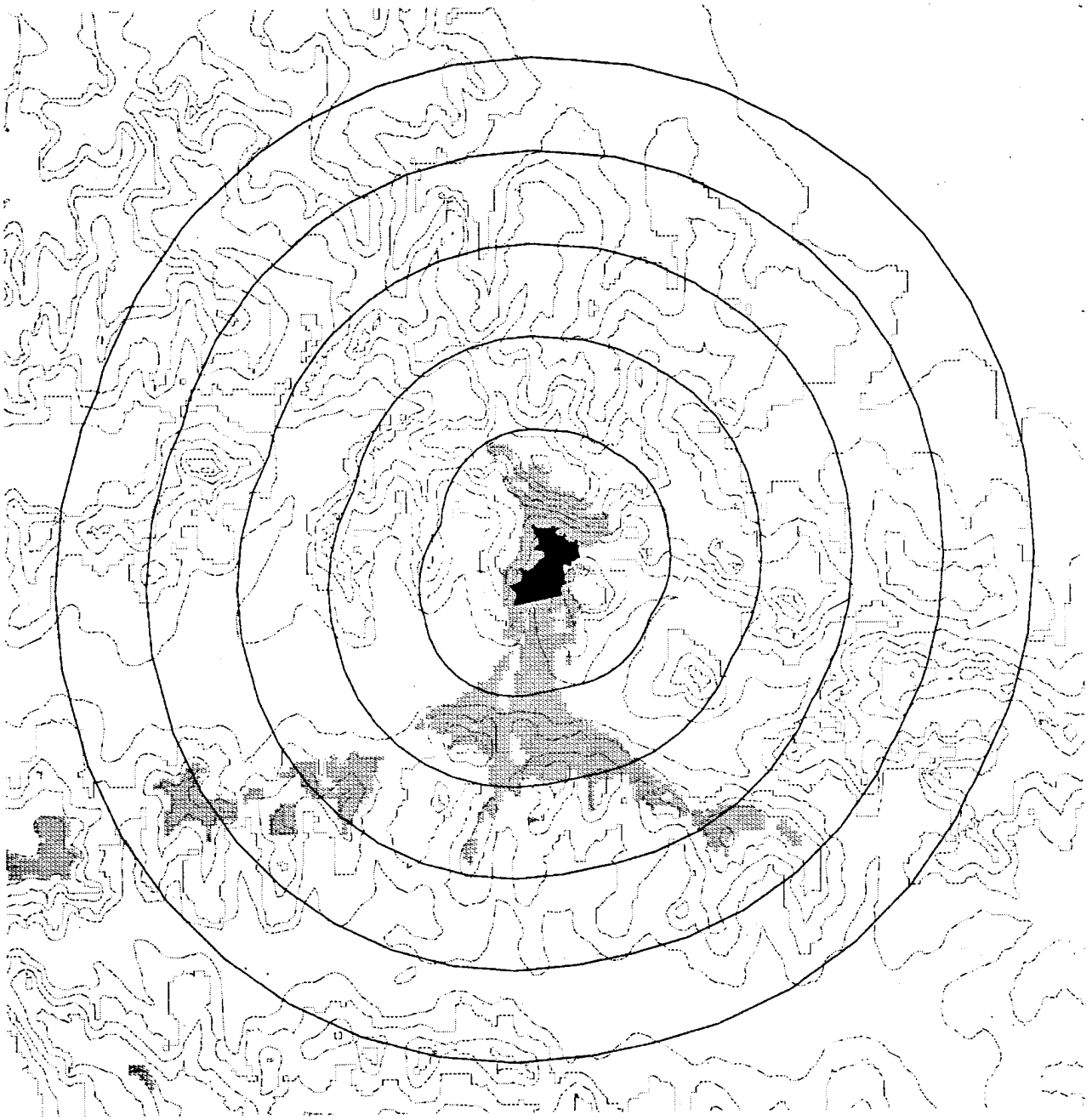
VISIBILITY MAPPING Figure 4.14-6a
VIEW FROM RESERVOIR
BLOOMFIELD RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile increments

source: Dames & Moore

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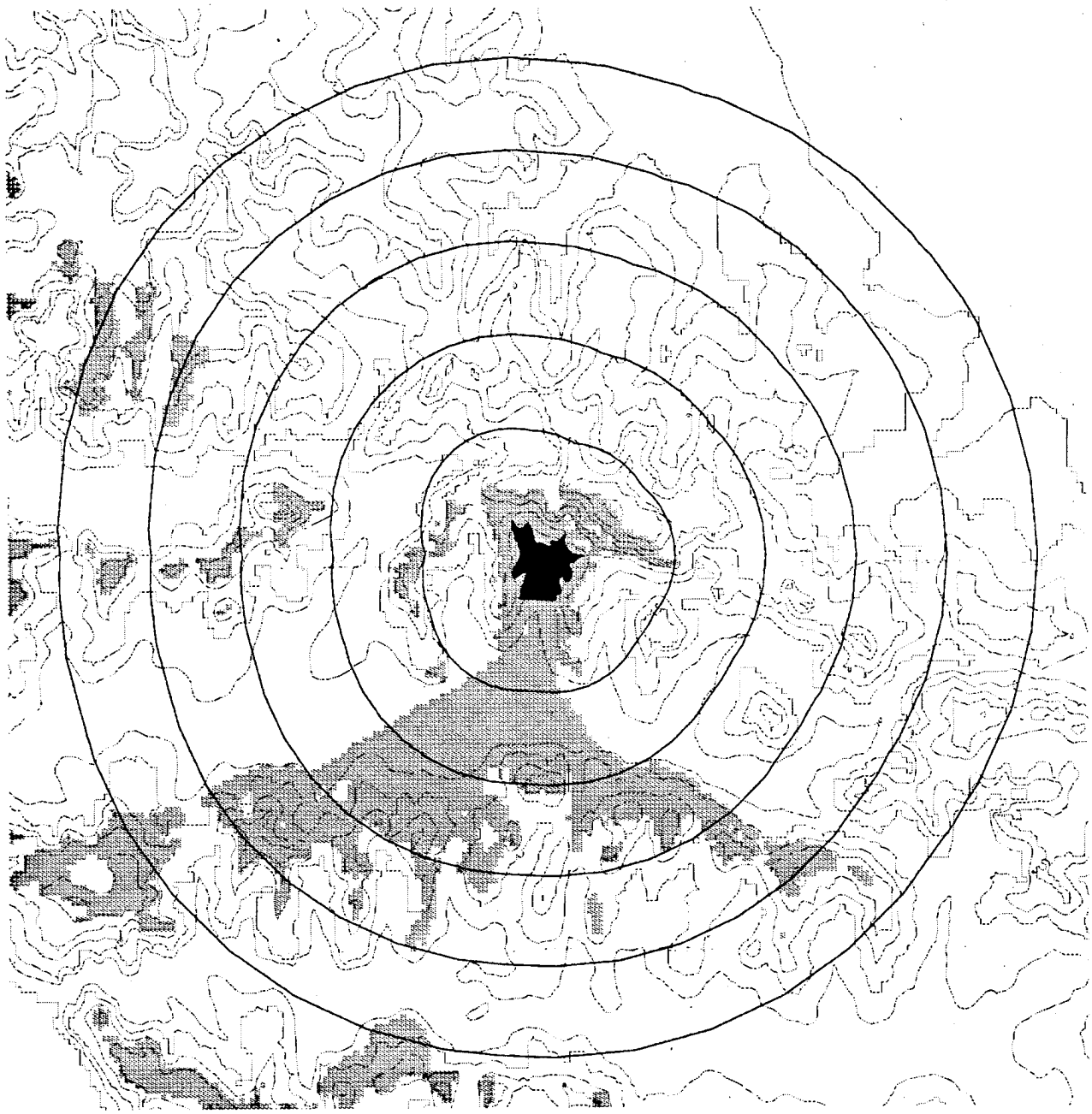
VISIBILITY MAPPING
VIEW FROM DAM
BLOOMFIELD RESERVOIR

Figure 4.14-6b



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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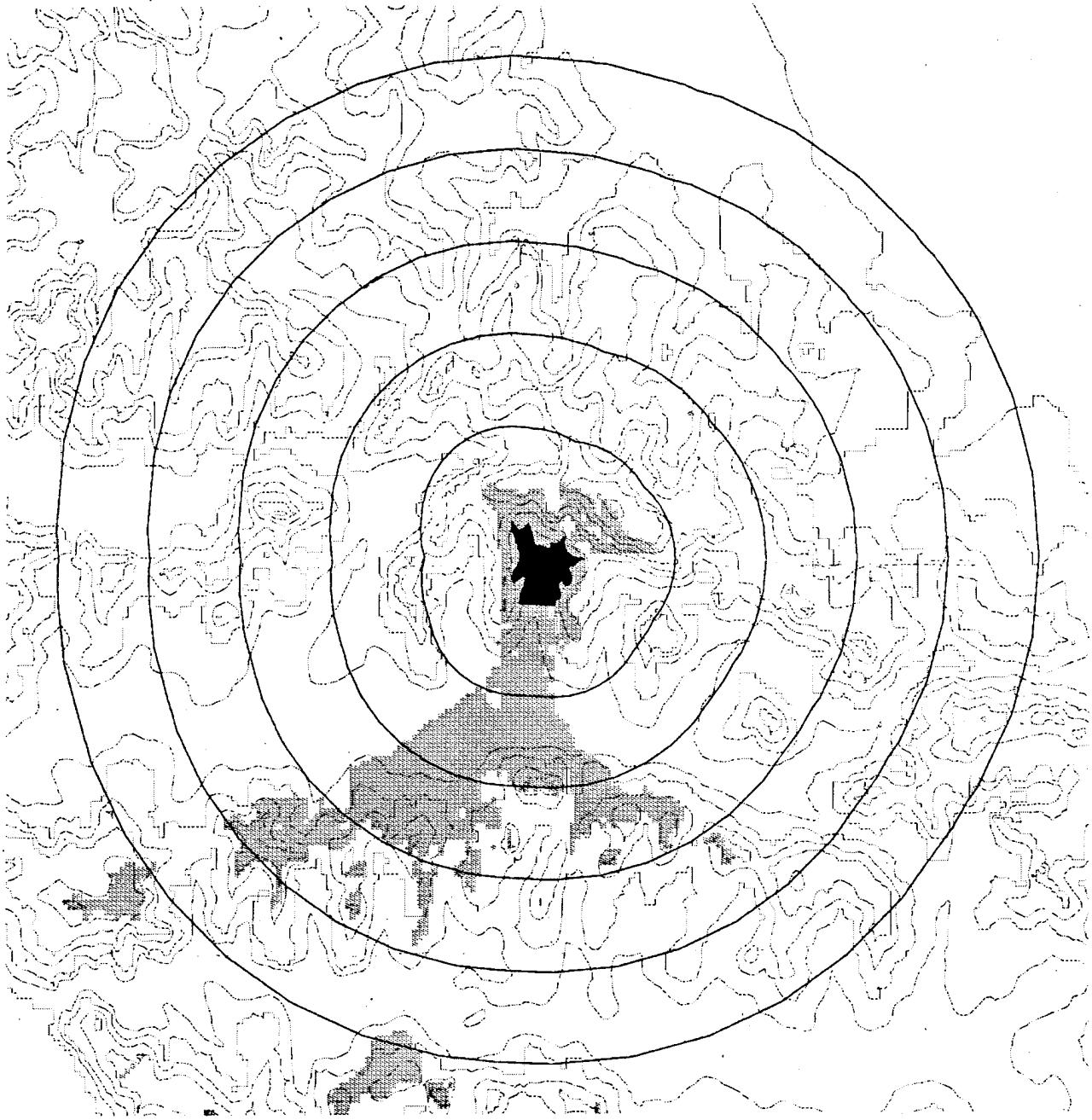
VISIBILITY MAPPING Figure 4.14-7a
VIEW FROM RESERVOIR
CARROLL ROAD RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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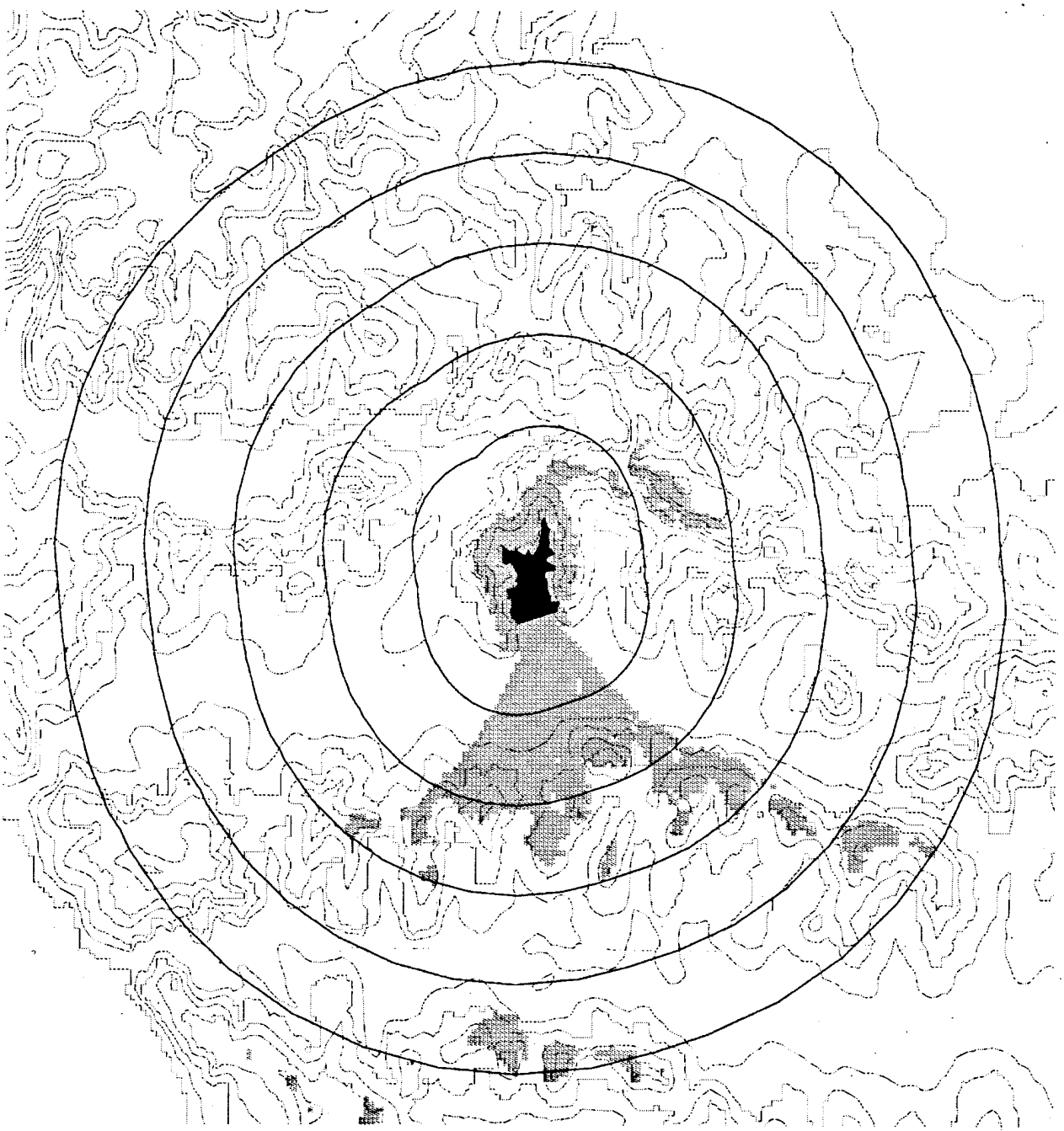
VISIBILITY MAPPING
VIEW FROM DAM
CARROLL ROAD RESERVOIR

Figure 4.14-7b



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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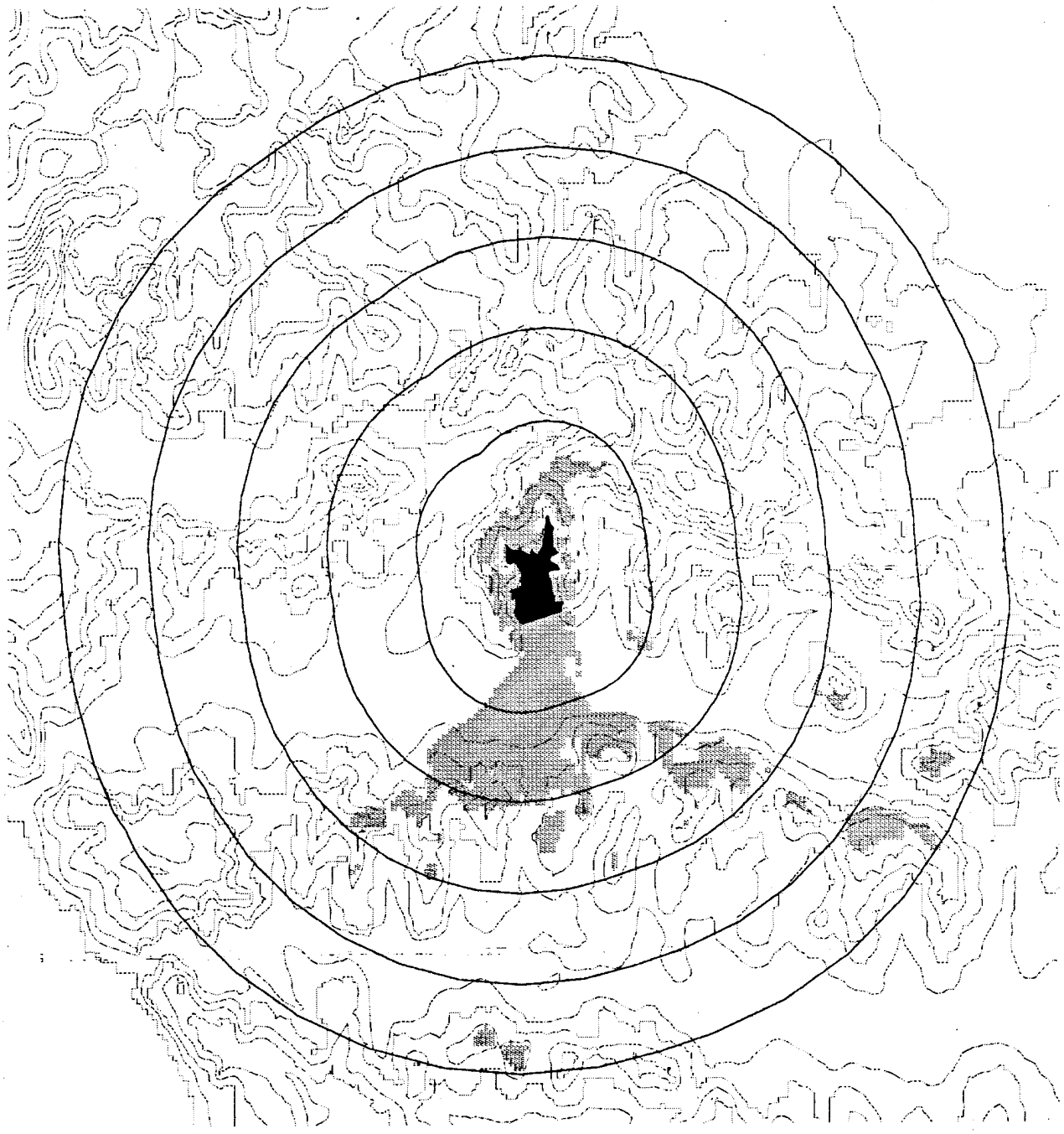
VISIBILITY MAPPING Figure 4.14-8a
VIEW FROM RESERVOIR
VALLEY FORD RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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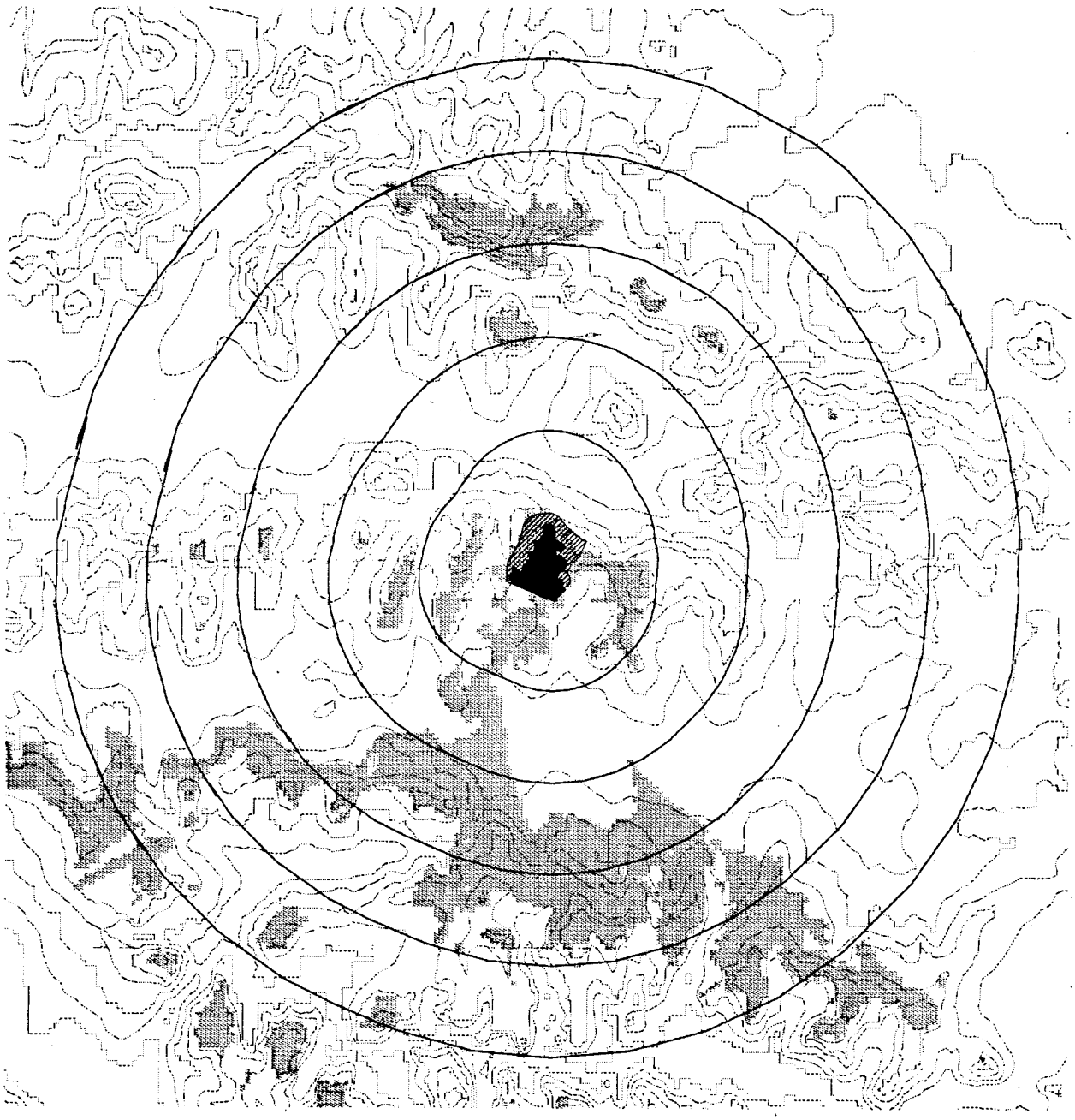
VISIBILITY MAPPING **Figure 4.14-8b**
VIEW FROM DAM
VALLEY FORD RESERVOIR



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Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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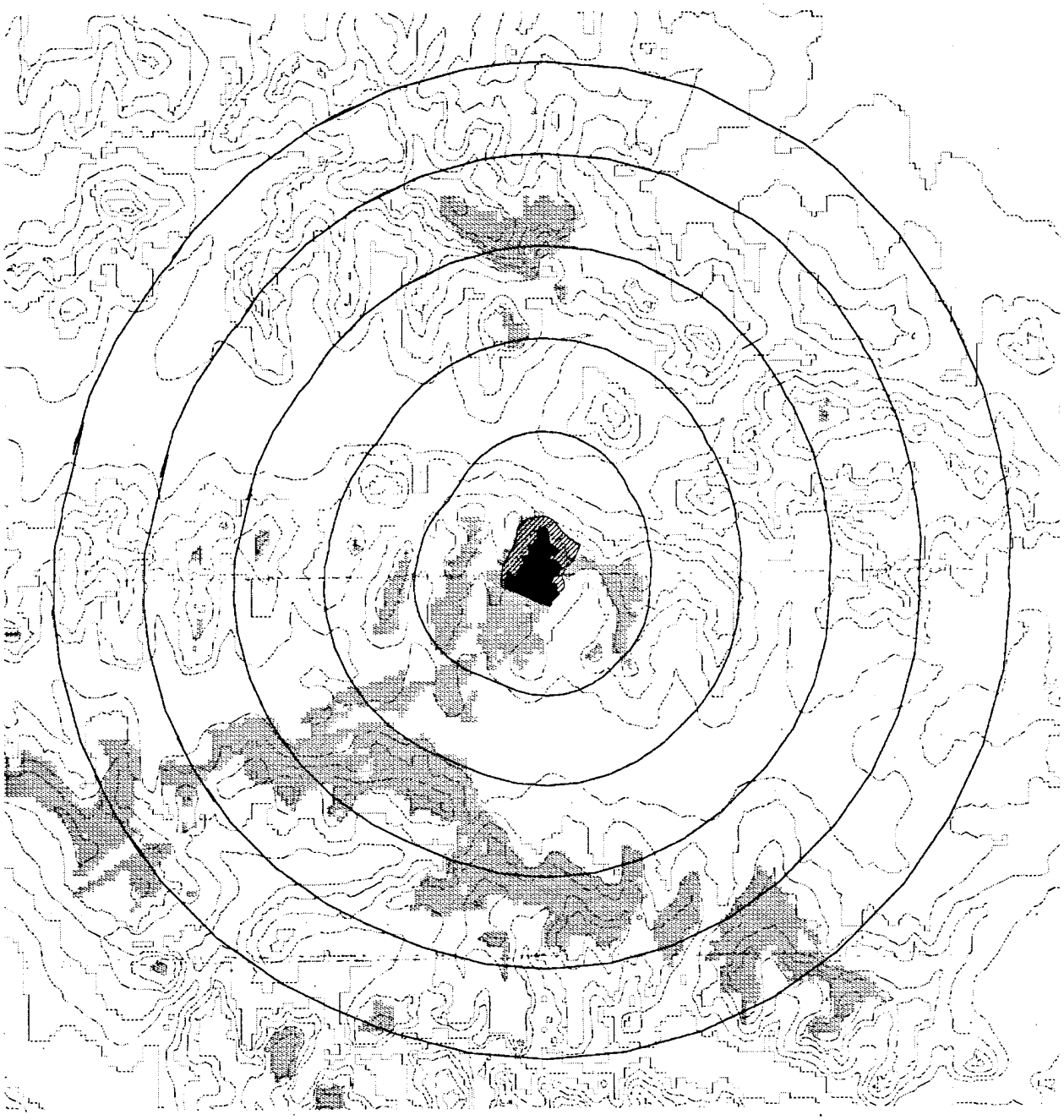
VISIBILITY MAPPING Figure 4.14-9a
VIEW FROM RESERVOIR
HUNTLEY RESERVOIR



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30 meter contours calculated by Arc/Info using USGS 1:250,000 DEM data.

Roads and streams from USGS 1:250,000 DLG data.

Rings represent buffering of the proposed reservoir at increments of one mile.

LEGEND

- Reservoir
- Watershed Boundary
- Areas Having Visibility
- Reservoir Buffering 1 Mile Increments

source: Dames & Moore

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VISIBILITY MAPPING
VIEW FROM DAM
HUNTLEY RESERVOIR

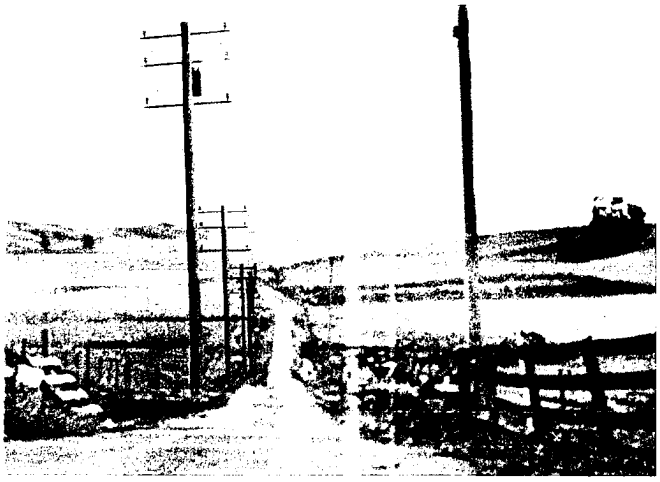
Figure 4.14-9b

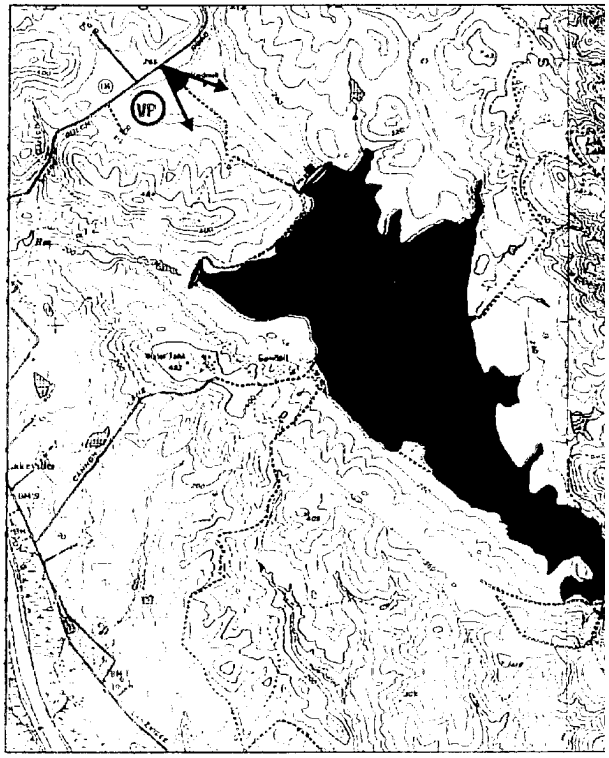
Existing view from Gulch Road.

Computer model of dam one year after construction.

Source: DAMES & MOORE

(2)

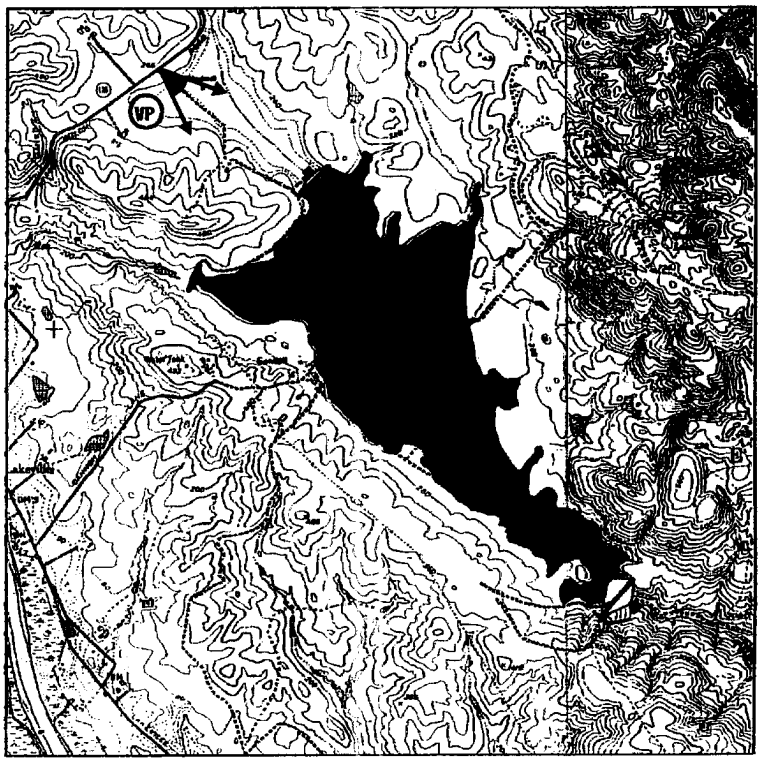




Viewpoint Location

Computer model of dam

(3)



Viewpoint Location

Source: USGS

Computer model of dam

VISUAL SIMULATION
TOLAY EXTENDED RESERVOIR SITE

Figure 4.14-10

(1)

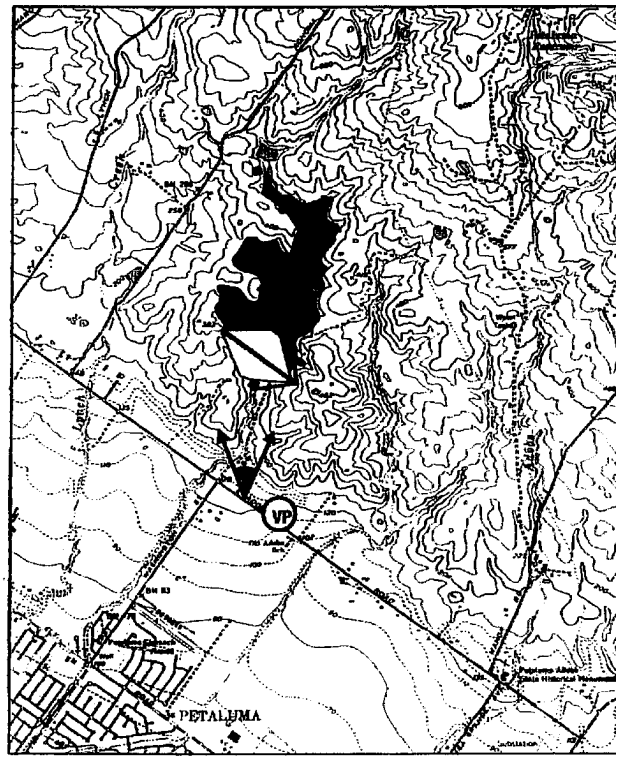
Existing view from Adobe Road near intersection of Washington Street

Computer model of dam one year after construction.

Source: DAMES & MOORE

(2)

Washington Street.



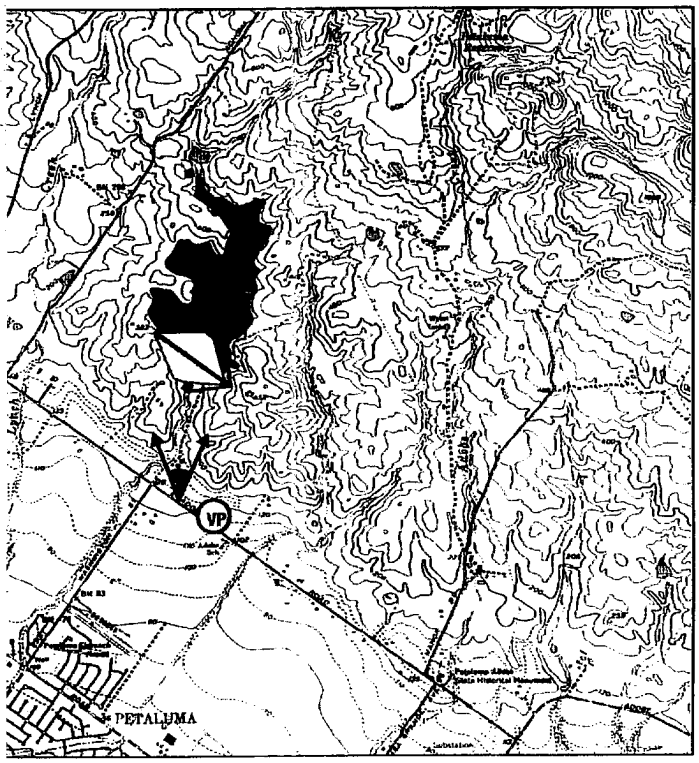
Viewpoint Location

Computer model of dam

Santa Rosa Subregional Long-Term Wastewater Project

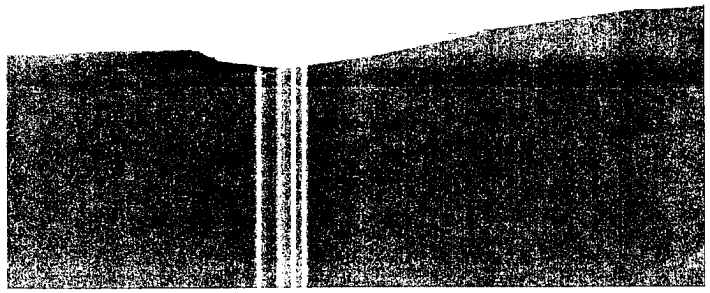
VISUAL SIMULATION Fig
ADOBE ROAD RESERVOIR SI

(3)



point Location

Source: USGS



puter model of dam

VISUAL SIMULATION
ADOBE ROAD RESERVOIR SITE

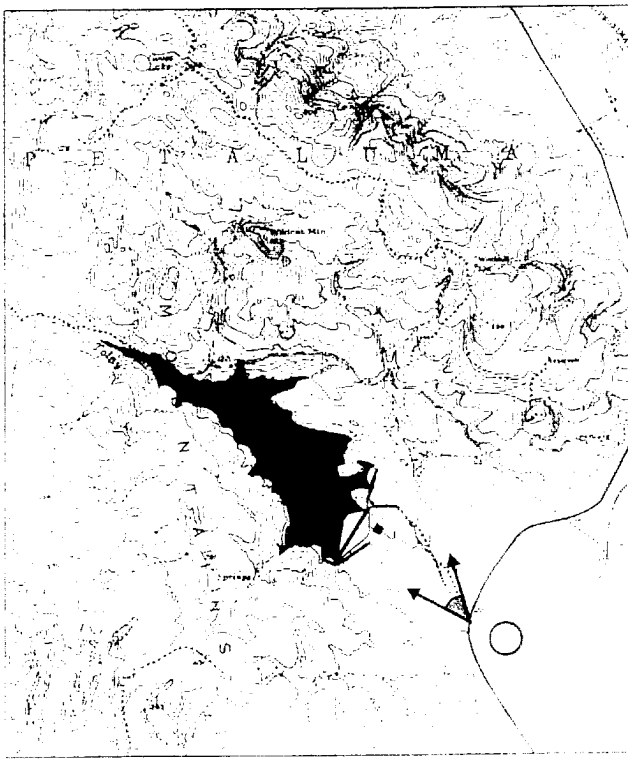
Figure 4.14-11

(1)

Existing view from Highway 121

Computer simulation of dam one year after construction.

Source: JAMES & MOORE



Viewpoint Location

Sc

uction.

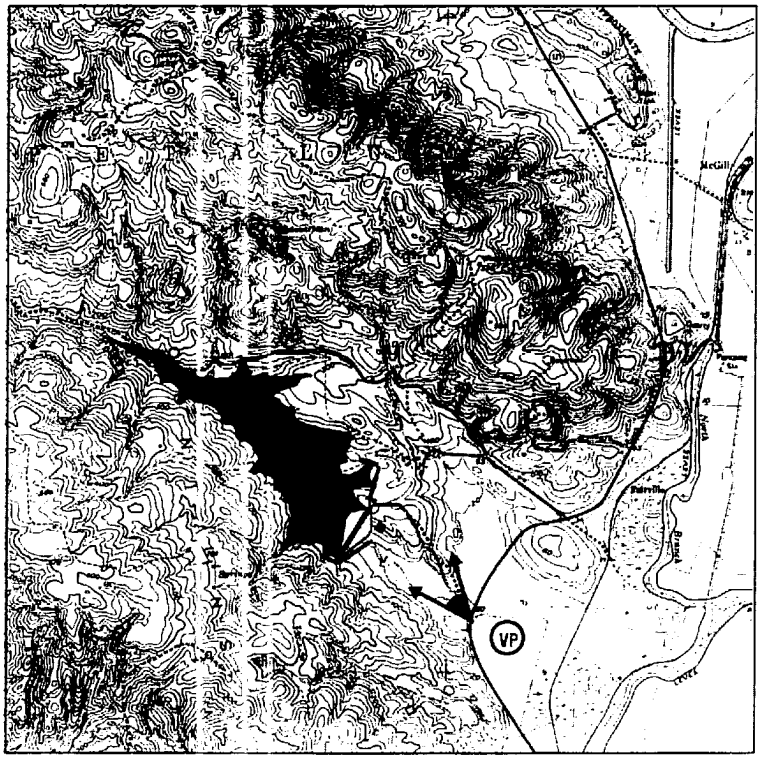
Computer model of dam.

Santa Rosa Subregional Long-Term Wastewater Project

VISUAL SIMULATION
SEARS POINT RESERVOIR SIT

Figu

(3)



Viewpoint Location

Source: USGS

Computer model of dam.

VISUAL SIMULATION
SEARS POINT RESERVOIR SITE

Figure 4.14-12

(1)

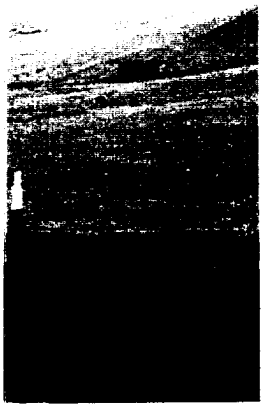
Existing view from road off Lakeville Highway.

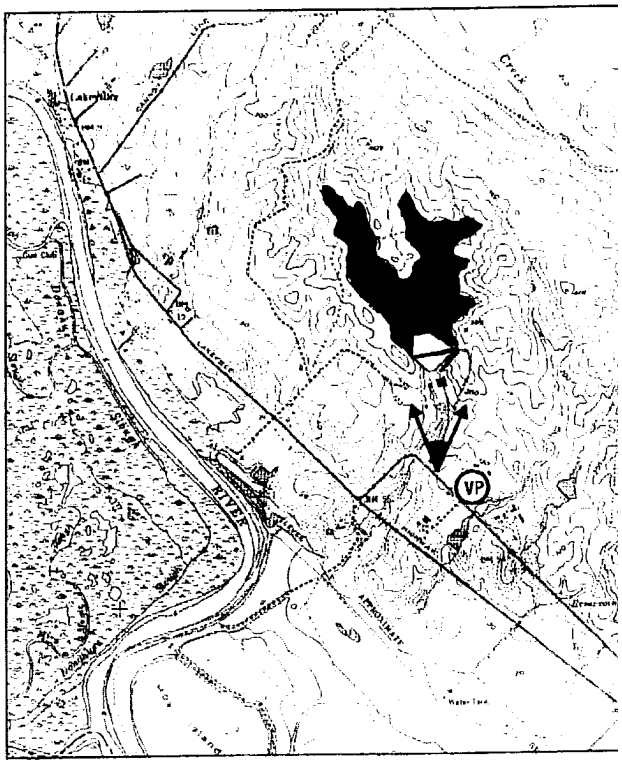
Computer simulation of dam one year after construction.

Source: DAMES & MOORE

Santa

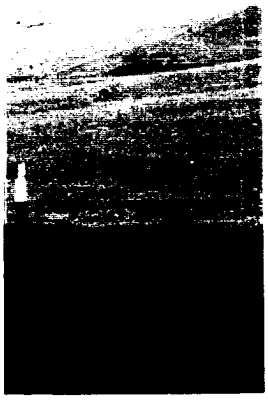
(2)





Viewpoint Location

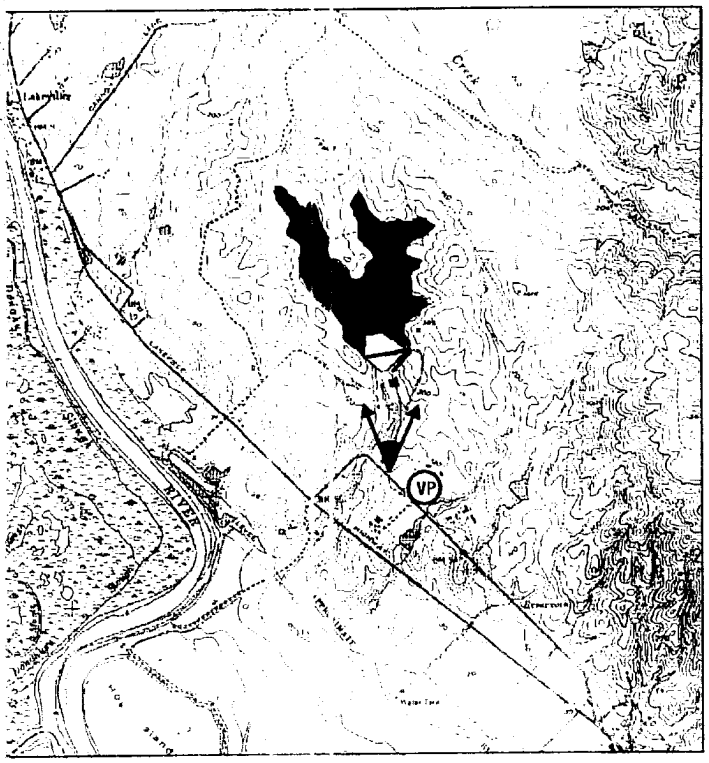
S



ruction.

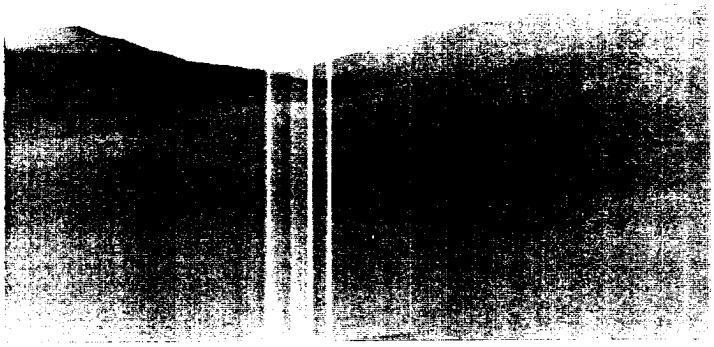
Computer model of dam.

(3)



vpoint Location

Source: USGS

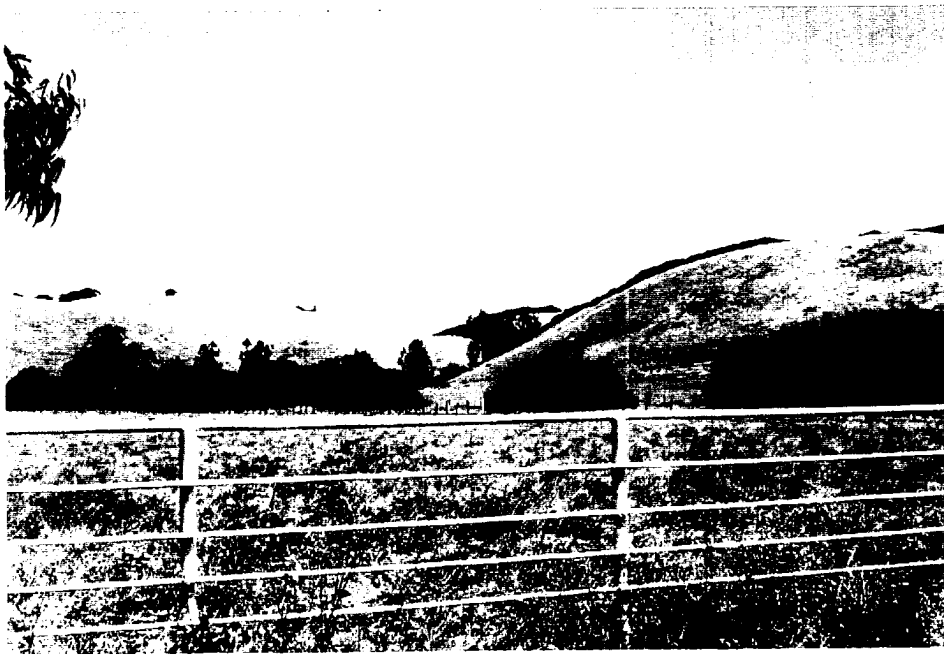


nputer model of dam.

VISUAL SIMULATION
LAKEVILLE HILLSIDE RESERVOIR SITE

Figure 4.14-13

(1)

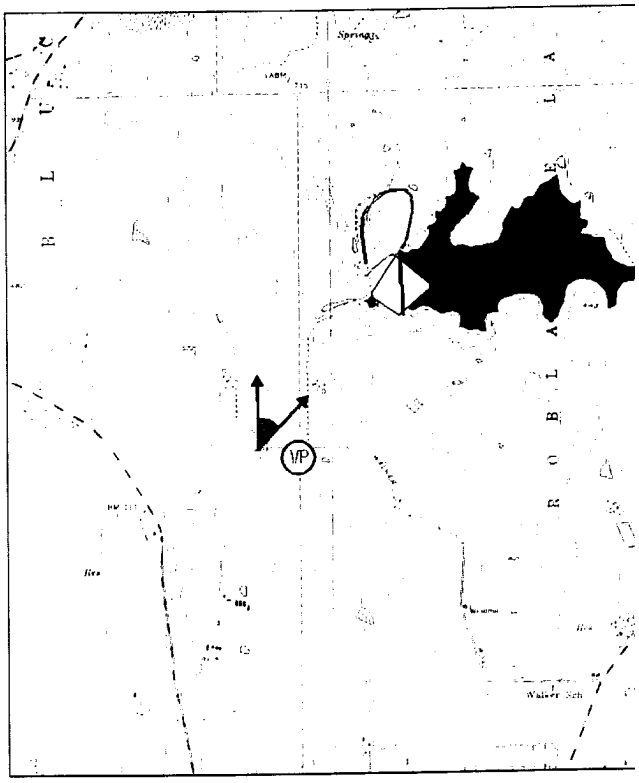


Existing view from Walker Road

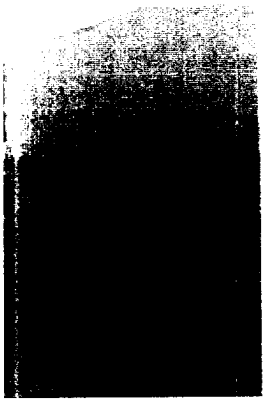
Computer model of view from Walker Road

Source: DAMES & MOORE

(2)



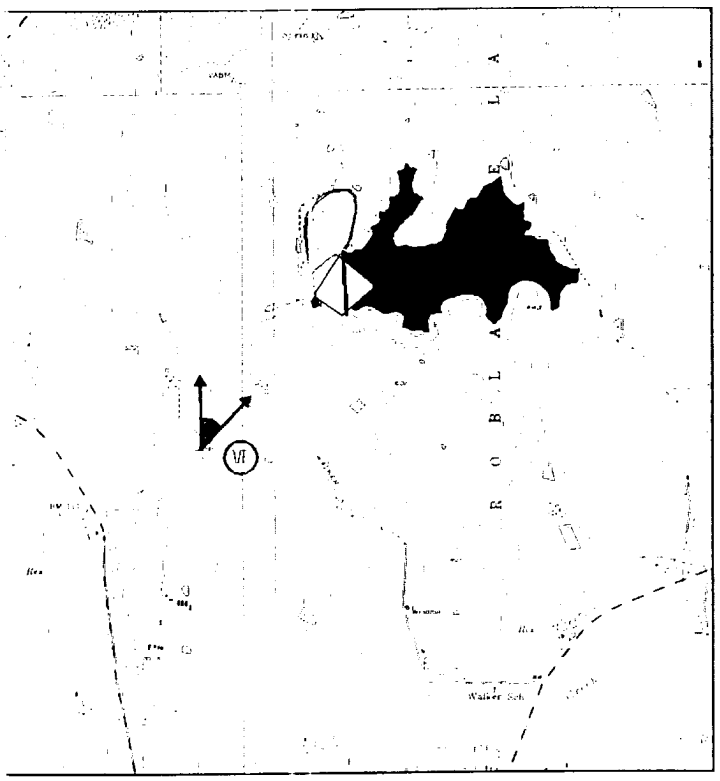
Viewpoint Location



Santa Rosa Subregional Long-Term Wastewater Project

VISUAL SIMULATION
TWO ROCK RESERVOIR SITE

(3)



vpoint Location

Source: USGS

VISUAL SIMULATION
TWO ROCK RESERVOIR SITE

Figure 4.14-14

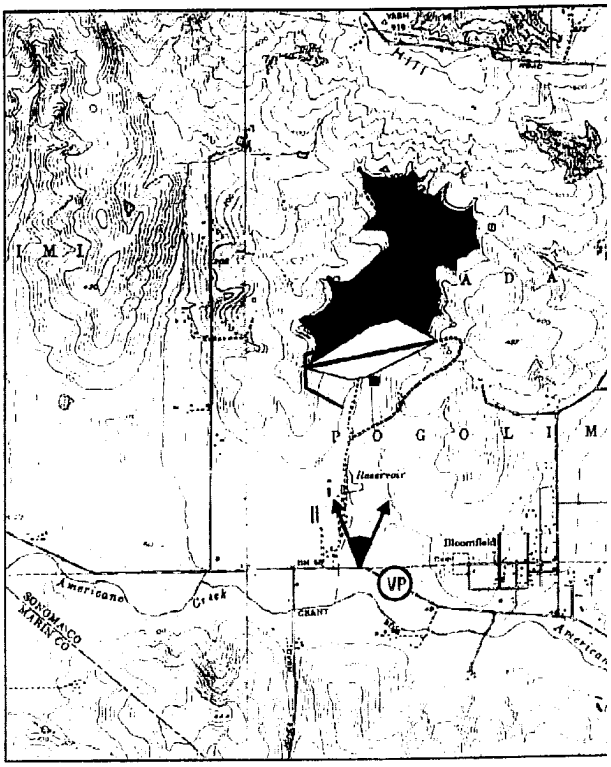
(1)

Existing view from Highway 1.

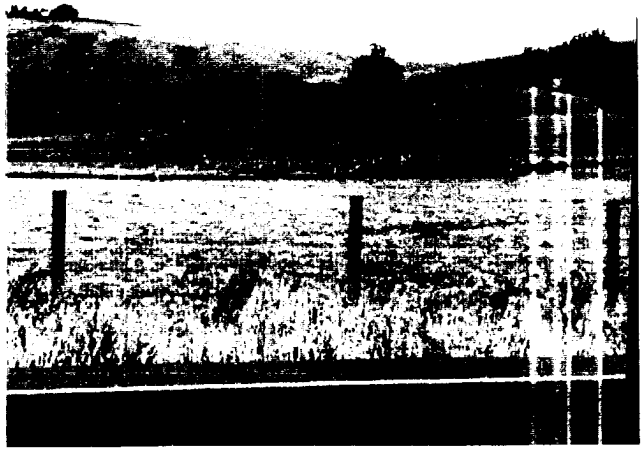
Computer model of dam one year after construction.

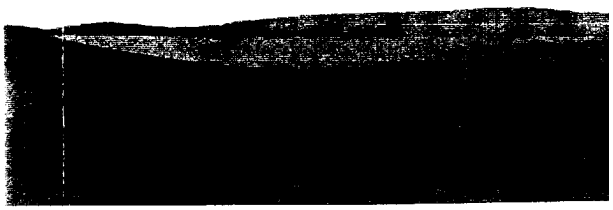
Source: DAMES & MOORE

(2)



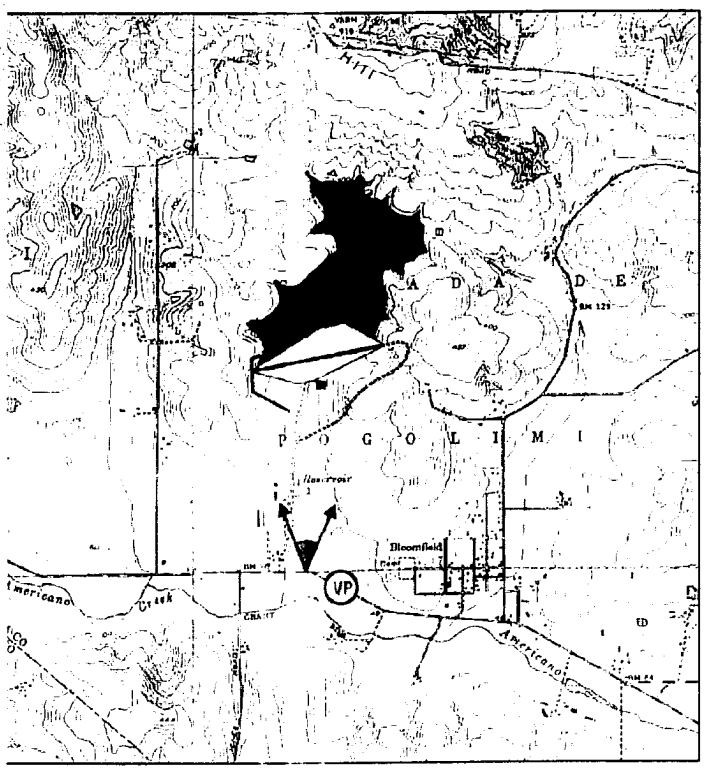
Viewpoint Location





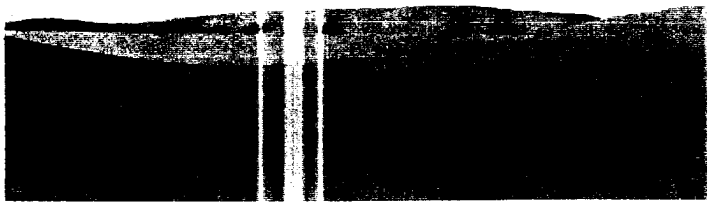
Computer model of dam

(3)



/point Location

Source: USGS

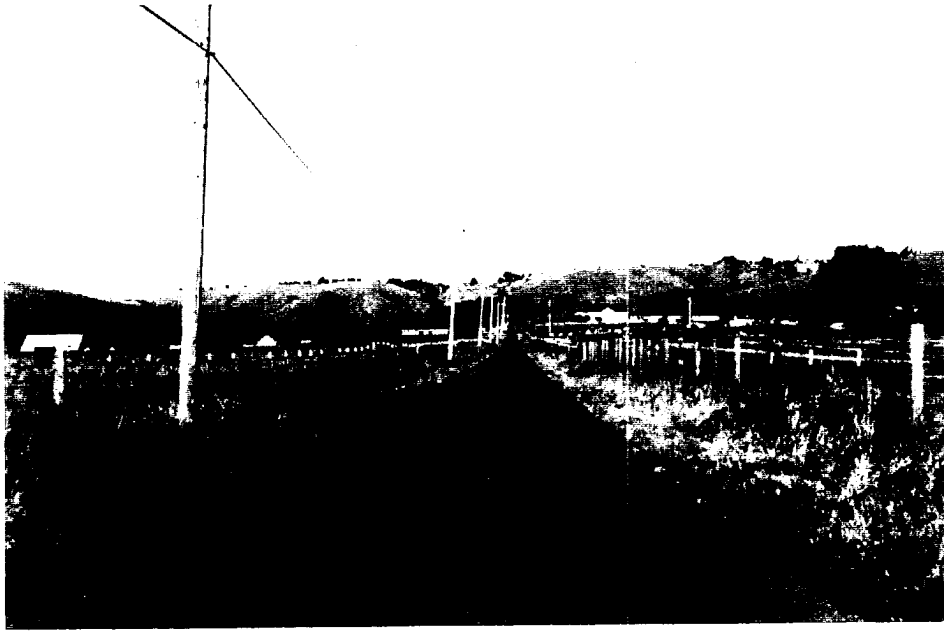


ıputer model of dam

VISUAL SIMULATION
BLOOMFIELD RESERVOIR SITE

Figure 4.14-15

(1)



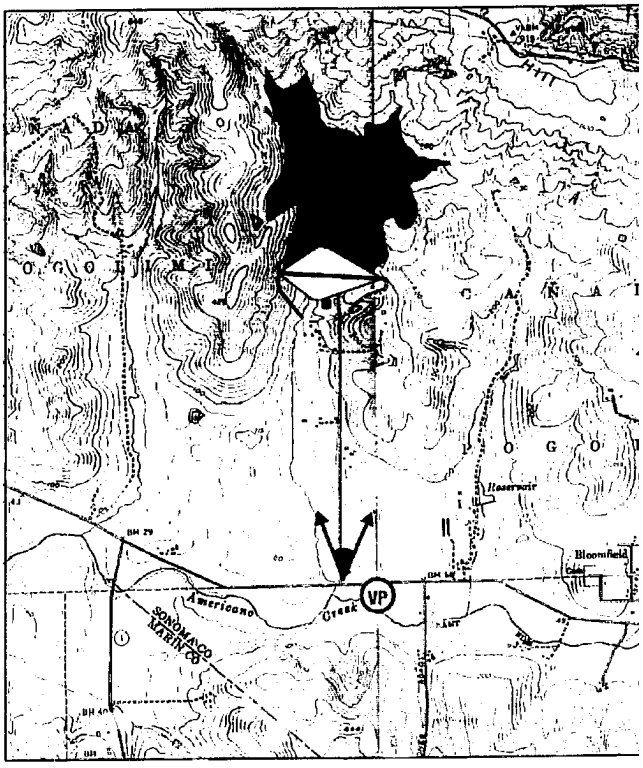
Existing view from intersection of Valley Ford Road and Carroll Roa

Computer model of dam one year after construction.

Source: DAMES & MOORE

(2)

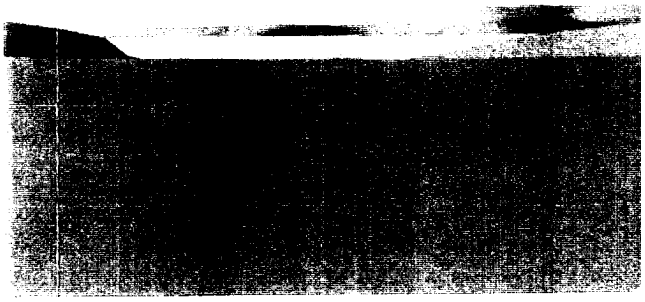
and Carroll Road.



Viewpoint Location

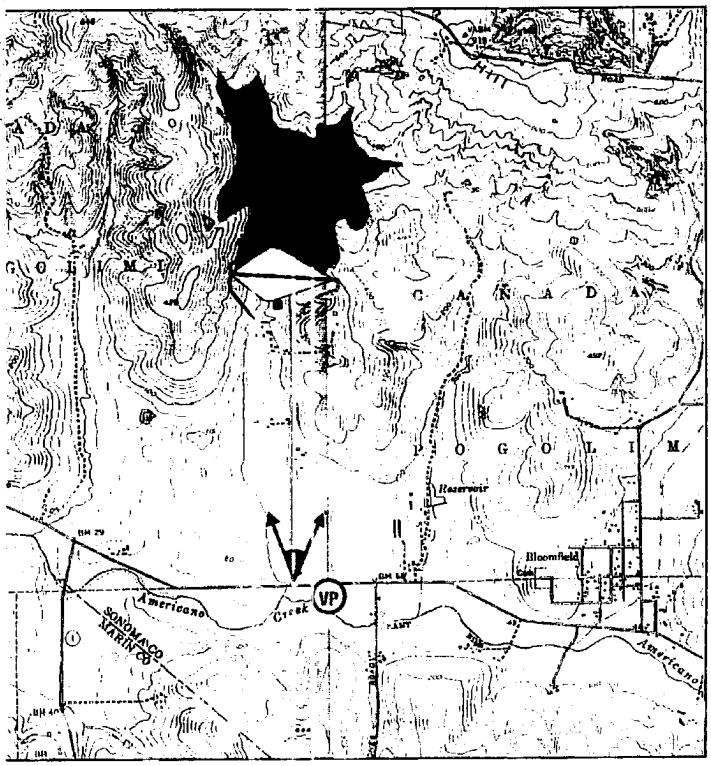
Sou

n.



Computer model of dam

(3)



vpoint Location

Source: USGS

nputer model of dam

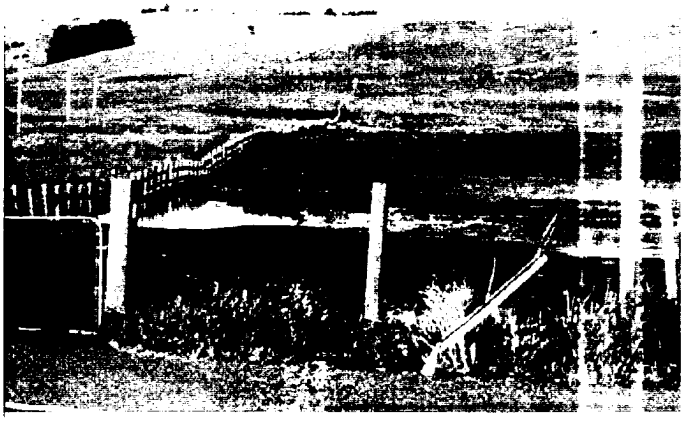
VISUAL SIMULATION Figure 4.14-16
CARROLL ROAD RESERVOIR SITE

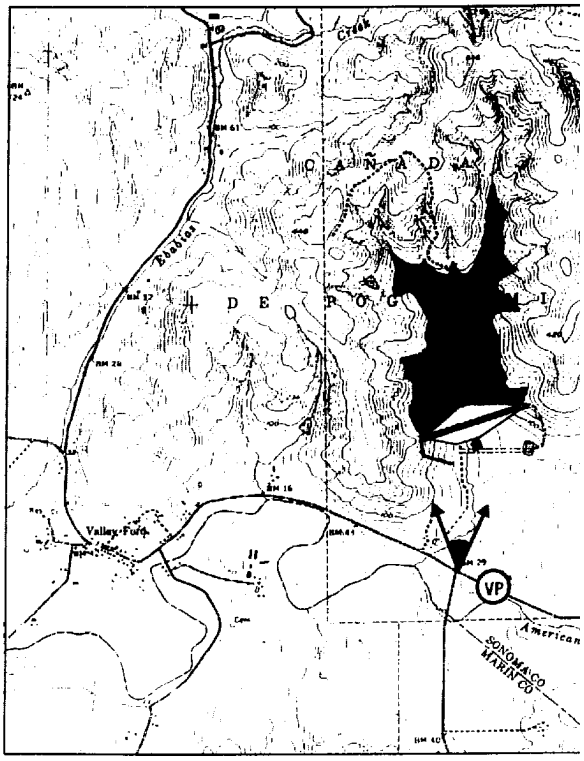
(1)

Existing view from Highway 1 and Valley Ford Road.

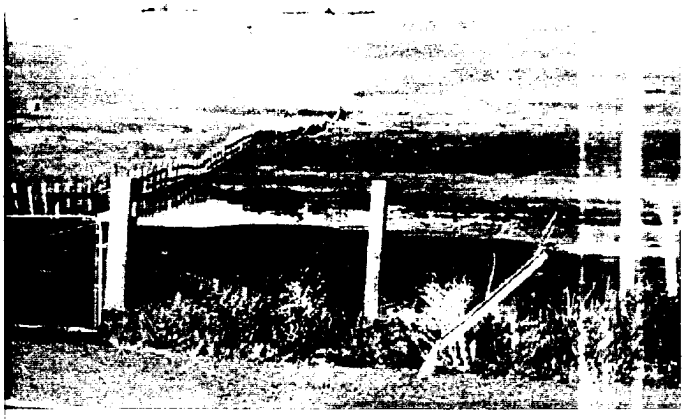
Computer model of dam one year after construction.

Source: DAMES & MOORE



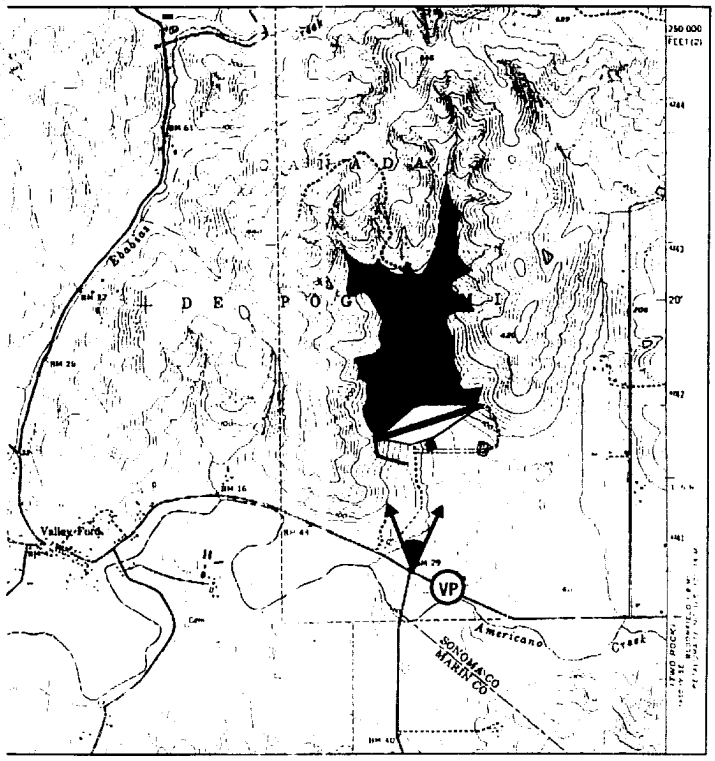


Viewpoint Location



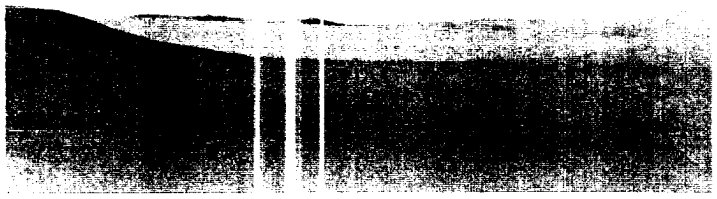
Computer model of dam

(3)



vpoint Location

Source: USGS

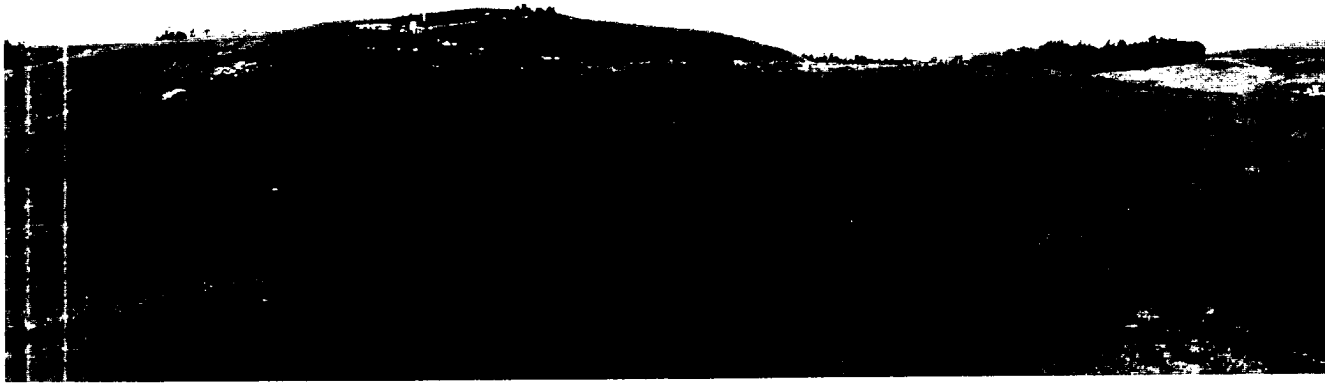


nputer model of dam

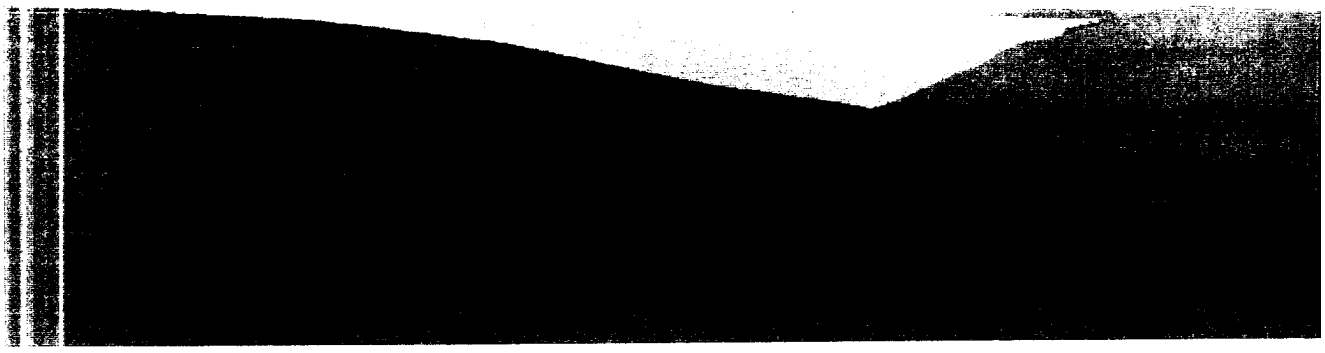
VISUAL SIMULATION
VALLEY FORD RESERVOIR SITE

Figure 4.14-17

(1)



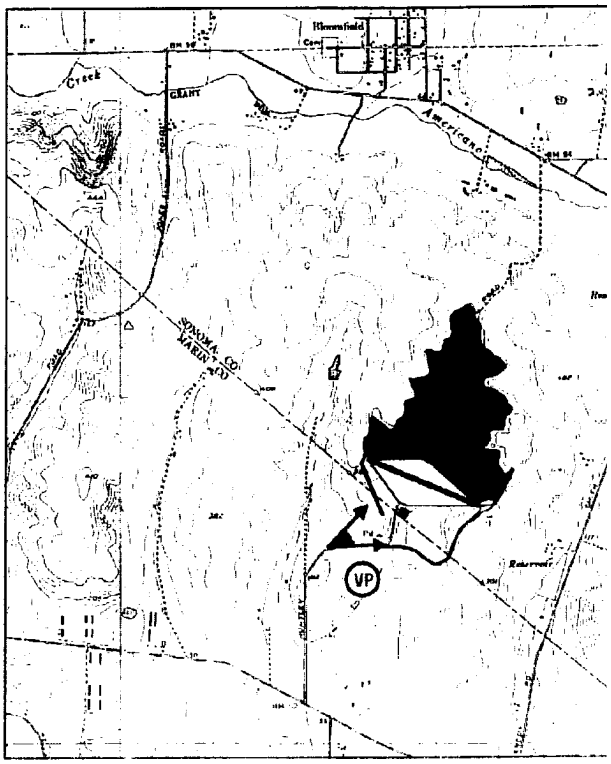
Existing view from Huntley Road.



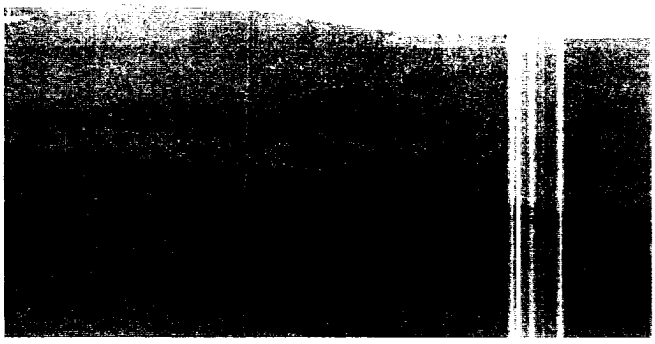
Computer model of dam.

Source: DAMES & MOORE

(2)



Viewpoint Location

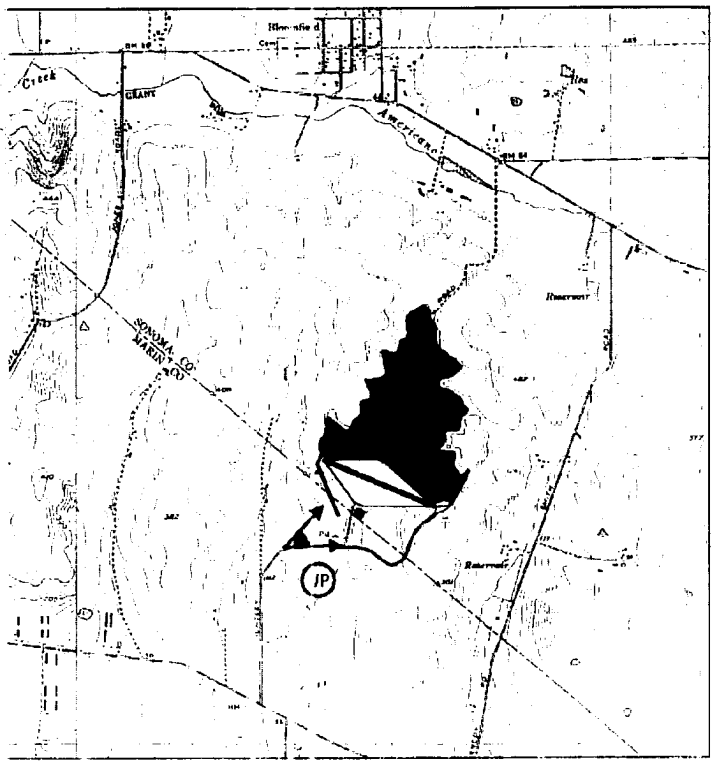


Santa Rosa Subregional Long-Term Wastewater Project

VISUAL SIMULATION
HUNTLEY RESERVOIR SITE

Fi

(3)



vpoint Location

Source: USGS

VISUAL SIMULATION
HUNTLEY RESERVOIR SITE

Figure 4.14-18

However, no mitigation is available to reduce the impact on visual contrast for the Bloomfield and Carroll Road sites (Alternatives 3B and 3C) related to views of the reservoir bottom from overlooking residences. There is no mitigation available to reduce the impacts on visual obstruction for the Tolay, Adobe Road, Sears Point, Two Rock, Bloomfield, Carroll Road and Valley Ford sites (Alternatives 2A, 2B, 2C, 2D, 3A, 3B, 3C and 3D) to less than significant. Mitigation measures intended to reduce view obstruction or replace a degraded/eliminated visual resource are not available. Typically, the dam will block views up a scenic valley containing interesting landform and trees. Another condition that cannot be mitigated is an elevated viewpoint that overlooks a scenic valley that will be inundated. Because the water level may fluctuate and the edge conditions may be unsightly, the presence of the reservoir does not constitute replacing a scenic resource of equal value.

PUMP STATION COMPONENT

Table 4.14-7

Visual Resource Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.6.1. Will the pump station component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?	Strong visual contrast	None	C, P,	=
	Permanent Visual Obstruction	None	C, P,	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.6.2. Will the pump station component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?				

Table 4.14-7

Visual Resource Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Pump Stations G1 and G2	Strong visual contrast	Strong	C, P	●
• Pump Stations SBPS-3, SBPS-11, SBPS-12, WBPS-6, LBPS-2, LBPS-3 and LBPS-4		Strong	C, P	⊙
• Pump Stations ARSW, AR, L, and SEB		Slight	C, P	○
• All other pump stations		None	C, P	=
• Pump Stations G1 and G2	Permanent Visual Obstruction	Permanent	C, P	●
• All other pump stations		None	C, P	=
• All pump stations	Loss or alteration of a specific scenic resource	None	C, P	=
14.6.3. Will the pump station component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?				
• Pump Stations G1, G2, SP, and SBPS-10	Strong visual contrast	Strong	C, P	●
• Pump Stations SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-11, SBPS-12, WBPS-5, WBPS-6, WBPS-8, LBPS-1, and LBPS-3		Strong	C, P	⊙
• Pump Stations SEB, T, AR, B, CR, and VF		Slight	C, P	○
• All other pump stations		None	C, P	=

Table 4.14-7

Visual Resource Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Pump Stations G1 and G2	Permanent Visual Obstruction	Permanent	C, P	●
• All other pump stations		None	C, P	=
• All pump stations	Loss or alteration of a specific scenic resource	None	C, P	=
14.6.4. Will the pump station component be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?				
• Pump Stations G2, SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-10, SBPS-11, SBPS-12, WBPS-5, WBPS-6, WBPS-8, LBPS-1, and LBPS-3	Less than 200 feet	25 feet or less	C, P	●
• All other pump stations		None	C, P	=
14.6.5. Will the pump station component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?				
• Pump Stations G3, G4, and S	Strong visual contrast	Strong	C, P	●
• Pump Stations FGB, BVB, SBPS-9, WBPS-3, WBPS-4, WBPS-7, LBPS-2, and LBPS-4		Strong	C, P	⊙
• Pump Stations L and H		Slight	C, P	○
• All other pump stations		None	C, P	=

Table 4.14-7

Visual Resource Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Pump Stations G3 and G4	Permanent Visual Obstruction	Permanent	C, P	●
• All other pump stations		None	C, P	=
• All pump stations	Loss or alteration of a specific scenic resource	None	C, P	=
14.6.6. Will the pump station component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?				
• Pump Station G-2, S, T, SP, TR, B and SBPS-10	Strong visual contrast	Strong	C, P	●
• Pump Stations SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-9, SBPS-11, SBPS-12, WBPS-1, WBPS-3, WBPS-4, WBPS-5, WBPS-6, WBPS-7, WBPS-8, LBPS-1, LBPS-2, LBPS-3, and LBPS-4		Strong	C, P	⊙
• Pump Stations L, AR, CR, VF, and H		Slight	C, P	○
• All other pump stations		None	C, P	=
• Pump Station G-2	Permanent Visual Obstruction	Permanent	C, P	●
• All other pump stations		None	C, P	=
• All pump stations	Loss or alteration of a specific scenic resource	None	C, P	=

Table 4.14-7

Visual Resource Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.6.7. Will the pump station component create a new light source?	Greater than 0 residential units affected	None	C, P	=

Source: Harland Bartholomew and Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
P Project

2. Level of Significance:
● Significant impact before and after mitigation
⊙ Significant impact before mitigation; less than significant impact after mitigation
= No impact
○ Less than significant impact; no mitigation proposed

Impact: **14.6.1. and 7. Will the pump station component impact visual resources as based on evaluation criteria 1 and 7?**

Analysis: *No Impact. All Alternatives.*

All the pump stations are located outside designated Community Separator areas delineated in the Sonoma County General Plan.

Low intensity lights at the building entrance may be used during maintenance, but the lights will be shielded to avoid casting light on residential properties. Lights will only be turned on by personnel when needed, and will not be on continuously or automatically.

Alternatives 1 and 5 do not have a new pump station component.

Mitigation: No mitigation is needed.

Impact: **14.6.2. Will the pump station component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?**

Analysis: *Significant; Alternatives 2, 3 and 4.*

Pump Stations G1, G2, SBPS-3, SBPS-11, SBPS-12, WBPS-6, LBPS-2, LBPS-3 and LBPS-4.

These sites are located within a designated Sonoma County Scenic Landscape Unit, and strong visual contrast due to the proximity of the

structures to the roadway will occur. View obstruction from public viewpoints will be minimal due to the small size of the structures (typically 20 feet by 20 feet or smaller), except for pump stations G-1 and G-2, which have larger structures (a 30 feet by 60 feet pump station building, along with a 50 foot high storage tank and, for pump station G-2, an electrical substation). In addition, the proposed electrical service to Pump Station G-2 will introduce another overhead electrical line on the north side of Highway 128. (The other pump stations will have short [approximately 100-200 feet] connections to existing electrical service lines). Refer to photo simulations Figures 4.14-19 and 4.14-20 at the end of the pump station component evaluation.

No specific scenic resources have been identified which will be impacted by any of these pump station sites.

Pump Stations ARSW, AR, L, and SEB.

Pump stations ARSW AR and L which are at the Adobe Road and Lakeville Hillside reservoir sites will be several hundred feet from a public viewpoint, and due to the distance will not create a strong visual contrast. The proposed 12 kV electrical line from the existing service on Sonoma Mountain Road to Pump Station ARSW also will not be visible from public view except where it joins the existing line. (The other pump stations will have short [approximately 100-200 feet] connections to existing electrical service lines.)

Pump station SEB is located behind the Delta Pond south of Guerneville Road and screened from public view by the pond itself. It will also be served by a short underground connection from an existing electrical line. No specific scenic resources have been identified which will be impacted by any of these pump station sites.

All other pump stations.

None of the other pump stations are located in a designated Scenic Landscape Unit.

No Impact; Alternatives 1 and 5.

These alternatives do not have a new pump station component.

Mitigation: *Alternatives 2, 3, and 4.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternative 4 (Pump Stations G-1 and G-2)*

Less Than Significant after Mitigation; Alternatives 2 and 3 (Pump Stations SBPS-3, SBPS-11, SBPS-12, WBPS-6, LBPS-2, LBPS-3 and LBPS-4)

Except for Pump Stations G-1 and G-2, this measure will reduce the visual contrast of the pump stations by introducing vegetation to screen the structure from public view. The use of vegetation, will also blend the site with the surrounding landscape. The scale of structures at Pump Stations G-1 and G-2 is such that screening with vegetation will only partially eliminate views of the structures from public viewpoints. The 50 feet high storage tanks, in particular, will not be able to be screened from view by vegetation due to the proximity to the roadway. In addition, the proposed electrical service to Pump Station G-2 on the north side of Highway 128 could not effectively be screened from view.

Impact: **14.6.3. and 4. Will the pump station component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Corridors or with minimum building setbacks along Scenic Corridors?**

Significant. Alternatives 2, 3, and 4.

Pump Stations G1, G2, SP, SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-10, SBPS-11, SBPS-12, WBPS-5, WBPS-6, WBPS-8, LBPS-1, and LBPS-3. Except for Pump Station SP, these sites are located within a designated Sonoma County Scenic Corridor, and strong visual contrast due to the proximity of the structures to the roadway will occur. View obstruction from public viewpoints will be minimal due to the small size of the structures (typically 20 feet by 20 feet or smaller), except for pump stations G-1 and G-2, which have larger structures (a 30 feet by 60 feet pump station building, along with a 50 foot high storage tank and, for pump station G-2, an electrical substation).

To provide service to Pump Station SP at the Sears Point reservoir, a new 115 kV line will be constructed along Highway 121. This will introduce additional service with 70 foot high poles in a rural area. In addition, the proposed electrical service to Pump Station G-2 visual contrast from another overhead electrical line on the north side of Highway 128 and a proposed 115 kV line along Railroad Avenue and Petaluma Hill Road to Pump Station SBPS-10 will introduce additional service with 70 feet high of poles along these roads. (The other pump stations will have short [approximately 100-200 feet] connections to existing electrical service lines.)

All of these pump stations, except Pump Station SP, will have structures located within the 200 feet minimum setback required along Sonoma

County Scenic Corridors. No specific scenic resources have been identified which will be impacted by any of these pump station sites.

Pump Stations SEB, T, AR, B, CR, and VF. Pump stations located on the Tolay, Adobe Road, Bloomfield, Carroll Road and Valley Ford reservoir sites will be several hundred feet from a public viewpoint, and due to the distance will not create a strong visual contrast. The extension of the existing 12 kV electrical line on the Bloomfield site from its present terminus approximately 2,500 feet north of Valley Ford Road to Pump Station B will be in the middleground viewed from Valley Ford road and will not represent an additional contrasting visual element. The proposed new 12 kV electrical line from the east end of Cannon Lane to Pump Station T at the Tolay Dam site will not be visible from public view, except where it joins the existing line. (The other pump stations will have short [approximately 100-200 feet] connections to existing electrical service lines.)

Pump station SEB is located behind the Delta Pond south of Guerneville Road and screened from public view by the pond itself. No specific scenic resources have been identified which will be impacted by any of these pump station sites. None of these pump stations will be located within the required setback along Scenic Corridors.

All other pump stations. None of the other pump stations are located in a designated Scenic Corridor.

No Impact; Alternatives 1 and 5.

These alternatives do not have a new pump station component.

Mitigation: *Alternatives 2, 3, and 4. (Pump Stations G1, G2, SP, SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-10, SBPS-11, SBPS-12, WBPS-5, WBPS-6, WBPS-8, LBPS-1, and LBPS-3).*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3, and 4.*

Except for Pump Stations G-1, G-2, SP, and SBPS-10, this measure will reduce the visual contrast of the pump stations by introducing vegetation to screen the structure from public view. The use of vegetation, will also blend the site with the surrounding landscape. The scale of structures at Pump Stations G-1 and G-2 is such that screening with vegetation will only partially eliminate views of the structures from public viewpoints. The 50 foot high storage tank at Pump Station G-2, in particular, will not be able to be screened from view by vegetation due to the proximity to the

roadway, and the proposed electrical lines north of Highway 128, and along Railroad Avenue and Petaluma Hill Road cannot be screened from view.

The impact related to the location of structures within the required 200 foot setback along scenic corridors cannot be mitigated. The location of the structures cannot feasibly be changed and providing a greater setback will create additional intrusions on agricultural land, potential natural habitat and residential areas. The structures will be subject to design review under Sonoma County policies for Scenic Corridors.

Impact: **14.6.5. Will the pump station component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?**

Analysis: *Significant; Alternatives 2, 3, and 4.*

Pump Stations S, G3, G4, FGB, BVB, SBPS-9, WBPS-3, WBPS-4, WBPS-7, LBPS-2, and LBPS-4. These sites are along frequently traveled roads, and strong visual contrast due to the proximity of the structures to the roadway will occur. View obstruction from public viewpoints will be minimal due to the small size of the structures (typically 20 feet by 20 feet or smaller), except for pump stations G-3 and G-4, which have larger structures (a 30 feet by 60 feet pump station building, along with a 50 foot high storage tank and, for pump station G-2, an electrical substation). A new electrical service along Pine Flat Road to Pump Stations G-3 and G-4 (and extending to Pump Station G-2 at the west end of Pine Flat Road as well) will introduce a new visual element. While this line at least in part will parallel the existing 230 kV line to the Geysers, it will create additional visual contrast in an otherwise undeveloped area.

Although the proposed electrical line Pump station S is located among other structures at the Laguna Treatment Plant, and will not present any visual contrast with its surroundings, the proposed 115 kV electrical line with 70 foot high poles along the Laguna de Santa Rosa to serve Pump Station S will introduce a new contrasting visual element along the Laguna. The other pump stations will have short (approximately 100-200 feet) connections to existing electrical service lines.

No specific scenic resources have been identified which will be impacted by any of these pump station sites.

Pump Stations L and H. Pump stations L and H are at the Lakeville Hillside and Huntley reservoir sites several hundred feet from a public viewpoint, and due to the distance will not create a strong visual contrast. These pump stations will have short (approximately 100 feet) connections

to existing electrical service lines which will not introduce a new contrasting visual element.

All other pump stations. None of the other pump stations are located along a high volume travelway (excluding scenic corridors), recreation use area, or other public use area.

No Impact; Alternatives 1 and 5.

These alternatives do not have a new pump station component.

Mitigation: *Alternatives 2, 3, and 4.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternative 2, 3, and 4. (Pump Stations G3, G4 and S).*

Except for Pump Stations G-3, G-4 and S, this measure will reduce the visual contrast of the pump stations by introducing vegetation to screen the structure from public view. The use of vegetation, will also blend the site with the surrounding landscape. The scale of structures at Pump Stations G-3 and G-4 is such that screening with vegetation will only partially eliminate views of the structures from public viewpoints. The 50 foot high storage tanks, in particular, will not be able to be screened from view by vegetation due to the proximity to the roadway. The new electrical service lines to Pump Stations G-3, G-4 and S cannot be effectively screened from public view.

Impact: **14.6.6. Will the pump station component may an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?**

Analysis: *Significant; Alternatives 2, 3 and 4.*

Pump Stations G-2, S, T, SP, TR, B, SBPS-2, SBPS-3, SBPS-7, SBPS-8, SBPS-9, SBPS-10, SBPS-11, SBPS-12, WBPS-1, WBPS-3, WBPS-4, WBPS-5, WBPS-6, WBPS-7, WBPS-8, LBPS-1, LBPS-2, LBPS-3 and LBPS-4. Pump Station G-2 and all of the agricultural irrigation booster pump stations are within the potential foreground view of one or more residences, and due to the small size of the parcels (approximately one acre), and proximity of the structures to the roadway, strong visual contrast with the residential character will occur. However, view obstruction from residences will be minimal due to the small size of the structures (typically 20 feet by 20 feet or smaller), except for pump station

G-2, which has larger structures (a 30 feet by 60 feet pump station building, along with a 50 foot high storage tank and, for pump station G-2, an electrical substation). The new electrical services to Pump Stations S, T, SP, TR, B and SBPS-10 will be visible to residences in the foreground view and will introduce new visual contrast in these views. (The other pump stations will have short [approximately 100-200 feet] connections to existing electrical service lines.)

No specific scenic resources have been identified which will be impacted by any of these pump station sites.

Pump Stations L, AR, CR, VF and H. These pump stations are at the proposed reservoir sites several hundred feet from the nearest residence, and while they will be in the foreground view (less than 2,000 feet) will not create a strong visual contrast or block any scenic views, due to the distance from the residence. These pump stations will have short (approximately 100-200 feet) connections to existing electrical service lines.

No specific scenic resources have been identified which will be impacted by any of these pump station sites.

All other pump stations. None of the other pump stations are visible in a foreground view from any residence.

No Impact; Alternatives 1 and 5.

These alternatives do not have a new pump station component.

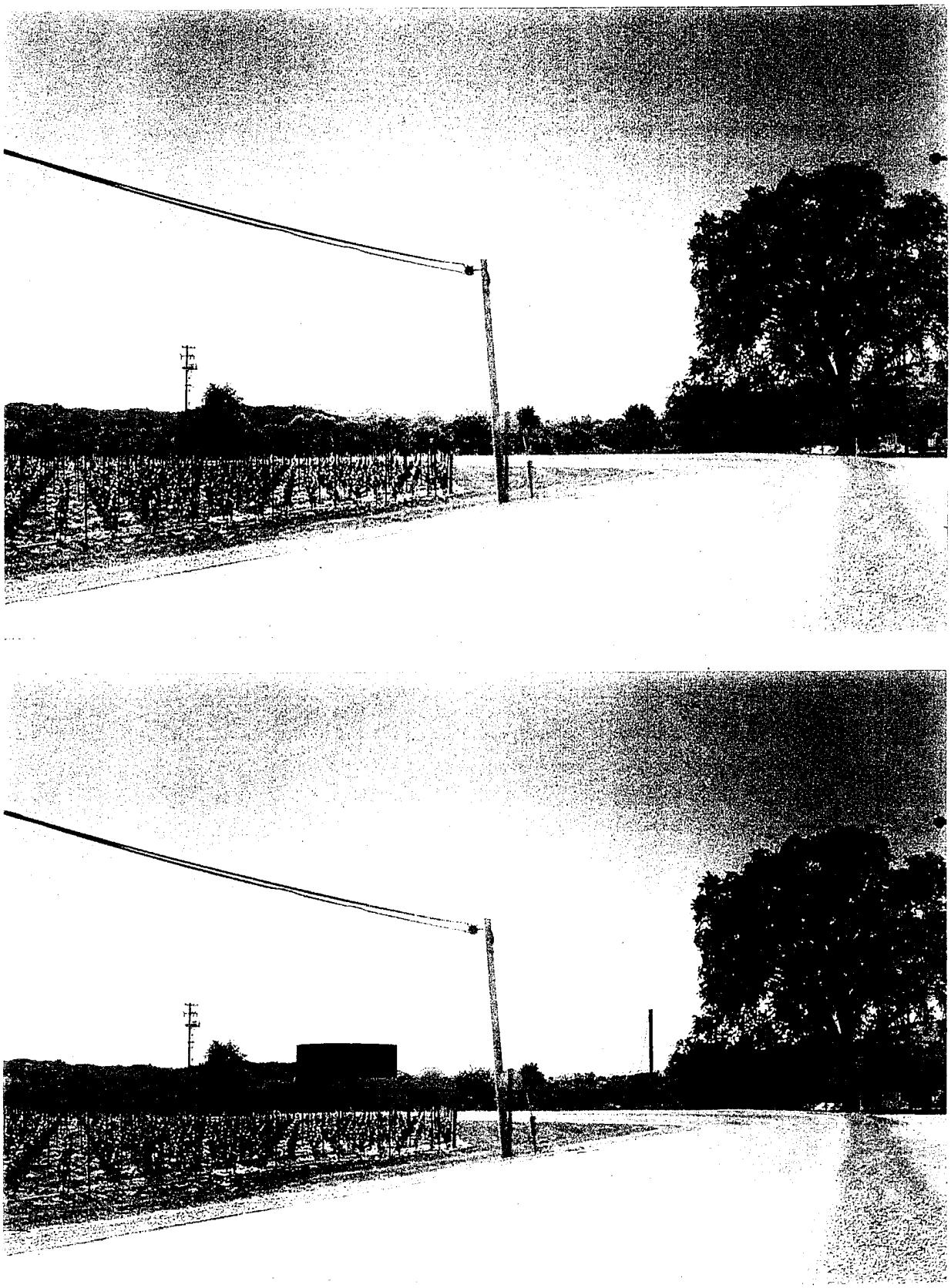
Mitigation: *Alternatives 2, 3, and 4.*

2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Significant after Mitigation; Alternatives 2, 3 and 4.*

Except for Pump Stations G-2, S, T, SP, TR ,B and SBPS-10, this measure will reduce the visual contrast of the pump stations by introducing vegetation to screen the structure from public view. The use of vegetation, will also blend the site with the surrounding landscape. The scale of structures at Pump Station G-2 is such that screening with vegetation will only partially eliminate views of the structures from public viewpoints. The 50 foot high storage tanks, in particular, will not be able to be screened from view by vegetation due to the proximity to the roadway. The new electrical service lines to Pump Stations G-2, S, T, SP, TR , B and SBPS-10 cannot feasibly be screened from the view of nearby residences.



Source: William Kanemoto

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Santa Rosa Subregional Long-Term Wastewater Project

VISUAL SIMULATION PUMP STATION G-2 SITE

Figure 4.14-19

Source: William Kanemoto

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VISUAL SIMULATION PUMP STATION G-3 SITE

Figure 4.14-20

Agricultural Irrigation Component

Table 4.14-8

Visual Resource Impacts by Component - Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.7.1. Will the agricultural irrigation component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?	Strong visual contrast	Slight	C, P	O
	Permanent View Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.7.2. Will the agricultural irrigation component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?	Strong visual contrast	Slight	C, P	O
	Permanent View Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P,	=
14.7.3. Will the agricultural irrigation component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?	Strong visual contrast	Slight	C, P	O
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.7.4. Will the agricultural irrigation component be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?	Less than 20 feet	None	P	=

Table 4.14-8

Visual Resource Impacts by Component - Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.7.5. Will the agricultural irrigation component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?	Strong visual contrast	Slight	C, P	O
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.7.6. Will the agricultural irrigation component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?	Strong visual contrast	Slight	C, P	O
	Permanent Visual Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.7.7. Will the agricultural irrigation component create a new light source?	Greater than 0 residences affected	None	C, P	=

Source: Harland Bartholomew and Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
P Permanent
-- Not Applicable

2. Level of Significance:
O Less than significant impact; no mitigation proposed
= No impact

Impact: **14.7.1-3, 5-6. Will the agricultural irrigation component be inconsistent with the Sonoma County General Plan Open Space Elements regarding Community Separators and Scenic Landscape Units seen from Public Viewpoints; with Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors; with foreground or middleground views from high volume travelways or public areas; and with foreground views from one or more private residences?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

Agricultural irrigation facilities may result in changes in cropping patterns and visible irrigation lines, which may cause some visual contrast, but will not be considered a strong visual contrast because they will be consistent with the mosaic of different cultivation types associated with agricultural activity. View obstruction and loss of scenic resources will not occur because crops are low to the ground, and no visual impacts will occur for these criteria. Winter irrigation may be utilized as part of the city's contingency plan operation.

No Impact; Alternatives 1, 4 and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Impact: **14.7.4 and 7. Will the agricultural irrigation component impact visual resources based on evaluation criteria 4 and 7?**

Analysis: *No Impact; All Alternatives.*

None of the irrigation facilities will conflict with the 20-foot setback along Sonoma County scenic corridors, because they are not considered a permanent building or structure. No new light source will be created by the pipelines.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No mitigation is needed.

Geysers Steamfield Component

Impact: **14.8.1-7. Will the geysers steamfield component impact visual resources based on evaluation criteria 1 through 7?**

Analysis: *No Impact. All Alternatives.*

The geysers steamfield is not located in or near a Community Separator or Scenic Landscape Unit as defined in the Open Space Element of the Sonoma County General Plan. The steamfield is not visible from a

designated Scenic Corridor, the foreground or middleground of a public viewpoint as defined in Evaluation Criterion 5, or a private residence. There are no new lighting sources proposed.

Alternatives 1, 2, 3, and 5 do not have a geysers steamfield component.

Mitigation: No mitigation is needed.

Discharge Component

Table 4.14-9

Visual Resource Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.9.1. Will the discharge component be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoints?	Strong visual contrast	None	C, P	=
	Permanent View Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.9.2. Will the discharge component be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?	Strong visual contrast	None	C, P	=
	Permanent View Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=
14.9.3. Will the discharge component be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?	Strong visual contrast	None	C, P	=
	Permanent View Obstruction	None	C, P	=
	Loss or alteration of a specific scenic resource	None	C, P	=

Table 4.14-9

Visual Resource Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.9.4. Will the discharge component be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?	Less than 200 feet	None	P	=
14.9.5. Will the discharge component cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area, or other public use area?				
• Russian River Discharge	Strong visual contrast	Slight	C, P	O
• Laguna Discharge		None	C, P	=
• All discharge	Permanent Visual Obstruction	None	C, P	=
• All discharge	Loss or alteration of a specific scenic resource	None	C, P	=
14.9.6. Will the discharge component cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?				
• Russian River Discharge	Strong visual contrast	Slight	C, P	O
• Laguna Discharge		None	C, P	=
• All discharge	Permanent Visual Obstruction	None	C, P	=
• All discharge	Loss or alteration of a specific scenic resource	None	C, P	=

Table 4.14-9

Visual Resource Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
14.9.7. Will the discharge component create a new light source?	Greater than 0 residences affected	None	C, P	=

Source: Harland Bartholomew and Associates, Inc., 1996

Notes:
1. Type of Impact:
C Construction
P Permanent

2. Level of Significance:
● Significant impact before and after mitigation
O Less than significant impact; no mitigation proposed
= No Impact

Impact: **14.9.1-4 and 7. Will the discharge component impact visual resources based on evaluation criteria 1, 2, 3, 4, and 7?**

Analysis: *No Impact; All Alternatives.*

None of the existing or proposed discharge facilities is located in a Community Separator or Scenic Landscape Unit, is located along or visible from a designated Scenic Corridor, or will create a new source of light.

Mitigation: No mitigation is needed.

Impact: **14.9.5 and 6. Will the discharge component be inconsistent with foreground or middleground views from high volume travelways or public areas; and with foreground views from one or more private residences?**

Analysis: *Less than Significant; Alternative 5A.*

For discharge to the Russian River, the discharge structure located at an elevation nearing summer flow in the river will provide less visual impact during high flow/discharge season, and recreationists are not expected to observe increased turbulence at the discharge point. A few residences may see the proposed Russian River discharge area within an industrial context, but potential visibility of the discharge structure will blend with adjacent sand and gravel operations. Contingency discharge to the Russian River may be required, however, existing structures will be used, and the additional volume will not be sufficient to cause additional visual impacts.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

Use of existing facilities for the discharge of reclaimed water to the Laguna de Santa Rosa will increase the amount of water discharged, but the increase will not be noticeable, and there will be no new structures constructed.

Mitigation: No mitigation is proposed.

CUMULATIVE IMPACTS

There are six types of impacts -- either significant or less than significant -- identified in the Visual Resources section:

Impact: **14.1C. Will the Project plus cumulative projects be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas seen from public viewpoint?**

Analysis: Alternatives 2, 3, 4, and 5A.

There are three segments of Project pipeline routes which are located in Community Separators: one on Pleasant Avenue in Windsor; and three north of Petaluma on Stony Point Road, West Railroad Avenue, and Adobe Road. These segments have been determined to have significant impacts because construction may destroy vegetation along the side of the road and revegetation will take one to two years to reduce the visual contrast created by the construction.

The cumulative projects list includes the following projects which are in the vicinity of these pipeline segments and may have similar impacts:

- Road reconstruction on Adobe Road from Davis Lane to Willow Brook;
- Road signalization and turn lane addition on Adobe Road at Frates Road;
- Road channelization on Petaluma Hill Road at Adobe Road;
- Road improvements on Stony Point Road from Meacham to Pepper Road; and
- Channelization of Willow Brook to 75 feet wide and 10 feet deep from Petaluma Blvd. North to Old Redwood Hwy.

Each of these projects is expected to have similar impacts as the Project on the views within the Community Separator. However, the Project impact is already determined to be significant and mitigation will be effective at returning the views to baseline conditions within one to two years. The cumulative projects may extend the length of time that disturbance is experienced alongside the roadways.

Impact: **14.2C. Will the Project plus cumulative projects be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units seen from public viewpoints?**

Analysis: Alternatives 2, 3, 4, and 5A.

There are 21 segments of pipeline routes, four reservoirs, and 13 pump stations within Scenic Landscape Units. There are at least a hundred cumulative projects in the vicinity of these Project components which could have related visual impacts. A few of the cumulative projects will have permanent impacts, but most will be temporary construction impacts due to road or utility improvements . For temporary construction impacts, similar to the discussion of Community Separators above, the cumulative projects may extend the time span in which views are disturbed within the Landscape Units, but Project impacts are considered to be significant and mitigation fully rehabilitates the baseline views. For permanent impacts, cumulative projects may exacerbate the impact of Project components on views within the Scenic Landscape Units. However, impacts are identified as significant and already mitigated to the extent feasible.

Impact: **14.3C. Will the Project plus cumulative projects be inconsistent with the Sonoma County or City General Plan Open Space Elements regarding Scenic Corridors?**

Analysis: Alternatives 2, 3, 4, and 5A.

The Project includes two pipeline segments within state designated Scenic Corridors, 21 segments within County designated Scenic Corridors, two segments within Santa Rosa Scenic Roads, six segments within Petaluma Scenic Routes, and three segments within Windsor Scenic Corridors. In addition, seven reservoirs and 21 pump stations are visible from scenic corridors, most of which have temporary construction impacts. Again, there are well over a hundred projects on the cumulative project list which are in the vicinity of these Project components and could have visual impacts similar to those of the Project. For temporary construction impacts, the cumulative projects may extend the time span in which views are disturbed from the scenic corridor, but Project impacts are considered to be significant and mitigation fully rehabilitates the baseline views. For permanent impacts, cumulative projects may exacerbate the impact of Project components on views from scenic corridors. However, impacts are identified as significant and already mitigated to the extent feasible.

Impact: **14.4C. Will the Project plus cumulative projects be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors?**

Analysis: Alternatives 2, 3, and 4.

There are 13 pump stations within the minimum setback distance from County Scenic Corridors. No known cumulative projects will be located within the setback near any of the pump stations. Even if there were such projects, they will not cause Project impacts to change or new mitigation to be required.

Impact: 14.5C. Will the Project plus cumulative projects cause an adverse effect on foreground or middleground views from a high volume travelway (excluding scenic corridors), recreation use area or other public use area?

Analysis: Alternatives 2, 3, 4, and 5A.

Any Project pipeline segments not included in the impacts listed above are assumed to have impacts on high volume travelways. Adobe Road reservoir is visible from many streets throughout Petaluma as well as the Petaluma Airport; Sears Point reservoir is visible from the Roche Winery and Sears Point Raceway; Bloomfield reservoir is visible from Bloomfield cemetery; and Huntley reservoir is visible from Fallon Two Rock Road. Thirteen pump stations are visible from public roads. Again, these widespread and numerous Project components have many cumulative projects located near them with similar impacts. But because Project impacts have been listed as significant, and because mitigation has been provided to the extent feasible, cumulative impacts have been fully considered within the main analysis.

Impact: 14.6C. Will the Project plus cumulative projects cause an adverse effect on foreground views from one or more private residences (not subject to relocation as a result of the Project)?

Analysis: Alternatives 2, 3, 4, and 5A.

The Project includes many pipelines routes visible from private residences. Also, all reservoirs and 31 pump stations are in the foreground views from at least one private residence. Many projects on the cumulative projects list will also be visible from the same private residences with visual impacts similar to Projects components. But because Project impacts are already considered as significant and mitigation has been provided to the extent feasible, cumulative impacts have been fully considered.

Summary of Significant Impacts and Mitigation Measures

Table 4.14-10

Summary of Significant Impacts and Mitigation Measures - Visual Resources

Impact	Level of Significance	Mitigation Measure
Pipeline Component		
14.4.1. The pipeline component may be inconsistent with the Sonoma County General Plan Open Space Element regarding Community Separator Areas.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙	2.3.10. Limit Construction Disturbance.
14.4.2. The pipeline component may be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙ Alt 5A - ⊙	2.3.9. Adjust Pipeline Alignments. 2.3.10. Limit Construction Disturbance.
14.4.3. The pipeline component may be inconsistent with the Sonoma County or City General Plans regarding designated Scenic Corridor.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙ Alt 5A - ⊙	2.3.9. Adjust Pipeline Alignments. 2.3.10. Limit Construction Disturbance.
14.4.5. The pipeline component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ● Alt 5A - ⊙	2.3.9. Adjust Pipeline Alignments. 2.3.10. Limit Construction Disturbance.
14.4.6. The pipeline component may cause an adverse effect on foreground or middleground views from one or more private residence.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙	2.3.9. Adjust Pipeline Alignments.
	Alt 5A - ⊙	2.3.10. Limit Construction Disturbance.
Storage Reservoir Component		
14.5.2. The storage reservoir component may be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units.	Alt 2B - ⊙	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other

Table 4.14-10

Summary of Significant Impacts and Mitigation Measures - Visual Resources

Impact	Level of Significance	Mitigation Measure
		Facilities. 2.4.7. Establish Tree Screening. 2.4.8. Revegetate Face of Reservoir Dam.
14.5.3. The storage reservoir component may be inconsistent with the County Open Space Element regarding Scenic Corridors.	Alt 2 - ● Alt 3B - ● Alt 3C - ● Alt 3D - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities. 2.4.7. Establish Tree Screening. 2.4.8. Revegetate Face of Reservoir Dam.
14.5.5. The storage reservoir component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.	Alt 2B - ⊙ Alt 2D - ● Alt 3B - ⊙ Alt 3E - ⊙	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities. 2.4.7. Establish Tree Screening. 2.4.8. Revegetate Face of Reservoir Dam.
14.5.6. The Storage reservoir component may cause an adverse effect on foreground or middleground views from one or more private residences.	Alt 2 - ● Alt 3A - ● Alt 3B - ● Alt 3C - ● Alt 3D - ● Alt 3E - ⊙	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities. 2.4.7. Establish Tree Screening. 2.4.8. Revegetate Face of Reservoir Dam.

Table 4.14-10

Summary of Significant Impacts and Mitigation Measures - Visual Resources

Impact	Level of Significance	Mitigation Measure
Pump Station Component		
14.6.2. The pump station component may be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.
14.6.3. The pump station component may be inconsistent with the County Open Space Element regarding Scenic Corridors.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.
14.6.4. The pump station component may be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.
14.6.5. The pump station component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.
14.6.6. The pump station component may cause an adverse effect on foreground or middleground views from one or more private residences.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	2.4.6. Screen Concrete Diversion Channels, Pump Stations, and Other Facilities.

Source: Harland Bartholomew & Associates, Inc. 1996

Summary of Impacts By Alternative

Table 4.14-11

Summary of Impacts by Alternative - Visual Resources

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Project	=	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	=	=	=	=	=	=	=	=	=	=	=	=
Urban Irrigation	--	=	=	=	=	=	=	=	=	=	--	--	--
Pipelines	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	●	⊙	--
Storage Reservoirs	--	●	●	●	●	●	●	●	●	⊙	--	--	--
Pump Stations	--	●	●	●	●	●	●	●	●	●	●	--	--
Agricultural Irrigation	--	○	○	○	○	○	○	○	○	○	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	=	--	--
Discharge	--	=	=	=	=	=	=	=	=	=	=	○	=

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: Level of Significance

-- Not applicable

= No impact

● Significant impact before and after mitigation

⊙ Significant impact; less than significant after mitigation

○ Less than significant impact; no mitigation proposed

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Howard Hahn, Dames & Moore
Dennis Papilion, Dames and Moore
Robert Duchek, Harland Bartholomew & Associates, Inc.

Reviewers

Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Stephen Sheppard, EDAW
John Cummings, Ph.D., Peer Review Committee
David Ziegler, Peer Review Committee

References

HBA Team Documents

None

Other References

Bureau of Land Management. 1980. *Visual Resource Management Program.* USD1, Washington, D.C.

City of Petaluma. 1993. *Petaluma General Plan. 1987-2005.* March.

City of Rohnert Park. 1990. *General Plan of the City of Rohnert Park.* April.

City of Santa Rosa. 1991. *General Plan. Santa Rosa 1000.* July.

City of Sebastopol. 1994. *Sebastopol General Plan.* May

Sonoma County. 1989. *Sonoma County General Plan.* March.

Federal Highway Administration. n.d. *Visual Impact Assessment for Highway Projects.* ASLA, Washington, D.C.

U.S. Forest Service. n.d. *National Forest Service Landscape Management, Volume 2, Chapter 1 - The Visual Management System.*

Consultation and Coordination

Persons Contacted

None

Correspondence

None

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4.15 CULTURAL RESOURCES AND PALEONTOLOGY

This section discusses the Project impacts on cultural resources related to disturbance of archaeological, historical, architectural, and Native American/traditional heritage resources. The section also addresses disturbance of unknown archaeological resources, as well as paleontologic resources (fossils). To provide a basis for this evaluation, the setting section describes broad periods of cultural history in the Project area including the prehistoric period.

IMPACTS EVALUATED IN OTHER SECTIONS

All items pertinent to cultural resources and paleontology are included in this section.

AFFECTED ENVIRONMENT (SETTING)

Cultural Resources

The following is a summary of the broad periods of cultural history in central and southern Sonoma County and northern Marin County, including the Santa Rosa Plain and the geysers area. This information is based on field studies and archival research. An extended discussion of the cultural setting for the Project, as well as the results from the field surveys and sensitivity studies (see Methodology section), may be found in Gerike et al. (1996).

Prehistoric Period

Central Sonoma County

The earliest documented period of human use of California, known as the Paleoindian period, occurred between 10,000 and 6000 B.C., at a time of variable climate, rising sea levels, and other broad scale environmental change. Evidence of this early habitation is scarce in the Sonoma Archaeological District within central Sonoma County. It is assumed that people living in this early period were organized into small, highly mobile groups occupying broad areas. Because of this type of adaptation and the small populations involved, most occupations will not have been of sufficient intensity or duration to leave significant remains. The only clear evidence to date of Paleoindian use in Sonoma County is a cave on the Coast of Bodega Bay (CA-SON-348), with extensive deposits dating to ca. 7000 B.C. (Jones 1991). On the Laguna de Santa Rosa, distinctive artifacts suggest use at that time depth, but no dates have been obtained (Origer and Fredrickson 1980).

The gradual climatic warming of the Paleoindian period accelerated during the Lower Archaic period (6000 to 3000 B.C.), no doubt altering the extensive wetlands that will have characterized the Laguna during Paleoindian use. Adaptations to these more arid conditions, as available water decreased and grasses became more abundant, included relatively widespread use of the millingstone and handstone.

Within the Middle Archaic period (3000 to 1000 B.C.), the appearance of the first well-represented culture on the Santa Rosa Plain occurs, probably reflecting larger populations and a more sedentary settlement pattern.

Changes during the Upper Archaic period (1000 B.C. to A.D. 500) may represent either a local adaptation to changing (cooler, wetter) climatic conditions and/or the arrival of a new cultural group. Fredrickson has suggested that the appearance of a new artifact assemblage and mode of settlement may reflect Miwokan expansion from the San Francisco Bay - a response to intensified resource competition as a result of increasingly large, relatively sedentary populations focusing on the bayshore (Fredrickson 1974). In a cooler climatic regime, the string of marsh habitats along the Marin and Sonoma bayshore may have become more productive, while the Laguna de Santa Rosa's productivity may have been refreshed after the long, relatively arid Lower and Middle Archaic periods. The southern Project area contains lands that will have been targeted by such expanding populations. Tracking this hypothesized intrusion archaeologically is difficult, however, due to the lack of intensive investigations between the San Francisco Bay and the Laguna.

Locally, the Upper Archaic period is represented by the Laguna culture in which acorn-processing becomes a dominant subsistence trait.

Unsettled climatic activity and widespread population movements have been hypothesized throughout much of California and the western Great Basin at the transition from the Upper Archaic to the Lower Emergent period (A.D. 500 to 1500) (Moratto 1984)An important innovation in the artifactual assemblage is the introduction of the bow and arrow, replacing the earlier atlatl (spear thrower) and dart point. Mortars and pestles become especially abundant during this time period, attesting to a well-developed acorn economy.

Some sites also appear in previously little used areas, perhaps suggesting the firming up of tribelet territories and, with it, a more formalized seasonal round that will result in regular reuse of outlying areas. At the geysers for example, most of the datable sites saw their initial use during this period.

The lifeways represented by the Upper Emergent period (A.D. 1500 to Historic period), also termed the Protohistoric period, are believed to be the same as they were at the time of historic contact. Clam disc beads were manufactured at Santa

Rosa Plain sites and used as a form of currency for exchange in a network that ranged throughout California and into the Great Basin.

In the Santa Rosa Plain, the Upper Emergent culture is typified by a settlement shift, a movement away from the Laguna in favor of more elevated, creekside locations, at the same time that a drastic reduction in the number of sites occurs. One of the Laguna sites excavated for an earlier phase of the Santa Rosa Wastewater Project in the late 1970s (Origer and Fredrickson 1980) evidenced site abandonment about 500 years ago. Some large occupation sites on the Laguna, however, continued in use, probably as permanent villages. At the southern edge of the Laguna, and within the current Project area, CA-SON-159 shows evidence of intensive occupation and bead manufacturing through both phases of the Emergent period. Excavation of nearby CA-SON-518 revealed the well-preserved remains of a large circular housefloor, radiocarbon-dated to ca. A.D. 1700 (Upson 1973). This latter site, mostly buried under one meter of soil, also possessed evidence of shell bead manufacturing.

Southern Sonoma/Northern Marin Counties

The Marin Archaeological District is located south of the Sonoma Archaeological District. The boundaries of these districts are unclear because of the lack of excavated sites in the northern Marin District. Excavations of eight sites along San Antonio Creek at the boundary between Sonoma and Marin counties were reported (King, Upson, and Milner 1966). Analysis of the remains at one of the sites (MRN-357) indicated an early dependence on bayshore molluscs during the Upper Archaic; the upper levels depicted a shift from shellfish to a greater emphasis on vegetal food.

At the ethnographic village of Olompoli (CA-MRN-193), substantial investigation has occurred on the extensive cultural deposits, as this was a major exchange center for the area. The deposits, covering some 320,000 square meters, make it the largest known Coast Miwok village site (Moratto 1984). The 1976 investigations near Nicasio, a few miles south of the Project area, focused on the historic-period Native American use of Halleck Creek Valley. Work focused on the study of acculturation at the ethnographic village of Echa-tamal. Inhabited for about 400 years, the site was finally abandoned in 1884.

The only archaeological studies within the southern Sonoma/northern Marin portion of the Project area occurred at Tolay Valley, currently a candidate storage reservoir site. The first report of the valley's prehistory was an article on CA-SON-371, "Charmstone site," at the location of an extinct lake estimated to have covered several hundred acres (Elsasser 1955). In the early 1960s, the Tolay Valley was repeatedly visited by avocational archaeologist George Phebus, Jr., who excavated and surface-collected nine prehistoric sites, recovering human burials and cremations and an abundant and diverse collection of artifacts (George Phebus Jr. 1990). The investigated Tolay sites, consisting of middens and

nonmidden lithic scatters, represent a long period of use from the Early period to the Late period.

The Geysers Area

The geysers area, located in the northernmost portion of the Project area, possesses a significantly different environment from the Santa Rosa Plain and deserves special attention. An area of no less than 64,000 acres has been intensively surveyed for archaeological remains, recording hundreds of sites in the process. The sites are primarily Lower Emergent phase (A.D. 500-1500) although some Middle Archaic period (3000-1000 B.C.) artifact assemblages have been identified (Fredrickson 1984). In the geysers area, some of the sites that exhibit Middle Archaic artifact assemblages may in fact represent a retention during the Upper Archaic period of earlier lifeways by the Wappo, an adaptation better suited to this mountainous landscape. Recently, however, sites have been identified in some well-watered areas of the geysers that date to the Upper Archaic and appear to be culturally affiliated with the hypothesized Miwokan expansion from San Francisco Bay (Gerike et al. 1996, Peak & Associates 1985, Stewart 1993). Of particular interest is CA-SON-1406, a single-component Upper Archaic period site with deep midden soil, milling equipment, and evidence of the site's use as a biface-manufacturing and distribution center.

Ethnography

At the time of historic contact, the Native Americans controlling the lands of the Project area spoke languages derived from three distinctly separate linguistic stocks: Yukian, Hokan, and Penutian. Within the Project area, these stocks were represented by the Wappo, the Southern Pomo, and Coast Miwok languages. The speakers of each of these languages were socio-politically organized into several tribelets that controlled specific territories and were distinct from each other. These people also shared similar cultural traits (Driver 1940, Kroeber 1925, Sawyer 1978), probably as a result of similar economies in similar environments, with centuries of contact with each other.

Within the Project area, tribelets of the Western and Central Wappo were situated in Alexander Valley and the adjacent eastern uplands; Southern Pomo tribelets were south of these people to about the Cotati area; and Coast Miwok tribelets were in southern Sonoma and Marin counties. These peoples' cultures were disrupted and their populations radically declined with the intrusion of foreigners beginning in the latter half of the eighteenth century. As such, there is a lack of information about their lifeways. The information that is available about these people and their lifeways comes from archaeological sites, historical and ethnographic accounts from the sixteenth century on, and continuing oral histories and traditions.

Historical Period

The primary historical period land uses of Sonoma County, as well as most of the County's environmental zones, are represented within the Project area. The Project area takes in portions of the lands controlled by two missions, more than one dozen Mexican land grants, and most of the County's population centers. Excluded from the Project area is the coastal zone and the mountainous timber region in the northwest. Despite this exclusion, even the early nineteenth-century Russian presence on coastal California is represented by farming outposts in and near the Project area.

Sonoma and Marin were among California's original 27 counties, indicative of cultural and political separateness as early as 1849. While the early history of the two counties was similarly shaped by Mexican events, they later diverged, with Sonoma focusing on agriculture while Marin was influenced by its proximity to San Francisco. The portion of Marin in the Project area is today a part of the North Bay Dairyshed, which straddles both sides of the Marin/Sonoma border.

Central and Southern Sonoma/Marin Counties

The Russians first explored Bodega Bay and vicinity with an eye for settlement in 1809. From 1812, for three decades, the Russians ran Fort Ross and a network of settlements, farms, and outposts stretching over 55 miles of coastline (Lightfoot, Wake, and Schiff 1991).

Containing the growth of Fort Ross was the primary impetus for the northern expansion of the Spanish mission system and the Mexican settlement of the North Bay. Father José Altamira founded Mission San Francisco Solano at the site of present-day Sonoma in 1823 with the express purpose of establishing a Mexican presence on the northern frontier. Altamira may have been the first non-native to visit Tolay Lake (site of the Tolay candidate storage reservoir); he found it shallow and choked with tules and therefore an unsuitable water source (Heig 1982).

Secularizing the missions between 1833 and 1835 was intended to result in returning half the lands of California back to the native peoples, with the remainder to be distributed to clerical authorities. In 1833, Mariano Guadalupe Vallejo was sent to establish a pueblo on the northern frontier. The new pueblo was sited at Sonoma.

Vallejo personally received the more than 66,000-acre Rancho Petaluma land grant, the largest grant in the North Bay and one of the largest in the entire state (Beck and Haase 1974). The center of the rancho, which served as Vallejo's country home, was his grand adobe, now the focal point of a state historic park east of Petaluma; the "several adobe houses" also built on his grant during the 1840s have not been relocated (Gebhardt 1963). The land containing the Adobe

Road candidate storage reservoir, just over one mile northwest of the adobe, will have been used during this period. The Tolay, Sears Point, and Lakeville Hillside candidate storage reservoirs are within the eastern extreme of the Petaluma grant; given their distinctive settings, they too will likely have been used during Vallejo's tenure. Twenty-five additional grants were made in the area to become Sonoma County during Mexican rule.

The Mexican thrust against Russian encroachment had resulted, by the mid-1840s, in the granting of virtually all arable land in the North Bay, more than half of what was to become Sonoma County. Meanwhile scores of foreigners, most from the U.S. and Great Britain, began arriving to settle on the Santa Rosa Plain and Alexander Valley in the early 1840s.

Up to the time of statehood, three primary land uses had prevailed in the North Bay: the hide-and-tallow trade on the Mexican ranchos; the timber production on the grants of the redwood region; and the small subsistence farms of the scattered foreign squatters and landless Californios. After the initial rush to the goldfields, Sonoma County's attraction shifted to its commercial agricultural potential. The area held expansive arable land in close proximity to the new city of San Francisco. It was also close to the shipping routes to the mines, which continued to have a seemingly limitless demand for food.

With the tremendous increase in population in the County, services began to appear. Way-stations for individual travelers, and later for formal stage routes, were built; the first-possibly within the Project area--was run by Guadalupe Vásquez West, who continued to run the Rancho Miguel after her husband's death in 1849 (LeBaron et al. 1985).

By July of 1852, Petaluma had become a bustling town with several hotels and an ever-growing population; in September 1853, there was a cluster of about 50 houses in the town (Heig 1982). In contrast, the town of Santa Rosa consisted of only a few shacks in 1853. In 1854, however, Santa Rosa was chosen by the county's population as the county seat as a result of a series of political maneuvers by a group of developers and local boosters.

By the mid-1850s nearly all of the present-day population centers were on the map. Sebastopol was founded in 1855. In 1853 the first house was built in Bloomfield, named for F.G. Blume, who had married the widow of grantee James Dawson and became the owner of the Rancho Cañada de Pogolimi grant. Within a few years, Bloomfield quickly surpassed the other small towns in the area; it had a population of several hundred residents (Clayborn 1976). North of Bloomfield, the village of Two Rock also got its start in the early 1850s, when farmer John Schwobeda chose the name of the local landmark (*Dos Piedras*) for the settlement. Just west of the Project area in Marin County, the town of Tomales was settled early due to its proximity to transportation on Tomales Bay.

Traffic between Sonoma County and San Francisco went not through Marin, as it does today, but by stage along the Petaluma River to the steamers docked at the town of Lakeville, in the vicinity of Tolay and Lakeville Hillside candidate storage reservoirs. Established in the early 1850s, Lakeville was the social and commercial center for several farming families who had purchased some of Vallejo's Rancho Petaluma holdings. One of the area's large landholders was German immigrant William Bihler, who bought the land containing 1,100-acre Lake Tolay in 1859, "dynamited the southern end of the lake, watched the water drain off toward San Pablo Bay and planted potatoes and corn in the lake bed" (LeBaron 1987). Just northeast of Lakeville, the town of Sonoma was said to have stagnated after it lost its role as the county seat; two decades later it was described as "the same old Mexican town it was in 1846" (Menefee 1873).

The southern terminus of the San Francisco & North Pacific Railroad, where the steamers met the tracks, was operating by January 1871, and was situated near the mouth of the Petaluma River about eight miles downstream from the City of Petaluma and one mile south of the town of Lakeville. As population increased in Marin County, the terminus was moved in 1882 to Tiburon (Heig 1982). Most of Sonoma County benefited from this move. Lakeville, however, lost not only the revenue from its commercial establishments for travelers but also the residents' own direct access to steamer traffic. Bloomfield was another town to lose with the coming of the railroad. When the railroad failed to connect with the town, the overnight trade diminished; soon the railroad eliminated most stagecoach travel as well. Bloomfield stabilized at a population of about 250 in 1877, the same figure reported a century later (Clayborn 1976).

The end of the national wheat boom in the 1880s and the rise of specialty agriculture in California coincided in the last decades of the nineteenth century. At the same time, a large commercial population of processors, packers, and distributors grew up around each industry. Crops grown within the County included potatoes, grains, wine-grapes, hops, apples, plums, and prunes. Hops were especially well-suited to the alluvial plains and terraces along the Russian River, the Laguna de Santa Rosa, and on the Santa Rosa Plain. The success of hops coincided with a drop in wheat prices, and most grain farmers with the right soils and climate switched to the new crop. By 1890, hops were the leading field crop in the County, and the Santa Rosa area became known as the hop capital of the nation (LeBaron et al. 1985).

Cattle were the mainstay of the California rancho hide-and-tallow trade. A series of factors in the 1860s led to a shift to sheep; first raised for mutton, sheep were later kept for wool, sparked by the need to clothe Civil War troops. A wool-growing boom occurred, with Sonoma County becoming one of the country's leading wool producers. In most of the Project area, small flocks of sheep were kept on many farmsteads; the Two Rock area was particularly known for its sheep.

The Project area includes much of the North Bay Dairyshed (Abbott 1986), which is focused on a wide belt running along the Marin-Sonoma County line. Other focal points for dairying also occur in the Project area: the Laguna de Santa Rosa region near Sebastopol; the southern Santa Rosa Plain; and the Lakeville area. While there were numerous small dairies operating early in the County's history, it was the establishment of the San Francisco & North Pacific Railroad in 1870 that vitalized the industry. Before the railroad, fluid milk could not be shipped for any distance, and most dairies sold milk to a local clientele, taking their cheese and butter for sale in town. With the refrigerator cars (introduced in 1888) and fast travel of the railroad, Sonoma ranchers began supplying milk to a ready market in San Francisco. In 1986 dairying was Sonoma County's largest industry.

Beginning with the invention of the chick incubator in 1879 in Petaluma and followed by nationwide promotion, thousands of outsiders moved to southern Sonoma County to take up egg production, while most of local farmers turned to that occupation by the turn of the century. In 1885, at least 50 farms in the Petaluma area had purchased incubators and were hatching chicks artificially (Johnson 1994); by 1904, a government report estimated that 90 percent of the people living near Petaluma were raising poultry (Heig 1982:111). Two Rock was the site of the world's first commercial hatchery, housed on the 100-acre property of Danish farmer Christopher Nisson; in 1898 he moved his Pioneer Hatchery to downtown Petaluma (Heig 1982). Two Rock later became known for blending dairies and sheep raising with chicken ranching, and for producing hatching eggs, not table eggs (Lowry 1993).

By the beginning of the twentieth century, the towns of the Project area had developed into industries in their own right, with hundreds of services and administrative and professional offices. Developers began promoting the rural subdivision that will provide clean, natural surroundings for growing families, while the head of household acquired an income in Santa Rosa or Petaluma.

The Geysers Area

The rugged country of the geysers portion of the Project area held important resources within relatively easy access of Sonoma County's towns. Thus the area became the site of considerable population, if only on a seasonal or intermittent basis.

While towns began growing up in the west and south, another kind of community developed early in Sonoma County history—the rural resort, which by definition was some distance from the growing population centers. The North Bay had numerous such resorts, but the geysers area was the first to be established and probably the most widely known. It offered a series of hot springs and spectacular scenery, less than a few hours from Healdsburg or Calistoga in Napa County. The area became a commercial resort soon after American settler William Elliot came across the hot springs in 1847. Initially, the area was visited

by an adventurous sporting crowd, who took the stage up the old Geysers-Healdsburg Road, partly following the proposed Project pipeline route along Pine Flat Road. By 1854, a broader clientele was attracted when an inn was constructed at the Geysers area. Later, the renowned stage-driver Clark Foss established his own hostelry at Fossville in Knights Valley, taking another route up the mountain. The resort eventually gained international attention, attracting political figures and celebrities from the entertainment and literary worlds, as well as vacationing California families. The resort continued in popularity into the twentieth century. But when the hotel was destroyed by fire in 1937 (Hoover et al. 1990), the attraction of hot-springs resorts had already declined and no replacement was erected.

Cinnabar was discovered in abundance near the geysers springs in the early 1850s. The mines were briefly worked in 1861, but they were not economically viable until 1872, when the price of quicksilver (mercury) doubled. The Socrates Mine, located along the Project's pipeline route, and the adjacent Rattlesnake Mine were the only sources of native quicksilver (i.e., quicksilver without the presence of sulphur) in the County. A prolonged period of mining activity occurred between 1888 and 1906, and again in conjunction with World War I. Sporadic mining continued in the twentieth century, with a productive spurt in the 1960s made possible by modern techniques and equipment (Peri, Patterson, and McMurray 1978). Despite the erratic operations, quicksilver mining was an important County industry.

Despite the remote location, the local community was involved with the mines; farmers supplied produce to the mines during the growing season and sometimes worked surface mines during the winter months. The mines also generated a voracious market for timber (Peri, Patterson, and McMurray 1978). Camps to accommodate single miners grew up around all the more established operations. Other miners lived in the area with their families, in Sonoma County within the towns of Pine Flat (within the Project area) and Mercury. Pine Flat had a permanent population of more than 100 residents in the 1870s (LeBaron et al. 1985).

The geysers area, functioning today as a geothermal steamfield, continues the extractive tradition of the historic mercury mines.

Paleontology

Paleontologic resources include fossil specimens, fossil sites, and fossil-bearing rock units. Vertebrate fossils are generally considered to be significant because their occurrence is relatively rare. Invertebrate and plant fossils and microfossils tend to occur in much greater abundance than vertebrate fossils. Non-vertebrate fossils are generally ranked with low significance unless they are in short supply, they are age-diagnostic, or the paleoenvironmental framework is unique (EIP 1990). Generally, fossils are not

considered to be significant if they are found in large numbers and/or over a large geographic area (Reynolds 1988).

The Project area contains the following six main geologic units: Franciscan Complex, Wilson Grove Formation (previously the Merced Formation), Petaluma Formation, Sonoma Volcanics, Glen Ellen Formation, and Pliocene and Quaternary alluvial/colluvial deposits (Rust Environment and Infrastructure 1995). The Franciscan Complex contains a variety of rock types, including shale, clay, graywacke, sandstone, greenstone, and chert. The majority of these rocks are not fossiliferous (fossil-bearing). Chert within the Franciscan Complex may contain marine microfossils which are abundant and widespread throughout coastal northern California and are therefore not considered to be a significant paleontologic resource (Reynolds 1988).

The Wilson Grove Formation comprises marine sediments, including sandstone, conglomerate, and tuff. It is fossiliferous and contains many marine invertebrate species such as clams, snails, brachiopods, sand dollars, sea urchins, crabs, and polychaete tubes. Vertebrate fossils have also been identified in the Wilson Grove Formation, but museum collections are from few localities and there is very little published information regarding these sites.

A wide range of species of invertebrate and vertebrate fossils, including bison, horse, deer, turtle, and birds, have been recovered from the Petaluma Formation. The Petaluma Formation consists primarily of non-marine claystone, siltstone, sandstone, and mudstone. The Sonoma Volcanics which consist of basalt, andesite, rhyolite, ruff, and other pyroclastic rocks are not considered to be fossiliferous.

The Glen Ellen Formation consists of fluvial gravel, silt, sand, and clays eroded from the adjacent highlands. Recent fossils have been recovered from Quaternary alluvial/colluvial deposits in the Glen Ellen Formation within Sonoma County.

Cultural Resources and Paleontology Goals, Objectives, and Policies

Table 4.15-1 identifies goals, objectives, and policies which provide guidance for development in relation to cultural resources in the Project area. The table also indicates which evaluation criteria are responsive to each set of policies. There are no goals, objectives, and policies related to Paleontology in the Project area.

Table 4.15-1

General Plan Goals, Objectives, and Policies - Cultural Resources

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Open Space Element	Goal OS-9 Objective OS-9.3 Policy OS-9f	Preserve significant archaeological and historical sites which represent the ethnic, cultural and economic groups of the county	1,2
Marin Countywide Plan	Environmental Quality Element	Policy EQ-3.30 Policy EQ-3.31	Development sites identified as having potential for the presence of archaeological resources shall be evaluated to ascertain if a site is present and development shall be situated or designed to avoid impact on such resources	1,2
Santa Rosa General Plan	Historic Preservation Element	Goal HP-2 Objective HP-2a	Preserve Santa Rosa's historic, architectural and cultural heritage using the widest possible array of public and private mechanisms	1
Santa Rosa General Plan	Historic Preservation Element	Goal HP-3 Objective HP-3a	Identify and conserve Native American archaeological resources	1,2
Petaluma General Plan	Community Character Element	Objective (q)	Promote greater sensitivity toward Petaluma's archaeological heritage and take all possible precautions to insure that no action results in the loss of the irreplaceable archaeological record	1,2
Sebastopol General Plan	Community Identity Element	Goal 11 Policy 38	Preserve archaeological and historic resources.	1,2
Windsor General Plan	Environmental Resources Element	Policy E.1 Policy E.1.1	Identify and preserve significant cultural or historical sites or structures within the Town	1,2

Source: Harland Bartholomew and Associates, Inc., 1995

1 The evaluation criteria can be found on Table 4.15.2.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

Cultural Resources

The significance of cultural resources is evaluated under the criteria for inclusion on the National Register of Historic Places (National Register), authorized under the National Historic Preservation Act of 1966, as amended. The criteria defined at 36 CFR 60.4 are as follows:

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, association, and
>
> a. that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> b. that are associated with the lives of persons significant in our past; or
>
> c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> d. that have yielded, or may be likely to yield, information important to prehistory or history.

Since the process for actually listing a site on the National Register can be a lengthy one, federal agencies and the California State Office of Historic Preservation can determine a site as eligible for listing on the National Register, which has the same effect as regards the treatment of the property. Unless a resource is of exceptional importance or value, sites younger than 50 years are not considered eligible for the National Register. However, it is recommended that sites 45 years old or older be considered during the evaluation process to allow for potential delays between evaluation and Project construction periods For the purposes of this Project, all cultural resources identified within the Project's area of potential effects are considered to be potentially eligible for inclusion to the National Register of Historic Places. Once a preferred alternative is chosen, the cultural resources affected by that alternative will be formally evaluated for inclusion to the National Register. This approach has been approved by the State Historic Preservation Officer. "Unknown archaeological resources," referred to in the Evaluation Criteria below, means previously undiscovered and/or buried archaeological resources.

Paleontology

The significance of paleontologic resources is evaluated using state and federal guidelines. CEQA guidelines indicate that a Project could have a significant effect on the

environment if Project activities disrupt or adversely affect a paleontologic site (CEQA, Appendix G).

The California Public Resources Code, Section 5097.5, prohibits the excavation or removal of any "vertebrate paleontological site, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." Public lands are defined as lands owned by or under the jurisdiction of the state or any city, county, district, authority, or public corporation. Any unauthorized disturbance or removal of archaeological, historic, or paleontologic materials or sites located on public lands is considered a misdemeanor.

The Archaeological and Historic Data Preservation Act of 1974, as amended, provides for the survey, recovery, and preservation of significant scientific, prehistoric, historic, archaeological, or paleontologic data when such data may be destroyed or irreparably lost due to a federal, federally licensed, or federally funded Project.

According to standard procedures published by the Society of Vertebrate Paleontology (1991), sedimentary rock units with a high potential for containing significant nonrenewable paleontologic resources are those within which vertebrate or significant invertebrate fossils have been determined by previous studies to be present or likely to be present (Society of Vertebrate Paleontology 1991). Significant paleontologic resources are fossils or assemblages of fossils which are unique, unusual, rare, uncommon, diagnostically or stratigraphically important, and those which add to an existing body of knowledge in specific areas, stratigraphically, taxonomically, or regionally (Reynolds 1988).

The Wilson Grove Formation, the Petaluma Formation, and the Glen Ellen Formation are sedimentary rock units in which vertebrate paleontologic resources have been documented, although no known sites are in the Project area. A Project effect on any of these units is considered a potentially significant impact (Table 4.15-2).

Table 4.15-2

Evaluation Criteria with Point of Significance -
Cultural Resources and Paleontology

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will the Project disturb known, potentially-eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Number of sites affected by Project facilities	Greater than 0 sites	National Historic Preservation Act, Section 106; CEQA, Appendix K; PRC Section 5020-5024, 21084.1

Table 4.15-2

Evaluation Criteria with Point of Significance - Cultural Resources and Paleontology

Evaluation Criteria	As Measured by	Point of Significance	Justification
2. Will the Project disturb unknown archaeological resources?	Sensitivity analysis	Greater than 0 Projected locations	National Historic Preservation Act, Section 106; CEQA, Appendix K; PRC Section 5020-5024, 21084.1
3. Will the Project disturb unknown vertebrate paleontologic resources.	Underground construction within geologic units with the potential to contain vertebrate fossils, i.e., Wilson Grove, Petaluma, or Glen Ellen Formation	Greater than 0 occurrences	CEQA, Appendix G; PRC Section 5097.5 The Archeological and Historic Data Preservation Act of 1974

Source: Harland Bartholomew & Associates, Inc. 1996

METHODOLOGY

Cultural Resources

The goal of the cultural resources study for this Project is to identify prehistoric and historic archaeological sites, architectural and historical sites, historic landscapes, traditional cultural properties (including Native American heritage resources), and heritage trees that might be affected by implementation of the Project. The study was performed by the Anthropological Studies Center, Sonoma State University, Academic Foundation, Inc.

The study used the definitions for prehistoric and historic archaeological sites in National Register Bulletin 15 (*How to Apply the National Register Criteria for Evaluation*, National Park Service 1991), for historic landscapes in Preservation Briefs 36 (*Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*, Birnbaum 1994), for traditional cultural properties in Bulletin 38 (*Guidelines for Evaluating and Documenting Traditional Cultural Properties*) and CRM 16 (*Traditional Cultural Properties: What You Do and How We Think*, Parker 1993), and Heritage and/or Landmark Trees as stated in Chapter 26D of the Sonoma County Code.

Records and literature searches were conducted at the Northwest Information Center of the California Historic Resources Information System for all components of the Project area. In addition, the following local, state, and federal cultural resource inventories were reviewed: *National Register of Historic Places Index* (March 31, 1995); *Directory of Properties in the Historic Property Data File for Sonoma County* (March 31, 1995); *Directory of Properties in the Historic Property Data File for Marin County* June 6, 1995); *California Inventory of Historic Resources* (1976); *Five Views: An Ethnic Sites Survey for California* (1988); *California Historical Landmarks* (1990); *Points of Historic Interest* (1992); *Sonoma County Landmarks Listing* (1993); and *Historic Civil Engineering Landmarks of San Francisco and Northern California* (1977). Historical maps were reviewed in order to identify architectural and historical archaeological properties and to provide context in documenting architectural properties.

Interested parties were contacted by letter or were personally addressed for any comments that they might have concerning cultural resources that might be affected by the Project. Interested parties included professional archaeologists familiar with the Project area, local residents and landowners, historical societies, local Native American individuals and recognized groups, local agencies, the State Office of Historic Preservation, and the State Native American Heritage Commission.

All 10 storage reservoir locations were subjected to field survey by a crew consisting of qualified archaeologists, historians, and architectural historians. A cultural resource "buffer zone" of 100 feet outside the construction zone for each of the storage reservoir locations was used in order to more adequately ensure the identification of cultural resources that might be impacted by the Project. On flat and gently sloping land, 10 to 15 meter zig-zag transects were walked. On moderately steep slopes, 30 to 40 meter transects were used. On slopes over 30 percent, the best possible visual observations were made. Areas receiving special attention were cut banks, stream sides, level ground, both valleys and ridgetops, springs, landform and vegetation anomalies, rock outcrops, and creekbeds. Each crew member maintained a Project field notebook to document observations on topography, soil type and color, water sources, bedrock outcroppings, field methods, personal communications, and constraints. Individual crew members depicted their transects on a topographic map. A master map of surveyed areas and crew member's transects was maintained.

Newly identified archaeological, historical, and historic architectural sites were recorded to State of California standards on Department of Parks and Recreation forms (DPR 523 series). Previously located resources (identified during the record search at the Northwest Information Center) were relocated and examined. If necessary, supplements to the existing resource records were prepared to provide additional information about the resource (e.g., additional features, further disturbance to the resource).

An area consisting of a one-mile radius around each storage reservoir site was reviewed for historic buildings that might have their setting affected by reservoir and/or dam construction. Determination of affected setting was based on the possibility that elements of the reservoir or dam could be seen as part of the resource or part of its background.

Field review of potentially affected settings was conducted, if the property was accessible, upon completion of the record and literature search.

The Project components other than the storage reservoirs were subjected to a sensitivity study that, based on previously identified resources in the component area and the type of environment in the Project component vicinity, provides an estimate of the number of cultural resources that could be expected to occur within the impact area of the specific component. A 300-foot buffer zone was plotted around the Project component areas to ensure that resources on or near the boundary will be identified. Estimates for numbers of expected cultural resources in each area were made.

An archaeological monitor was present during the groundwater well and geologic testing studies to ensure that the drill locations did not affect known archaeological sites and that buried resources were identified immediately upon drilling so that the work could cease until evaluation of the resource by the archaeologist. A records search was done prior to field monitoring in order to avoid the location of recorded sites.

The methodology, findings, and results were incorporated in a cultural resources technical report prepared by the Anthropological Studies Center at Sonoma State University.

Once a preferred alternative is chosen, it will be necessary for field surveys to occur in the areas not previously surveyed for cultural resources, including pipelines and irrigation areas. All cultural resources affected by the Project will be formally evaluated for inclusion to the National Register before commencement of construction. Those resources determined to be eligible will require a program of mitigation in order to bring the impacts to a less than significant level, if they cannot be avoided.

In the following impact, analysis, and mitigation discussion, the evaluation criteria refer in general terms to "archaeological, historical, architectural, and Native American/traditional heritage resources." Within each Impact analysis, the discussion is divided into more specific subheadings that pertain to specific types of resources. Some examples are "known prehistoric and historic archaeological sites," "historic architectural resources," "historic architectural resource settings" and "historic districts." Subheadings fall under one or more of the general terms used in the evaluation criteria.

Paleontology

Existing paleontologic and geological sources were reviewed (EIP 1990, Rust Environment and Infrastructure 1995, Society for Vertebrate Paleontology 1991). To identify Project components that might affect vertebrate paleontologic resources in fossiliferous rocks, the Project maps were compared with geologic maps for Sonoma, Marin, and Napa counties. The geologic base maps, Figures 9-1 and 9-2 from the *Geotechnical Assessment of Alternative Reservoir Sites and Pipeline Routes, Volume I,* delineate the occurrence of surface rock of the various rock units within the Project area (Rust Environment and Infrastructure 1995).

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Impact: **15.1.1-2. Will the No Action Alternative impact cultural resources based on evaluation criteria 1 and 2?**

Analysis: *No Impact; Alternative 1.*

The No Action Alternative will not involve any construction and therefore will not result in an impact to cultural resources.

Mitigation: No mitigation is needed.

Impact: **15.1.3. Will the No Action (No Project) Alternative disturb unknown vertebrate paleontologic resources?**

Analysis: *No Impact*

The No Action Alternative does not involve underground construction, therefore there will be no impact on paleontologic resources.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Impact: **15.2.1-3. Will the headworks expansion component impact cultural and paleontologic resources based on evaluation criteria 1 through 3?**

Analysis: *No Impact; All Alternatives.*

The expansion of the headworks will not result in an impact to cultural or paleontologic resources because all of the expanded facilities will be contained within the existing Laguna Plant site. No ground disturbance is expected. The recommendations presented in previous cultural resource studies for the original Laguna Plant construction and improvements should be followed.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is needed.

Urban Irrigation Component

Impact: **15.3.1-3. Will the urban irrigation component impact cultural and paleontological resources based on evaluation criteria 1 through 3?**

Analysis: *No Impact; All Alternatives.*

No cultural resources field survey has been conducted for the urban irrigation component; the analysis was based on records on file at the

Northwest Information Center of the California Historical Resources Information System, Sonoma State University, Rohnert Park.

The Fountaingrove and Bennett Valley urban irrigation components will not result in additional impacts to cultural resources because the reclaimed water will be piped through already existing irrigation facilities and the resources are already subjected to the effects of irrigation from existing activity. Although eight archaeological sites and four historical resources are located within the irrigation areas, no ground disturbance is expected that might impact archaeological sites, nor will any historical resources be impacted by the Project

The Fountaingrove and Bennett Valley urban irrigation components will not result in an impact to fossiliferous rocks because the reclaimed water will be piped through already existing irrigation and watering facilities. Although the Petaluma Formation is present within the urban irrigation component, no ground disturbance is expected that might impact a paleontologic site.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Construction of the pipelines will potentially disturb cultural resources, specifically prehistoric and historic archaeological sites, historic architectural resources, and historic districts. The resources enumerated under the impact column in Table 4.15-3 include those known archaeological sites within 300 feet of the pipeline route, and historic architectural resources that are immediately adjacent to the pipelines and might, therefore, be impacted by construction vibration and noise. No cultural resources field survey has been conducted for the pipeline component; number of resources per alternative was derived from records on file at the Northwest Information Center of the California Historical Resources Information System, Sonoma State University, Rohnert Park. The information is presented by alternative rather than by specific pipeline section in order to protect the sensitive nature of cultural resource locations.

Table 4.15-3

Cultural Resources and Paleontology Component Impacts - Pipelines

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
15.4.1. Will the pipeline component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites			
• Alt 2A - Tolay Extended		97	C, O&M	⊙
• Al 2B - Adobe Road		97	C, O&M	⊙
• Alt 2C - Tolay Confined		97	C, O&M	⊙
• Alt 2D - Lakeville/Sears Point		100	C, O&M	⊙
• Alt 3A - Two Rock		97	C, O&M	⊙
• Alt 3B - Bloomfield		98	C, O&M	⊙
• Alt 3C - Carroll Road		95	C, O&M	⊙
• Alt 3D - Valley Ford		95	C, O&M	⊙
• Alt 3E - Huntley		96	C, O&M	⊙
• Alt 4 - Geysers		19	C, O&M	⊙
• Alt 5A - Russian River Discharge		2	C, O&M	⊙
• Alt 5B - Laguna Discharge		--	C, O&M	--
15.4.2. Will the pipeline component disturb unknown archaeological resources?	Greater than 0 Projected locations	Greater than 0	C, O&M	⊙
15.4.3. Will the pipeline component disturb unknown vertebrate paleontologic resources?	Greater than 0 occurrences	Greater than 0	C	⊙

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
P Permanent

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation

Impact: **15.4.1. Will the pipeline component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?**

Analysis: ***Prehistoric and Historic Archaeological Sites***

Significant; Alternatives 2, 3, 4, and 5A.

Construction of the reclaimed water transmission pipelines could result in impacts to cultural resources. Ground disturbance associated with the placement of the pipelines, including the effects of heavy equipment activity and possibly ongoing maintenance activities, will result in the destruction or alteration of known prehistoric and historic archaeological sites. Table 4.15-4 shows the number of prehistoric and historic archaeological sites occurring within each alternative.

No Impact; Alternatives 1 and 5B.

These alternatives do not have a pipeline component.

Table 4.15-4

Number of Prehistoric and Historic Archaeological Sites - Pipelines

Alternative	Prehistoric[1]	Historic[2]	Architectural[3]	Prehistoric/ Historic[4]	Total
2A	9	6	81	1	97
2B	9	6	81	1	97
2C	9	6	81	1	97
2D	12	6	81	1	100
2E	10	6	81	1	98
3A	8	2	86	1	97
3B	8	2	87	1	98
3C	6	2	86	1	95
3D	6	2	86	1	95
3E	6	3	86	1	96
3F	8	2	86	1	97
4	5	1	9	0	19
5A	1	1	0	0	2
5B	0	0	0	0	0

Source: Harland Bartholomew & Associates, Inc. March 1996

Notes: 1 - Prehistoric archaeological site
2 - Historic archaeological site
3 - Historic architectural site
4 - Site with both prehistoric and historic components

Historic Architectural Sites

Significant; Alternatives 2, 3, and 4.

Construction of the reclaimed water transmission pipelines could result in impacts to known historic architectural resources. The effect on the historic architectural resources may consist of disturbance or alteration by the effects of vibration from construction earth-moving and associated heavy equipment or the disturbance or destruction of small-scale features associated with the historic architectural resource, i.e., fencelines, outbuildings, roads, and buried features and artifacts. In addition, the operation and maintenance of the pipelines might lead to such activities as ground disturbance, access to cultural resources by personnel, heavy equipment activity, and repairs to pipelines, all of which can result in the damage to or destruction of the historic architectural resources.

Table 4.15-4 shows the number of historic architectural resources occurring within each alternative. The Petaluma Adobe, a National Register listed historic property as well as a California Historic Landmark, occurs adjacent to the pipeline alignment for Alternative 2, South County Reclamation, and might be affected by vibration from construction of the pipeline. The Llano Road Roadhouse, a National Register listed historic property and Sonoma County Landmark, is adjacent to the pipeline alignment for Alternative 3, West County Reclamation. The pipelines for Alternative 2 pass through the Olive Park, West Third, and Westside historic districts of the City of Santa Rosa, potentially affecting many buildings that are recognized as contributors to the districts. In addition, two Sonoma County Landmarks on Bennett Valley Road and the Peterson Dairy might be impacted by pipeline construction for alternatives 2 and 3.

No Impact; Alternatives 1 and 5.

Alternative 5A does not have any impacts to historic architectural sites. Alternatives 1 and 5B do not have a pipeline component.

Mitigation: *Alternatives 2, 3, 4 and 5A.*

2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

The Memorandum of Agreement, developed under the federal guidelines and regulations of Section 106 of the national Historic Preservation Act, will present measures to avoid, reduce, or mitigate Project impacts to cultural resources. These measures may consist of Project redesign and/or a data recovery work plan requiring extensive archival research, documentation, subsurface testing, full excavation, and/or data analysis and reporting, dependent on the resource. These measures will fulfill the

lead agency obligation under Section 106 to take into account the effects to historic properties (cultural resources) for a federal undertaking. Following these measures will reduce impacts to a less than significant level.

Impact: **15.4.2. Will the pipeline component disturb unknown archaeological resources?**

Analysis: *Significant; Alternatives 2, 3, 4, and 5A.*

There is the possibility that surface or subsurface cultural resources not identified during the field survey of the pipeline routes or from the review of records at the Northwest Information Center will be encountered during construction or operation/management of the pipelines, or that there are unexpected effects on known cultural resources. There is the possibility of unknown resources occurring along the pipeline components for each of the alternatives.

No Impact; Alternatives 1 and 5B.

These alternatives do not have a pipeline component.

Mitigation: *Alternative 2, 3, 4, and 5A.*

2.4.12. Protect Undiscovered Cultural Resource Sites.

Alternative 1 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, 4, and 5B.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: **15.4.3. Will the pipeline component disturb unknown vertebrate paleontologic resources?**

Analysis: *Significant; Alternatives 2, 3, 4, and 5A.*

Pipeline construction for Alternatives 2, 4 and 5A may result in disturbance to paleontologic resources because trenching could disturb vertebrate fossil-bearing rock units (Petaluma, Wilson Grove, and/or Glen Ellen formations). The pipeline component for Alternative 2 traverses the Petaluma Formation in the southern part of Sonoma County, while the pipeline component for Alternative 3 passes through the Wilson Grove Formation in the western portion of the county. The Geysers (Alternative 4) pipeline component will disturb potential fossiliferous deposits (Glen

Ellen Formation). The Russian River pipeline (Alternative 5A) briefly traverses Wilson Grove Formation deposits.

No Impact; Alternatives 1 and 5B.

These alternatives do not have a pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.*

2.4.13 Protect Vertebrate Paleontologic Resources.

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

Paleontological monitoring will serve to protect previously undiscovered significant paleontologic resources by early identification before extensive disturbance by construction activities. The qualified paleontological monitor will evaluate any fossil find for significance and perform sampling/excavation and collection, if necessary, to bring the impact to a less than significant level.

Storage Reservoir Component

Table 4.15-5

Cultural Resources and Paleontology Component Impacts - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact (sites)	Type of Impact[1]	Level of Significance[2]
15.5.1. Will the storage reservoir component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites			
• Tolay Extended		34	C, P, O&M	⊙
• Adobe Road		23	C, P, O&M	⊙
• Tolay Confined		21	C, P, O&M	⊙
• Lakeville Hillside		10	C, P, O&M	⊙
• Sears Point		18	C, P, O&M	⊙
• Two Rock		46	C, P, O&M	⊙
• Bloomfield		16	C, P, O&M	⊙
• Carroll Road		13	C, P, O&M	⊙
• Valley Ford		7	C, P, O&M	⊙
• Huntley		11	C, P, O&M	⊙

Table 4.15-5

Cultural Resources and Paleontology Component Impacts - Storage Reservoirs

Evaluation Criteria	Point of Significance	Impact (sites)	Type of Impact[1]	Level of Significance[2]
15.5.2. Will the storage reservoir component disturb unknown archaeological resources? All Reservoirs.	Greater than 0 projected locations	Greater than 0	C, P, O&M	⊙
15.5.3. Will the storage reservoir component disturb unknown paleontologic resources?	Greater than 0 occurrences	Greater than 0	C	⊙

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
P Permanent

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation

Impact: **15.5.1. Will the storage reservoir component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, or Native American/traditional heritage resources?**

Analysis: ***Prehistoric and Historic Archaeological Sites***

Significant; Alternatives 2, 3A, 3B, 3C, and 3E.

Construction and operation and maintenance of the storage reservoirs and associated dam, spillway, riprap, and diversion channel facilities will result in disturbance to known prehistoric and historic archaeological sites at all of the storage reservoir locations, except for Valley Ford. The effect on the cultural resources may consist of destruction or alteration of archaeological sites and components by construction earth-moving and associated heavy equipment or physical and chemical alterations of faunal, botanical, and lithic remains as a result of inundation by the storage waters. In addition, the operation and maintenance of the reservoirs might lead to such activities as ground disturbance, access to cultural resources by personnel, heavy equipment activity, filling and drawdowns of reservoirs, and repairs to pipelines, all of which can result in damage to or destruction of prehistoric and historic archaeological sites. Table 4.15-6 shows the number of prehistoric and historic archaeological sites occurring within each reservoir site.

There are at least four prehistoric archeological sites at Tolay Extended and three at Tolay Confined that are known to have human remains.

Table 4.15-6

Number of Prehistoric and Historic Archaeological Sites - Reservoirs

Reservoir	Prehistoric[1]	Historic[2]	Architectural[3]	Prehistoric /Historic[4]	Historic Architectural[5]	Architectural Historic Setting[6]	Historic Vernacular Landscape[7]	Total
Tolay Extended	12	1	3	1	0	16	1	34
Adobe Road	2	1	1	0	0	19	1	23
Tolay Confined	9	0	2	0	0	9	1	21
Lakeville Hillside	0	1	0	0	0	8	1	10
Sears Point	3	0	2	0	0	12	1	18
Two Rock	7	3	0	0	0	35	1	46
Bloomfield	0	1	0	0	0	14	1	16
Carroll Road	0	0	2	1	0	9	1	13
Valley Ford	0	0	1	0	0	5	1	7
Huntley	0	0	0	0	2	8	1	11

Source: Harland Bartholomew & Associates, Inc., March 1996

Notes:
1 - Prehistoric archaeological site
2 - Historic archaeological site
3 - Architectural historical site
4 - A site with both a prehistoric and historic component
5 - A site with both a historic and architectural component
6 - Architectural historical setting
7 - Historic vernacular landscape

No Impact; Alternatives 1, 3, 4, and 5.

There are no known prehistoric or historic archaeological sites identified at the Valley Ford reservoir site.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Historic Architectural Sites

Significant; Alternatives 2, 3C, 3D, and 3E.

Operation and maintenance of the storage reservoir component will result in disturbance to historic architectural resources at 7 of the 10 reservoir sites. The effect on the historic architectural resources may consist of destruction or alteration by construction earth-moving and associated heavy equipment or physical and chemical alterations of faunal, botanical, and historic remains as a result of inundation by the storage waters. In addition, the operation and maintenance of the reservoirs might lead to such activities as ground disturbance, access to cultural resources by personnel, heavy equipment activity, filling and drawdowns of reservoirs, repairs to pipelines, and installation of new facilities, all of which can result in the damage to or destruction the historic architectural resources. Table 4.15-6 shows the number of historic architectural resources occurring within each proposed storage reservoir.

No Impact; Alternatives 1, 3A, 3B, 4, and 5.

No historic architectural sites have been identified at the Lakeville Hillside, Two Rock, and Bloomfield reservoir sites.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Historic Architectural Settings

Significant; Alternatives 2 and 3.

Construction, operation, and maintenance of the storage reservoirs may introduce visual, audible, or atmospheric elements that alter the setting, integrity of locations, or feeling associated with cultural resources. The introduction of such features as dams and reservoirs can affect the integrity of architectural sites by altering the setting in which such cultural resources are situated and by altering cultural landscapes themselves. For example, large dams and bodies of water that dominate the landscape will be at a scale not in keeping with the elements of the architectural sites or cultural landscapes.

An estimate for the numbers of historic architectural settings that might be affected by each storage reservoir location was made using historic data, maps, field checks, or a combination of the techniques. Table 4.15-5 shows the number of historic architectural site settings that may be affected for each proposed storage reservoir. In particular, the Two Rock

storage reservoir might impact the setting of a Sonoma County Landmark on Roblar Road.

Historic Districts

Significant; Alternatives 2A, 2C,2D, and 3A.

A cultural resource may possess significance in and of itself, and/or it may possess significance by being a contributing element to a historic district. Preliminary evaluation of cultural resources in the Tolay Extended and Confined, Sears Point, and Two Rock storage reservoir locations indicates that such resources may form a portion of a historic district. *National Register Bulletin 15*, "How to Apply the National Register Criteria for Evaluation," states that "A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." In addition, the bulletin states "A district derives its importance from being a unified entity, even though it is often composed of a wide variety of resources. The identity of a district results from the interrelationship of its resources, which can be an arrangement of historically or functionally related properties into a grouping of archaeological sites related primarily by their common components; these types of districts often will not visually represent a specific historic environment" (Andrus 1991).

As a whole, twenty prehistoric archaeological sites have been identified to date within the Tolay Creek watershed (including parcels outside the Project area), which provides a unifying element to these sites. The cultural resources within this watershed appear to represent a continuum from initial occupation to the historical period. These sites include substantial and minor midden deposits, lithic scatters, bedrock mortars, petroglyphs, and deposits containing numerous charmstones. The sites represent a variety of major and minor habitation, resource processing, and ceremonial sites. They represent occupation or use from 5,000 years before the present to the 1850s. Of the twenty known prehistoric sites in the Tolay Creek watershed, 11 are within the Tolay Extended reservoir site, eight are within the Tolay Confined reservoir site, and three are within the Sears Point reservoir site.

The Two Rock storage reservoir is within a unique watershed whose distinctive setting provides a unifying element for the cultural resources within it. This protected valley has its own water source and contains an abundance and diversity of vegetational resources not found in other drainages in the general vicinity. The cultural resources within this watershed may represent a single continuum from initial use through historical occupation, or there may be two distinct phases of occupation represented by the prehistoric and historical sites. The seven prehistoric sites appear to represent a long period of occupation, with interrelated

function. Considering the overall lack of information about the prehistoric settlement and use of the West County area, the Two Rock prehistoric sites provide a unique data potential. The three historical sites of the Two Rock storage reservoir location provide an excellent opportunity to research not only the three farm/ranches located within the drainage itself but also use of the area by other farms/ranches that used portions of the valley as part of their agricultural operations. The manner in which the occupants of these sites interacted with each other and the land they held is of general historic interest.

No Impact; Alternatives 1, 2B, 3B, 3C, 3D, 3E, 4, and 5.

There are no potential historic districts at the Adobe Road, Lakeville Hillside, Bloomfield, Carroll Road, Valley Ford, and Huntley reservoir sites.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Historic Vernacular Landscape

Significant; Alternatives 2 and 3.

Originally, the natural landscape of the reservoir sites in South County consisted of coastal prairie-scrub mosaic and mixed hardwood forest. As a result of historical use of the land, the environment was altered to its present condition. Character-defining features of the current landscape include cypress and eucalyptus tree rows, clusters, and windbreaks, heavily grazed, grassy, rolling hills; and ranch complexes with associated small-scale elements such as fences, feed and water troughs, windmills, roads, orchards, and farm machinery. The historic vernacular (common or local) landscape is an example of a rural landscape that "gradually took form when people moved into a place, did what they could to survive and prosper with the resources at hand" (Jackson 1980). This historic vernacular landscape represents an important trend in Sonoma County history in which land was initially occupied and farmed to meet the individual needs of its settlers. As populations grew, technological advancements occurred, and transportation methods improved, specialized farming gradually came to replace subsistence and general farming. The current landscape is a by-product of this history.

The historic vernacular landscapes at all the reservoir locations convey a strong sense of the area's agriculturally based history. For the most part, the agricultural activity of the late-19th century continues to the present. The cultural aspects of these landscapes indicate how space was organized, boundaries drawn, land divided, and communal facilities developed (see Jackson 1980). These landscapes are potentially eligible for listing to the National Register of Historic Places under Criteria A.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

The Memorandum of Agreement, developed under the federal guidelines and regulations of Section 106 of the national Historic Preservation Act, will present measures to avoid, reduce, or mitigate Project impacts to cultural resources. These measures may consist of Project redesign and/or a data recovery work plan requiring extensive archival research, documentation, subsurface testing, full excavation, and/or data analysis and reporting, dependent on the resource. These measures will fulfill the lead agency obligation under Section 106 to take into account the effects to historic properties (cultural resources) for a federal undertaking. Following these measures will reduce impacts to a less than significant level.

Impact: **15.5.2. Will the storage reservoir component disturb unknown archaeological resources?**

Analysis: *Significant; Alternatives 2 and 3.*

There is the possibility that surface or subsurface cultural resources not identified during the field survey or subsequent additional studies of the access roads, pump stations, and pipelines, will be encountered during construction or operation and maintenance of the reservoirs, or that there are unexpected effects on known cultural resources.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.4.12. Protect Undiscovered Cultural Resource Sites.

Alternatives 1, 4, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: **15.5.3. Will the storage reservoir component disturb unknown vertebrate paleontologic resources?**

Analysis: *Significant; Alternatives 2 and 3.*

Storage Reservoir construction under Alternatives 2 and 3 may result in disturbance to paleontologic resources because the grading and trenching required for construction of the reservoirs, access roads, and diversion ditches could disturb vertebrate fossil-bearing rock units (Petaluma and/or Wilson Grove formations). The storage reservoirs in South County (Tolay, Adobe Road, Lakeville, and Sear Point) are underlain by rocks of the Petaluma Formation, which is common in the southern part of Sonoma County. Within all of the West County storage reservoir sites (Two Rock, Bloomfield, Carroll Road, Valley Ford, and Huntley), the Wilson Grove Formation, common in the western portion of the County, is present.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: *Alternatives 2 and 3.*

2.4.13. Protect Vertebrate Paleontologic Resources.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

Paleontological monitoring will serve to protect previously undiscovered significant paleontologic resources by early identification before extensive disturbance by construction activities. The qualified paleontological monitor will evaluate any fossil find for significance and perform sampling/excavation and collection, if necessary, to bring the impact to a less than significant level.

Pump Station Component

Construction of the intermediate pump stations along the transmission lines will potentially disturb cultural and paleontological resources, specifically buried resources and the setting of historic architectural resources. No cultural resources field survey has been conducted for the pump station component; number of resources per alternative was derived from records on file at the Northwest Information Center of the California Historical Resources Information System, Sonoma State University, Rohnert Park. The information is presented by alternative rather than by specific pump station in order to protect the sensitive nature of cultural resource locations.

Table 4.15-7

Cultural Resources and Paleontology Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
15.6.1. Will the pump station component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites			
• Alt 2 - South County		33	C, P, O&M	⊙
• Alt 3 - West County		18	C, P, O&M	⊙
• Alt 4 - Geysers Recharge		24	C, P, O&M	⊙
15.6.2. Will the pump station component disturb unknown archaeological resources?	Greater than 0 projected locations	Greater than 0	C, P, O&M	⊙
15.6.3. Will the pump station component disturb unknown vertebrate paleontologic resources?	Greater than 0 occurrences			
• Alternative 2A		3	C	⊙
• Alternative 2B		3	C	⊙
• Alternative 2C		3	C	⊙
• Alternative 2D		4	C	⊙
• Alternative 3A		4	C	⊙
• Alternative 3B		4	C	⊙
• Alternative 3C		4	C	⊙
• Alternative 3D		4	C	⊙
• Alternative 3E		4	C	⊙
• Alternative 4		0	C	==

Source: Harland Bartholomew & Associates, Inc., 1995

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
P Permanent

2. Level of Significance:
⊙ Significant impact before mitigation; less than significant impact after mitigation
== No impact

Impact: **15.6.1. Will the pump station component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, or Native American/traditional heritage resources?**

Analysis: ***Prehistoric and Historic Archaeological Sites***

Significant; Alternatives 2, 3, and 4.

Construction and operation of the proposed pump stations will result in disturbance to known prehistoric and historic archaeological sites for Alternatives 2, 3, and 4. Table 4.15-8 shows the number of prehistoric and historic archaeological sites known to occur within the pump station sites of each alternative. The effect on the cultural resources may consist of the destruction or alteration of archaeological sites and components by construction earth-moving and associated heavy equipment.

Table 4.15-8

Number of Prehistoric and Historic Archaeological Sites - Pump Stations

Alternative	Prehistoric[1]	Historic[2]	Prehistoric/ Historic[3]	Historic Architectural Setting[4]	Total
2A	2	0	1	30	33
2B	2	0	1	30	33
2C	2	0	1	30	33
2D	2	0	1	30	33
2E	2	0	1	30	33
3A	2	0	1	15	18
3B	2	0	1	15	18
3C	2	0	1	15	18
3D	2	0	1	15	18
3E	2	0	1	15	18
3F	2	0	1	15	18
4	1	2	0	21	28

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1 - Prehistoric archaeological site
2 - Historic archaeological site
3 - Site with both a prehistoric and historic component
4 - Historical architectural setting

Historic Architectural Settings

Significant; Alternatives 2, 3, and 4.

Construction and operation of the pump stations may introduce visual, audible, or atmospheric elements that alter the setting, integrity of locations, or feeling associated with cultural resources. The introduction of such features as pump stations can affect the integrity of architectural sites by altering the setting in which such cultural resources are situated.

No Impact; Alternatives 1 and 5.

These alternatives do not have a pump station component.

Mitigation: *Alternatives 2, 3 and 4.*

2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, and 4.*

The Memorandum of Agreement, developed under the federal guidelines and regulations of Section 106 of the national Historic Preservation Act, will present measures to avoid, reduce, or mitigate Project impacts to cultural resources. These measures may consist of Project redesign and/or a data recovery work plan requiring extensive archival research, documentation, subsurface testing, full excavation, and/or data analysis and reporting, dependent on the resource. These measures will fulfill the lead agency obligation under Section 106 to take into account the effects to historic properties (cultural resources) for a federal undertaking. Following these measures will reduce impacts to a less than significant level.

Impact: **15.6.2. Will the pump station component cause disturbance of unknown archaeological resources?**

Analysis: *Significant; Alternatives 2, 3, and 4.*

There is the possibility that surface or subsurface cultural resources not identified during the field survey of the pump station sites or from the review of records at the Northwest Information Center will be encountered during construction or operation/maintenance of the pump stations, or that there are unexpected effects on known cultural resources. There is the possibility of unknown resources occurring at each of the alternatives.

No Impact; Alternatives 1 and 5.

These alternatives do not have a pump station component.

Mitigation: *Alternatives 2, 3 and 4.*

2.4.12. Protect Undiscovered Cultural Resource Sites.

Alternatives 1 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, and 4.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: 15.6.3. Will the pump station component disturb unknown vertebrate paleontologic resources?

Analysis: *Significant; Alternatives 2 and 3.*

Pump station construction for Alternatives 2 and 3 may result in disturbance to paleontologic resources because the ground disturbance required for the construction of the pump stations and installation of the pumps could disturb vertebrate fossil-bearing rock units (Petaluma and/or Wilson Grove formations). Table 4.15-9 lists each of the pump stations that might impact fossiliferous deposits.

Table 4.15-9

Fossiliferous Rock Units Affected by Pump Stations

Pump Station	Alternative	Affected Rock Unit
FGB	2, 3	Petaluma Formation
SBPS-9	2D	Petaluma Formation
SBPS-10	2	Petaluma Formation
LBPS-1	2, 3	Wilson Grove Formation
LBPS-2	2, 3	Wilson Grove Formation
LBPS-3	2, 3	Wilson Grove Formation
LBPS-4	2, 3	Wilson Grove Formation

Source: Harland Bartholomew & Associates, Inc., 1996

No Impact; Alternatives 1, 4, and 5.

Pump stations for the geysers alternative are not located on fossil bearing rock formations.

Alternatives 1 and 5 do not have a pump station component.

Mitigation: *Alternatives 2 and 3.*

2.4.13. Protect Vertebrate Paleontologic Resources.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

Paleontological monitoring will serve to protect previously undiscovered significant paleontologic resources by early identification before extensive disturbance by construction activities. The qualified paleontological monitor will evaluate any fossil find for significance and perform sampling/excavation and collection, if necessary, to bring the impact to a less than significant level.

Agricultural Irrigation Component

No cultural resources field survey has been conducted for the agricultural irrigation component; Number of resources per area was derived from records on file at the Northwest Information Center of the California Historical Resources Information System, Sonoma State University, Rohnert Park and are listed under criterion #1. A sensitivity model was used to predict the number and kinds of cultural resources present on previously unsurveyed parcels of each irrigation area and they are listed under criterion #2.

Table 4.15-10

Cultural Resources and Paleontology Impacts by Component - Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
15.7.1. Will the agricultural irrigation component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites			
• Adobe Road		4	C, P, O&M	⊙
• Lakeville		29	C, P, O&M	⊙
• Bay Flats		4	C, P, O&M	⊙
• East of Rohnert Park		13	C, P, O&M	⊙
• North Petaluma Valley		20	C, P, O&M	⊙
• Americano		49	C, P, O&M	⊙

Table 4.15-10

Cultural Resources and Paleontology Impacts by Component - Agricultural Irrigation

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
• Stemple		4	C, P, O&M	⊙
• Sebastopol		14	C, P, O&M	⊙
• Miscellaneous		4	C, P, O&M	⊙
15.7.2. Will the agricultural irrigation component disturb unknown archaeological resources?	Greater than 0 projected locations			
• Adobe Road		Greater than 19	C, P, O&M	⊙
• Lakeville		Greater than 34	C, P, O&M	⊙
• Bay Flats		Greater than 6	C, P, O&M	⊙
• East of Rohnert Park		Greater than 15	C, P, O&M	⊙
• North Petaluma Valley		Greater than 6	C, P, O&M	⊙
• Americano		Greater than 52	C, P, O&M	⊙
• Stemple		Greater than 72	C, P, O&M	⊙
• Sebastopol		Greater than 28	C, P, O&M	⊙
• Miscellaneous		Greater than 0	C, P, O&M	⊙
15.7.3. Will the agricultural component disturb unknown vertebrate paleontologic resources?	Greater than 0 occurrences	Greater than 0	C	⊙

Source: Harland Bartholomew & Associates, 1995

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
P Permanent

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation

Impact: 15.7.1. Will the agricultural irrigation component disturb known potentially eligible National Register properties, including archaeological, historic, architectural, or Native American/traditional heritage resources?

Analysis: *Significant; Alternatives 2 and 3.*

Prehistoric and Historic Archaeological Sites

Construction and operation/maintenance of the agricultural irrigation areas will result in disturbance to known prehistoric and historic archaeological sites at all of the agricultural irrigation areas in the West and South County. The effect on the cultural resources may consist of destruction or alteration of archaeological sites by the construction of the irrigation pipelines, the effects of new crop types, and the cycles of wetting and drying by irrigation. In addition, the operation and maintenance of the agricultural irrigation areas might lead to such activities as ground disturbance, access to cultural resources by personnel, heavy equipment activity, repairs to pipelines, and installation of new facilities, all of which can result in the damage to or destruction of prehistoric and historic archaeological sites. Table 4.15-11 shows the number of prehistoric and historic archaeological sites occurring within each area.

Table 4.15-11

Number of Prehistoric and Historic Archaeological Sites - Agricultural Irrigation

Irrigation Area	Prehistoric[1]	Historic[2]	Architectural[3]	Prehistoric /Historic[4]	Historic Vernacular Landscape[5]	Total
Adobe Road	3	0	0	0	1	4
Lakeville	18	3	6	1	1	29
Bay Flats	3	0	0	0	1	4
East of Rohnert Park	6	3	3	0	1	13
North Petaluma	4	3	12	0	1	20
Americano	4	1	42	1	1	49
Stemple	2	1	0	0	1	4
Sebastopol	10	1	1	1	1	14
Miscellaneous	1	0	1	0	1	3

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
1 - Prehistoric Archaeological Site
2 - Historic Archaeological Site
3 - Architectural Historical Site
4 - Site with both prehistoric and historic components
5 - Historic Vernacular Landscape

Historic Architectural Settings

Construction and operation/maintenance of the agricultural irrigation areas may introduce visual, audible, or atmospheric elements that alter the setting, integrity of locations, or feeling associated with cultural resources. The introduction of irrigation techniques to previously uncultivated lands may affect the integrity of architectural sites by altering the setting in which such cultural resources are situated and by altering cultural landscapes themselves.

An estimate for the numbers of historical architectural site settings that might be affected by each agricultural irrigation location was made using historic data, maps, field checks, or a combination of the techniques. Within the Lakeville irrigation area, specific historical architectural properties are Donahue's Landing and the Bordessa Dairy. The Edwin Merritt Farm and the John T. Merritt Residence are historical architectural properties within the North Petaluma irrigation area, and the Americano irrigation area encompasses many historical architectural properties, including six Sonoma County Landmarks (three buildings, a bridge, a dairy/creamery, and a school).

Table 4.15-11 shows the number of historic architectural resource settings affected within each irrigation area.

No known cultural resource sites have been identified in the Adobe Road, Bay flats, and Stemple agricultural irrigation Areas.

Historic Vernacular Landscape

The historic vernacular landscapes at each of the agricultural irrigation areas could be changed as a result of proposed irrigation procedures and the addition of currently uncultivated parcels to irrigation. Although irrigation will not change the landscape to a non-agricultural use, the type of agriculture could change, for example from dry pasture to vineyard. For the most part, the agricultural activity of the late-19th century continues to the present. The cultural aspects of these landscapes indicate how space was organized, boundaries drawn, land divided, and communal facilities developed (Jackson 1980). These landscapes are potentially eligible for listing to the National Register of Historic Places under Criteria A.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: *Alternatives 2 and 3.*

2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.

Alternatives 1, 4, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

The Memorandum of Agreement, developed under the federal guidelines and regulations of Section 106 of the national Historic Preservation Act, will present measures to avoid, reduce, or mitigate Project impacts to cultural resources. These measures may consist of Project redesign and/or a data recovery work plan requiring extensive archival research, documentation, subsurface testing, full excavation, and/or data analysis and reporting, dependent on the resource. These measures will fulfill the lead agency obligation under Section 106 to take into account the effects to historic properties (cultural resources) for a federal undertaking. Following these measures will reduce impacts to a less than significant level.

Impact: **15.7.2. Will the agricultural irrigation component disturb unknown archaeological resources?**

Analysis: *Significant; Alternatives 2 and 3.*

There is the possibility that surface or subsurface cultural resources not identified during the required future field survey of the agricultural irrigation areas, will be encountered during construction or operation/maintenance of the agricultural irrigation areas, or that there are unexpected effects on known cultural resources. Based on the sensitivity study conducted by the Anthropological Studies Center, Sonoma State University, the possibility of unknown resource locations occurs at all the agricultural irrigation areas.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: *Alternatives 2 and 3.*

2.4.12. Protect undiscovered cultural resource sites.

Alternatives 1, 4, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: **15.7.3. Will the agricultural irrigation component disturb unknown vertebrate paleontologic resources?**

Analysis: *Significant; Alternatives 2 and 3.*

Within Alternative 2, the Petaluma Formation occurs, as does a small area of the Wilson Grove Formation near Sebastopol. Alternative 3 agricultural irrigation areas contain Wilson Grove Formation rock units as well. Typically, a 6-inch-diameter main pipe may be installed in the agricultural areas and some ground disturbance will occur. Such disturbance will be minimal and occur within the top 2 feet of the ground surface. The lateral lines leading off the main line will be laid on the surface. There are, however, larger pipelines placed at depth leading from the distribution pipelines in public rights-of-way to individual parcels.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: *Alternatives 2 and 3.*

2.4.13. Protect Vertebrate Paleontologic Resources.

Alternatives 1, 4 and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2 and 3.*

Paleontological monitoring will serve to protect previously undiscovered significant paleontologic resources by early identification before extensive disturbance by construction activities. The qualified paleontological monitor will evaluate any fossil find for significance and perform sampling/excavation and collection, if necessary, to bring the impact to a less than significant level.

Geysers Steamfield Component

No cultural resources field survey has been conducted for the geysers steamfield component; number of resources was derived from records on file at the Northwest Information Center of the California Historical Resources Information System, Sonoma State University, Rohnert Park.

Table 4.15-12

Cultural Resources and Paleontology Impacts by Component - Geysers Steamfield

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
15.8.1. Will the geysers steamfield component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites	9	C, P, O&M	⊙
15.8.2. Will the geysers steamfield component disturb unknown archaeological resources?	Greater than 0 projected locations	Greater than 0	C, P, O&M	⊙
15.8.3. Will the geysers steamfield component disturb unknown vertebrate paleontologic resources?	Greater than 0 occurrences	0	C	==

Source: Harland Bartholomew & Associates, Inc., October, 1995

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
P Permanent

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation
== No impact

Impact: **15.8.1. Will the geysers steamfield component disturb known potentially eligible National Register properties, including archaeological, historic, architectural, or Native American/traditional heritage resources?**

Analysis: ***Prehistoric and Historic Archaeological Sites***

Significant; Alternative 4.

Construction, operation and maintenance of the pipelines in the geysers steamfield component will result in disturbance to known prehistoric and historic archaeological sites. The effect on the cultural resources may consist of destruction or alteration of archaeological sites and components by construction earth-moving and associated heavy equipment. In addition, the operation and maintenance of the component might lead to such activities as ground disturbance, access to cultural resources by personnel, heavy equipment activity, and repairs to pipelines, all of which can result in damage to or destruction of prehistoric and historic archaeological sites. Table 4.15-13 shows the number of prehistoric and

historic archaeological sites occurring within each alternative, based on archival records.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geyser steamfield component.

Mitigation: *Alternative 4.*

2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.

Alternative 1, 2, 3, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 4.*

The Memorandum of Agreement, developed under the federal guidelines and regulations of Section 106 of the national Historic Preservation Act, will present measures to avoid, reduce, or mitigate Project impacts to cultural resources. These measures may consist of Project redesign and/or a data recovery work plan requiring extensive archival research, documentation, subsurface testing, full excavation, and/or data analysis and reporting, dependent on the resource. These measures will fulfill the lead agency obligation under Section 106 to take into account the effects to historic properties (cultural resources) for a federal undertaking. Following these measures will reduce impacts to a less than significant level.

Table 4.15-13

Number of Prehistoric and Historic Archaeological Sites - Geysers Steamfield

Geysers	Prehistoric[1]	Historic[2]	Total
Alt 4	7	2	9

Source: Harland Bartholomew & Associates, Inc., March 1996

Notes:
1 - Prehistoric Archaeological Site
2 - Historic Archaeological Site

Impact: **15.8.2. Will the geysers steamfield component disturb unknown archaeological resources?**

Analysis: *Significant; Alternative 4.*

There is the possibility that surface or subsurface cultural resources not identified during the field survey of the Geysers steamfield component or from the review of records at the Northwest Information Center will be

encountered during construction or operation/maintenance of the component, or that there are unexpected effects on known cultural resources. There is the possibility of unknown resources occurring within this component.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geyser steamfield component.

Mitigation: *Alternative 4.*

2.4.12. Protect Undiscovered Cultural Resource Sites.

Alternatives 1, 2, 3, and 5. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 4.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: 15.8.3. Will the geysers steamfield component disturb unknown vertebrate paleontologic resources?

Analysis: *No Impact; All Alternatives.*

No known paleontologic site is present in the geysers steamfield component. In addition, the geysers steamfield area is located in its entirety within the Franciscan Complex of rocks, of which the majority are not fossiliferous. Chert within the Franciscan Complex may contain marine microfossils, but these are not considered to be a significant paleontologic resource.

Alternatives 1, 2, 3 and 5 do not have a geyser steamfield component.

Mitigation: No mitigation is needed.

Discharge Component

No cultural resources field survey has been conducted for the discharge component; number of resources was derived from records on file at the Northwest Information Center (Northwest Information Center) of the California Historical Resources Information System, Sonoma State University, Rohnert Park.

Table 4.15-14

Cultural Resources and Paleontology Impacts by Component - Discharge

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
15.9.1. Will the discharge component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?	Greater than 0 sites			
• Russian River		0	C, P, O&M	==
• Laguna		--	--	--
15.9.2. Will the discharge component disturb unknown archaeological resources?	Greater than 0 projected locations			
• Russian River		Greater than 0	C, P, O&M	⊙
• Laguna		--	--	--
15.9.3. Will the discharge component disturb unknown vertebrate paleontologic resources?	Greater than 0 occurrences			
• Russian River Discharge		Greater than 0	C	⊙
• Laguna Discharge		None	C	==

Source: Harland Bartholomew & Associates, Inc., October, 1995

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance
-- Not Applicable
P Permanent

2. Level of Significance codes:
⊙ Significant impact before mitigation; less than significant impact after mitigation
== No impact

Impact: **15.9.1. Will the discharge component disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?**

Analysis: *No Impact; All Alternatives.*

No cultural resource sites have been identified near the discharge outfall on the Russian River. No construction is proposed for alternatives 1, 2, 3, 4, and 5B, and therefore no impacts will result.

Mitigation: No mitigation is needed.

Impact: 15.9.2. Will the discharge component cause disturbance of unknown archaeological resources?

Analysis: *Significant; Alternative 5A.*

There is the possibility that surface or subsurface cultural resources not identified during the archival research for the Russian River discharge component will be encountered during construction or operation/maintenance of the component, or that there are unexpected effects on known cultural resources.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

The use of the existing facilities for the Laguna discharge will not result in an impact to cultural resources because no ground disturbance is expected and existing pipelines and connections will be used.

Mitigation: *Alternative 5A.*

2.4.12. Protect Undiscovered Cultural Resource Sites.

Alternatives 1, 2, 3, 4, and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 5A.*

Archaeological monitoring will serve to protect previously undiscovered cultural resources by early identification before extensive disturbance by construction activities. The Memorandum of Agreement provides for an evaluation of the resource by a qualified archaeologists, a determination of resource significance, and resulting management/mitigation recommendations that will bring the impact to a less than significant level.

Impact: 15.9.3. Will the discharge component disturb unknown vertebrate paleontologic resources?

Analysis: *Significant; Alternative 5A.*

The discharge of treated water into the Russian River will not result in an impact to paleontologic resources. However, the outfall structure will be constructed in the Wilson Grove Formation and it is possible that fossiliferous deposits might be disturbed by this construction.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

Because the Laguna Discharge involves no construction, it will not impact paleontologic resources.

Mitigation: *Alternative 5A.*

2.4.13. Protect Vertebrate Paleontologic Resources.

Alternatives 1, 2, 3, 4, and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternative 5A.*

Paleontological monitoring will serve to protect previously undiscovered significant paleontologic resources by early identification before extensive disturbance by construction activities. The qualified paleontological monitor will evaluate any fossil find for significance and perform sampling/excavation and collection, if necessary, to bring the impact to a less than significant level.

CUMULATIVE IMPACTS

There are three significant impacts identified in the Cultural Resources and Paleontology section:

Impact: **15.1C. Will the Project plus cumulative projects disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources?**

Analysis: Project impacts are for pipelines for alternatives 1, 2, 3, 4, and 5A; all storage reservoirs; pump stations for alternatives 2, 3, and 4; agricultural irrigation areas; and geysers steamfield.

Extensive cultural resources of all types have been identified throughout the Project area, both within urban and rural areas. Significant impacts to known resources could result from many different sources, for example, construction, demolition, or rehabilitation, and many of the cumulative projects identified could impact known cultural resources. For example, there is a trend in the Project area, irrespective of the Long-Term Project, to convert grazing land to vineyards. This conversion process will significantly impact the Historical Vernacular Landscapes present throughout the rural portions of both South County and West County. Although there are many cumulative projects which will increase the impacts identified in the Cultural Resources section, all Project impacts on known cultural resources have already been listed as significant and have been avoided or fully mitigated. The cumulative projects will not warrant a change in either the finding of significance or the mitigation proposed.

Impact: **15.2C. Will the Project plus cumulative projects disturb unknown archaeological resources?**

Project impacts are for pipelines for alternatives 2, 3, 4 and 5B; storage reservoirs; pump stations; all agricultural irrigation areas; geysers steamfield; Russian River discharge outfall.

The discussion of cumulative impacts to unknown cultural resources is similar to that for undiscovered resources. Disturbance of unknown vertebrate paleontologic resources. Pipelines for all alternatives except Laguna Discharge; all storage reservoirs; pump stations for all alternatives except Discharge; all agricultural irrigation areas; Russian River discharge outfall.

The potential for vertebrate fossils exists throughout much of the Project area. The fossils could be disturbed whenever construction occurs at a depth to bedrock. Large scale construction to bedrock which might affect vertebrate fossils may occur, for example, at the Petaluma reclaimed water reservoir or the City's of Healdsburg proposed potable water reservoir. However, all Project impacts have already been listed as significant, and are fully mitigated. Even if vertebrate fossils were found on adjacent properties, no further mitigation will be required of the Project.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION

Table 4.15-15

Summary of Significant Impacts and Mitigation Measures - Cultural Resources and Paleontology

Impact	Level of Significance	Mitigation Measure
Pipeline Component		
15.4.1. The pipeline component may disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙ Alt 5A - ⊙	2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.
15.4.2. The pipeline component may disturb unknown archaeological resources.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙ Alt 5A - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.

Table 4.15-15

Summary of Significant Impacts and Mitigation Measures - Cultural Resources and Paleontology

Impact	Level of Significance	Mitigation Measure
15.4.3. The pipeline component may disturb unknown vertebrate paleontologic resources.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙ Alt 5A - ⊙	2.4.13 Protect Vertebrate Paleontologic Resources.
Storage Reservoir Component		
15.5.1. The storage reservoir component may disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.
15.5.2. The storage reservoir component may disturb unknown archaeological resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.
15.5.3. The storage reservoir component may disturb unknown vertebrate paleontologic resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.4.13. Protect Vertebrate Paleontologic Resources.
Pump Station Component		
15.6.1. The pump station component may disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙	2.3.18. Identification, Evaluation, and Avoidance of Cultural Resources.
15.6.2. The pump station component may disturb unknown archaeological resources.	Alt 2 - ⊙ Alt 3 - ⊙ Alt 4 - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.
15.6.3. The pump station component may disturb unknown vertebrate paleontologic resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.4.13. Protect Vertebrate Paleontologic Resources.

Table 4.15-15

Summary of Significant Impacts and Mitigation Measures - Cultural Resources and Paleontology

Impact	Level of Significance	Mitigation Measure
Agricultural Irrigation Component		
15.7.1. The agricultural irrigation component may disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.3.18. Identification, evaluation, and Avoidance of Cultural Resources.
15.7.2. The agricultural irrigation component may disturb unknown archaeological resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.
15.7.3. The agricultural irrigation component may disturb unknown vertebrate paleontologic resources.	Alt 2 - ⊙ Alt 3 - ⊙	2.4.13. Protect Vertebrate Paleontologic Resources.
Geysers Steamfield Component		
15.8.1. The geysers steamfield component may disturb known potentially eligible National Register properties, including archaeological, historical, architectural, and Native American/traditional heritage resources.	Alt 4 - ⊙	2.3.18. Identification, Evaluation and Avoidance of Cultural Resources.
15.8.2. The geysers steamfield component may disturb unknown archaeological resources.	Alt 4 - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.
Discharge Component		
15.9.2. The discharge component may disturb unknown archaeological resources.	Alt 5A - ⊙	2.4.12. Protect Undiscovered Cultural Resource Sites.
15.9.3. The discharge component construction may disturb unknown vertebrate paleontologic resources.	Alt 5A - ⊙	2.4.13. Protect Vertebrate Paleontologic Resources.

Source: Harland Bartholomew & Associates, Inc., 1996

Notes:
⊙ Significant impact before mitigation; less than significant after mitigation.

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.15-16

Summary of Impacts by Alternative - Cultural Resources and Paleontology

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	==	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	==	==	==	==	==	==	==	==	==	==	==	==
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	--
Storage Reservoirs	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	--	--	--
Pump Stations	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	--	--
Agricultural Irrigation	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	⊙	--	--
Discharge	--	==	==	==	==	==	==	==	==	==	==	⊙	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: Level of Significance Codes

-- Not applicable

== No impact

⊙ Significant impact; less than significant after mitigation

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Jody Brown, Harland Bartholomew & Associates, Inc.

Reviewers

Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D. Parsons Engineering Science, Inc.
Seana L.S. Gause, Anthropological Studies Center, Sonoma State University
Christian Gerike, Anthropological Studies Center, Sonoma State University
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Suzanne Stewart, Anthropological Studies Center, Sonoma State University
Sandia Potter, Parsons Engineering Science, Inc.
John Cummings, Ph.D. Peer Review Committee.
David Ziegler, Peer Review Committee.

References

HBA Team Documents

Gerike, Christian, Seana L. S. Gause, Suzanne Stewart, and Katherine Johnson. 1996. *Cultural Resources.* Anthropological Studies Center, Sonoma State University, Rohnert Park, California. Submitted to Harland Bartholomew & Associates, Inc. (Appendix P-1)

Rust Environment & Infrastructure. 1995. *Geotechnical Assessment of Alternative Reservoir Sites and Pipeline Routes, Volume 1.* (Appendix F-1)

Other References

Abbott, Sue. 1986. T*he Changing Landscape of Sonoma County Dairies: An Interpretive Guide.* Professional Project for Master's degree, Department of Landscape Architecture, University of California, Berkeley.

Beck, Warren A., and Ynez D. Haase. 1974. *Historical Atlas of California.* University of Oklahoma Press, Norman, Oklahoma.

Birnbaum, J. 1994. *Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes*, Department of Parks and Recreation, Preservation Brief 36.

California Department of Parks & Recreation. 1976. *California Inventory of Historic Resources*, State of California, Sacramento, California.

Clayborn, Hannah M. 1976. Dirt Roads and Dusty Tales, A Bicentennial History of Bloomfield, Sonoma County, California. Second edition. Cleone Publishing Co., Santa Rosa, California.

Driver, Harold E. 1940. Wappo Ethnography. *University of California Publications in American Archaeology and Ethnology* 36(3):179-220.

EIP and Associates. 1990. *Santa Rosa Subregional Water Reclamation System Long-Term Wastewater System Draft Environmental Impact Report/Statement.*

Elsasser, Albert B. 1955. A Charmstone Site in Sonoma County, California. *Reports of the University of California Archaeological Survey* 28:29-33.

Fredrickson, David A.1974. *Cultural Diversity in Early Central California: A View from the North Coast Ranges.* Journal of California Anthropology 1(1):41-53.

Fredrickson, David A. 1984. The North Coastal Region. In *California Archaeology*, edited by Michael J. Morrato, pp. 471-528. Academic Press, San Francisco.

Gebhardt, Charles L. 1963. *Historic Archaeology at Vallejo's Petaluma Adobe State Historical Monument: Summer 1962.* Report prepared for the Central California Archaeological Foundation. Reprinted by Coyote Press, Salinas, California.

Heig, Adar. 1982. *History of Petaluma: A California River Town.* Scottwall Associates, Petaluma, California.

Hoover, Mildred Brooke, Hero Eugene Rensch, Ethel Rensch, and William N. Abeloe. 1990. *Historic Spots in California.* Fourth edition, revised by Douglas E. Kyle. Stanford University Press, Stanford, California.

Jackson, John Brinkerhoff. 1980. By Way of Conclusion: How to Study the Landscape. In *The Necessity for Ruins and Other Topics,* by John Brinkerhoff Jackson, pp. 113-126. University of Massachusetts Press, Amherst, Massachusetts.

Jones, Terry L. 1991. Marine Resource Value and the Priority of Coastal Settlement: A California Perspective. *American Antiquity* 56(3):419-443.

King, Tom, Ward Upson, and Ralph Milner. 1966. Northwestern California Archaeological Society: *Archaeological Investigations in the San Antonio Valley, Marin and Sonoma Counties, California.* Occasional Paper 1.

Kroeber, Alfred L. 1925. *Handbook of the Indians of California.* Bureau of American Ethnology, Bulletin 78. Smithsonian Institution, Washington, D.C. (Reprint by Dover Publications, Inc., New York, 1976.).

LeBaron, Gaye. 1987. Lost Lakes, Lost Towns Revisited. *The Press Democrat,* 5 May 1987: A2. Santa Rosa. Available at Sonoma County Library System, Central Branch, Santa Rosa.

LeBaron, Gaye, Dee Blackman, Joann Mitchell, and Harvey Hansen. 1985. *Santa Rosa: A Nineteenth Century Town.* Historia, Ltd., Santa Rosa.

Lightfoot, Kent, Thomas A. Wake, and Ann M. Schiff. 1991. *The Archaeology and Ethnohistory of Fort Ross, California, Vol. 1: Introduction.* Contributions to the University of California Archaeological Research Facility. No 49. Berkeley.

Lowry, Thea S. (editor). 1993. *Petaluma's Poultry Pioneers Recall the Heyday of Chicken Ranching.* Manifold Press, Fort Ross, California, under the auspices of the Petaluma Museum Association.

Menefee, C.A. 1873. *Historical and Descriptive Sketch Book of Napa, Sonoma, Lake and Mendocino.* Reporter Publishing House, Napa, California.

Morrato, Michael J. 1984. *California Archaeology.* Academic Press, San Francisco.

National Park Service. 1991. How to Apply the National Register Criteria for Evaluation. *National Register Bulletin 15,* revised edition, edited by Rebecca H. Shrimpton. National Park Service; U.S. Dept. of the Interior. Government Printing Office, Washington, D.C.

Origer, Thomas M., and David A. Fredrickson. 1980. T*he Laguna Archaeological Research Project, Sonoma County, California.* Anthropological Studies Center, Sonoma State University Academic Foundation, Inc., Rohnert Park, California. Submitted to the Public Works Department, City of Santa Rosa, California.

Parker, Patricia L. 1993. What You Do and How We Think. In *CRM* 16. U.S. Department of the Interior, National Park Service.

Peak & Associates, Inc. 1985. *Archaeological Investigations in the Mayacmas Mountains: Volume I, CA-SON-1406 and CA-SON-1407, Sonoma County, California.* Peak & Associates, Inc., Sacramento. Submitted to GEO Operator Corporation, Santa Rosa, California.

Peri, David W., Scott M. Patterson, and Susan L. McMurray. 1978. Ethnographic and Historical Cultural Resources Study of the Aminoil, Little Geysers, Ford Flat, Cobb Mountain (Units 16, 18, 19, 20, 21) Geothermal

Leaseholds, Sonoma and Lake Counties, California. The Ethnographic Laboratory, Department of Anthropology, Sonoma State University, Rohnert Park, California. Submitted to Pacific Gas and Electric Company, San Francisco.

Phebus, George, Jr. 1990. *Architectural Investigations in the San Pablo-Suisin Region of Central California.* Published privately, Astoria, Oregon.

Reynolds, Robert E. 1988. *Paleontologic Resource Overview and Management Plan for Edwards Air Force Base, California.* San Bernardino County Museum.

Sawyer, Jesse O. 1978. Wappo. In *California*, edited by R.F. Heizer, pp. 256-263. Handbook of North American Indians, vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Society of Vertebrate Paleontology. 1991. Measures for Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Procedures. Official Business, *Society of Vertebrate Paleontology News Bulletin* 15.2 (June 1991):1-2.

Stewart, Suzanne B. 1993. *Upper Archaic Diversity in the Warm Springs Locality Sonoma County, California.* Master's thesis in Cultural Resources Management, Department of Anthropology, Sonoma State University, Rohnert Park, California.

Upson, Ward F. 1973. *The Gossage-Washoe Archaeological Project; Excavations at SDA-30A and 4-SON-518.* Submitted to Sonoma County Water Agency, Santa Rosa, California.

Consultation and Coordination

Persons Contacted

State Office of Historic Preservation
State Native American Heritage Commission
Richard Stradford, Archaeologist, U.S. Army Corps of Engineers, San Francisco District
Lisa Luptowitz, Paleontologist, Parsons Engineering Science, Inc.
Society of Vertebrate Paleontology

Correspondence

None

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4.16 PUBLIC SERVICES, UTILITIES, AND RECREATION

This section discusses Project impacts on service standards due to increased demands for police, fire, park and recreation facilities, water, sewage treatment and disposal, and solid waste disposal. It also discusses impacts on service standards resulting from disruption of such services or increases in response times due to the Project. To provide a context for these analyses, the setting section provides information on current levels of service and recreational opportunities for the affected jurisdictions in the Project area, and also provides a summary of local general plan policies for provision of services.

IMPACTS EVALUATED IN OTHER SECTIONS

The following issues are related to the Public Services, Utilities, and Recreation Section but are evaluated in other sections of this document:

- Health Effects of Reclaimed Water Used at School or Recreation Sites. Potential health effects of reclaimed water are discussed in Section 4.7, Public Health and Safety.
- Emergency Planning. Section 4.19, Inundation Due to Dam Failure evaluates what will happen in the event of a dam failure.
- Bicycle Travel. Section 4.11, Transportation, evaluates the impact of construction traffic on bikeways and bicycle travel.
- Population Growth. Please refer to the Section 5.0, NEPA/CEQA Required Sections for a full discussion. The Project is considered growth-accommodating and not growth-inducing.
- Construction Period Noise Impacts on Schools and Recreation Facilities. Impacts are discussed in Section 4.13, Noise.

AFFECTED ENVIRONMENT (SETTING)

Public Services

Police

The cities of Santa Rosa, Rohnert Park, Cotati, Petaluma, and Sebastopol provide their own police services. Sonoma County and Marin County provide sheriff's

services to the unincorporated areas of the counties. The California Highway Patrol is responsible for all vehicle or traffic related law enforcement in the study area.

City of Santa Rosa

Police protection for the wastewater treatment plant is provided by the Santa Rosa Police Department. The property in the Subregional System is incorporated into the City of Santa Rosa. In addition, the treatment plant has a security officer on duty 24 hours per day.

The Santa Rosa Police Department currently employs 155 sworn officers and 78 civilian employees. One hundred twenty-eight (128) of the sworn are first line officers. The level of service is approximately 1 officer per 1,000 residents. Currently, the average response times in the City for police services are 6 minutes for emergencies, 13 minutes for urgent calls, and 32 minutes for routine calls.

City of Rohnert Park

The Department of Public Safety provides police and fire related services as a combined operation in Rohnert Park. The Department of Public Safety currently operates under mutual aid agreements with Sonoma County and all its cities. In addition to standard police and fire services, the Department of Public Safety is responsible for emergency preparedness coordination and emergency medical service dispatching.

The Department of Public Safety employs approximately 75 individuals (including fire personnel) and utilizes three police reserves, and 15 police service aides. The response time for the highest priority calls (potentially life threatening emergencies only) was 3.6 minutes in 1989.

City of Cotati

The Cotati Police Department services the incorporated area of Cotati, which encompasses approximately two square miles. The Cotati Police Department, through a mutual aid agreement, supports the County in the rural areas surrounding Cotati when necessary. The Department has one police station and consists of 12 sworn officers, including a Chief of Police, and is supplemented with four reserve police officers. Seven officers are assigned to patrol activities; the normal staffing level is two officers and a supervisor per shift. The level of service is 1.79 officers per 1,000 residents.

The average response time to emergency calls within the city limits is 3 minutes, with routine calls being handled in 10 minutes.

City of Sebastopol

The Sebastopol Police Department provides full police services for the incorporated area of the City of Sebastopol, approximately two square miles. The police department consists of 14 sworn full time officers, 8 reserve officers, 4 dispatchers, and 1 control aide. The existing level of service is 1.87 officers per 1,000 residents.

The average emergency response time within the city limits is approximately 2.5 minutes. The average response time to routine calls is 5 minutes. The Sebastopol Police Department has identified a need for civilian staff and equipment needs, including radio, computer, radar, and armory equipment.

City of Petaluma

The City of Petaluma Police Department provides services within the City of Petaluma. The Police Department consists of 62 sworn officers and 24 non-sworn employees, for a total of 86 employees. Currently, there are four beat areas staffed by one officer per unit. The number of officers on duty ranges from 5 to 12, including supervisors. The level of service is 1.22 officers per 1,000 residents.

Sonoma County

The Sonoma County Sheriff's Department provides law enforcement services for the unincorporated area of Sonoma County The Department consists of approximately 600 employees, of which about 210 are sworn California Peace Officers. The remaining employees are non-sworn correctional personnel and civilians. The ratio of patrol deputies to population is therefore 1 to 2,000, approximately twice the norm, according to the Sheriff's Department.

The County is divided into law enforcement zones and has a main office in Santa Rosa, and three substations (Guerneville, Boyes Hot Springs, and the Roseland area of Santa Rosa). The area of the Subregional Wastewater Project will be handled by the main office in Santa Rosa and the Roseland Substation. Both of these offices are operating at near full capacity. The average response time throughout the County is 14.5 minutes.

Marin County

The Marin County Sheriff's Department provides law enforcement services for the unincorporated area of Marin County. The Department consists of approximately 290 employees, of which 194 are sworn California Peace Officers. The ratio of patrol deputies to population is 1 for every 976 citizens served.

The law enforcement zone is divided into four Districts and ten beats. There are four substations (Marin City, Kentfield, West Marin, and Civic Center), and the Civic Center substation is the main office. The average response time throughout the County is three minutes.

California Highway Patrol

The California Highway Patrol (CHP) has responsibility for traffic management of roadways and highways outside of local municipalities. Upon request from municipal agencies the CHP provides mutual aid to cities and counties and has localized agreements with the Santa Rosa Police Department and the Sonoma County Sheriff.

There are five CHP offices that could respond to emergencies within the Project area. These offices are the Santa Rosa (Rohnert Park), Ukiah, Clear Lake (Kelseyville), Napa County (Napa), and Marin County (Corte Madera) area offices.

For each of the five area offices, the number of sworn officers ranges from 35 to 95. Each officer is certified in first aid and CPR, and 50 percent of all officers are EMT trained. The CHP has emergency contingency plans in place for statewide and local assistance, and has staff trained to deal with hazardous waste spills and emergencies.

Fire Services

City of Santa Rosa

The City of Santa Rosa Fire Department provides a full range of fire service activities within the city limits and, by contract, to the Roseland Fire Protection District. The fire department consists of 118 employees, including 99 firefighters and captains, 3 battalion chiefs, 1 deputy chief, 1 division chief training and safety, 1 fire marshal, 5 fire inspectors, 1 fire protection engineer, 1 administrative analyst, 5 clerical, and 1 fire chief. There are no volunteer personnel. The current Insurance Service Office (ISO) rating is a Class 3, and no reassessment is scheduled at this time. The ISO ratings range from Class 1 to Class 10, with Class 1 being the best. A Class 3 rating indicates that the Santa Rosa Fire Department is strategically placed throughout City, and has more than adequate personnel, equipment, and expertise to serve the City of Santa Rosa.

Eight stations service the City of Santa Rosa; one station is owned by the Roseland Fire Protection District. The fire department provides the full spectrum of emergency services to the city limit area and the Roseland Fire Protection District. Automatic aid agreements exist between the City and the Rincon Valley Fire Protection District. The fire department provides emergency medical skills

common in the fire service. All personnel are trained to at least the "First Responder" level. Paramedicine is not provided. Average response time within the city limits is 4 minutes.

City of Rohnert Park

The Department of Public Safety provides police and fire related services as a combined operation in Rohnert Park. The Department currently operates under mutual aid agreements with Sonoma County and all its cities and fire districts. The Department employs approximately 75 individuals (including police personnel) and utilizes about 35 volunteer firefighters. Fire calls had an average response time of 4.3 minutes in 1989.

City of Cotati

The Cotati Fire Protection District provides fire protection services in the Cotati area, including the City of Cotati and its Sphere of Influence, approximately 14 square miles. The service area population is about 10,000 for the District. The District operates under mutual aid agreements with Sonoma County and the cities of Rohnert Park and Petaluma.

The District provides fire protection services from one station in the downtown area of Cotati. Currently, the District employs a fire chief and two firefighters on a 24-hour basis and maintains a trained reserve firefighting force of 25 volunteer firefighters. The staff to population ratio is 0.3 firefighting officers to 1,000 population; including volunteer staff, the ratio is 2.8 firefighters to 1,000.

City of Sebastopol

The City of Sebastopol Fire Department responds to fires, calls for medical assistance, vehicle accidents, hazardous materials spills, and "public assists" within the limits of the City of Sebastopol. Fire department personnel consist of one full-time chief, a half-time secretary, and 34 volunteers. It operates out of one station near downtown Sebastopol.

City of Petaluma

Fire protection services, including inspection, fire suppression, and emergency medical response, are provided by the City of Petaluma Fire Department, which has three stations within the city limits. Its service area is approximately 13 square miles inside the incorporated limits of the City of Petaluma. Ambulance service is provided for approximately 165 square miles in and out of the incorporated boundaries of the city. The Fire Department currently operates under mutual aid agreements with Sonoma County and nearby cities, including

Santa Rosa, Cotati, Rohnert Park, Penngrove, and Novato. The Fire Department consists of 53 employees, including 27 firefighters, nine engineers, nine captains, one Fire Marshal, three Battalion Chiefs, one Fire Chief, one Fire Inspector, and two clerical staff. Currently, there are no volunteer personnel. Equipment comprises three first-out engines, two 1,500 gpm pumpers carrying 500 gallons of water and one 1,250 gpm pumper with elevated stream carrying 300 gallons of water. Two of the stations are staffed with ambulances that provide medical response for Petaluma and the surrounding area. Additional equipment includes a Battalion Chief's van and a rescue truck.

All on-duty firefighters are trained to EMT I levels. The ambulance service provides two paramedic-staffed Advanced Life Support (ALS) ambulances on a 24-hour basis. Back-up ambulances are provided either from the City of Sonoma, City of Novato, or the county ambulance from the Santa Rosa franchise area.

The Fire Department requires a 4-minute response time within its service area. Average response times within the city are four minutes for initial response and seven minutes for backup response. The City of Petaluma operates an Emergency Operation Center (EOC) for times of city-wide disasters, and it has a number of specific plans to deal with those operations within the city. It operates a city-wide emergency plan using the Incident Command System, as well as Management Operation Plans that guide various departments through critical operations during activation of the EOC.

Rincon Valley Fire Protection District

The Rincon Valley Fire Protection District provides emergency fire and medical services to its 125-square-mile territory, which encompasses unincorporated areas of Sonoma County from Windsor south to the Rohnert Park Expressway and from the Napa County line east to Oakmont.

The Rincon Valley Fire Protection District consists of 22 permanent and 64 volunteer or on-call personnel. The personnel includes 1 fire chief, 3 deputy or assistant chiefs, 3 battalion chiefs, 6 captains, 71 firefighters, and one non-fire force employee.

The Gold Ridge Fire Protection District

The Gold Ridge Fire Protection District provides all types of emergency services in the Sebastopol area, with the exception of hazardous materials, which are handled by the Sonoma County Department of Fire Services. The Gold Ridge District personnel consist of 3 full-time personnel, including 1 fire chief and 2 battalion chiefs, 3 part-time personnel, including 1 captain and 2 engineers, 90 volunteer firefighters, including 4 assistant chiefs, 15 captains, 30 drivers, and 41 firefighters, 15 explorer scouts, and 10 support personnel.

Geysers Reserve

The geysers area is a private, gated area with security at three gates; the other gates are locked. Fire protection is provided by Sonoma County out of Geyserville and the California Division of Forestry, in case of wildfires. An Emergency Response Plan and Incident Command Structure are in place in case of emergency (Doug Hackley, UNOCAL 1996).

Sonoma County

Eighteen fire protection districts provide fire protection, emergency medical, and rescue services within the County. Nineteen volunteer companies provide local services in rural communities. Two county service areas and a community service district also rely primarily on volunteer staffs. The County contracts with various municipal and district fire agencies to provide backup services to volunteer companies. The County has established a Department of Fire Services to coordinate the 52 service agencies in the county.

While the County generally has acceptable levels of service, problems have resulted from the condition of existing equipment and matching the type of equipment and staff training to the type of fire. The Department of Fire Services projects that the most pressing and costly needs involve person power. It anticipates a shift from volunteer supported services to an even greater reliance on paid personnel.

Marin County

There is a total of 11 fire protection districts in Marin County. These districts provide fire protection, inspection, emergency first aid, and paramedic services within the County.

Schools

The Project does not have direct impacts on the school system, the existing setting is not described with regard to schools.

Recreation

City of Santa Rosa

Within the City of Santa Rosa, there are over 434 acres of developed park land. The two general categories of parks are neighborhood (10 or less acres) and community (more than 10 acres). There are 36 neighborhood parks, eight community parks, and one regional park, Howarth Memorial. Recreational

facilities at these parks include two swimming pools, tennis courts, and hiking and bicycle trails. In addition, the Bennett Valley Golf Course and the Fountaingrove Golf Course are available for use by Santa Rosa residents. Joint use of school facilities for recreation activities occurs but is limited because of availability.

The City of Santa Rosa has the goal of acquiring approximately 6 acres of park and open space land per 1,000 persons in its General Plan. A total of 320 acres of new park land is proposed to be created within the city limits, including open space along creek corridors.

City of Rohnert Park

The City of Rohnert Park maintains 13 neighborhood and community parks, totaling 88 acres. Recreational facilities include four swimming pools, tennis courts located at neighborhood parks and on school grounds, two community centers, a recreation center, a sports center, and a senior center. In addition, the City has two golf courses called Mountain Shadows North and South. Outdoor facilities at Rohnert Park schools may also be used for recreational activities by the public.

City of Cotati

Within the City of Cotati, recreational opportunities are provided by the City, the Cotati-Rohnert Park Unified School District, and St. Joseph's Church. Nine parks presently exist within the city limits, and total park area is 26 acres.

The City of Cotati has a stated goal of one acre of parkland per 100 residents. The current parkland to population ratio of 1:200 is considered appropriate by the City since the 1:100 ratio may be difficult to achieve. The City Council is presently considering a 1.5-acre park where the City of Cotati Corporation Yard now exists.

City of Sebastopol

The City of Sebastopol maintains five parks with a total area of 23 acres. Recreational facilities include a community center, a swimming pool, and a new County-maintained bicycle and walking trail that begins at Petaluma Avenue and extends to the City of Santa Rosa.

The four public school campuses and the Ragle Ranch Regional Park, operated by the Sonoma County Regional Parks Department, are also available for recreational use in the City of Sebastopol area. City-owned open space areas for proposed passive recreation use, including biking and hiking trails, consist of the Laguna Open Space along the Laguna de Santa Rosa, Railroad Forest, and Barlow Field.

In 1994, the City of Sebastopol had a ratio of 1 acre of parkland per 323 persons. The 1994 General Plan adopted a park standard of 1 acre per 200 persons. The projected buildout population of 8,669 persons will require another 20.8 acres of park to meet the standard established above. The City of Sebastopol proposes to acquire another 19.3 acres of additional park within the city limits and its sphere of influence, consisting of six discrete neighborhood parks. Approximately 264 acres of open space area has also been proposed, including additional area around Ragle Ranch Regional Park and the Laguna de Santa Rosa.

The Russian River

Recreational opportunities available on the Russian River include fishing, boating, swimming, and shore activities. Swimming or rafting in the Russian River is allowed between Memorial Day and Labor Day. Fishing season runs from October through March. Sonoma County has a County Park at Steelhead Beach, downstream from the proposed Project discharge point. The County also has boat access at Forestville and Wohler Bridge which is located immediately upstream from Mark West Creek.

Sonoma County

Sonoma County maintains 34 parks and 7 marina and launch facilities. Fourteen of the parks are regional parks that combined, have a total acreage of approximately 4,250. Park facilities overall consist of trail systems, athletic fields and courts, picnic areas, playgrounds, open space, and beach and/or boat ramp access.

Annadel State Park is located at the eastern edge of the City of Santa Rosa in Sonoma County. Encompassing nearly 5,000 acres, it contains 35 miles of trail, Lake Ilsanjo, and picnic areas. Jack London State Historic Park is located to the south of Annadel State Park.

Marin County

Marin County parks are managed by the Marin County Department of Parks, Open Space, and Cultural Services. The department maintains 12 county parks, consisting of beach parks, regional and community parks, and boat launch and fishing access. Various park facilities include trail systems, picnic areas, athletic fields and courts, playgrounds, and open space. The County also maintains paved pathways throughout the county for use by bicyclists and pedestrians.

Public Utilities

Water and Sewer

Sonoma County

The Sonoma County Water Agency (SCWA) is a special district created in 1949, with the responsibility to produce and furnish surface water and groundwater, to control flood waters, to generate electricity, and to provide recreational facilities in connection with the SCWA's facilities. In 1994, legislation was passed that added the disposal of wastewater in County areas to the SCWA's overall responsibilities (SCWA 1995).

Approximately 325,000 people in Sonoma and Marin counties are served by the SCWA as the primary provider of potable water. The SCWA also provides supplemental potable water to an additional 170,000 people in the Marin Municipal Water District service area. The main source of water to the SCWA system is the Russian River. Principal tributaries of the Russian River are the East Fork of the Russian River, Big Sulphur Creek, Mark West Creek, Maacama Creek, Dry Creek, and the Eel River. Three reservoirs, Lake Pillsbury, Lake Mendocino, and Lake Sonoma, provide the water supply storage for the Russian River Basin (SCWA 1995).

The SCWA's water system includes Russian River diversion and chlorination facilities and an aqueduct system consisting of pipelines, pumps, and storage tanks. In addition, the SCWA water system has five Ranney collector wells, five infiltration ponds, sixteen steel water storage tanks, ten vertical turbine pumps, and five booster pumping stations (SCWA 1995).

As of 1995, the highest peak-month demand experienced by the SCWA was 75.5 mgd (average daily pumping during the month), which occurred in July 1994. In 1974, The SCWA entered into an agreement with the cities of Santa Rosa, Cotati, Petaluma, and Rohnert Park and with the Forestville, North Marin, and Valley of the Moon water districts. Under this agreement, each of the water contractors identified above have certain fixed water delivery entitlements.

Within the County, two agencies regulate the water and wastewater systems - the Regional Water Quality Control Board and the State Department of Health and Safety. Wastewater management services are provided by various agencies, including County Service Areas, County Sanitation Districts, Municipal Agencies, and Independent Sewer Districts.

City of Santa Rosa

The City of Santa Rosa has a water delivery entitlement of approximately 13,033 million gallons per year from the SCWA aqueduct system. Current use by the City is 7,046 million gallons per year (54 percent of entitlement). This water is under the jurisdiction of the City of Santa Rosa Utilities Department which owns and operates the water distribution system within the City's Urban Boundary. The City also provides service to the South Park Sanitation District, which includes the unincorporated Roseland area and land on either side of Highway 101. The City of Santa Rosa provides water service to approximately 41,000 customers, and this service consists of wholesale purchase and subsequent resale to the customers and the operation and maintenance of the water distribution system. The wastewater service consists of the industrial waste program, the collection and treatment of wastewater, and disposal of reclaimed water and sludge.

The City of Santa Rosa Utilities Department owns eight emergency standby wells within the city limits. The City has an allotment from the SCWA of 50 mgd, and current peak month demand is 30 mgd. Average daily water supply demand is expected to increase from 19.3 mgd to about 36.7 mgd in the year 2010, requiring an increase in maximum monthly withdrawal from the SCWA from 50 mgd to 56.6 mgd.

In 1994, agricultural irrigation utilized 55 percent of the annual reclaimed water flow produced by the Laguna Plant. The City of Santa Rosa Utilities Department supplies non-potable water to 55 private customers (4,226 total acres) and seven municipal customers (1,123 total acres) for a total acreage of 5,349. Please refer to Chapter 3, Description of the Existing System and Alternatives (Project Description) for a discussion of the existing wastewater system.

City of Rohnert Park

The water supply for the City of Rohnert Park is provided by 36 wells, 11 connections to the SCWA aqueduct, and five water storage tanks. Approximately 80 percent of the City's water supply is from the wells, and the remaining 20 percent is taken from the SCWA aqueduct. Total water use in the City of Rohnert Park has grown since 1975 from 0.67 billion gallons per year to 1.93 billion gallons per year in 1991. This increased demand has been met primarily from groundwater and to a lesser extent from the SCWA aqueduct.

City of Rohnert Park wastewater is treated and disposed of by the City of Santa Rosa Subregional Wastewater System. A 24-inch interceptor sewer main delivers the wastewater to the Laguna Plant from the Rohnert Park Wastewater Pump Station via the north banks of Hinebaugh Creek and the Laguna de Santa Rosa. The City of Rohnert Park's entitlement in the Subregional Wastewater System is

3.12 mgd. In 1992, the City allocated the last remaining wastewater treatment capacity available within its entitlement.

City of Cotati

The City of Cotati obtains water from the SCWA aqueduct and three City wells. Water use in 1994 was 70 percent aqueduct water and 30 percent well water. The City of Cotati entitlement from the SCWA is 1.7 mgd, and current use of the aqueduct is 1.19 mgd. City well capacity is 1 mgd, and current use of the wells is at 0.4 mgd. The City of Cotati plans to replace an existing storage tank with a 1-million-gallon steel water storage reservoir. The City is negotiating with the SCWA to increase its entitlement from 1.7 mgd to 2.6 mgd. There are no non-potable water customers.

The City wastewater facilities consist of gravity sanitary sewer collection lines that connect to the City of Rohnert Park collection system with eventual discharge to the City of Santa Rosa Laguna Plant. The daily entitlement is 0.624 mgd (average dry weather flow [ADWF]). City of Cotati daily discharge is approximately 0.582 mgd (ADWF), approximately 93 percent of the entitlement. The City of Cotati proposes to improve the collection system by constructing the Helman Lane Sanitary Sewer Interceptor which will by-pass the City of Rohnert Park collection system (scheduled to begin construction in July 1996). With the proposed expansion of the wastewater treatment and disposal facilities under the Subregional Wastewater Project, the City of Cotati anticipates additional entitlement which will allow the proposed growth included in the City of Cotati General Plan projections.

City of Sebastopol

Water service to residents and businesses is provided by the City of Sebastopol. The City has four wells, one of which is inactive because of groundwater contamination. The City maintains three water storage reservoirs with a total capacity of 7 million gallons. The City's total water use increased by 32 percent from 1981 to 1991 while the average per capita use has increased by 8 percent during this period of time.

The City also provides sewer collection service for areas within the city limits. The City contracts with the City of Santa Rosa for sewage treatment at the Laguna Plant. The City of Sebastopol's entitlement is 0.84 mgd, which was increased in 1989 from 0.70 mgd, a result of the expansion of the sewage treatment plant. In 1991, the City of Sebastopol used approximately 73.7 percent of its total sewer entitlements. There is sufficient sewer capacity to accommodate the anticipated buildout within the city. There is, however, insufficient sewer capacity to accommodate the potential buildout within the Sphere of Influence.

City of Petaluma

Water service is provided by the City of Petaluma. The City purchases its water from the SCWA, but also has a well-field that is used as an emergency back-up system as well as to irrigate athletic fields and parks.

The City of Petaluma's existing wastewater facilities include a wastewater treatment plant on Hopper Street operated by Wheelabrator Envirotech Operating Services and oxidation ponds on Lakeville Highway. Because the existing system has been determined inadequate to meet the needs of the community, the City is in the process of studying possible alternatives to meet projected future needs.

Small Water Systems

The unincorporated part of the County has numerous small water providers located throughout the County utilizing groundwater as a source of potable water.

Individual Systems

The unincorporated areas of both Marin and Sonoma Counties receive water from individual wells and treat wastewater via individual septic systems.

Solid Waste

Cities of Santa Rosa, Rohnert Park, and Petaluma

In the cities of Santa Rosa, Rohnert Park, and Petaluma, the refuse and recycling hauling services are provided by Empire Waste Management, which also provides these services to unincorporated areas of Sonoma County. Empire Waste Management utilizes a landfill operated by the County of Sonoma Public Works Department. It hauls between 1,000 and 1,500 tons per day of refuse and recyclables.

Cities of Cotati and Sebastopol

The cities of Cotati and Sebastopol have a contract with Larry's Sanitary Service to provide refuse and recycling collection under terms of franchise agreements. Larry's Sanitary Service also provides these services to the unincorporated areas immediately adjacent to the cities as well as the rural area in southern Sonoma County under a franchise administered by the County of Sonoma. Refuse is deposited at the Sonoma County Central Landfill, and collected recyclables are processed at the Larry's Sanitary Service facility on Gravenstein Highway South.

Sonoma County

Sonoma County, in cooperation with the cities in the County, prepared and adopted a County Solid Waste Management Plan, which was most recently revised in 1985. The County Plan is the principal planning document for solid waste management in the County. Issues pertaining to solid waste management include the need to expand or replace the Sonoma County Central Landfill, the need to accommodate the sludge disposal needs of wastewater treatment facilities serving both the cities and the unincorporated areas, and reduction of the quantity of waste deposited in landfills through additional emphasis on recycling.

Currently, the Central Landfill is expected to last until 2005-2007, based on the provisions of California Integrated Waste Management Act of 1989 (AB 939). Meanwhile the County of Sonoma is in the process of evaluating possible sites for a new landfill. The Central Landfill, a Class III landfill, has an Operating Permit for Facilities Receiving Solid Waste issued by the Sonoma County Health Department to receive residential, commercial, industrial, and agricultural waste as well as sludge, construction/demolition debris, liquid, tires, street sweepings, and wood waste. The Central Landfill does not accept hazardous or infectious waste. The Central Landfill's service area includes Rohnert Park, Santa Rosa, Cotati, Petaluma, and Sebastopol, and the County.

Currently 33 percent of sludge produced at the Laguna Plant is utilized for land application and the remainder is disposed of at the Central Landfill. Within the next five years 50 percent of the sludge from the plant will be land applied, while remaining will be processed at the Laguna Treatment Plant's Compost Facility (as part of the Santa Rosa Subregional Sludge Beneficial Use Project).

Public Services, Utilities, and Recreation Goals, Objectives, and Policies

Table 4.16-1 identifies goals, objectives, and policies for public services, utilities, and recreation which provide guidance in relation to Project activities. The table also indicates which criteria in the Public Services, Utilities, and Recreation Section are responsive to each set of policies.

Table 4.16-1

General Plan Goals, Objectives and Policies - Public Services, Utilities, and Recreation

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Sonoma County General Plan	Open Space Element	Goal OS-7 Objective OS-7.1	Provide for adequate parklands and trails to meet future recreational needs of the County's residents while protecting agricultural uses	1
Sonoma County General Plan	Public Facilities Element	Objective PF-1.1 Policy PF-1a Policy PF-1b	Plan for water supply and wastewater management facilities adequate to serve the growth projected in the general plan	1
Sonoma County General Plan	Public Facilities Element	Goal PF 2 Objective PF-2.1 Policy PF-2a Policy PF-2	Assure that park and recreation; public education; fire suppression, emergency medical and solid waste services; and public utility sites are available to meet future needs of county residents in accordance with projected growth	1
Santa Rosa General Plan	Public Services and Facilities Element	Goal PSF-2	Provide recreation and park facilities and services needed by different neighborhoods and by various segments of the population	1
Santa Rosa General Plan	Public Services and Facilities Element	Goal PSF-8	Expand the water supply through an increase in maximum monthly withdrawal from the Sonoma County Water Agency	1
Santa Rosa General Plan	Public Services and Facilities Element	Goal PSF-11	Tie wastewater treatment plant expansion to population growth	1

Table 4.16-1

General Plan Goals, Objectives and Policies - Public Services, Utilities, and Recreation

Adopted Plan Document	Document Section	Document Numeric Reference	Policy	Relevant Evaluation Criteria[1]
Santa Rosa General Plan	Public Services and Facilities Element	Goal PSF-14 Objective PSF-14a Objective PSF-14b	Provide for citizen safety through expedient response to emergency calls; a system of fire protection which will control the spread of fire and limit the threat to property; and maintain an efficient, well-trained police force	1, 2

Source: Harland Bartholomew & Associates, Inc., 1995

Note:
1. The evaluation criteria are in Table 4.16-2.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

Table 4.16-2

Evaluation Criteria with Point of Significance - Public Services, Utilities, and Recreation

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will the Project increase demand for police, fire, park and recreation facilities, water, sewage treatment and disposal or solid waste removal to such a degree that accepted service standards are not maintained?	Ratio of service personnel or facilities to population; ratio of park acreage to population	Greater than 0 change in the ratio	General Plans of the Cities of Cotati, Petaluma, Rohnert Park, Sebastopol, and Santa Rosa; General Plan of Sonoma County

Table 4.16-2

Evaluation Criteria with Point of Significance -
Public Services, Utilities, and Recreation

Evaluation Criteria	As Measured by	Point of Significance	Justification
2. Will Project construction disrupt police, fire, schools, parks and recreation facilities, water, sewage treatment and disposal, or solid waste removal to such a degree that accepted service standards are not maintained?	Change in response times or distance away from Project construction	Greater than 0 change in the ratio, or within 500 feet of construction	General Plans of the Cities of Cotati, Petaluma, Rohnert Park, Sebastopol, and Santa Rosa; General Plan of Sonoma County

Source: Harland Bartholomew & Associates, Inc., 1996

METHODOLOGY

A questionnaire was developed for each public service and utility that might be impacted by the proposed Project. The questionnaire was sent out in letter form, along with a summary Project description, requesting information about the kinds and levels of service provided by the service or utility and soliciting comment about potential impacts that the proposed Project might have. Written responses were requested although verbal responses over the telephone were taken. Where a response was not received within one month of the initial request, a phone call was made to the agency or utility company and a response obtained.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Table 4.16-3

Public Services, Utilities, and Recreation Impacts by Component-
No Action (No Project) Alternative

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
16.1.1. Will the No Action Alternative increase demand for police, fire, park and recreation facilities, water, sewage treatment and disposal or solid waste removal to such a degree that accepted service standards are not maintained?	Greater than 0 change in the ratio	Greater than 0 change in the ratio	O&M	●
16.1.2. Will Project construction disrupt police, fire, schools, parks and recreation facilities, water, sewage treatment and disposal, or solid waste removal to such a degree that accepted service standards are not maintained?	Project facility construction within 500 ft of police or fire stations, schools, parks, or other public service or utility.	There is no Project facility construction.	C	--

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:

1. Type of Impact:		2. Level of Significance:
O&M	Operation and Maintenance	● Significant impact before and after mitigation
C	Construction	-- Not Applicable

Impact: **16.1.1. Will the No Action Alternative increase demand for public services, utilities, and recreation to such a degree that accepted service standards are not maintained?**

Analysis: *Significant; Alternative 1.*

The Subregional System is currently under a cease and desist order from the North Coast Regional Water Quality Control Board because of inadequate sewage treatment and disposal capacity. If a Long-Term Project is not selected, the capacity of the system will remain out of compliance with its original NPDES permit, even as the population continues to grow. Eventually, the Regional Board will issue a moratorium on new connections. Until then, the existing situation will continue to degrade.

Mitigation: No mitigation is proposed. .

Impact: **16.1.2. Will construction of the No Action Alternative disrupt public services, utilities, and recreation?**

Analysis: *No Impact; Alternative 1.*

The No Action Alternative will not involve any construction activity and will not have any construction impacts.

Mitigation: No mitigation is needed.

Headworks Expansion Component

Impact: **16.2.1-2. Will the headworks expansion component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?**

Analysis: *No Impact; All Alternatives.*

Construction of this component will have no impact on emergency response times for fire and police services. The headworks expansion does not require any additional public services, utilities, or recreational facilities. The ratio of service personnel or facilities to population will not change.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is needed.

Urban Irrigation Component

Impact: **16.3.1-2. Will the urban irrigation component impact public services, utilities and recreation based on evaluation criteria 1 and 2?**

Analysis: *No Impact; All Alternatives.*

No construction is involved with the urban irrigation component. This component involves only replacement of existing water sources with reclaimed water in existing irrigation systems. It will not result in any changes to service providers, population, schools or recreation.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.16-4

Public Services, Utilities, and Recreation Impacts by Component - Pipelines

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
16.4.1. Will the pipeline component increase demand for police, fire, park and recreation facilities, water, sewage treatment and disposal or solid waste removal to such a degree that accepted service standards are not maintained?	Greater than 0 change in the ratio	No change in the ratio	O&M	==
16.4.2. Will the pipeline construction component disrupt police, fire, schools, parks and recreation facilities, water, sewage treatment and disposal, or solid waste removal to such a degree that accepted service standards are not maintained?	Project facility construction within 500 ft of police or fire stations, schools, parks, or other public service or utility.	Pipelines are adjacent to fire stations and schools.	C	⊙

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:
1. Type of Impact:
O&M Operation and Maintenance
C Construction

2. Level of Significance:
● Significant impact before and after mitigation
⊙ Significant impact; less than significant after mitigation
== No Impact

Impact: **16.4.1. Will the pipeline component increase demand for public services, utilities, and recreation to such a degree that accepted service standards are not maintained?**

Analysis: *No Impact; All Alternatives.*

The pipelines will be placed within public rights-of-way. The City of Santa Rosa will obtain an easement for the pipelines within these rights-of-way.

The pipelines are underground and do not require any public services, utilities, or recreational facilities. The pipeline component does not change the ratio of service personnel or facilities to population.

Alternatives 1 and 5B do not have a pipeline component.

Mitigation: No mitigation is needed.

Impact: **16.4.2: Will the pipeline component construction disrupt public service, and utilities, and recreation to such a degree that accepted service standards are not maintained?**

Analysis: *Significant; Alternatives 2, 3, 4, and 5A.*

Construction of the Sebastopol irrigation pipelines will occur within 500 feet of the fire station located at Pleasant Hill Road and Water Trough Road. Construction of Urban Irrigation pipelines will occur within 500 feet of two fire stations. The Bennett Valley pipeline runs near a fire station located on Douglas Drive and Yalupai Avenue. The Fountaingrove pipeline passes directly in front of a fire station located on Stony Point Road, south of College Avenue.

Pipeline construction will also occur within 500 feet of numerous schools for Alternatives 2, 3, and 4. Disruption of traffic related to schools is analyzed in Section 4.11, Transportation.

Measures 2.2.16, Emergency Response Vehicles Will Not Be Impeded; 2.2.17, Maintain Maximum Number of Open Lanes on Roadways; and 2.2.20, Access to Businesses and Residences, all adopted as part of the Project, will minimize delays in police and fire emergency response and reduce disruption of schools. However, pipeline construction occurring immediately in front of a fire station or school will still result in significant delays and disruption.

No Impact; Alternatives 1 and 5B.

These alternatives do not have a pipeline component.

Mitigation: *Alternatives 2, 3, 4, and 5A.*

2.4.9. Construction Noise Control Measures.

2.4.14. Coordinate Alternative Fire Response Service.

Alternatives 1 and 5B. No mitigation is needed.

After Mitigation: *Less than Significant after Mitigation; Alternatives 2, 3, 4, and 5A.*

Timing of construction, and other noise control measures will minimize noise impacts on schools. Coordination of fire response will ensure that adequate capacity for response to fires is maintained throughout construction.

Storage Reservoir Component

Impact: 16.5.1-2. Will the storage reservoir component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?

Analysis: *No Impact; All Alternatives.*

Storage reservoir construction will not occur within 500 feet of a police or fire station, public service or utility provider, school, or park. Construction of this component will have no impact on emergency response times for fire and police services. As proposed, the storage reservoirs will not be annexed by the City. Emergency response will be provided by the County of Sonoma. The reservoir sites will be fenced with an alarm and signs prohibiting trespass.

The storage reservoirs will have a very low risk of requiring either police or fire protection and do not require any increase in existing public services, utilities, or recreational facilities. The storage reservoir component will not change the ratio of service personnel or facilities to population.

Alternatives 1, 4, and 5 do not have a storage reservoir component.

Mitigation: No mitigation is needed.

Pump Station Component

Impact: **16.6.1-2. Will the pump station component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?**

Analysis: *No Impact; All Alternatives.*

Pump station construction will not occur within 500 feet of a police or fire station, public service or utility provider, school or park. Construction of this component will have no impact on emergency response times for fire and police services. As proposed, the pump station property will not be annexed into the City of Santa Rosa. Emergency response will be provided by the County of Sonoma. The pump stations will be fenced with an alarm and signs prohibiting trespass.

The pump stations will have a very low risk of needing either police or fire protection and do not require any increase in existing public services, utilities, or recreational facilities. Also, the pump station component does not cause any increase in population or otherwise change the ratio of service personnel or facilities to population.

Alternatives 1 and 5 do not have a new pump station component.

Mitigation: No mitigation is needed.

Agricultural Irrigation Component

Impact: **16.7.1-2: Will the agricultural irrigation component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?**

Analysis: *No Impact; All Alternatives.*

Agricultural irrigation will take place on private property rather than City of Santa Rosa property. No special provisions regarding security will be required of the irrigation recipients. Irrigation of existing farmlands will not increase the need for any public services, utilities, or recreational facilities. In the event the contingency plan requires winter irrigation, there will be no impacts to public services, utilities and recreation. No construction will occur within 500 feet of a police or fire station, public service or utility provider, school or park. Construction of this component will have no impact on emergency response times for fire and police services.

Alternatives 1, 4, and 5 do not have an agricultural irrigation component.

Mitigation: No mitigation is needed.

Geysers Steamfield Component

Impact: 16.8.1-2: Will the geysers steamfield component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?

Analysis: *No Impact; All Alternatives.*

This component consists of two large holding tanks, pipeline, and conversion of existing geothermal wells into injection wells, all on private property within the geysers reserve. No construction will occur within 500 feet of a police or fire station, public service or utility provider, school or park. Construction of this component will have no impact on emergency response times for fire and police services.

The geysers area is a private, gated area with its own security system. The geysers facilities associated with this Project will have a very low risk of requiring either police or fire protection and do not require any increase in existing public services, utilities, or recreational facilities. Also, the geysers steamfield component will not change the ratio of service personnel or facilities to population.

Alternatives 1, 2, 3, and 5 do not have a geysers steamfield component.

Mitigation: No mitigation is needed.

Discharge Component

Impact: 16.9.1-2. Will the discharge component impact public services, utilities, and recreation based on evaluation criteria 1 and 2?

Analysis: *No Impact; All Alternatives.*

The discharge facilities along the Laguna de Santa Rosa are already annexed into the City of Santa Rosa. The discharge facility on the Russian River will be purchased by the City. Both will be fenced with an alarm and signs prohibiting trespass.

The discharge facilities will have a very low risk of needing either police or fire protection and do not require any increase in existing public services, utilities, or recreational facilities. The discharge component will not change the ratio of service personnel or facilities to population.

In the event the Contingency Plan requires additional discharge to the Russian River, there will be no impacts to public services, utilities and recreation. No construction will occur within 500 feet of a police or fire station, public service or utility provider, school or park. Construction of this component will have no impact on emergency response times for fire and police services.

Mitigation: No mitigation is needed.

CUMULATIVE IMPACTS

There are two impacts -- both significant -- identified in the Public Services section:

Impact: **16.1C. Will the Project plus cumulative projects increase demand for public services, utilities, and recreation to such a degree that accepted service standards are not maintained?**

Analysis: The No Project Alternative would mean that the Subregional System would not meet the existing demand for sewage treatment and disposal.

This impact is, by its nature, a reflection of the cumulative demand for wastewater facilities within the Subregional System. If no Project is constructed the system will not be able to meet existing needs or the cumulative wastewater disposal demand expected from planned growth.

Impact: **16.2C. Will the Project plus cumulative projects construction disrupt public services, utilities, and recreation to such a degree that accepted service standards are not maintained?**

Analysis: Pipeline construction for the Sebastopol and Urban Irrigation components will occur in the vicinity of fire stations and schools.

There is the possibility of cumulative impacts associated with other construction projects that may occur at the same time as the pipeline construction for the Long-Term Project. Measure 2.4.9, Construction Noise Control Measures, will address impacts for schools. Measure 2.2.16, Emergency Response Vehicles Will Not Be Impeded, will address potential cumulative impacts on fire services.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION

Table 4.16-5

Summary of Significant Impacts and Mitigation Measures - Public Services, Utilities and Recreation

Impact	Level of Significance	Mitigation Measure
No Action (No Project) Alternative		
16.1.1. The No Action Alternative may increase demand for police, fire, parks, and recreation facilities, water, sewage treatment and disposal, or solid waste to such a degree that accepted service standards are not maintained.	Alt 1 - ●	None
Pipeline Component		
16.4.2 The pipeline component may disrupt police, fire, schools, parks and recreation facilities, water, sewage treatment and disposal, or solid waste removal to such a degree that accepted service standards are not maintained.	Alts 2 - ⊙ Alt.3 - ⊙ Alt. 4 - ⊙ Alt. 5A - ⊙	2.4.9 - Construction Noise Control Measures 2.4.14 - Coordinate Alternate Fire Response Service.

Source: Harland Bartholomew & Associates, Inc. 1996

Notes: Level of Significance:

● Significant impact before and after mitigation

⊙ Significant impact before mitigation; less than significant impact after mitigation

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.16-6

Summary of Impacts by Alternative - Public Services

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	●	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	==	==	==	==	==	==	==	==	==	==	==	==
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	--
Storage Reservoirs	--	==	==	==	==	==	==	==	==	==	--	--	--
Pump Stations	--	==	==	==	==	==	==	==	==	==	==	--	--
Agricultural Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	==	--	--
Discharge	--	==	==	==	==	==	==	==	==	==	==	==	==

Source: Harland Bartholomew & Associates, Inc., 1996

Notes: Level of Significance Codes

-- Not applicable
● Significant impact before and after mitigation
== No impact
⊙ Significant impact; less than significant after mitigation

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Jody Brown, Harland Bartholomew & Associates, Inc.
Rob Brueck, Harland Bartholomew & Associates, Inc.
Frank Wein, Harland Bartholomew & Associates, Inc.

Reviewers

Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Maile Deppe, Harland Bartholomew & Associates, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.
John Cummings, Ph.D., Peer Review Committee
David Zieger, Peer Review Committee

References

HBA Documents

None

Other References

CH2M Hill. 1993. *Santa Rosa Subregional Water Reclamation System Laguna Wastewater Treatment Plant, Advanced Treatment Upgrade and First Stage Expansion,* Technical Memorandum No. 8: Predesign-Solids Processing.

City of Sebastopol. 1994. *Sebastopol General Plan.*

City of Rohnert Park. 1994. *The General Plan, Second Draft.*

City of Santa Rosa Department of Community Development. 1990. *Santa Rosa 2010 General Plan.* July. With amendments to Nov. 94.

Earth Metrics, Inc. 1990. *City of Cotati General Plan Final Environmental Impact Report.*

PAS & Associates. 1992. *City of Sebastopol General Plan Background Report #3: Existing Plans, Environment & Infrastructure.*

City of Petaluma. 1995. *Petaluma Wastewater Facilities Project and Long-Range Management Program, Revised Draft EIR.*

Sonoma County Water Agency. 1995. *Russian River Activities Workshop Staff Report.*

Consultation and Coordination

Persons Contacted

Veronica Berlin, Marin County Department of Parks, Open Space and Cultural Services

Dara, Marin County Fire Protection

Terry, Marin County Sheriff's Department

Anna McBride, Sonoma County Parks Department

Correspondence

Letters Sent

Letter to Warren Salmons, City of Petaluma, City Manager's Office, 21 August 1995.

Letter to Warren Salmons, City of Petaluma, City Manager's Office, 5 September 1995.

Letter to Jim Flugum, Sonoma County Water Agency, 19 May 1995.

Letter to Dick Grube, Fire Chief, Rancho Adobe Fire Protection District, 19 May 1995.

Letter to Dick Grube, Fire Chief, Rancho Adobe Fire Protection District, 27 July 1995.

Letter to Vern Losh, Sonoma County Department of Fire Services, 19 May 1995.

Letter to Jim Pekkain, City of Rohnert Park, Recreation Department, 13 June 1995.

Letter to Patrick Rooney, Director, City of Rohnert Park, Department of Public Safety, Police, and Fire, 19 May 1995.

Letter to the Office of Education, Sonoma County Schools, 19 May 1995.

Letter to the County of Sonoma Parks Department, 13 June 1995.

Letter to the City of Petaluma Police Department, 19 May 1995.

Letter sent to the City of Cotati Public Works Department, 19 May 1995.

Letter sent to Empire Waste Management, 19 May 1995.

Letter sent to City of Sebastopol, Water and Sewer Department, 19 May 1995.

Letter sent to the South Park Sanitation District, 19 May 1995.

Letter sent to Lt. Dan Dragos, Sonoma County Sheriff's Department, 19 May 1995.

Letter sent to the City of Rohnert Park Utilities Department, 19 May 1995.

Letter sent to Cotati Police Department, 19 May 1995.

Letter sent to the City of Petaluma, Department of Public Works, 19 May 1995.

Letter sent to the Sonoma County Department of Public Works, Refuse Disposal Sites, 19 May 1995.

Letter sent to the City of Sonoma Water Department, 19 May 1995.

Letter sent to Dick Rowland, Public Works Director, City of Sonoma Water Department, 20 June 1995.

Letter sent to the City of Santa Rosa, Recreation and Parks Department, 13 June 1995.

Letter sent to Susan Kelly, City of Sebastopol Public Works Department, 13 June 1995.

Letter sent to the City of Sebastopol Public Works Department, 19 May 1995.

Letter sent to the City of Sonoma Police Department, 19 May 1995.

Letter sent to the City of Sebastopol, Police Department, 19 May 1995.

Letter sent to the Goldridge Fire Protection District, 19 May 1995.

Letter sent to the Santa Rosa Fire Department, 19 May 1995.

Letter sent to the City of Sebastopol Fire Department, 19 May 1995.

Letter sent to the City of Sonoma Fire Department, 19 May 1995.

Letter sent to Larry's Sanitary Service, 19 May 1995.

Letter sent to City of Santa Rosa Utilities Department, 19 May 1995.

Letter sent to the City of Santa Rosa Recreation and Parks Department, 13 June 1995.

Letter sent to the Santa Rosa School District, 19 May 1995.

Letter sent to Cotati-Rohnert Park Unified School District, 19 May 1995.

Letter sent to Sebastopol Union School District, 19 May 1995.

Letter sent to Sonoma Valley Unified School District, 19 May 1995.

Letter sent to the Petaluma School District, 19 May 1995.

Letters Received

Letter received from Susan Kelly, Public Works Analyst, City of Sebastopol, Public Works Department, 26 May 1995.

Letter received from Gene Beatty, Director of Public Works, City of Petaluma, 29 June 1995.

Letter received from Captain Robert Stewart, Cotati Police Department, 30 June 1995.

Letter received from Dwight Crandall, Chief of Police, City of Sebastopol Police Department, 1 June 1995.

Letter received from Gene Beatty, Assistant City Manager, City of Petaluma, for Police Services, 26 June 1995.

Letter received from Lt. Dan Dragos, County of Sonoma Sheriff's Department, 12 July 1995.

Letter received from Steve Marler, Assistant Chief, City of Sonoma Fire Department, 5 June 1995.

Letter received from Kent Reynolds, Fire Chief, Gold Ridge Fire Protection District, 25 June 1995.

Letter received from John Zanzi, Fire Chief, City of Sebastopol Fire Department, 15 June 1995.

Letter received from Douglas Williams, Assistant Chief/Fire Marshal, Rincon Valley Fire Protection District, 19 June 1995.

Letter received from Vernon Losh, Deputy Chief/Fire Marshal, County of Sonoma Department of Emergency Services, 11 August 1995.

Letter received from Richard Johnson, Larry's Sanitary Service, Inc., 31 May 1995.

Letter received from Miles Ferris, Director of Utilities/City Engineer, City of Santa Rosa Utilities Department, 20 June 1995.

Letter received from Gary Negri, Sergeant, City of Santa Rosa Police Department, 22 June 1995.

Letter received from Robert Peterson, Deputy Fire Chief, City of Santa Rosa Fire Department, 24 May 1995.

Letter received from Ray Holmes, Division Manager, Empire Waste Management, 28 June 1995.

Letter received from Paul Schoch, City Engineer, City of Cotati, for Water and Sewage, 31 May 1995.

Letter received from Richard Rowland, Public Works Director, City of Sonoma Public Works Department, 5 July 1995.

Letter received from James Pekkain, Director of Recreation, City of Rohnert Park, Recreation Department, 19 July 1995.

Letter received from Chuck Rust, Director, City of Santa Rosa Recreation and Parks Department, 16 June 1995.

Letter received from Terry Krout, Fire Chief, City of Petaluma Fire Department, 19 September 1995.

Letter received from Leanne Myers, District Secretary, Sebastopol Union School District, 27 June 1995.

Letter received from Marilyn Kelly, Superintendent, Sonoma Valley Unified School District, 27 June 1995.

Telephone/Fax

Telephone response from John Gurney, Chief of Police, City of Sonoma Police Department, 22 June 1995.

Telephone and fax response from Jean Calsy, Santa Rosa School District, 18 July 1995.

Fax response from Cotati-Rohnert Park Unified School District, 26 June 1995.

Fax response from Cathy Marello, Petaluma School District, 7 July 1995.

Telephone response from Officer Ziese, California Highway Patrol, Santa Rosa Area, 21 February 1996.

Fax response from Terry Bastida, Sherriff's Secretary, Marin County Sherriff's Department, 29 April 1996.

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4.17 ENERGY

This section discusses the Project's operational energy requirements. For comparison, existing energy use of the Subregional System is described.

IMPACTS EVALUATED IN OTHER SECTIONS

The following items are related to the Energy Section but are evaluated in other sections of this document.

- Cost of Energy. The cost of energy during Project operation and maintenance is included in costs shown in Section 3.5 in the Description of Existing System and Alternatives (Project Description).

AFFECTED ENVIRONMENT (SETTING)

Laguna Plant Operations

The current total annual energy consumption of the Laguna Plant is 17.4 million kilowatt hours (kwh); annual natural gas use is 4.5 million cubic feet. Of the electrical use, about 10.7 million kwh are used for general plant operations while approximately 7 million kwh are used for the existing irrigation distribution. In addition, the plant can use digester gas which is a by-product of treatment; the annual digester gas use is 73 million cubic feet. (Because digester gas energy content equals 60 percent of natural gas, this represents the equivalent of 43.8 million cubic feet of natural gas.) Gas powers 26 percent of the total plant energy requirements, with natural gas making up 10 percent of the total gas use at the plant (Scott Stinebaugh, City of Santa Rosa, personal communication 1993).

Geysers Operations

The geysers is the largest developed geothermal reservoir in the world. In 1994, 23 power plants operated in the geysers with an installed capacity of approximately 1,896 megawatts (mw) (Geysers Geothermal Association 1995). Approximately 600 production and injection wells have been drilled; about 450 of these are currently in use (Doug Hackley, UNOCAL, personal communication, June 1995). Reservoir engineers recognize that providing additional water to the reservoir Project prolong the ability to generate steam and consequently produce increased power.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

Table 4.17-1

Evaluation Criterion with Point of Significance - Energy

Evaluation Criterion	As Measured by	Point of Significance	Justification
1. Will the Project require more energy than providers could deliver?	Report of energy providers	If energy providers indicate they cannot supply project	Requiring energy providers to construct new generating facilities to meet Project demand Project result in substantial energy use.

Source: Parsons Engineering Science, Inc. 1996.

METHODOLOGY

Implementation of the Project will involve energy expenditures for treatment plant and pump station operations. This energy analysis focuses on the amount of energy required to pump treated water from the Laguna Plant to storage reservoirs, irrigation areas, the geysers, or aquifer storage and recovery areas. Although each component may require small amounts of energy, the primary use of energy is for pumping. Therefore, all analysis is based on energy demand for pumping reclaimed water.

Tables 3.3-4 and 3.3-5 in Chapter 3 list the pump stations associated with each alternative. Pumping requirements were based on the distance and the amount of water to be transported. The technical memorandum *Energy Demand of Alternative Projects* (Parsons Engineering Science, Inc. 1995a) presents energy requirements for each pump summing them for each alternative. This section summarizes those calculations.

Construction energy is not calculated for each component, but measures have been adopted as part of the Project description to ensure that construction takes place in an energy-efficient way. Refer to Measure 2.2.25, Minimize/Reduce Fossil Fuel Consumption, in Chapter 2.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

No Action (No Project) Alternative

Table 4.17-2

Energy Impacts by Component - No Action (No Project) Alternative

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.1.1. Will the No Action Alternative require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	O&M	○

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
O&M Operation and Maintenance

2. Level of Significance:
○ Less than significant impact; no mitigation proposed

Impact: **17.1.1. Will the No Action Alternative require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternative 1.*

Operation of the Subregional System will require continued expenditure of energy. Energy providers are able to supply necessary electric service and natural gas for operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter dated September 29, 1995). Therefore, this impact is considered less than significant.

Mitigation: No mitigation is proposed.

Table 4.17-3

Energy Impacts by Component - Headworks Expansion

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.2.1. Will the headworks expansion component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	O

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
O Less than significant impact; no mitigation proposed

Impact: **17.2.1. Will the headworks expansion component may require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5.*

The expansion of the Laguna Plant headworks will result in increased energy. The increase will be an approximately 16 percent increase due to pumping requirements, raising energy use for general plant operations to approximately 12.4 million kwh and 5.2 million cubic feet of natural gas annually.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter 29 September 1995). Therefore, this impact is considered less than significant.

No Impact; Alternative 1.

Alternative 1 does not have a headworks expansion component.

Mitigation: No mitigation is proposed.

Urban Irrigation Component

Impact: **17.3.1. Will the urban irrigation component require more energy than energy providers could deliver?**

Analysis: *No Impact; All Alternatives.*

No new facilities need to be constructed to implement the urban irrigation component. Existing irrigation systems will use reclaimed water instead of their current source of water. Operation of the urban irrigation system does not require energy. The systems are dependent on the pumps to function; energy use of pumps is presented under pump station component later in this section.

Alternatives 1, 4, and 5 do not have an urban irrigation component.

Mitigation: No mitigation is needed.

Pipeline Component

Table 4.17-4

Energy Impacts by Component - Pipelines

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.4.1. Will the pipeline component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide None	C O&M	O ==

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
O Less than significant impact; no mitigation proposed
== No Impact

Impact: **17.4.1. Will the pipeline component require more energy than providers could deliver?**

Analysis: ***Construction***

Less than Significant; Alternatives 2, 3, 4, and 5A.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter September 13, 1995 and Craig Kennedy, PG&E, letter September 29, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1 and 5B.

Alternatives 1 and 5B do not have a pipeline component.

Operation and Maintenance

No Impact; All Alternatives.

Operation of the pipelines does not require energy because the pipelines are dependent on the pumps to function.

If a pipeline were to fail, no additional energy consumption will result. If the geysers pipeline were to rupture, steamfield injection will cease. Electricity generation at the geysers will not be impacted by a temporary (one year or less) interruption in injection.

Alternatives 1 and 5B do not have a pipeline component

Mitigation: No mitigation is proposed.

Storage Reservoir Component

Table 4.17-5

Energy Impacts by Component - Storage Reservoirs

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.5.1. Will the storage reservoir component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	O

Source: Parsons Engineering Science, Inc. 1996.

Notes: 1. Type of Impact:
C Construction
O&M Operation and Maintenance

2. Level of Significance:
O Less than significant impact; no mitigation proposed

Impact: **17.5.1. Will the storage reservoir component require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

Construction of the storage reservoirs will require energy. Operation of the reservoirs requires a small amount of energy for two functions: opening of the gate in the dam perhaps two to five times a year for maintenance and operating a small light near the ancillary facilities. Lights will not normally be on, but will be used if maintenance staff needed to visit the facility at night. This is estimated to require 40 kwh per year.

Energy providers are able to supply necessary electric service and natural gas for both construction and operation (Gary Quast, PG&E, letter 13 September 1995 and Craig Kennedy, PG&E, letter 29 September 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have a storage reservoir component.

Mitigation: No mitigation is proposed.

Pump Station Component

Table 4.17-6

Energy Impacts by Component - Pump Stations

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.6.1. Will the pump station component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	O

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
O Less than significant impact; no mitigation proposed

Impact: **17.6.1. Will the pump station component require more power than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2, 3, 4, and 5A.*

Construction of the pump stations will require energy. Operation of the pumps will also require energy as shown in Figure 4.17-1. The geysers pump stations will require the most energy consumption due to the distance (34 miles) and the elevation differential (3,200 feet).

At buildout, an average of 17.4 million gallons (MG) of reclaimed water would be pumped to the geysers daily. Over the course of a year, this would result in an annual average of 6,350 MG. Figure 4.17-1 indicates that it would take 103,100,000 kilowatt-hours (kwh) of energy annually or 282,500 kwh daily to transport this amount of reclaimed water to the geysers.

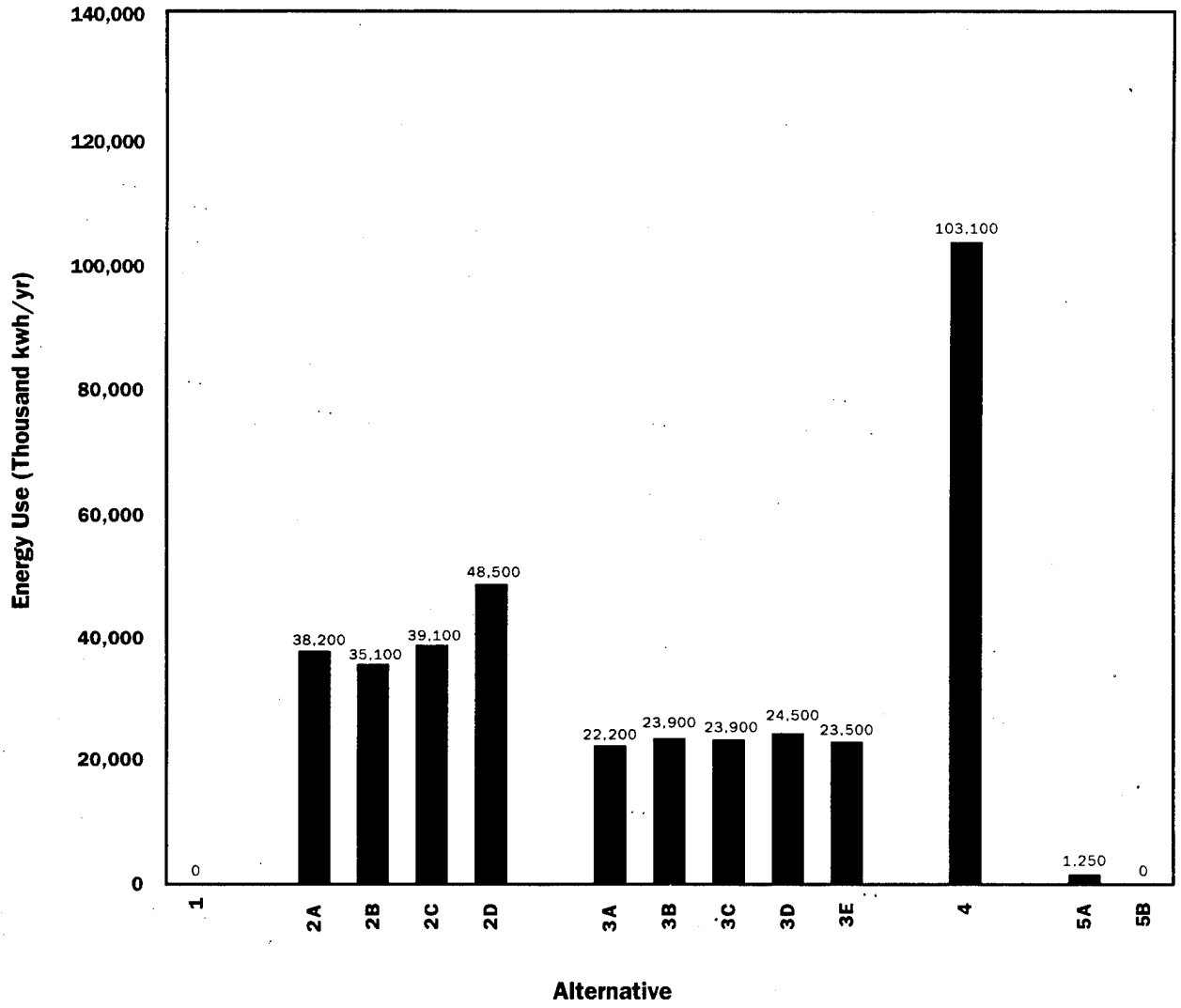
Preliminary engineering of the Project was performed to minimize energy use during operation. Measures to reduce energy use for pumping included a detailed analysis of transmission pipeline routes to reduce pumping distance and head. (Head refers to the elevation increase along a pipeline route; large increases in elevation along a pipeline require additional energy to pump the water up to the higher elevation). This analysis is discussed in the technical memorandum on *Transmission Pipeline Routes to Reservoir Sites* (Parsons Engineering Science, Inc. 1995b). Measures to reduce pumping include use of tunnels to reduce the amount of energy to pump water over high points in topography. The technical memorandum on *Transmission Pipelines to Storage, Tunnel Length Optimization Analysis* presents methods for determining when tunneling was warranted. Various pumping schedules were also evaluated to determine if off-peak pumping would be more energy efficient (see Technical memorandum on *Transport Pipeline Flowrate and Pumping Schedule Present Worth Analysis,* Parsons Engineering Science, Inc. 1995c). Measures to maximize energy efficiency have thus already been included in Project design.

Energy providers are able to supply necessary electric service and natural gas for construction and operation of the pump stations (Gary Quast 1995). Therefore, this impact is considered less than significant.

No Impact: Alternatives 1 and 5B.

These alternatives do not have a new pump station component.

Mitigation: No mitigation is proposed.



Source: Parsons Engineering Science

HARLAND BARTHOLOMEW & ASSOCIATES, INC.
PARSONS ENGINEERING SCIENCE, INC.
UNITS OF PARSONS INFRASTRUCTURE & TECHNOLOGY INC.
PARSONS

Santa Rosa
Subregional Long-Term Wastewater Project

ENERGY CONSUMPTION for ALTERNATIVES

Figure 4.17-1

Table 4.17-7

Energy Impacts by Component - Agricultural Irrigation

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.7.1. Will the agricultural irrigation component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C, O&M	○

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
○ Less than significant impact; no mitigation proposed

Impact: **17.7.1. Will the agricultural irrigation component require more energy than providers could deliver?**

Analysis: *Less than Significant; Alternatives 2 and 3.*

Operation of the agricultural irrigation system will require a small amount of energy for small pumps on individual properties (these small pumps were not included in the analysis of major pump stations above) both under normal operations and under Contingency Plan operation. This impact is considered less than significant.

Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer, PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

If accidental irrigation runoff were to occur, no additional energy consumption will result.

No Impact; Alternatives 1, 4, and 5.

These alternatives do not have an agricultural irrigation component.

Mitigation: No mitigation is proposed.

Geysers Steamfield Component

Table 4.17-8

Energy Impacts by Component - Geysers Steamfield

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.8.1. Will the geysers steamfield component require more energy than providers could deliver?	If energy providers indicate they cannot supply project	Can provide	C	○
		Can provide	O&M	+

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
○ Less than significant impact; no mitigation proposed
+ Beneficial impact

Impact: **17.8.1. Will the geysers steamfield component may require more energy than providers could deliver?**

Analysis:

Construction

Less than Significant; Alternative 4.

Construction of this component will require energy. Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer; PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Operation and Maintenance

Beneficial; Alternative 4.

Operation of the geysers steamfield component will not require additional energy, since the holding tanks are placed at the highest elevation, and all pipelines and injections wells are gravity fed from the holding tanks. Injection of the reclaimed water will allow the geysers operators to continue

use of the steamfield for electric generation. The geysers operators estimate they can generate approximately 58,000 kwh per million gallons of water injected (Doug Hackley, UNOCAL, personal communication, June 1995). Using this relationship, reclaimed water from the Project will generate 368,000,000 kwh of electricity per year, assuming wastewater infusion 24 hours per day. Comparing the 103,100,000 kwh energy consumption for the geysers pump stations with the energy production results in a net gain of 265,000,000 kwh per year, a 3.6 to 1 ratio of electricity produced to electricity used.

The Geysers Alternative will be a net generator of energy. Therefore, this impact is considered beneficial.

No Impact; Alternatives 1, 2, 3, and 5.

These alternatives do not have a geysers steamfield component.

Mitigation: No mitigation is proposed.

Discharge Component

Table 4.17-9

Energy Impacts by Component - Discharge

Evaluation Criterion	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
17.9.1. Will the discharge component require more energy than providers could deliver?	If energy providers indicate they cannot supply project			
• Russian River		Can provide	C	O
• Laguna		None	C	==
• Russian River or Laguna		None	O&M	==

Source: Parsons Engineering Science, Inc. 1996.

Notes:
1. Type of Impact:
C Construction
O&M Operation and Maintenance
2. Level of Significance:
== No impact
O Less than significant impact; no mitigation proposed

Impact: 17.9.1. Will the discharge component require more energy than providers could deliver?

Analysis: ***Construction***

Less than Significant; Alternative 5A.

Construction of the discharge components will require energy. Energy providers are able to supply necessary electric service and natural gas for construction and operation (Gary Quast, Senior Industrial Power Engineer, PG&E, letter September 13, 1995). Therefore, this impact is considered less than significant.

No Impact; Alternatives 1, 2, 3, 4, and 5B.

No construction is required for discharge to the Laguna.

Operation & Maintenance

No Impact; All Alternatives.

Operation of the discharge component is dependent upon the pumps to function. Energy requirements were presented above under pump stations.

Mitigation: No mitigation is proposed.

CUMULATIVE IMPACTS

Only one impact has been identified in the Energy section:

Impact: 17.1C. Will the Project plus cumulative project require more energy than providers could deliver?

Analysis: Although energy demand will increase substantially over the life of the Project, providers will keep pace with demand by installing new facilities. Any secondary impacts of new facilities cannot be predicted at this time, so no analysis is provided.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES

No significant impacts have been identified.

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.17-10

Summary of Impacts by Alternative - Energy

Component	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
No Action (No Project) Alternative	O	--	--	--	--	--	--	--	--	--	--	--	--
Headworks Expansion	--	O	O	O	O	O	O	O	O	O	O	O	O
Urban Irrigation	--	==	==	==	==	==	==	==	==	==	--	--	--
Pipelines	--	O	O	O	O	O	O	O	O	O	O	O	--
Storage Reservoirs	--	O	O	O	O	O	O	O	O	O	--	--	--
Pump Stations	--	O	O	O	O	O	O	O	O	O	O	--	--
Agricultural Irrigation	--	O	O	O	O	O	O	O	O	O	--	--	--
Geysers Steamfield	--	--	--	--	--	--	--	--	--	--	+	--	--
Discharge	--	==	==	==	==	==	==	==	==	==	==	O	==

Source: Parsons Engineering Science, Inc. 1996.

Notes: Level of Significance Codes

-- Not applicable

== No impact

O Less than significant impact; no mitigation proposed

\+ Beneficial impact

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparer

Li Boccia, Parsons Engineering Science

Reviewers

John Hake, Parsons Engineering Science, Inc.
Rich Maurer, Parsons Engineering Science, Inc.
Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Anders Hauge, Harland Bartholomew & Associates, Inc.
Robin Cort, Ph.D., Parsons Engineering Science, Inc.
John Cummings, Ph.D., Peer Review Committee
David Ziegler, Peer Review Committee

References

HBA Team Documents

Parsons Engineering Science, Inc. 1995a. *Energy Demand of Alternative Projects*. 15 September. (Appendix R-1).

Parsons Engineering Science, Inc. 1995b. *Transmission Pipeline Routes to all Reservoir Sites*. (Appendix D-25).

Parsons Engineering Science, Inc. 1995c. *Transport Pipeline Flowrate and Pumping Schedule Present Worth Analysis*. (Appendix D-29).

Other Documents

Geysers Geothermal Association. 1995. *An Update on the Geysers November 1994*. Geothermal Resources Council Bulletin. January.

Consultation and Coordination

Persons Contacted

Scott Stinebaugh, City of Santa Rosa, Utilities Operations Administrator, 1993.
Doug Hackley, UNOCAL, June, 1995.

Correspondence

Gary R. Quast, PG&E, Senior Industrial Power Engineer, 13 September 1995.
Craig Kennedy, PG&E, Major Account Representative, 29 September 1995.

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4.18 SOCIO-ECONOMICS

This section presents population estimates upon which wastewater flow projections were based. Existing and future population, housing, employment, and economic conditions are described. The impact analysis provides estimates for each alternative of increases in service charges and demand fees for wastewater services and describes numbers of buildings removed by alternative facilities. In addition, potential positive effects on the local agricultural economy and negative effects on the tourist economy are discussed. Overall effects on the local economy are also reviewed. There is a potential that the Project may need to use condemnation to obtain land for Project facilities. This is discussed in the Acquisition Options Report (Economic Planning Systems 1993).

IMPACTS EVALUATED IN OTHER SECTIONS

All impacts related to Socio-economics are discussed in this section.

AFFECTED ENVIRONMENT (SETTING)

Population, Housing, and Employment

The purpose of this section is to describe the existing and future population, housing and employment conditions that will be affected by the proposed Santa Rosa Subregional Long-Term Wastewater Project.

The Subregional System includes the cities of Santa Rosa, Sebastopol, Rohnert Park and Cotati. The system currently serves residential, commercial, and industrial uses within each city's incorporated boundaries, and could serve uses within the Spheres of Influence of the member jurisdictions if these are annexed in the future. There are also unincorporated areas which are served by the Subregional System as a result of the failure of the existing septic system: the Bellevue area, Roseland area and the Country Club area. There is very little growth potential in these areas so they are not included in the total Project area buildout projections.

This section presents existing conditions and buildout projections implied by each jurisdiction's General Plan as of April, 1994. The total projected growth designated by the General Plans of each jurisdiction was used as the basis for determining the size and physical specifications of each alternative. Buildout is the point at which areas included in the General Plan have been developed at their full capacity as designated in the General Plan. For example, at buildout all vacant land with land use designations for residential use will have been developed and no vacant residential parcels will remain.

The actual rate of growth projected in the Project area is not critical to the sizing of the Project. However, in order to provide an indication of the time frame implied by the

General Plan population, housing and employment buildout projections, the buildout projections from the General Plans of the affected cities were compared to the Association of Bay Area Governments (ABAG) projections for the Years 2000 and 2010 and both are presented in the following section (Association of Bay Area Governments 1995).

In this analysis, employment estimates are presented for five industry sectors, including agriculture and mining, manufacturing and wholesale, retail, service and "other jobs". Certain sectors have a larger impact on the generation of wastewater; therefore it is important to understand which sectors are projected to experience the greatest growth in order to more accurately estimate the sewage treatment capacity that will be required to serve total growth.

There are two geographical areas of interest in this analysis:

1. The Subregional System and its member jurisdictions; and
2. The "affected area", the area that could be affected by implementing the Long-Term Project, including most of Sonoma County and the area of Marin County bordered on the west by Tomales Bay and on the Northeast by the Sonoma/Marin County line.

The data used in this section is taken from two sets of sources. The existing conditions are based on the Association of Bay Area Governments, Projections '94, which provides historical data and projections through 2010. The buildout projections are taken from each City's General Plan in effect in April 1994.

The General Plan buildout estimates are based on each jurisdiction's assessment of the development potential of vacant and under-utilized land within its Sphere of Influence. The buildout estimates were reviewed and confirmed by representatives of each City. The General Plans do not provide projections for employment by sector at buildout.

Affected Area

The affected area for this study extends from northern Marin County to the City of Healdsburg, encompassing almost all of Sonoma County. The area in Northern Marin County included in the affected environment is primarily agricultural and is not expected to experience significant growth. Therefore, demographic projections for this area are not discussed in detail.

The 1995 population in Sonoma County is estimated at 423,700. By 2010, the County is projected to increase to 528,700, with an annual average growth rate of 1.5 percent. A majority of the population growth in this area is projected to occur in Santa Rosa. Significant population growth is also projected in Windsor, Rohnert Park, and Petaluma.

Employment growth in Sonoma County is projected to grow at an annual average rate of 2.7 percent between 1995 and 2010, with the greatest growth occurring in the

manufacturing, wholesale and service sectors. The largest employment growth in the County is projected to occur in Santa Rosa, Rohnert Park, and Petaluma.

Total Subregional System Service Area

Population and Housing Units

The Subregional System's service area accounted for slightly less than 50 percent of Sonoma County's population and housing units in 1995 and is projected to increase to over 50 percent at buildout. The existing and projected population and occupied housing units for the total service area are shown in Table 4.18-1. Based on all the cities' General Plans (as in effect in April, 1994), the projected buildout population is 236,966 and 96,835 occupied housing units, an average of 2.45 persons per household. ABAG's 2010 projections show a slightly higher population by 2010. Based on information in their respective General Plans, the cities are expected to reach buildout beginning in the year 2000, with some not reaching buildout until well after the year 2010. The ABAG projections show somewhat higher numbers than do the cities' General Plans, because ABAG assumed 2.57 persons per household, which is higher than the General Plans' average assumption of 2.45. Thus, ABAG projections show higher populations in 2010 than the cities project at General Plan buildout, even though current growth rates show that buildout is likely to occur after 2010.

The ABAG forecasts show that Sonoma County is an attractive place to live and work, and that there is demand for housing and jobs in the area. The lower General Plan numbers reflect the policies of local jurisdictions to control the rate at which growth occurs.

Employment

The Subregional System's service area provides about 65 percent of the total employment in Sonoma County in 1995 and is projected to maintain the same share at buildout.

Future employment and population in the "Affected Area" will be discussed in the analysis of the potential impacts of the alternatives/components.

Subregional System Members

The population and housing units and employment data for each member of the Subregional System are shown in Tables 4.18-2 through 4.18-5.

Santa Rosa

The buildout estimates for Santa Rosa are based on the Santa Rosa General Plan 2010, completed in July 1991. Recent changes in the Santa Rosa General Plan are discussed in the Cumulative Projects Section, 3.5.

Table 4.18-1

Population, Housing Units, and Employment Data for Total Subregional System Service Area [1]

Data	1980[4]	1990[4]	1995[4]	2000[4]	2010[4]	Buildout[5]
Household Population	135,599	177,657	196,800	212,900	243,626	236,966
Persons per Household [2]	2.53	2.53	2.57	2.57	2.54	2.45
Occupied Housing Units [3]	53,360	70,237	82,680	82,680	96,050	96,835
Total Employment	65,270	99,640	122,900	122,900	157,040	127,431
Employment Breakdown						
Agriculture and Mining	2,037	2,150	2,250	2,250	2,230	n/a
Manufacturing and Wholesale	12,251	17,860	22,300	22,300	31,410	n/a
Retail	13,526	20,940	24,390	24,390	30,250	n/a
Service	16,857	29,780	41,940	41,940	54,250	n/a
Other	20,599	28,910	32,110	32,110	38,900	n/a

Sources: Association of Bay Area Governments, Projections '94 .1993; General Plans of all cities.

Notes:
1 The total service area includes Santa Rosa, South Park, Sebastopol, Rohnert Park, and Cotati.
2 Persons per household at buildout is calculated based on the total household population and the occupied housing units.
3 Occupied housing units is the total number of households.
4 Based on ABAG projections.
5 Based on General Plan projections of April, 1994.

Table 4.18-2

Population, Housing Units, and Employment Data for Santa Rosa and Sphere of Influence

Data	1980[3]	1990[3]	1995[3]	2000[3]	2010[3]	Buildout[4]
Household Population	100,160	126,840	142,000	154,600	177,100	174,500
Persons per Household [1]	2.48	2.49	2.54	2.55	2.52	2.39
Occupied Housing Units [2]	40,433	50,876	55,920	60,640	70,290	72,900
Total Employment	55,926	81,340	85,240	96,230	119,000	98,500
Employment Breakdown						
Agriculture and Mining	1,469	1,560	1,490	1,590	1,570	n/a
Manufacturing and Wholesale	10,741	14,030	15,470	17,110	21,610	n/a
Retail	11,382	17,010	17,080	19,480	22,580	n/a
Service	13,756	24,170	27,790	31,420	40,570	n/a
Other	18,578	24,570	23,410	26,720	32,670	n/a

Source: Association of Bay Area Governments, Projections '94, 1993; City of Santa Rosa, Santa Rosa 2010 General Plan 1991; Economic and Planning Systems, Inc. 1996

Notes:
1 Persons per household at buildout is calculated based on the total household population and the occupied housing units.
2 Occupied housing units is the total number of households.
3 Based on ABAG projections.
4 Based on General Plan projections

Table 4.18-3

Population, Housing Units, and Employment Data for Sebastopol

Data	1980[3]	1990[3]	1995[3]	2000[3]	2010[3]	Buildout[4]
Household Population	7,252	7,883	8,400	8,900	10,200	10,417
Persons per Household [1]	2.50	2.53	2.53	2.53	2.49	2.39
Occupied Housing Units [2]	2,898	3,112	3,320	3,520	4,100	4,359
Total Employment	3,220	4,890	5,070	6,140	6,810	6,600
Employment Breakdown						
Agriculture and Mining	407	420	430	460	460	n/a
Manufacturing and Wholesale	622	780	830	1,100	1,280	n/a
Retail	675	1,040	1,070	1,100	1,230	n/a
Service	975	1,800	1,870	2,440	2,570	n/a
Other	541	850	870	1,040	1,270	n/a

Source: Association of Bay Area Governments, Projects '94 1993; 1994 City of Sebastopol, General Plan, 1994; Economic and Planning Systems, Inc. 1996

Notes:
1 Persons per household at buildout is calculated based on the total household population and the occupied housing units.
2 Occupied housing units is the total number of households.
3 Based on ABAG projections.
4 Based on General Plan projections, April 1994.

Table 4.18-4

Population, Housing Units, and Employment Data for Rohnert Park

Data	1980[3]	1990[3]	1995[3]	2000[3]	2010[3]	Buildout[(4)]
Household Population	24,119	36,862	39,200	41,400	46,826	41,400
Persons per Household [1]	2.74	2.64	2.63	2.67	2.60	2.67
Occupied Housing Units [2]	8,813	13,965	14,900	15,510	18,010	15,510
Total Employment	5,280	12,030	14,870	18,850	28,430	20,000
Employment Breakdown						
Agriculture and Mining	119	120	130	150	150	n/a
Manufacturing and Wholesale	728	2,830	2,630	3,700	7,580	n/a
Retail	1,191	2,340	2,520	3,240	5,640	n/a
Service	1,969	3,550	6,440	7,700	10,440	n/a
Other	1,273	3,190	3,150	4,060	4,620	n/a

Source: Association of Bay Area Governments, Projections '94 1993; City of Rohnert Park, Second Draft City of Rohnert Park General Plan, 1994; Economic and Planning Systems, Inc., 1996

Notes:

1 Persons per household at buildout is calculated based on the total household population and the occupied housing units.
2 Occupied housing units is the total number of households.
3 Based on ABAG projections.
4 Based on General Plan projections as of April, 1994.

Sebastopol

The City of Sebastopol adopted a growth management ordinance in 1994 which limits the number of new housing units that can be built in the next 20 years and thus, limits the projected population. The ordinance was adopted to control growth that will otherwise exceed the City's sewage treatment capacity. However, the growth management ordinance affects the rate at which new development will occur and it does not affect the overall growth capacity within the existing city limits and Sphere of Influence. Thus, the buildout projections originally stated in the City's General Plan have been used in this analysis.

Rohnert Park

At buildout, the 1995 Rohnert Park General Plan projects a population of 41,400, which represents a slight decrease in Rohnert Park's relative share of the total service area population.

Cotati

Cotati is currently the smallest city in the service area. The 1985 Cotati General Plan projects a buildout population of 10,649.

Southpark Sanitation District

Population, housing and employment statistics are not available for the South Park County Sanitation District, because it does not have separate General Plan (the area is included in the Sonoma County General Plan) and ABAG does not provide projections for this area.

The following economic factors will be considered in assessing the impacts of the Long-Term Project:

1. Subregional System Service Charges and Demand Fees
2. Agricultural Economy
3. Tourism

Service Charges and Demand Fees

This section summarizes the existing service charges and demand fees in the Subregional System's member jurisdiction and provides a comparison between the service charges and demand fees in Santa Rosa and other similar communities in California.

Table 4.18-5

Population, Housing Units, and Employment Data for Cotati

Data	1980[3]	1990[3]	1995[3]	2000[3]	2010[3]	Buildout[4]
Household Population	4,068	6,072	7,200	8,000	9,500	10,649
Persons per Household [1]	2.74	2.66	2.68	2.66	2.60	2.62
Occupied Housing Units [2]	1,486	2,284	2,690	3,010	3,650	4,066
Total Employment	844	1,380	1,420	1,680	2,800	2,331
Employment Breakdown						
Agriculture and Mining	42	50	50	50	50	n/a
Manufacturing and Wholesale	160	220	240	390	940	n/a
Retail	278	550	500	570	800	n/a
Service	157	260	320	380	670	n/a
Other	207	300	310	290	340	n/a

Source: Association of Bay Area Governments, Projections '94 1993; Earth Metrics, Inc., City of Cotati EIR 1990; Economic and Planning Systems, Inc., 1996

Notes:
1 Persons per household at buildout is calculated based on the total household population and the occupied housing units.
2 Occupied housing units is the total number of households
3 Based on ABAG projections.
4 Based on General Plan projections as of April, 1994.

Existing Service Charges and Demand Fees

Table 4.18-6 shows the existing monthly service charges and demand fees (also referred to as connection fees) being charged by the member entities. As shown, the service charges range between $27.50 and $31.23 per month. The demand fees range between $2,000 and $6,360 per unit.

The City of Santa Rosa increased their service charge and demand fee in 1995 which are reflected in Table 4.18-6. The City also changed the method for calculating the demand fee for commercial uses. The new method is based on the projected flow of the user and pollutant loadings in the effluent.

Table 4.18-6

Existing Monthly Service Charges and Demand Fees in Member Entities
Single Family Dwellings

Member Entities	Monthly Service Charge	Demand Fee
Santa Rosa	$31.23	$5,000
Sebastopol	$30.50 [1]	$6,360
Rohnert Park	$27.70	$5,690
Cotati	$38.51 [2]	$7,883
South Park County Sanitation District	$27.50	$2,000

Source: State Water Resources Control Board, Division of Clean Water Programs, Wastewater User Charge Survey Report, 1995; City of Sebastopol, Sewer Billing Services, 1995; Economic and Planning Systems, Inc., 1995

(1) City has 2 month billing cycle. Based on base rate of $34.37 plus $2.59 per 100 cubic feet of wastewater discharge. Each residence has different discharge service so there isn't an average discharge. Based on City estimate, bill for single family residence with 3 people will be about $71 for two months.

(2) City has 2 months billing cycle. Based on assumption that an average person uses 5,002 gallons of water every two month in the off peak season. The charge is based on the base charge of $28 for a 3/4" meter, the standard for a single family unit, plus $3.63 per 1,000 gallons used. The example shown assumes an average of 2.7 persons per household.

Comparison of Service Charges and Demand Fees to Other Communities

Increased service charges and demand fees may be considered within the context of fees and charges being assessed throughout the state and in comparable communities. The demand fee and service charges in Santa Rosa have been compared to similar communities elsewhere in California with a population over 100,000, and that provide tertiary treatment level. Santa Rosa was also compared

with cities surveyed by the California State Water Resources Control Board, Division of Clean Water Programs (Economic and Planning Systems 1995a).

Santa Rosa's current service charge is the highest of any California city with over 100,000 population (the average is (11.61/month). The charge is also higher than the average charge for cities that provide tertiary treatment level ($18.94/month), but it is not the highest in the state. In terms of demand fees, Santa Rosa's rate of $5,000 is higher than the average for large cities ($2,055), those with tertiary treatment ($2,603), and all cities ($1,841) surveyed by the State.

The charges and fees have also been compared to the rates being assessed in Petaluma, Fairfield, Vallejo, Napa County, and parts of Marin County. The existing service charge in Santa Rosa is more than double the average rate charged in these areas, except for Napa. The existing demand fees, however, are somewhat less than those charged in Fairfield and Napa (see Table 2 in Appendix S-3 for the entire comparison).

Agricultural Economy

The following section presents an overview of the agricultural economy of Sonoma and northern Marin Counties and describes how the availability of reclaimed water may affect the local economy. Supporting data are provided in Tables 11-17 in Appendix S-3.

In order to test the economic viability of Project irrigation alternatives a set of "cropping scenarios" was developed for the 1%, 5% and 10% Discharge scenarios. The cropping scenarios reflect soil capabilities, soil limitations, and cropping restrictions as defined in *Irrigation Suitability Land Classification and Existing and Potential Agricultural Land Uses, Sebastopol and South County Reclamation Study Areas* and *Irrigation Suitability Land Classification and Existing and Potential Agricultural Land Uses, West County Reclamation Study Area* (Questa Engineering Corporation 1996b and c) and the *Irrigation Management Guidelines for West County and South County Alternatives* (Questa Engineering 1996d). Five levels of farming intensity were considered:

- vineyards and orchards;
- berry crops such as strawberries, blueberries, and raspberries;
- vegetable crops such as cool season vegetables (onions, swiss chard, lettuce, broccoli, green beans);
- forage, hay, or silage crops (irrigated hay, Sudan grass, field corn); and
- improved irrigated permanent pasture (with cross fencing for rotational management).

The cropping scenarios represent progressive levels of farming intensity. In general the higher the farming intensity the more inputs of labor and management are required and the greater the likelihood that the commodity grown can generate

higher potential income per acre. The more intensively farmed crops require higher capability soils and/or greater attention to soil management and erosion control. Three cropping scenarios (high tech, medium tech and low tech) were developed which distributed the available irrigable acreage among the five levels of farming intensity. The cropping scenarios are designed to test composite area-wide farming intensities with different degrees of investment (management and labor) and potential income generation. The three scenarios are described in the Methodology portion of this section.

The purpose of this assessment is to determine whether agricultural irrigation is a long-term, viable option for the Project. The economic viability will depend on the potential benefits to farmers of using reclaimed water and on the long-term prospects for the agricultural industry in Sonoma County. Also, because the costs of water storage facilities are high, there should be some certainty that there will be a long-term and stable demand for the reclaimed water along with a potential for cost recovery and cost justification.

Overview of the Agricultural Economy in Sonoma County

The value of Sonoma County agricultural production grew 11 percent in real terms between 1988 and 1994 from $305 million to $339 million (expressed in constant 1994 dollars). Wine grapes are the most valuable crop produced in Sonoma County representing 45 percent of total countywide agricultural value in 1994, followed by market milk representing 22 percent of total agricultural value. Between 1988 to 1994 the value of milk production in Sonoma County (not including manufactured products such as cheese and yogurt) declined by about 4 percent, while the value of wine grape production increased by 47 percent (1994 constant dollars). The decline in the value of milk produced in Sonoma County was due mainly to reductions in milk quota prices during that period (Rick Bennett, Co. Farm Advisor, Cooperative Extension, pers. comm., December 1995). Other million dollar crops in Sonoma County in 1994 included miscellaneous livestock and poultry, timber, vegetables, cattle and calves, miscellaneous livestock and poultry products, grapevines, apples, nursery products, oat silage, oat hay, turkeys, and sheep and lambs (Office of Agricultural Commissioner, 1994a).

The North Bay Dairy Industry

Sonoma County represents about three percent of total milk production in California. The Sonoma dairy industry reflects trends in the state's dairy industry, which has been marked by increased concentration of dairy farms, a decreasing number of dairies, increasing herd sizes, and increased milk production per cow. These changes are due in large part to technological changes in feeding and milking practices which require large capital investments in order to stay competitive. Another reason for increased herd sizes has been the increase in the cost of dairy animal waste management due to more stringent regulations required

by the Regional Water Quality Control Board. The number of dairies in Sonoma County has declined from 127 in 1988 to 113 in 1993, while the average dairy herd size has increased from 260 to 310 head. Estimates for 1995 suggest that the average Sonoma dairy herd size is now closer to 350 head, which is closer to the 1993 state average of 476 head per dairy herd.

Marin County has 48 dairy farms. Taken as whole, the North Bay (Sonoma and Marin Counties) milk market has experienced a decrease in the number of dairy farms. In 1993 there were 161 dairies in the North Bay as compared to 181 dairies in 1988. The average herd size increased from 251 to 292 between 1988 and 1993.

Future growth in the State's dairy industry is expected to occur mainly in the San Joaquin and Central Valleys (Tom Gossard, Economist, California Department of Agriculture Milk Pooling Branch, pers. comm., November 1994). Most North Bay dairies use dry-land farming techniques relying on oat hay, silage, pasture, and imported alfalfa hay, while the large San Joaquin Valley dairies use feed lots, have access to inexpensive water and have the climate and soils conducive to growing their own alfalfa hay. However, the availability of reclaimed water could decrease the production costs of North Bay dairy farmers by allowing locally grown irrigated forage and pasture to replace alfalfa hay imports. Current imported feed could be reduced from the typical 80 to 85 percent of total animal feed requirement to about 40 to 45 percent.

The future of the North Bay dairy industry is at least in part dependent on the continuation of the dairy price support system which is currently under review by the U.S. Congress. California milk marketing orders are legislated separately from national milk marketing orders. However, changes in the national pricing system are likely to be reflected in the State eventually. California dairies are not as dependent on government price supports as they were three to four years ago. The number of dairies nationwide producing manufactured milk products has declined, giving the California dairies a bigger share of the manufactured milk products market. The commercial price for manufactured milk products in California is often higher than the government support price (Donald Shippelhaute, California Department of Agriculture Milk Pooling Branch pers. comm., March 1996).

At this point it is too early to speculate on how Congressional changes to the milk marketing orders may affect the North Bay dairy farmer, although anything that will improve their competitiveness with the larger Central Valley dairies will be beneficial to the Sonoma and Marin agricultural economies. In the midwest, a number of dairies have begun to rely more heavily on pasture for dairy feeding. Such a strategy has resulted in lower production costs. The availability of irrigation water for dairy pasture in the North Bay might allow increased use of year-round permanent pasture with resulting savings in imported feed costs.

Current Reclaimed Water Agricultural Users

Most dairies in Sonoma County depend upon alfalfa hay imported from other regions of California as a primary source of forage.) However, in February 1995 the Subregional System had contracts with 55 Sonoma County farmers who use between three and four billion gallons of reclaimed water a year for irrigation. The primary use is for pasture and forage crops. In 1995, about 4,300 acres of agricultural land were under contract with the City and were being irrigated with reclaimed water (Dan Carlson, City of Santa Rosa, pers. comm, August 1995). The majority of the acres are irrigated pasture (33 percent) or a mix of pasture and forage (31 percent). The third largest category includes a mix of pasture and other crops such as pumpkins, vegetables, grapes, corn, and sod (15 percent). Grapes account for six percent of the irrigated acreage, urban uses about seven percent.

In addition to the contracts with private landowners, the City of Santa Rosa leases City-owned land to several farmers who have contracts for the use of reclaimed water. In February 1995, the City-owned farms totaled 1,458 acres, of which about 1,100 acres were being irrigated. The majority of this irrigated land is used for forage (63 percent) followed by a mix of pasture, fodder and pumpkins (28 percent). Based on the above numbers it can be seen that the majority of current reclaimed water users are dairies growing forage for their own use or for sale to other farmers.

Opportunities Provided by Increased Irrigation Water

The following section describes how the availability of reclaimed water could affect the various sectors of the Sonoma and northern Marin agricultural economy.

The three Project areas considered as potential recipients of reclaimed water are the South County area (Alternative 2), the West County area (Alternative 3) and the Sebastopol area which could be included with either alternative. The West County area consists of approximately 18,000 acres and incorporates the watersheds of Americano and Stemple Creeks and includes irrigation areas in Marin County. The South County Project area consists of approximately 16,500 acres and incorporates the flat valley lands immediately east of the Petaluma River and along Old Lakeville Road. The South County Project area also includes acreage east of Rohnert Park, along Adobe Road, and just north of Petaluma. The Sebastopol Project area consists of 2,800 acres and incorporates many existing apple orchards and vineyards east of Highway 116 and north of Bodega Highway.

The majority of the potential irrigation areas in the West and South County are not currently intensively farmed. Irrigated croplands account for less than five percent of these lands. The predominant agricultural use in both the West and South County areas is winter oat hay and dry pasture lands for beef cattle and

dairy operations. There are approximately 18 dairies in the West County and about four dairies in or close to the South County area. In the South County better soils and a higher percentage of flat lands account for more acreage in berry and vegetable crops, orchards and vineyards than in the West County.

The West County has a cooler and foggier climate. The warmer temperatures of the South County can potentially support a wider variety of crops and generate higher yields than in the West County. The lack of irrigation water has constrained agricultural development in the West County and to a lesser extent in the South County Project areas (Questa Engineering Corporation, 1996a). Agronomic studies prepared as part of this analysis indicate that Sonoma County's climate and soil types could allow for a wide variety of crop types if water supplies were available. Reclaimed water could be used to grow new acreage or increase existing yields for apples, vineyards, berry crops, vegetable crops, dairy forage, and irrigated pasture. The following section describes existing agricultural conditions in the potential irrigation areas and the potential capacity for increasing production given the availability of reclaimed water for irrigation. Table 4.18-7 summarizes the existing crop locations and opportunities for expansion. The existing acreage under crop cultivation described below for each of the areas may be less than total existing acreage. Areas that could potentially be irrigated within each potential irrigation area were selected based on parcel size and contiguity. Some smaller scattered parcels within each area were excluded due to the difficulty and expense of pumping and piping irrigation water to them. As indicated in Table 4.18-7, for many crops potential expansion will likely depend more on whether markets for these crops provide sufficient economic incentive for conversion rather than other factors such as soils and climate.

Apples

There are less than fifty acres of orchards in the West County area and few in the South County area. The shallow soils and generally poor drainage conditions in the West County area are not considered conducive for the deep rooting requirements for many fruit trees. The Sebastopol area has approximately 1,600 acres of apple orchards and there has been considerable interest expressed by farmers in obtaining irrigation water for orchards. Apples may be grown either as a drip or sprinkler-irrigated crop or as a dry crop. Many growers in Sebastopol have both irrigated and non-irrigated orchards, although the majority of apple orchards remain un-irrigated. Field tests have shown that apple yields can double from 20 tons to 40 tons per acre if irrigated, and can yield up to 65 tons per acre (Paul Vossen, Sonoma County Farm Advisor, UC Cooperative Extension, pers. comm., August 1995).

Table 4.18-7

Crop Expansion Opportunities

Crop	West County Project Area		South County Project Area		Sebastopol Project Area	
	Existing[1]	Future	Existing[1]	Future	Existing[1]	Future
Apples	Very few	Soils not considered well suited.	Very few	Unlikely	About 1600 acres	Significant potential for increased yields
Wine Grapes	None	Climate not considered suitable - expansion potential will be dictated by market forces.	About 300 acres	Some expansion potential	About 400 acres	Expansion potential will be dictated by market forces, some conversion from apples will continue
Berry Crops	Very few	Significant potential for expansion	Very few	Significant potential for expansion	Very few, some berries	Expansion potential will be dictated by market forces
Vegetable Crops	About 70 acres	Some potential for expansion	About 200 acres	Significant potential for expansion	Very few	Expansion potential will be dictated by market forces
Forage Crops	Dry oat hay winter crop	Potential for summer crops of Sudan grass and/or field corn for green chop or silage	Dry oat hay winter crop	Potential for summer crops of Sudan grass and/or field corn for green chop or silage	Very few	Expansion potential will be dictated by market forces
Irrigated Pasture	Less than 300 acres irrigated pasture in West and South County combined	Significant potential for permanent pasture with cross-fencing and rotational management	Less than 300 acres irrigated pasture in West and South County combined	Significant potential for permanent pasture with cross-fencing and rotational management	Very few	Expansion potential will be dictated by market forces

Sources: Questa Engineering Corporation, Cropping Scenarios for the West County and South County Alternatives, 1996; Economic & Planning Systems, Inc., 1996

Notes:

1 Existing acres shown within the Project areas may be less than total existing acres under production. Some smaller scattered parcels were excluded as it will be too costly to provide irrigation water to these areas.

Currently, Sonoma County has average apple yields of only 12 to 13 tons per acre mainly due to lack of irrigation and investment in new orchard technology. If irrigation were available Sebastopol apple growers could raise specialty apples such as the dwarf and semi-dwarf varieties Gala, Fuji, and Sierra Beauty. These apple varieties can reap a quick return on investment as they bear fruit in the second or third year after planting as opposed to standard apple trees that take 10 to 12 years to bear fruit (Paul Vossen, Sonoma County Farm Advisor, UC Cooperative Extension, pers. comm., August 1995).

Wine Grapes

The West County area has historically been viewed as being unsuitable for vineyards, although recently there has been interest expressed in growing cool-weather grape varietals. The South County area has about 300 acres of vineyards, mainly along Lakeville Highway. The Sebastopol area, on the other hand, contains micro-climates well-suited to cool-climate grape varieties and this area has about 400 acres of vineyards. Due to the higher returns on wine grapes (compared to dry-farmed apples) there has a been a gradual switch from apples to vines in the Sebastopol area. Wine grapes are not a water intensive crop, although in recent years most bulk-growers of grapes have converted from dry-farmed to drip-irrigated vines in order to improve yields. Grape vines currently yield on average about 4.5 tons per acre in Sonoma County. Because water does not appear to be a significant constraint to wine grape production in the Project area, it is not expected that the availability of water will significantly stimulate vineyard expansion (Questa Engineering Corporation 1996a).

Berries

Berry crops currently grown in Sonoma County include drip-irrigated bush berries, and strawberries. Very few acres of berry crops are currently being grown in Sonoma County due in part to a lack of irrigation water. Berry crops are characterized by relatively high value per acre and are typically marketed directly to the consumer either by on-farm sales, at farmer's markets, or sold directly to restaurants or retailers in the Bay Area.

Several thousand acres of gently sloping to moderately sloping lands are potentially suited to drip-irrigated strawberries, blueberries, and raspberries in the West and South County. Extensive conversion from oat hay land to berry crops is not expected in the short term, even with irrigation water, due to the lack of necessary farm machinery and suitable harvesting and shipping infrastructure. In the long-term, however, market conditions may encourage growers to raise these berry crops for local markets. One important advantage of specialty fruit crops is that they can

be grown on a small scale and that parcels of land that are too small for a commercial vineyard or truck farm could be used for berry crops.

Vegetable Crops

Most vegetable crops grown in Sonoma County are sold as specialty crops to farmer's markets and through other direct-sale methods. Vegetable crops currently grown in the West and South County areas include potatoes, squash, corn, pumpkins, and other row crops. In the West County area, there are about 30 acres of organically grown vegetables in the vicinity of Bodega Highway and Roblar Road and about 40 acres of dry-farmed potatoes. Even with irrigation water, extensive expansion of row crops in the West County Project area will be limited due to wet and poor quality soils and the lack of level land. However, over time, as fresh produce markets develop, it could become economical to increase production of salad greens, broccoli, green beans, onions, and swiss chard.

There are estimated to be about 150 acres of vegetable crops in the South County area grown mainly in the Tolay Valley and immediately east of Rohnert Park along Petaluma Hill Road. A variety of crops is produced in the Tolay Valley, including pumpkins, corn, and safflower. Lettuce, beans, peppers, and pumpkins are grown along Petaluma Hill Road for the local markets and organic fruit and vegetable stands. The flat valley floors and deep soils of these areas have potential, with additional irrigation water, to support a wider variety of vegetable crops, or increased production of existing vegetable crops.

There are estimated to be approximately 1,700 acres of high capability lands in the West County and 2,300 acres of high capability lands in the South County (Questa Engineering Corporation, 1996b and c). High capability lands are gently to moderately sloping lands (up to 10 percent slopes) with deep soils, that are suitable for the most intensively farmed vegetable crops, including drip-irrigated crops.

Forage crops and dry-farmed oat hay, either bailed or stored in barns, or chopped and put up as silage in plastic bags or bunkers, is the most extensive agricultural use the potential irrigation areas. The South County Project area produces more oat hay than the West County Project area. Currently irrigable lands are producing dry-farmed oat hay or silage in 60% of the South County and 30% of the West County areas. A very small percentage of oat hay and silage is sold; the majority of oat hay produced is used directly on the farms where it is grown, by ranchers and dairy operators. Dry-farmed oat hay production yields an average of 2.4 tons per acre in Sonoma County according to the Sonoma County Crop Reports. Sonoma dairy farmers are heavily dependent on imported feeds, despite the large oat hay production and extensive acreage in rangeland.

High-protein feeds such as alfalfa and grain are needed to insure good milk production from dairy cows. Often over 80 percent of the required dairy feed must be purchased by a typical West County dairy; slightly less feed is imported for dairy operations in South County.

In recent years, the high cost of alfalfa hay, imported from the Central Valley, has encouraged Sonoma dairy farmers to produce more forage locally. The climate and soils in the Project areas are not considered ideally suited for the production of alfalfa hay. However, in addition to oat hay, Sudan grass or field corn can be grown for green chop or silage in both the West and South County areas. Currently less than 200 acres are devoted to these other forage crops. The warmer South County climate is better suited for Sudan grass and field corn than the cooler West County.

Native Pasture and Irrigated Pasture

Although there is extensive native rangeland and dry-pasture grazed by beef cattle, sheep, and dairy animals, there are currently less than 300 acres of irrigated pasture in the West County and South County areas combined. Irrigable lands used for native range for dairy or beef cattle constitute 35% of the South County and 65% of the West County areas. Less than 200 acres in the West County area is currently used for irrigated pasture using liquid dairy wastes and on-farm reservoir storage. However, this cannot really be considered to be permanent irrigated pasture as it is principally a means for disposing of dairy waste. Dry native pasture yields approximately four animal unit months per acre while well managed permanent irrigated pasture, with cross fencing for rotational management, could be expected to yield 16 animal unit months per acre, which is the amount of feed required to maintain one animal unit (i.e., one cow, five sheep, or one and one-quarter horses) for a period of 30 days (Rick Bennett memorandum, 1995).

Tourism

This section provides an overview of tourism along the Russian River. The impact of the Project alternatives on the tourism industry along the Russian River must be considered within the context of the existing tourism market. The following describes key trends in tourism and the sources of tourism demand for the Russian River area.

Trends in Tourism

Tourism along the Russian River has fluctuated over the years, but generally the number of visitors to the area has been increasing. The Transient Occupancy Tax is the tax placed on all hotels/motels and campgrounds and is an indicator of tourism activity in the area. The Transient Occupancy Tax collected during the tourist season in the Russian River area increased by 40 percent from 1988 to

1994. However, growth has not been consistent, and there was a decline in the tax in 1989 and 1992.

In 1995, tourism was significantly lower than the same time in 1994, mainly as a result of the winter floods and damage to some of the big resorts. The Transient Occupancy Tax for the months of April, May, and June decreased by about 37 percent as compared to the same months in 1994, and the number of tourists as of June 1995 who had visited the Russian River Region Visitors Center was down by almost 2,000 (see Table 18 and 19 in Appendix S-3). While the resorts that are open are doing well, the reduction in the number of tourists has had a negative impact on all the businesses along the River.

Visitors to the Russian River come primarily from the San Francisco Bay Area, with additional market support provided by the Sacramento area and the Central Valley. Some out-of-state tourists also visit this area.

Summer and early Fall are the busiest seasons for tourism. Tourists come to the area for the activities the River offers as well as the proximity to both the vineyards and the ocean. The main recreational activities on the river include canoeing, inner-tubing, swimming, and fishing. Proximity to the Bay Area is an attraction to the Russian River area.

EVALUATION CRITERIA WITH POINT OF SIGNIFICANCE

There are very few significance criteria, as defined by NEPA and CEQA, for socio-economic impacts. The first evaluation criterion is based on U.S. Environmental Protection Agency's (EPA) guidelines regarding affordable levels of wastewater service charges (U.S. EPA, 1993). The guidelines state that annual service charges are "difficult to afford" if they exceed 1.5 percent of the area's median household income.

Because there are several other important socio-economic issues for which it is not possible to develop quantitative criteria, this section includes discussion of several other potential Project effects for which there are no defined points of significance. This information is presented for information; no conclusions regarding significance of results have been drawn. Table 4-18-8 lists criteria and Table 4.18-9 presents the other socio-economic issues that are discussed in the remainder of this section.

Table 4.18-8

Evaluation Criteria with Points of Significance - Socio Economics

Evaluation Criterion	As Measured by	Point of Significance	Justification
1. Will the Project increase the service charge for wastewater?	The projected total service charge as a percent of the area's median household income	Greater than 1.5% in any of the jurisdictions	Guidelines set forth by the U.S. EPA
2. Will the Project result in loss of homes displaced by construction of Project facilities?	Number of homes or agricultural buildings lost.	Greater than 0 homes or buildings	Uniform Relocation Assistance and Real Property Acquisition Policies Act

Source: Economic & Planning Systems, 1996

Table 4.18-9

Other Issues - Socio-economics

Other Issues	As Measured by
3. Will the Project increase the demand fee for wastewater, resulting on decreased land values?	Decrease in land value per square foot.
4. Will the Project increase the value of agricultural production through irrigation?	Increase in value of crop; increase in value to dairy farmer; increase in value to apple farmer
5. Will the Project decrease the tourism economy through increased wastewater discharge?	Decrease in tourism demand
6. Will the Project have a net economic effect on the local economy?	Adverse and beneficial impacts as calculated by the Input-Output Model
7. Will the Project disproportionately affect low income or ethnic minority communities?	Evaluation of Environmental Justice - whether the affected area includes a higher proportion of low income and minority residents as compared to the County average

Source: Economic & Planning Systems, 1996

METHODOLOGY

The following section summarizes the methodology that was used for the various components of the economic impact analysis: the impact of increased sewer charges and rates on the economy, the agricultural impacts, the impact of increased wastewater discharge on Russian River tourism and the combined economic impact analysis. Five technical memoranda provide a detailed description of the background data and analytic models used. The technical memoranda are:

1. *Alternative Projects Construction Cost Estimates*, Parsons Engineering Science, Inc., November, 1995.
2. *Land Value Estimates*, Economic & Planning Systems, November, 1995.
3. *Cropping Scenarios for the West County and South County Reclamation Alternatives*, Questa Engineering, January 10, 1996.
4. *Agriculture Impact Analysis Methodology*, Economic & Planning Systems, March 1996.

Service Charges and Demand Fees

The methodology used to estimate the demand fees and service charges needed to finance each Project alternative is similar to that used by the City of Santa Rosa to develop their existing charges and demand fees. The methodology is described in detail in the memorandum, *Service Charge and Demand Fee Model* (Economic & Planning Systems 1995). The service charge and fee estimate have been prepared for the entire service area. Differences in charges and fees by member entities have not been prepared.

The following summarizes the key assumptions used to estimate the service charge and demand fee levels needed to finance each Project alternative.

Project Phasing

A majority of the improvements are projected to be phased in over the initial three year period, 1998 to 2000. The balance of the improvements are projected to occur in 2005 (Economic and Planning Systems 1996)..

Project Improvement Cost Allocation Estimates

The following section describes the calculations used to allocate the disposal, nitrogen removal, and treatment costs to demand fees and service charges. The allocation of the disposal costs is estimated separately from the treatment and nitrogen removal costs in order to credit the existing users for the portion of the disposal system that currently exists and credit existing and new users for the benefits of water conservation.

Disposal

Future wastewater disposal needs were calculated based on expected populations at buildout of the General Plans in effect in April 1994. Existing disposal capacity is estimated at 3,800 MG, and the future volume is expected to be 8,220 MG, a short fall of 4,420 MG. The share of the total disposal costs for existing users is estimated to be 52 percent of the disposal improvements costs, based on the existing users' share of total disposal volume. The future users generate a need for 48 percent of the disposal.

Nitrogen Removal

Nitrogen removal may be required as a water quality mitigation for higher levels of discharge. (Impacts associated with nitrogen levels in reclaimed water are discussed in the Surface Water Quality Section, 4.6). The nitrogen removal costs are needed by both new and existing users. The costs have been allocated based on the existing share of buildout system users equivalent dwelling units. Existing equivalent dwelling units are projected to be 89,955. This represents 73 percent of the total equivalent dwelling units at buildout. Therefore, existing users have been allocated 73 percent of the nitrogen removal costs.

Treatment

All of the treatment costs of the additional wastewater inflow allowed by headworks expansion have been allocated to new users and will be funded through demand fees.

Operation and Maintenance

All of the operating and maintenance costs are funded through service charges.

Calculation of Demand Fee and Service Charge

The total costs for each Project alternative are translated into the annual debt payment requirements assuming a 6.5 percent interest rate, 20 year term, 25 percent debt coverage ratio, and an issuance cost of 9 percent.

The gross demand fee is based on the total projected growth of households and employment in the Subregional System between 1997 and buildout, divided by the total costs allocated to new users. A fee credit is applied to the gross demand fee on an annual basis to reflect the fact that the new users will also pay for a portion of the debt service through the service charge. The fee credit declines over time. The annual service charge is based on the remaining amount of revenue that must be collected to cover the annual debt service and coverage fund, divided by the total number of users in the service area. As the communities reach buildout and new development declines, the service charge increases.

Project Costs Used in Analyses

As basis for evaluating alternatives, estimates of the construction costs, land acquisition costs, and operating and maintenance costs were prepared (Parsons Engineering Science, Inc. 1995b and Economic & Planning Systems 1995a). Table 4.18-10 summarizes Project cost estimates for each alternative.

Table 4.18-10

Project Cost Data
(1,000's)

Alternative	Disposal Costs	O&M Costs	Treatment Costs	Nitrogen Removal Costs
1 No Action (No Project)	$0	$0	$0	$0
2 South County Reclamation				
2A S. Co. - Tolay Extended	$312,326	$2,513	$10,000	$0
2B Adobe/Lakeville	$352,216	$2,411	$10,000	$0
2C Tolay Confined	$353,287	$2,627	$10,000	$0
2D Lakeville/Sears Point	$376,720	$3,153	$10,000	$0
3 West County Reclamation				
3A W. Co. - Two Rock	$246,410	$1,648	$10,000	$0
3B Bloomfield	$282,659	$1,745	$10,000	$0
3C W. Co. Carroll Road	$243,456	$1,753	$10,000	$0
3D W. Co. Valley Ford	$251,478	$1,785	$10,000	$0
3E W. Co. Huntley	$253,904	$1,713	$10,000	$0
4 Geysers Recharge	$208,252	$6,683	$10,000	$0
5 Discharge				
5A Discharge Russian River	$35,953	$97	$10,000	$28,000
5B Discharge Laguna	$18,352	$0	$10,000	$28,000

Source: Parson Engineering Science, Inc. 1995
Economic Planning Systems, Inc., 1996

Loss of Homes

The reservoir component of alternatives 2 and 3 is the only Project element that will result in loss of homes or agricultural buildings. The footprint of each reservoir was determined and the number of dwellings was counted. Houses within 25 feet of the construction zone were counted as lost.

Agricultural Impact Analysis

The following section briefly describes the methodology used to measure the effects of irrigation with reclaimed water on the Sonoma County and northern Marin County agricultural economy. Supporting tables are provided in Appendix S-3. A more detailed explanation of the methodology is provided in the technical memorandum titled Agricultural Impact Analysis Methodology (Economic & Planning Systems 1996).

In order to test the potential impact of the availability of reclaimed water for irrigation on the Sonoma agricultural economy, three cropping scenarios (low tech, medium-tech, and high-tech) were developed for the West and South County irrigation areas and the Sebastopol irrigation area, for the one percent discharge alternative (Questa Engineering Corporation, 1996b). These cropping scenarios were based on soil capability, micro-climates, and topography. The three scenarios represent different levels of farming intensity requiring increasing amounts of input for labor and management. The amount of reclaimed water available to the irrigation areas was held constant across all alternatives and scenarios.

The low tech scenario envisions a minimum level of labor and capital input and consequently the lowest return per acre on investment. In the low tech scenario, the majority of acreage will be used for irrigated pasture and a minimum amount of acreage will be used for higher value crops such as berry and vegetable crops. The medium tech cropping scenario envisions less irrigated pasture and more acres in forage crops such as oat hay and corn silage. The high tech cropping scenario envisions more acreage in berry and vegetable crops and less in irrigated pasture and forage crops (Table 4.18-11). The acreage shown in Table 4.18-11 represents net adjusted acreage by cropping scenario and alternative. Existing acreage under production has been subtracted from the total irrigated acreage in order to estimate the net impact of the new agricultural production.

Table 4.18-11

Net Adjusted Irrigated Acres by Area and Crop Type
for the Alternatives 2 and 3

Alternative/Crop Type/ Cropping Scenario	Low Tech Scenario (acres)	Medium Tech Scenario (acres)	High Tech Scenario (acres)
West County			
Berry Crops	0	450	2,000
Vegetable Crops	50	450	1,350
Forage/Hay/Silage (1)	900	2,750	2,300
Irrigated Pasture (2)	4,500	2,400	1,000
Total (5)	**5,450**	**6,050**	**6,650**

Table 4.18-11

Net Adjusted Irrigated Acres by Area and Crop Type for the Alternatives 2 and 3

Alternative/Crop Type/ Cropping Scenario	Low Tech Scenario (acres)	Medium Tech Scenario (acres)	High Tech Scenario (acres)
West County with Sebastopol			
Apples (3)	1,600	1,600	1,600
Vineyards (4)	0	0	0
Berry Crops	0	300	1,350
Vegetable Crops	50	400	1,150
Forage/Hay/Silage (1)	950	2,000	1,300
Irrigated Pasture (2)	2,850	1,550	750
Total (5)	**5,450**	**5,850**	**6,150**
South County			
Vineyards	0	100	1,100
Berry Crops	0	250	900
Vegetable Crops	50	650	750
Forage/Hay/Silage (1)	800	1,300	800
Irrigated Pasture (2)	2,400	1,150	300
Total (5)	**3,250**	**3,450**	**3,850**
South County w/Sebastopol			
Apples (3)	1,600	1,600	1,600
Vineyards (4)	0	0	0
Vineyards	0	250	600
Berry Crops	0	200	600
Vegetable Crops	100	500	1,000
Forage/Hay/Silage (1)	600	1,100	400
Irrigated Pasture (2)	1,500	450	200
Total (5)	**3,800**	**4,100**	**4,400**

Source: Questa Engineering Corporation, "Cropping Scenarios for the West County and South County Reclamation Alternatives", 1996a

Notes:

1 Irrigated forage/hay/silage represents a new use, so these acres are not subtracted from existing dry-farmed hay/silage.

2 Irrigated pasture represents a new use, so these acres are not subtracted from existing native pasture/rangeland.

3 Existing orchards in Sebastopol. These existing acres are included in order to estimate increased yields due to irrigation.

4 No net increase in the number of vineyards in Sebastopol is assumed as a result of irrigation.

5 Where there are existing similar uses in the Project area these acres are subtracted from the new irrigated acres except where noted above.

Average irrigated crop yields and gross crop values per ton were estimated for each crop by cropping scenario and alternative to measure the potential net new benefit to the local agricultural economy. All values are defined in gross expenditure terms as the purpose of this study is to look at the total benefit to the local agricultural economy. From the perspective of the individual farmer the total benefit will be reduced by production costs for each crop type.

All dollar values are expressed in terms of the maximum cumulative annual gross values available at completion of the Project. Production, and therefore the potential gross values, will be less in the early years of the Project as the irrigation systems will need to be phased in, and farm infrastructure and production practices will need to be adapted.

The increased value of permanent irrigated pasture due to irrigation was estimated based on an average gross value of about $608 per acre of irrigated pasture (Rick Bennett, memorandum 1995). The average gross value per acre was decreased by about $100 per acre to account for the value of existing native pasture and the gross value per acre for the West County areas were further reduced by 15 percent to account for the cooler climate and shorter growing season. Assumptions were made regarding how much of the new irrigated pasture might be used by dairy cows and how much might be used by non-dairy animals based on the number of dairies in each Project area. Average gross value increases due to irrigation will be $430 and $508 per acre for the West and South County areas, respectively.

From the farmer's perspective the gross values per acre will be reduced by the cost of converting from dry to irrigated pasture. The main cost to the farmer of converting to irrigated pasture will be labor. The farmer will also be responsible for installing and constructing fencing required for rotational pasture.

A prototypical distribution of forage crops likely to be grown in Sonoma County within the irrigation areas was assumed in order to estimate for the value of increased forage production under each alternative and cropping scenario. The distribution of forage crops included oat hay, oat silage, corn and Sudan grass silage, and green chop. Based on a five-year average of forage crop yields and gross values per ton, a weighted average yield and gross value per ton were derived for the assumed prototypical forage distribution. Weighted average yields were decreased 15 percent for the West County Alternative to account for the cooler climate and shorter growing season. A weighted average value per ton of $42 was multiplied by the tons of new forage produced for each area and cropping scenario to estimate the total value of the increased forage production.

The value of new fruit and vegetable crops produced for each area and cropping scenario was estimated based on five-year average gross yields and gross values per acre for each category of crop (Office of Agricultural Commissioner, 1989-1994a). Average gross yields and gross values per acre were decreased for the West County Area to account for the shorter growing season. The total new acreage of wine grapes, apples, berry, and vegetable crops under each alternative and cropping scenario was multiplied by the

appropriate gross yields per acre. In the case of apples it was assumed that there will be no net increase in the number of acres under production but that apple yields will double as a result of the availability of reclaimed water for irrigation.

Tourism Impact

This section describes the methodology used to evaluate the impacts of increasing the discharge of reclaimed water into the Russian River on the tourism economy. Trends in tourism economy were evaluated by examining the transient occupancy tax receipts since 1988. However, as the potential impacts are more qualitative, the primary source of data came from interviews with local resort owners and the Russian River Region Visitors Center, in order to assess the current tourism market, including the demographics of the tourists and the source of tourism demand for the River. Based on the interviews, the major factors that have affected and could potentially affect the tourism economy were identified. The flooding of the Russian River was indicated to have the biggest impact on tourism. Perceptions about wastewater discharge were also cited as a potential effect.

Combined Economic Impact

This section presents the methodology used for the combined economic impacts analysis. The combined measure of the economic impacts of the Project alternatives considers the benefits the Project has on the agricultural economy, the benefits of ongoing operations and maintenance, the impacts of increasing service charges and the additional property tax revenue and royalties generated by the geysers. In order to combine the various economic effects into a single measure and assess the impact the Project alternatives will have on the local economy, an Input-Output Model was used. The Input-Output Model estimates the multiplier effect that results from a change in final demand in the local economy.

This economic impacts analysis uses the IMPLAN input-output modeling framework developed by the Minnesota IMPLAN Group for the U.S. Forest Service. Input-output modeling is used extensively in economic analysis and resource planning to assess the impact of a planned activity on the economy. The specific IMPLAN model used for this analysis reflects the inter-industry relationships that existed in Sonoma County as of 1991.

An Input-Output Model tracks the intricate web of economic linkages that exist within the local economy. The model reflects the impact that a one dollar change in final demand will have on the County economy in terms of jobs and income. An Input-Output model allows one to estimate the extent to which an increase (or decrease) in sales of an existing firm or introduction of a new firm into the local economy leads to additional economic activity. Furthermore, the model allows one to estimate the extent to which an increase (or decrease) in consumer expenditures will affect the local economy.

Input-Output models can be prepared for various levels of geography, including counties, regions, states, or the nation. In this analysis, an Input-Output model was used for Sonoma County to quantify the sales, income, and job impacts of:

- the increase in agricultural production value
- the investment in the service area (cost of the alternatives);
- the ongoing operation and maintenance expenditures; and
- the reduction in personal expenditures in the service area as a result of the increase in service charges.

Definition of Terms used in the Input-Output Model

A multiplier analysis estimates the economic impacts that result from a change in final demand (sale of goods and services) for a specific commodity or group of commodities. Two types of multipliers are presented in this analysis: employment and income. The multipliers can be expressed in terms of the impact of a $1 million change in final demand or a one unit change in income or employment.

For example, the employment multiplier for the construction of new utilities in Sonoma County is 4.16, which means that for each new construction job, 3.16 additional jobs are created throughout the County. The income multiplier for this industry is 2.81. This implies that for each new dollar of employee compensation provided in this sector, $1.81 of income is generated throughout the County. The employment and income multipliers can also be expressed in terms of a $1 million change in final demand. For the utility construction industry, a $1 million increase in sales (final demand) creates 19.07 total jobs and a $985,000 change in total personal income throughout the Sonoma County economy.

The results of the multiplier analysis are expressed in terms of direct, indirect, and induced impacts. The direct impacts as used in this analysis are the direct increase in sales that are assumed to occur in the local economy. In addition, direct impacts will commonly include the "first order" impacts which are the inputs required to produce an additional unit of sales in the given industry. For example, if investment in utility construction increases, inputs are required from other sectors, including business services, real estate, and various manufacturing sectors. Although these impacts are commonly labeled direct impacts, in this analysis they have been combined with the indirect impacts.

Indirect impacts are the second-order impacts generated by the change in investment. The indirect impacts are the inputs required to produce the goods and services of suppliers to the utility construction industry.

Induced effects are the changes in regional household spending patterns that result from the changes in employment and income generated by both the direct and indirect effects. The induced effects measure the economic impact of the personal

expenditures that result from the change in employment and income. Taken together, these employment and income effects represent an economic multiplier.

No Action (No Project) Alternative

The income-output modeling framework has been used to measure the impact of the No Action Alternative. As defined in Chapter 3, future commercial and residential development will not occur after December 1997 because a growth moratorium will be imposed by the North Coast Regional Water Quality Control Board. This will curtail the normal increase in population and employment that might otherwise be expected in the Project area. While there may be some intensification of existing facilities throughout the County, the worst case condition presumes the loss of projected employment and household growth. These losses have been input into the income-output model to estimate the income and employment impacts of the No Action Alternative.

Environmental Justice

Environmental justice relates to whether a population is exposed to disproportionately high negative environmental impacts. To date, the focus has been on whether low income or minority populations are exposed to disproportionate impacts, as this has been the historical precedent. The concept is usually applied to projects that clearly involve strong negative environmental impacts, such as the location of toxic waste sites.

There is currently no official methodology for evaluating the impact of a Project from an environmental justice perspective. The Council on Environmental Quality has issued general guidelines and the U.S. Environmental Protection Agency is in the process of developing more detailed guidelines.

Population data are used to determine whether the Project will disproportionately impact low income and or ethnic minority residents. A disproportionate impact is measured by whether the affected area includes a higher proportion of low-income and or ethnic minority residents, relative to the average for the County. A significant deviation from the average county per capita income is assumed to be an average income of less than 80% of the average County per capita income. A significant deviation from the average county ethnic breakdown is assumed to be an additional 10% of non-white area residents relative to the average for the County.

Several steps were taken in compiling the ethnic breakdown and per capita income of the population in the affected area and the county as a whole. The affected area was assumed to be the census block groups which include the parcels where the proposed reservoirs, pump stations, storage tanks and pipelines will be located. The census tracts and block groups that corresponded with these parcels were identified and the 1990 U.S. Bureau of the Census was used to collect data for the census block groups in the affected area and the county as a whole. Some parcels, which lacked a site address, could not be linked to a particular census block group, and it was assumed that these parcels will either fall in

one of the selected census tract block groups, or will not have significantly different demographics from the identifiable census block groups.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND MITIGATION MEASURES

The analyses presented below are organized differently than for other sections. Other sections analyze impacts by Project component, but this is not possible for the analysis of socio-economic effects, which are generally attributable to the alternative as a whole, and to the costs of the entire Project. Thus, the discussion below is organized by criteria and issues, rather than by component. For each criterion or issue, the overall impacts of each alternative, as a whole, are discussed.

Service Charge Increase

Table 4.18-12

Socio-economic Impacts by Criteria - Increased Service Charge

Evaluation Criterion	Point of Significance	Impact	Types of Impact[1]	Level of Significance
1. Will the Project increase the service charge for wastewater facilities?	The projected total service charge greater than 1.5% in any of the jurisdictions			
• Alt 1-No Action	1.1%	1.10%[3]	O&M	○
• Alt 2A-Tolay A	2.1%	1.99%	O&M	●
• Alt 2B-Adobe Rd and Lakeville	2.1%	1.96%	O&M	●
• Alt 2C-Tolay C	2.3%	2.03%	O&M	●
• Alt 2D-Sears Pt and Lakeville	1.8%	2.19%	O&M	●
• Alt 3A-Two Rock	1.8%	1.69%	O&M	●
• Alt 3B-Bloomfield	1.8%	1.73%	O&M	●
• Alt 3C-Carroll Road	1.8%	1.72%	O&M	●
• Alt 3D-Valley Ford	1.8%	1.73%	O&M	●
• Alt 3E-Huntley	1.8%	1.71%	O&M	●
• Alt 4-Geysers Recharge	3.2%	3.14%	O&M	●

Table 4.18-12

Socio-economic Impacts by Criteria - Increased Service Charge

Evaluation Criterion	Point of Significance	Impact	Types of Impact[1]	Level of Significance
• Alt 5A-Discharge to River	1.2%	1.11%	O&M	○
• Alt 5B-Discharge to Laguna	1.1%	1.09%	O&M	○

Source: Parsons Engineering Science, Inc., 1996

Notes:

1. Type of Impact:

O&M Operation and Maintenance

2. Level of Significance:

○ Less than significant impact; no mitigation proposed

● Significant impact before and after mitigation

3. Total service charge (existing plus Project increase). Maximum impact in any of the four cities for any year

Impact: 18.1. Will the Project increase the service charge for wastewater?

Analysis: *Significant; Alternatives 2, 3, and 4.*

The increase in the monthly service charge will result in the total service charge exceeding 1.5% of the median income in the cities of Santa Rosa, Cotati, and Sebastopol. As of the year 2017, when the service charge is projected to be greatest, the service charge will exceed 1.5% in Rohnert Park as well. See Table 4.18-4 and Figures 4.18-1.

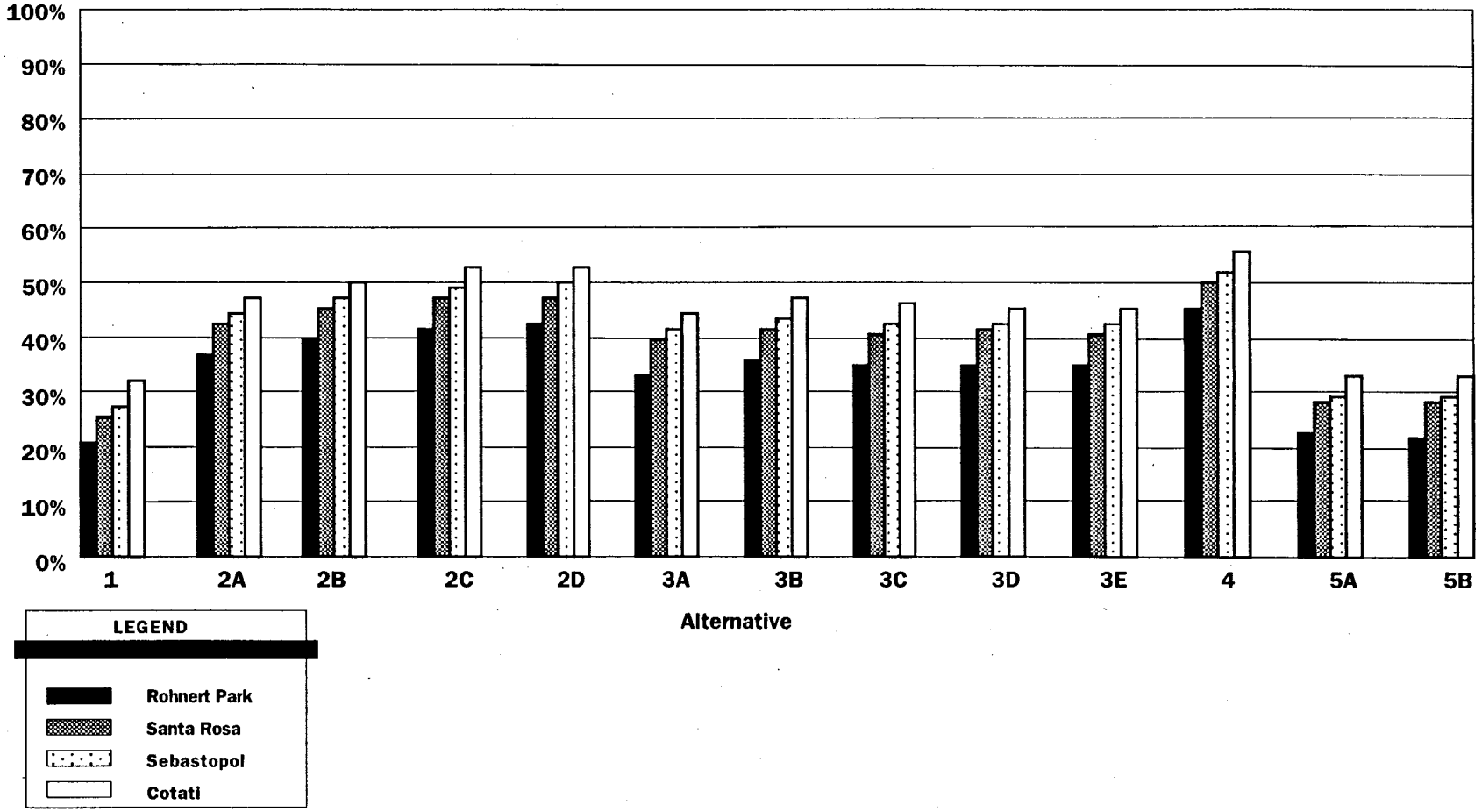
Table 4.18-13 shows the projected average monthly additional service charge for a single family dwelling as of Year 2000, 2005, 2010, and 2017 for each Project alternative. The year 2017 is used because it has the highest estimated fee. The figures are shown in 1995 constant dollars.

Less than Significant; Alternatives 1 and 5.

These alternatives do not exceed the significance criteria.

Mitigation: *Alternatives 2, 3, and 4.* No feasible mitigation has been identified

Alternatives 1 and 5. No mitigation is proposed. :



Source: Economic & Planning Systems

HARLAND BARTHOLOMEW & ASSOCIATES, INC.
PARSONS ENGINEERING SCIENCE, INC.
UNITS OF PARSONS INFRASTRUCTURE & TECHNOLOGY INC.
PARSONS

Santa Rosa Subregional Long-Term Wastewater Project

PERCENTAGE of HOUSEHOLDS FOR WHICH THE MONTHLY SERVICE CHARGE as of YEAR 2000 EXCEEDS 1.5% of INCOME

Figure 4.18-1

Table 4.18-13

Estimated Additional Average Monthly Service Charge [1]

Alternative	2000	2005	2010	Buildout-2017[2]
1 No Action (No Project)	$0.00	$0.00	$0.00	$0.00
2A So. Co. - Tolay Extended	$14.90	$25.80	$28.50	$33.90
2B So. Co. - Adobe/Lakeville	$17.80	$27.20	$29.40	$34.30
2C So. Co. - Tolay Confined	$19.90	$28.20	$31.20	$36.70
2D So. Co. - Lakeville/ Sears Point	$20.00	$31.70	$35.50	$42.40
3A W. Co. - Two Rock	$12.40	$18.90	$20.30	$23.70
3B W. Co. - Bloomfield	$14.00	$21.00	$22.20	$25.70
3C W. Co. - Carroll Road	$12.40	$19.20	$20.90	$24.60
3D W. Co. - Valley Ford	$12.80	$19.70	$21.40	$25.20
3E W. Co. - Huntley	$12.80	$19.50	$21.00	$24.50
4 Geysers Recharge	$23.20	$43.50	$57.90	$74.40
5A Russian River Discharge	$1.70	$2.00	$2.00	$2.20
5B Laguna Discharge	$0.70	$0.80	$0.60	$0.70

Source: Economic & Planning Systems, Inc., 1996

1 Estimated additional average monthly service charge per single family residence or equivalent. This additional service charge is expressed in 1995 consultant dollars and will be added to the existing service charges shown in Table 4.19-6, which range from $27.50 to $38.51.

Loss of Homes and Agricultural Buildings

Table 4.18-14

Socio-economic Impacts by Criteria - Loss of Homes

Evaluation Criterion	Point of Significance	Impact	Types of Impact[1]	Level of Significance[2]
18.2. Will the Project result in loss of homes displaced by construction of Project facilities?	Greater than 0 homes			
• Alt 1-No Project		None	P	==

Table 4.18-14

Socio-economic Impacts by Criteria - Loss of Homes

Evaluation Criterion	Point of Significance	Impact	Types of Impact[1]	Level of Significance[2]
• Alt 2A-Tolay A		4 houses	P	●
• Alt 2B-Adobe Rd and Lakeville		1 house	P	●
• Alt 2C-Tolay C		None	P	==
• Alt 2D-Sears Pt and Lakeville		None	P	==
• Alt 3A-Two Rock		2 houses	P	●
• Alt 3B-Bloomfield		None	P	==
• Alt 3C-Carroll Road		3 houses	P	●
• Alt 3D-Valley Ford		1 house	P	●
• Alt 3E-Huntley		4 houses	P	●
• Alt 4-Geysers Recharge		None	P	==
• Alt 5-Discharge		None	P	==

Source: Parsons Engineering Science, Inc. 1996

Notes:

1. Type of Impact:
P Permanent

2. Level of Significance:
○ Less than significant impact; no mitigation proposed
● Significant impact before and after mitigation
== No Impact

Impact: **18.2 Will the Project result in loss of homes displaced by construction of Project facilities.**

Analysis: *Significant; Alternatives 2A, 2B, 3A, 3C, 3D and 3E.*

Reservoir construction associated with both the West and South County Alternatives will result in loss of existing homes at the following reservoir sites: Tolay Extended, Adobe Road, Two Rock, Carroll Road, Valley Ford, and Huntley. Table 4.18-14 shows the number of homes and lost for each alternative.

Measure 2.2.27, Uniform Relocation Assistance, is adopted as part of the Project and will govern the acquisition of homes in accordance with the

Uniform Relocation Assistance and Real Property Acquisition Policies Act.

Less than Significant; Alternatives 2C, 2D and 3B.

There are no homes or agricultural buildings within the construction envelope for the Tolay Confined, Lakeville Hillside, Sears Point, or Bloomfield reservoirs. Pump stations facilities for Alternative 4 will not result in loss of homes or other buildings.

No Impact; Alternatives 1 and 5.

These alternatives will not require construction of new reservoirs or pump stations.

Mitigation: *Alternatives 2A, 2B, 3A, 3C, 3D and 3E.* No other feasible mitigation has been identified.

Alternatives 1, 2C, 2D, 3B, 4, and 5. No mitigation is proposed.

Increase in Demand Fees

Impact: **18.3. Will the Project increase the demand fee for wastewater resulting in decreased land values?**

Analysis: Table 4.18-15 shows the projected additional demand fee for a single family dwelling in the year 2000 for each Project alternative. The figures are shown in 1995 constant dollars. The demand fee represents the change of the existing Santa Rosa fee. In Santa Rosa, 73 percent of the existing fee is earmarked to fund the Long-Term Project. The net demand fee includes a credit for debt service payments included in service charge.

Table 4.18-15

Estimated Additional Demand Fees by Alternative in the Year 2000[1]

Alternative	2000	2005	2010	Buildout
1 No Action (No Project)	($3,650)	($3,700)	($3,700)	($3,650)
2A S. Co. - Tolay Extended	$4,069	$7,300	$5,300	$1,785
2B S. Co. - Adobe/Lakeville	$5,000	$8,600	$6,400	$2,467
2C S. Co. - Tolay Confined	$5,054	$8,700	$6,400	$2,522
2D S. Co. - Lakeville/Sears Point	$5,562	$9,400	$7,000	$2,869
3A W. Co. - Two Rock	$2,577	$5,100	$3,600	$732
3B W. Co. - Bloomfield	$3,407	$6,300	$4,500	$1,327
3C W. Co. - Carroll Road	$2,509	$5,000	$3,500	$684

Table 4.18-15

Estimated Additional Demand Fees by Alternative in the Year 2000[1]

Alternative	2000	2005	2010	Buildout
3D W. Co. - Valley Ford	$2,693	$5,300	$3,700	$815
3E W. Co. - Huntley	$2,748	$5,400	$3,800	$855
4 Geysers Recharge	$1,705	$3,900	$2,600	$134
5A Discharge - Russian River	($2,248)	($1,800)	($2,000)	($2,713)
5B Discharge - Laguna	($2,651)	($2,400)	($2,500)	($3,650)

Source: Economic & Planning Systems, Inc., 1996

1 Based on Net Demand Fee in 1995 dollars minus Long Term Project's share of existing fee. This additional demand fee will be added to the existing demand fees shown in Table 4.19-6, which range from $2,000 to $7,883.

2 For the purposes of calculating service charges, total buildout was assumed to occur by 2018.

An increase in the demand fee will primarily impact land prices in the service area in the long-term.

Table 4.18-16 shows the impact the increased demand fee may have on land values in the Subregional System. As shown on the table, Alternative 2D generates the largest impact.

Table 4.18-16

Decrease in Land Values Due to Increase in Demand Fees[1] in the Year 2000
Expressed as Reduction of Value per Square Foot

Alternative	Single Family Dwelling Unit			Office	Retail	Warehouse
	4 units/ acre	6 units/ acre	8 units/ acre			
1 No Action	($0.32)	($0.51)	($0.66)	($0.33)	($0.29)	($0.15)
2A Tolay A	$0.37	$0.57	$0.73	$0.37	$0.33	$0.16
2B Adobe Rd and Lakeville	$0.45	$0.70	$0.90	$0.45	$0.40	$0.20
2C Tolay C	$0.45	$0.71	$0.91	$0.45	$0.40	$0.20
2D Sears Pt and Lakeville	$0.50	$0.78	$1.00	$0.50	$0.44	$0.22
3A Two Rock	$0.23	$0.36	$0.46	$0.23	$0.20	$0.10
3B Bloomfield	$0.31	$0.48	$0.61	$0.31	$0.27	$0.14

Table 4.18-16

Decrease in Land Values Due to Increase in Demand Fees[1] in the Year 2000
Expressed as Reduction of Value per Square Foot

Alternative	Single Family Dwelling Unit			Office	Retail	Warehouse
3C Carroll Road	$0.23	$0.35	$0.45	$0.23	$0.20	$0.10
3D Valley Ford	$0.24	$0.38	$0.48	$0.24	$0.22	$0.11
3E Huntley	$0.25	$0.38	$0.49	$0.25	$0.22	$0.11
4 Geysers Recharge	$0.15	$0.24	$0.31	$0.15	$0.14	$0.07
5A Discharge to River	($0.20)	($0.31)	($0.40)	($0.20)	($0.18)	($0.09)
5B Discharge to Laguna	($0.24)	($0.37)	($0.48)	($0.24)	($0.21)	($0.11)

Source: Parsons Engineering Science, Inc. 1996; Economic & Planning Systems, Inc., 1996

Note:
1 Demand fee for 1 equivalent dwelling unit, using net demand fees.

The net demand fee required to finance the Project alternatives represents a maximum increase of over $7,000 per dwelling unit. Given the price competitive nature of real estate development, the projected fee increase will likely cause some changes in the type and pace of development in the service area. In the short-term, developers may delay development or reduce lot size and/or unit size in order to absorb the fee increase. In the long-term, the fee increase will most likely result in comparatively lower land prices in the service area. Further discussion and a comparison to 1995 land values has been presented in the technical memorandum, *Land Value Estimates* (Economic & Planning Systems 1995b).

Increased Value of Agricultural Production

Impact: **18.4. Will the Project increase the value of agricultural production through irrigation?**

Analysis: Alternative 2 and Alternative 3, propose to use reclaimed water to irrigate between 3,800 and 6,500 acres of agricultural land. The purpose of this analysis is to compare the agricultural economic benefits of using a fixed amount of reclaimed water for irrigation. There is less irrigated acreage in Alternative 2 because the South County requires more irrigation water per acre due to the higher evapotranspiration rates. The high

evapotranspiration rates per crop per acre in the South County are due to lower annual rainfall and higher temperatures. The same amount of water can irrigate a larger area in the West County due to lower evapotranspiration rates associated with the cooler temperatures and higher annual rainfall. Therefore, although the crop yields are generally higher in the South County the total agricultural benefits from a fixed amount of irrigation water are greater in the West County due to the substantial acreage difference (between 2,200 and 2,800 more acres could be irrigated in West County than in South County under the three cropping scenarios).

Table 4.18-17 estimates the annual gross value of new crops.

Table 4.18-17

Summary of Annual Gross Value of New Irrigated Fruit, Vegetable, Pasture, and Forage Crops (thousands of dollars)

Alternative/Crop Type Cropping Scenario	Low Tech Scenario	Medium Tech Scenario	High Tech Scenario
West County			
Apples	$0	$0	$0
Wine Grapes	$0	$0	$0
Berry Crops	$0	$11,340	$50,400
Vegetable Crops	$740	$6,660	$19,980
Total Fruit & Vegetable Crops	$740	$18,000	$70,380
Pasture and Forage Crops	$2,375	$2,360	$1,539
Grand Total	$3,115	$20,360	$71,919
West County with Sebastopol			
Apples	$50,400	$50,400	$50,400
Wine Grapes	$0	$0	$0
Berry Crops	$0	$7,560	$34,020
Vegetable Crops	$740	$5,920	$17,020
Total Fruit & Vegetable Crops	$51,140	$63,880	$101,440
Pasture and Forage Crops	$1,687	$1,632	$950
Grand Total	$52,827	$65,512	$102,390
South County			
Apples	$0	$0	$0
Wine Grapes	$0	$497	$5,468

Table 4.18-17

Summary of Annual Gross Value of New Irrigated Fruit, Vegetable, Pasture, and Forage Crops (thousands of dollars)

Alternative/Crop Type Cropping Scenario	Low Tech Scenario	Medium Tech Scenario	High Tech Scenario
Berry Crops	$0	$4,175	$15,030
Vegetable Crops	$925	$12,025	$13,875
Total Fruit & Vegetable Crops	$925	$16,697	$34,373
Pasture and Forage Crops	$1,671	$1,320	$605
Grand Total	$2,596	$18,017	$34,978
South County with Sebastopol			
Apples	$50,400	$50,400	$50,400
Wine Grapes	$0	$1,243	$2,983
Berry Crops	$0	$3,340	$10,020
Vegetable Crops	$1,850	$9,250	$18,500
Total Fruit & Vegetable Crops	$52,250	$64,233	$81,903
Pasture and Forage Crops	$1,101	$852	$328
Grand Total	$53,351	$65,085	$82,231

Source: Economic & Planning Systems, 1996

Increased Value of New Irrigated Pasture and Forage Crops

The total value of new irrigated pasture is lowest for the High Tech Scenario because more acreage will be converted from pasture to higher value fruit and vegetable crops. Under the Low Tech Scenario, which assumes the least input of labor and capital, the number of acres of irrigated pasture will be maximized.

The total value of new irrigated forage crops is highest under the Medium Tech Scenario because the number of acres of irrigated forage crops is maximized under this scenario.

Increased Value of Dairy Forage to the Average North Bay Dairy Farmer

The value of dairy forage was compared to the number of milk cows in the forage market area to estimate the potential value per cow. This value can contribute to savings for a dairy farmer, assuming that local irrigated forage produced can reduce the costs of imported feeds. In the West

County the medium tech cropping scenario produced maximum annual savings of $56 per cow or $19,600 per year for the average sized dairy herd (350 cows), while in the South County area the maximum annual savings was estimated to be $62 per cow or $21,900 per year for the average dairy herd. The individual farmer will be subsidized for the first year of operation when converting from dry-farmed to irrigated crops The gross annual savings per cow will be reduced by labor costs in year one, and in subsequent years, by labor costs and the normal costs of production for forage crops.

Increased Value of New Irrigated Apples, Wine Grapes, Berry and Vegetable Crops

Substantial increases in value are possible under the high tech scenario (see Table 4.18-17).

Increased Value of Apple Production for a Typical 50-Acre Sonoma Orchard

An average Sebastopol apple grower with a 50-acre orchard could expect in a good year a maximum yield of 15 tons per acre for dry-farmed apples and could on average expect to generate about $150,000 per year or $3,000 gross revenue per acre. With the availability of reclaimed water for irrigation, the grower could switch to dwarf-stock varieties (Gala, Fuji and Sierra Beauty for example) which can yield as much as 35 tons per acre by the fifth year. Assuming these apples are marketed as specialty varieties, in the fifth year of production, the orchard could average about $1.3 million in gross revenues annually or about $26,000 per acre which is more than an eight-fold increase over the gross annual revenues ($150,000) from the dry-farmed apples.[1]

Increased Agricultural Land Values Due to Irrigation

A secondary impact resulting from the availability of reclaimed water for irrigation will be an increase in the value of agricultural land. It is difficult to predict the actual amount of the increase since property values vary by location and property characteristics such as zoning, parcel size, soil type, and Williamson Act status. (The Williamson Act is discussed in Section 4.2, Agriculture.) Agricultural lands that are not under Williamson Act contracts are re-assessed when the property is sold and changes ownership while agricultural land that is under Williamson Act will be re-assessed based on the changes in the net capitalized income generated by the crop grown on the land after the availability of irrigation water. Quantification of this differential is not possible due to the uncertainty regarding the percentage of lands receiving reclaimed water that will be under Williamson Act contracts.

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[1] "Impacts of Irrigation Water" by Paul Vossen, Cooperative Extension for Sonoma County, University of California, January 8, 1996.

However, it is certain that there will be a one-time increase in the value of the land as a result of the availability of irrigation water, which will increase the net wealth of the agricultural landowners in the Project irrigation areas. For example, dry native pasture land in portions of Sonoma County currently sells for approximately $2,000 to $3,000 per acre. With the availability of irrigation water and the ability to grow year-round pasture, and depending on soil and climate conditions, the switch to higher value annual crops could increase the value of the land between two and five times. As these lands are sold and re-assessed there will be an increase in the property tax base which will in turn generate additional property tax revenues for the County of Sonoma.

For agricultural lands under a Williamson Act contract the increase will be less significant from a fiscal standpoint. For example the capitalized rent on non-irrigated pasture land is about $350 per acre which could increase to about $700 per acre for irrigated pasture and up to $1,700 an acre for orchards or vineyards. Therefore on 1,000 acres of agricultural land in the Project irrigation areas the assessed value under a Williamson Act contract could increase from $350,000 to $700,000 as a result of the availability of irrigation water.

Market Response

The following sections describe briefly how the market could respond to increased production of dairy forage crops and fruit and vegetable crops.

Dairy Industry

The dairy industry potentially stands to gain substantially from the availability of reclaimed water. Although milk production is not likely to increase, costs of production will go down with availability of water. Due to the complex restraints of the California milk marketing board quotas it is unlikely that milk production will increase as a result of available irrigation water. However, the high cost of alfalfa hay imports, currently at approximately $135 per ton, suggests that the ability to produce cheaper, locally-grown forage could improve the economics of Sonoma dairy farms by reducing the cost of a major factor of production. The average Sonoma dairy farm imports approximately 80 percent of all feed requirements in the West County. It will not be possible to entirely substitute all alfalfa hay imports with locally grown forage crops but the availability of irrigation could allow dairy farmers in the Project areas to reduce feed costs by growing more irrigated pasture and/or growing a summer crop of oat silage, corn or Sudan silage, or green chop. Some dairy farmers may also become net-exporters of forage to other farmers in the rest of Sonoma or Marin Counties.

Apples, Wine Grapes, Berry, and Vegetable Crops

There is a growing trend toward producing organic specialty fruit and vegetable crops to serve the large Bay Area consumer market for fresh produce. The consumers of the Bay Area are willing to pay a premium for unusual and exotic fresh produce and the large restaurant market contributes toward this demand for quality, locally produced fresh produce. The trend in fresh produce is toward direct marketing where supermarkets and restaurants contract directly with the farmer for a specific crop.

While the California Certified Organic Farmers (CCOF) has not taken a formal position on whether crops grown with reclaimed water could be certified organic, preliminary indications are that the answer will be a "qualified yes" for drip irrigated fruits and vegetables. The organic certification may be withheld from certain root crops and sprouts raised with reclaimed water sprinkler irrigation and the CCOF's position regarding salad greens is uncertain. However, the CCOF will study the issue and make a formal policy decision when requested for certification by a farmer using reclaimed water (Brian Baker, California Certified Organic Farmers, pers. comm., August 1995).

Interviews with representatives from farmers' markets and wholesale fruit and vegetable markets indicated that they did not see a problem in selling produce raised with reclaimed water. However, local growers of organic crops have noted a "perceptual problem" from customers regarding the use of reclaimed water for irrigation. Produce market representatives indicated that providing they could be satisfied that the reclaimed water had no heavy metals or levels of chemical residues any worse than tap water, they will not see a need to issue disclaimers (Bill Fujimoto, Monterey Foods, pers. comm., August 1995, and Lynn Bagley, Marin Farmers Market, pers. comm., August 1995). Some small scale Sonoma County farmers are already successfully using Santa Rosa's reclaimed water to grow vegetables (Paul Vossen, Sonoma County Farm Advisor, UC Cooperative Extension, pers. comm., August 1995).

The outlook for specialty crops of all types including locally made cheeses, salad greens, cut flowers, tomatoes, and berry crops can be expected to be strong as the Bay Area urban population expands. The availability of reclaimed water could enable new farmers to enter the market, as well as enable existing farmers to use fallow or under-utilized land more productively.

Summary of Agricultural Findings

In summary the total annual increase in gross value due to irrigation of all fruit, vegetable, wine grape, and forage crops ranges between $3.1 and $71.9 million in the annual income in West County and between $2.6 and $35.0 million in the South County depending on the cropping scenario (see Table 4.18-17). The Sebastopol area produces an additional $50.4 million due to increased apple yields, provided that most apple growers switch to the higher yielding new dwarf and semi-dwarf apple varieties.

The value of the increased local dairy forage production could exceed the gross crop values shown in this analysis if the ability to grow local forage and pasture ensures the long-term survival of the dairy industry in Sonoma and northern Marin counties. The North Bay dairy industry cannot currently compete effectively with the Central Valley, because the climate and availability of inexpensive water enables the Central Valley dairy farmers to feed locally-grown cheap alfalfa hay. North Bay dairy cows produce a high quality of milk due to the cool climate and the availability of pasture land.

Assuming that the current dairy price support system remains in place, the two factors that most threaten the dairy industry in the North Bay are the high cost of alfalfa hay and urban pressures that increase the price of agricultural land and increase the opportunities for urban dweller/agricultural landowner conflicts. The availability of reclaimed water to dairy farmers could substantially reduce the cost of imported feeds and improve the long-term viability of the dairy industry by reducing the competitive edge now enjoyed by the Central Valley dairy farmers. If they are able to produce more forage than they need, dairy farmers in the Project area may be able to secure a secondary income source from selling forage produced with reclaimed water to other dairy farmers in the region, to sheep and beef cattle ranchers, and to horse stables.

Potential Decrease in Tourism Economy

Impact: **18.5. Will the Project decrease the tourism economy through increased wastewater discharge?**

Analysis: Tourism in the Russian River area has been affected by a number of factors over the last several years. In the early 1990s the region experienced a slight decline in the number of tourists as a result of the economic recession. Most recently, the winter floods have slowed tourism. The discharging of reclaimed water into the Russian River has also been cited as having a negative impact on tourism. This section examines the various factors that potentially affect tourism demand and the impact on the tourism economy of increasing reclaimed water discharge.

In 1995, floods had a major impact on tourism along the Russian River. The floods and the damage to the Russian River area received heavy media coverage throughout California. However, after the area was repaired and many of the businesses reopened, there was very little public coverage. Most of the resort owners blame the slow year on the negative publicity and the fact that many tourists believe the River towns are still seriously damaged by the floods.

The current reclaimed water discharge does not appear to have a major impact on tourism. There was a slight decline in the transient occupancy tax in 1992, the same year as the last accidental summer discharge into the Laguna. However, the decline was minimal and cannot readily be linked to the discharge that occurred. Most tourists are unaware of the reclaimed water discharge issue, unless there has been some occurrence that has received media coverage in the major cities nearby.

According to merchants in the area and City officials, misunderstandings about the nature of the river discharge has led to confusion among some tourists. There is a common misconception that reclaimed water is raw sewage and this problem is exaggerated by some of the negative publicity regarding the reclaimed water. Most of the resort owners who were interviewed feel confident that if the reclaimed water discharge is not overly publicized, it will not affect tourism.

Alternatives 2 and 3, West County and South County Reclamation Irrigation, would decrease existing annual average volume of discharged into the Russian River.

Alternative 4, Geysers Recharge, will decrease existing discharge levels. Discharge will be less than 1 percent of river flows.

Alternative 5, Discharge to the Laguna or Russian River, will increase the design discharge rate to 20 percent. The permitted discharge period between October and May will still be enforced, so the discharge will not occur during the heaviest tourist months of July through September. However, there may still be a negative perception associated with increased discharge.

Based on the assessment of the factors affecting the Russian River tourism economy, it is evident that publicity regarding events such as the floods and discharge, rather than the event itself, can have the most significant impact on the local tourism economy. Therefore, increasing the discharge of the reclaimed water may not impact the local tourism economy if it is accompanied by educational information and appropriate publicity. The success of publicity campaigns is hard to predict, but it will be important to publicize accurate information about the timing of the discharge season and the high quality of reclaimed water.

Net Economic Impact

Impact: **18.6. Will the Project have a net economic effect on the local economy?**

Analysis: This section discusses the factors which contribute to the net economic impacts of the Project, including the benefits the Project has on the agricultural economy, the costs and benefits of ongoing operations and maintenance, and the impacts of increasing service charges.

Figure 4.18-2 shows the economic benefits and impacts of each alternative, in terms of total employment.

Those alternatives that include the reuse of water for agriculture (Alternatives 2 and 3) generate annual economic benefits of $50 to $60 million in the Sonoma and Marin counties' economy. The economic costs of the agricultural reuse alternatives range between $27 and $47 million. The Geysers Recharge Alternative is projected to have the largest economic impact due to the high cost of operation and maintenance. These costs will be offset by the additional property tax revenue and royalty payments that will accrue to Sonoma County.

In order to determine the economic benefits to the County from the Geysers Recharge Alternative it is necessary to determine how much additional electrical energy can be attributed directly to the extra steam which will result from the volume of water injected into the geothermal field. It is expected that wastewater injection into the geysers steamfield will have an immediate effect on increased electrical generation and will also extend the life of the steamfield. By increasing the pressure and flowrate of steam, it will take longer to reach the physical and economic limit of the power plants. If the life of the geysers is extended then the County will continue to enjoy the same benefits, property taxes and federal geothermal royalties as they do now but for a longer period of time. If there is a net increase in steam power produced the County could enjoy increased benefits in the Project startup year of 2000.

Property Taxes

According to the Sonoma County Assessors' office, responsible for assessing the real estate value of the geysers, in 1995 the assessed value of the geysers was $800 million, which generated approximately $1.6 million in annual property tax revenues for the Sonoma County General Fund.

The valuation of the geysers is dependent upon a variety of factors, including the price of alternative fuel sources. The property value of the geysers was at its highest during the 1970's, when alternative fuel prices were high. Today, the value has declined as alternative energy sources have dropped in price. Assuming that the valuation of the geysers remains similar to the current estimates, the injection of additional water

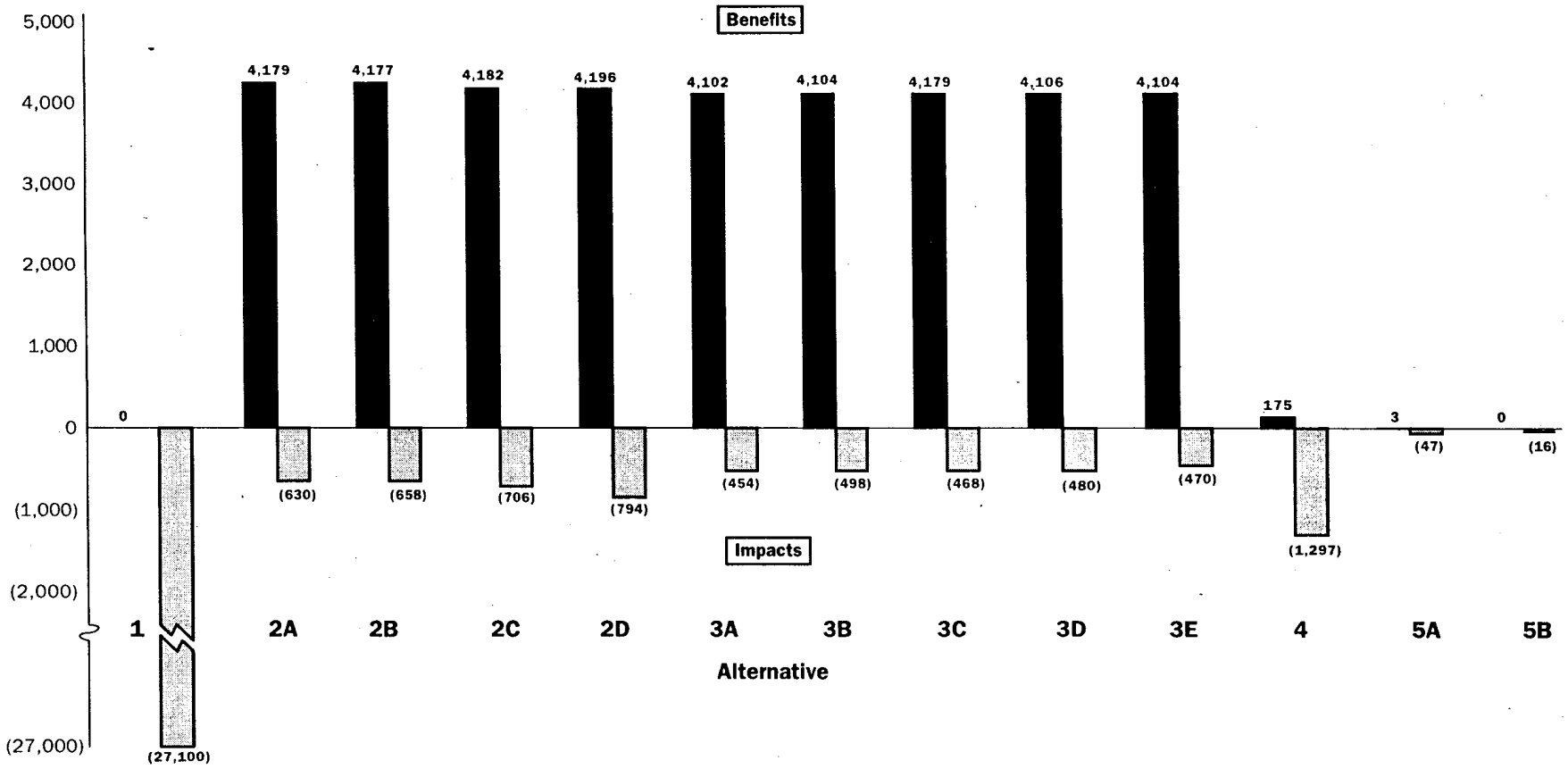
could extend the time period during which the County receives the approximately $1.6 million in property tax revenue per year. In addition, as the amount of electricity generated by the geysers increases with the accelerated steam flowrate, the County could re-assess the value of the geysers and receive a net increase in annual property taxes. However, there are so many factors that will affect the future value of the geysers, including fluctuations in future energy prices, changes in technology, and energy recovery rates, that it will be too speculative to estimate any future increases in property taxes.

Sonoma County also receives a share of federal geothermal royalties paid by UNOCAL. These royalties will also offset the high cost of the Geysers Recharge Alternative.

However, several issues make future projections of the amount of electrical power generation that will result from the Alternative uncertain. It has been estimated that the average annual volume of water to be delivered to the geysers will vary between 5,150 million gallons per year at Project start-up (about year 2000) and 6,350 million gallons per year by about 2020. Based on average unit energy recovery rates, as provided by UNOCAL and PG&E, it is expected that about 58,000 kilowatt-hours could be generated for every million gallons of water injected into the geothermal field. Based on this unit energy recovery value, the total annual energy production could range between 298 million kilowatt-hours in the Project startup year 2000 to about 413 million kilowatt hours by the year 2020.

UNOCAL pays a 12.5 percent royalty on steam produced from their federal leases at the geysers. Royalty is based on the value of electricity generated from the federal portion of the steam. Fifty percent of the federal royalties are collected by the U.S. Treasury and the other fifty percent is collected by the California Energy Commission. The State of California distributes 40 percent of the State's share of geothermal royalties to the local County of origin. Therefore, Sonoma County currently receives 20 percent of all federal royalties collected from the geothermal fields. According to the Sonoma County Administrator's Office, the County currently receives about $600,000 annually in geothermal royalties all of which are paid into the County General Fund.

It is estimated that between 20 and 40 percent of the additional steam will occur on federal leases. The other 60 to 80 percent of additional steam power will be produced from state and private leases which do not pay royalties to the County (Rich Estabrook, Petroleum Engineer, M.S., Bureau of Land Management, pers. comm., March 1996).



Source: Economic & Planning Systems

HARLAND BARTHOLOMEW & ASSOCIATES, INC.
PARSONS ENGINEERING SCIENCE, INC.
UNITS OF PARSONS INFRASTRUCTURE & TECHNOLOGY INC.
PARSONS

Santa Rosa Subregional Long-Term Wastewater Project

DIRECT ECONOMIC IMPACTS of CHANGE In TOTAL EMPLOYMENT

Figure 4.18-2

Based on the current price for steam of $0.0162 per kilowatt[2] hour, using the annual energy recovery range described above of 298 to 368 million kilowatt-hours, and assuming that 20 percent of the power will be produced from federal leases, potential additional royalties to the Sonoma County General Fund could be in the range of $24,000 (year 2000) to $30,000 (year 2020) annually. However, the actual incremental royalties to the County will depend on future steam prices, recovery rates, and the extent to which additional steam power can be attributed directly to the additional water injection.

The Discharge Alternative generates very little economic benefit, but will still generate economic costs due to the increase in service charges. In terms of the net economic benefits, Alternatives 2 and 3 are projected to generate benefits that exceed the costs.

Table 4.18-18 shows the net economic impacts in terms of total income, direct employment, and total employment. The net direct employment impacts of Alternatives 2 and 3 are positive under all of the subalternatives.

Table 4.18-18

Annual Economic Benefits and Costs of Project Alternatives

Alternative	Total Income ($1000)	Direct Employment	Total Employment
Economic Benefits [1]			
1 No Project	0	0	0
2A Tolay Extended	$141,886	2,068	4,179
2B Adobe Rd and Lakeville	$141,781	2,068	4,177
2C Tolay Confined	$142,003	2,069	4,182
2D Sears Pt and Lakeville	$142,545	2,071	4,196
3A Two Rock	$140,019	2,028	4,102
3B Bloomfield	$140,119	2,029	4,104
3C Carroll Road	$140,127	2,029	4,105
3D Valley Ford	$140,160	2,029	4,106
3E Huntley	$140,086	2,029	4,104
4 Geysers Recharge	$6,886	30	175
5A Discharge to River	$100	0	3
5B Discharge to Laguna	$0	0	0

[2] Telephone conversation with Doug Hackley, UNOCAL, Santa Rosa Office, on April 4, 1996.

Table 4.18-18

Annual Economic Benefits and Costs of Project Alternatives

Alternative	Total Income ($1000)	Direct Employment	Total Employment
Economic Costs [2]			
1 No Project	($1,482,840)	(27,100)	(27,100)
2A Tolay Extended	($21,790)	(292)	(630)
2B Adobe Rd and Lakeville	($22,768)	(305)	(658)
2C Tolay Confined	($24,424)	(327)	(706)
2D Sears Pt and Lakeville	($27,469)	(368)	(794)
3A Two Rock	($15,733)	(210)	(454)
3B Bloomfield	($17,250)	(231)	(498)
3C Carroll Road	($16,223)	(217)	(468)
3D Valley Ford	($16,615)	(222)	(480)
3E Huntley	($16,291)	(218)	(470)
4 Geysers Recharge	($44,861)	(602)	(1,297)
5A Discharge to River	($1,651)	(21)	(47)
5B Discharge to Laguna	($574)	(7)	(16)
Net Economic Impacts			
1 No Project	($1,482,840)	(27,100)	(27,100)
2A Tolay A	$120,095	1,776	3,549
2B Adobe Rd and Lakeville	$119,012	1,762	3,518
2C Tolay C	$117,579	1,741	3,476
2D Sears Pt and Lakeville	$115,076	1,703	3,401
3A Two Rock	$124,286	1,818	3,647
3B Bloomfield	$122,869	1,797	3,606
3C Carroll Road	$123,904	1,811	3,636
3D Valley Ford	$123,544	1,806	3,625
3E Huntley	$123,795	1,810	3,633
4 Geysers Recharge	($37,974)	(571)	(1,122)
5A Discharge to River	($1,551)	(20)	(44)
5B Discharge to Laguna	($574)	(7)	(16)

Source: Parsons Engineering Science, Inc. 1996;
Economic & Planning Systems, Inc., 1996

Notes:
1 Includes benefits from agriculture and operating & maintenance expenditures.
2 Due to reduction of expenditures to offset the increased service charge.

While the economic benefits offset the costs of Alternatives 2 and 3, the benefits and costs do not accrue to the same population groups. The benefits primarily accrue to farmers who will use the reclaimed water and their suppliers. The service charge increase impacts all of the rate payers. The benefits of the use of reclaimed water for irrigation will more directly offset the impacts if the users of the reclaimed water were charged for the water.

Environmental Justice

Impact 18.7: Will the Project disproportionately affect low income or ethnic minority communities?

Analysis

Approximately 10% of the persons living in the affected area in 1989 were non-white, compared to 9.3 % for Sonoma County as a whole (See Table 4.18-19). The Project is, therefore, not expected to have a significantly negative impact on ethnic minorities.

There is less than a 1% difference between per capita income of persons in the affected area and Sonoma County as a whole (see Table 4.18-19). The Project is, therefore, not expected to have a significantly negative impact on low income communities.

Table 4.18-19

Demographics of Affected Area and Sonoma County

Item	Affected Area	Sonoma County
Persons by Race		
White	90.0%	90.7%
Black	1.7%	1.4%
American Indian, Eskimo or Aleut	0.8%	1.2%
Asian or Pacific Islander	2.5%	2.8%
Other Race	5.0%	3.9%
TOTAL	100.0%	100.0%
Per Capita Income	$17,777	$17,239

Sources: 1990 U.S. Bureau of the Census

Notes:

1 The affected area was assumed to include the census block groups in the parcels where the proposed reservoir sites, pump stations, storage tanks, and pipelines will be located.

No Action (No Project) Alternative

If a Long-Term Wastewater Project is not implemented, it is likely that no new development in the Santa Rosa service area will be permitted after 1997 (see Chapter 3, Description of the No Action Alternative). Furthermore, as previously noted, approximately 52 percent of disposal cost is attributable to inadequate disposal reliability for existing residents. Therefore, the wastewater system will continue to operate with an inadequate disposal system.

While it is difficult to predict the economic effects of the growth moratorium that is expected to be imposed if no Project is constructed, the following discussion provides an analysis of potential economic impacts of not constructing a Project.

Economic activity in the local economy is dependent upon a variety of factors, including household formation and labor force. As new households are formed, an array of goods and services are purchased. In many areas, 60 to 70 percent of the economic activity is dependent upon expenditures from local residents. If there is no new development in an area, those residents that are forming new households could be forced to move to other areas to find housing. That portion of the local economy that is dependent upon expenditures from new households, such as the building industry and retailers selling home furnishings and appliances, could lose significant market support. It is estimated that every new household supports between 1 to 2 new jobs in the economy as a result of the multiplier effect generated by the construction of their home and their ongoing personal expenditures in the local economy.

Constraints on household formation will also adversely affect the labor force in the local economy. This, in turn, will have impacts on existing and prospective businesses. In much the same manner as existing Marin County based businesses have been moving their offices north to Sonoma County due to a lack of expansion space in Marin, some firms located in the service area may be forced to move their entire operation if expansion opportunities are not available.

Furthermore, a growth moratorium will distort the structure of the local labor force. Without new housing development, prices of existing homes could be bid upward. This could squeeze out lower income and perhaps moderate income households. This effect, in combination with the out-migration of new households, may make it difficult for employers to fill entry level jobs and service jobs that pay lower wages.

Overall, the economic impact of the No Action Alternative may be much greater than the 27,100 future jobs and 28,200 future housing units that will not be permitted. The No Action Alternative could impact the income growth of existing residents and workers. Ultimately, a growth moratorium could force the local economy to change from the current relatively self-sufficient economy with a healthy, diverse employment base to a bedroom community that is dependent on other communities

CUMULATIVE IMPACTS

There are two impacts -- both significant -- identified in the Socio-economics section:

Impact: **18.1C. Will the Project plus cumulative projects increase the service charge for wastewater?**

Analysis: The costs of Alternatives 2, 3, and 4 will increase wastewater service charges to a point exceeding 1.5 percent of the median income in the Project area.

In addition to the Project, there are other ongoing and potential projects that will increase service charges for water and wastewater in the Project area. The Annual Capital Improvement Program for the Santa Rosa Utilities Department for water and wastewater improvements averages about $3 million for wastewater projects and about the same for water projects. In addition to these regular expenditures for improving and upgrading existing facilities, there are several additional projects that could contribute to increased fees. Proposed improvements for the wastewater system include the possible conversion to ultraviolet disinfection, at a cost of $10 million, and a possible new wastewater line, the Todd Road trunk line, which could be built within the next 15 years at a cost of $7 million. Improvements to water service include new wells and seismic retrofit of the existing system, which could cost about $1 million per year over a period of five to seven years. Other projects may be determined to be necessary because of changing regulatory requirements. Because funding of these projects could occur by a variety of methods, including use of assessment districts, it is not possible to determine the amount of further service charge increase for each member of the Subregional System. However, these projects will collectively contribute to the total service charges for Subregional System users.

Impact: **18.2C. Will the Project plus cumulative projects result in loss of homes displaced by construction of Project facilities?**

Analysis: The Tolay Extended, Adobe Road, Two Rock, Carroll Road, Valley Ford, and Huntley reservoir sites will all displace homes. No other cumulative projects that will displace homes in the Project area have been identified. Thus, this significant Project impact will not be any greater on a cumulative level.

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES

Table 4.18-20

Summary of Significant Impacts and Mitigation Measures - Socio-economics

Impact	Level of Significance	Mitigation Measure
18.1. The Project may increase the service charge for wastewater.	Alt 2 - ● Alt 3 - ● Alt 4 - ●	No feasible mitigation has been identified.
18.2. The Project may result in loss of homes due to construction of facilities.	Alt 2A - ● Alt 2B - ● Alt 3A - ● Alt 3C - ● Alt 3D - ● Alt 3E - ●	No feasible mitigation has been identified.

Source: Economic & Planning Systems Inc., 1996

Notes:
● Significant impact before and after mitigation

SUMMARY OF IMPACTS BY ALTERNATIVE

Table 4.18-21

Summary of Impacts by Alternative -Socio-economics

	Alt 1	Alt 2A	Alt 2B	Alt 2C	Alt 2D	Alt 3A	Alt 3B	Alt 3C	Alt 3D	Alt 3E	Alt 4	Alt 5A	Alt 5B
Increase in service charge	○	●	●	●	●	●	●	●	●	●	●	○	○
Loss of Homes	--	●	●	==	==	●	==	●	●	●	==	==	--

Source: Economic & Planning Systems Inc., 1996

Notes: Level of Significance

○ Less than significant impact; no mitigation proposed

● Significant impact before and after mitigation

-- Not Applicable

== No impact

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Chuck Teller, Economic and Planning Systems
Sonia Jacques, Economic and Planning Systems
Jessica LeVeen, Economic and Planning Systems

Reviewers

Pat Collins, Harland Bartholomew & Associates, Inc.
Robin Cort, Ph.D., Parsons Engineering Science, Inc.
Robert Duchek, Harland Bartholomew & Associates, Inc.
Anders Hauge, Harland Bartholomew & Associates, Inc.
Walter Kieser, Economic and Planning Systems
Teifon Rice-Evans, Economic and Planning Systems
Jeffrey Peters, Questa Engineering
John Cummings, Ph.D., Peer Review Committee
David Zieger, Peer Review Committee

References

HBA Team Documents

Parsons Engineering Science, Inc. 1995a. *Energy Demand of Alternative Projects.* September. (Appendix R-1).

Parsons Engineering Science, Inc. 1995b. *Alternative Projects Construction Cost Estimates.* November. (Appendix D-30).

Economic & Planning Systems. 1993. *Acquisition Options Report.* October. (Appendix S-1)

Economic & Planning Systems. 1995a. *Land Value Estimates.* November. (Appendix S-2).

Economic & Planning Systems. 1996. *Agriculture Impact Analysis Methodology.* March. (Appendix E-4).

Questa Engineering Corporation. 1996a. *Cropping Scenarios for the West County and South County Reclamation Alternatives.* January 10. (Appendix E-3).

Questa Engineering Corporation. 1996b. *Irrigation Suitability Land Classification and Existing and Potential Agricultural Land Uses, Sebastopol and South County Reclamation Study Areas.* May 10. (Appendix E-1)

Questa Engineering Corporation. 1996c. *Irrigation Suitability Land Classification and Existing and Potential Agricultural Land uses,, West County Reclamation Study Area.* May 10. (Appendix E-2).

Questa Engineering Corporation. 1996d. *Irrigation Management Guidelines for the West County and South County Alternatives.* May 10. (Appendix D-19).

West Yost & Associates. 1996. *Wastewater Flow Projections.* (Appendix E-4).

Other References

Bennett, R.H., *The Sonoma County Dairy Industry.* UC Cooperative Extension

Vossen, Paul. 1996. *Impacts of Irrigation Water.* Cooperative Extension for Sonoma County, University of California. January 8.

Association of Bay Area Governments. 1993. *Projections '94.* December.

City of Rohnert Park. 1994. *Second Draft General Plan of the City of Rohnert Park.*

City of Santa Rosa. 1991. *Santa Rosa 2010 General Plan.* July.

City of Sebastopol. 1994. *City of Sebastopol General Plan.*

Earth Metrics, Inc. 1990. *City of Cotati Final Environmental Impact Report.*

Office of the Agricultural Commissioner. 1989-1994a. *Sonoma County Agricultural Crop Reports.*

Office of the Agricultural Commissioner. 1989-1994b. *Marin County Agricultural Crops Reports.*

State Water Resources Control Board, Division of Clean Water Programs. 1995. *Wastewater User Charge Survey Report.* April.

Transamerica Information Management Services. *Metroscan: Database of Sonoma County Assessor's Data.*

U.S. Bureau of the Census. 1990.

U.S. Environmental Protection Agency. 1993. *Combined Sewer Overflow Financial Capability Assessment Guidebook.* September.

Consultation and Coordination

Persons Contacted

Bill Bowan, Clifford & Bowman, Inc., July/August 1995.

Bill Fujimoto, Monterey Foods, August 1995.

Brian Baker, California Certified Organic Farmers, August 1995.

City of Cotati, Water and Sewer Billing Services, February 1996.

City of Sebastopol, Sewer Billing Services, December 1995.

Dan Carlson, City of Santa Rosa, Utilities Department, February 1996.

Dennis Dorch, Planning Director, City of Cotati, July 1995.

Don Test, Planning Director, Russian River Region, July 1995.

Donald Shipelhaute, California Department of Agriculture, Dairy Marketing/Milk Pooling Branch, August 1995.

Doug Hackley, UNOCAL, April 1996.

Dr. Vern Marble, Extension Agronomist (Retired), U.C. Davis, August 1995.

Frank Kasimov, City Planner, Department of Community Development, City of Santa Rosa, March 1996.

Jeff Peters, Questa Engineering Corporation, August 1995.

Lynn A. Brittan, Agricultural Consultant, August 1995.

Lynn Bagley, Marin Farmer's Market, August 1995.

Margaret Brannen, California Department of Agriculture, Dairy Marketing/Milk Pooling Branch, December 1994 and July 1995.

Marie Meredith, Senior Planner, City of Santa Rosa, June 1995.

Nathan Bo Bottwinick, REMAX Central Santa Rosa, July/August 1995.

Paul A. Rowan, July/August 1995.

Paul Skanchy, Planning Director, City of Rohnert Park, June 1995.

Paul Vossen, Sonoma County Fruits and Vegetables Farm Dairy Farm Advisor, U.C. Cooperative Extension, August 1995.

Pete Livingston, U.C. Davis, July/August 1995.

Rich Estabrook, Petroleum Engineer, U.S. Bureau of Land Management, March 1996.

Richard Spitler, Planning Director, City of Sebastopol, July 1995.

Rick Bennett, Sonoma County Farm Advisor, U.C. Cooperative Extension, February 1996.

Russian River Chamber of Commerce, July 1995.

Stephanie Larson, Sonoma County Forage Farm Advisor, U.C. Cooperative Extension.

Tamara McGee, California Department of Agriculture, Dairy Marketing/Milk Pooling Branch, August 1995.

Tom Gossard, California Department of Agriculture, Dairy Marketing/ Milk Pooling Branch, November 1994.

Tuck Vath, Regional Water Quality Control Board, August 1995.

Correspondence

Estabrook, Rich. 1996. Memorandum Comments on Federal Royalty Description. March.

Economic & Planning Systems. 1996. *Demand Fee and Service Charge Calculations.* November.

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4.19 INUNDATION DUE TO DAM FAILURE

In addition to other impacts for the Project components described in this Chapter, this section of the EIR/EIS addresses the potential for inundation from dam failure at the reservoir sites.

Storage reservoirs dams will be designed and constructed in accordance with the state Division of Safety of Dams. The potential for dam failure caused by a seismic event, unstable slope conditions, or damage from corrosive or expensive soils is extremely remote. Nonetheless, the potential impact on the storage reservoirs dams from one of these events has been evaluated.

PROBABILITY OF DAM FAILURE

Since 1929, following the catastrophic failure of the St. Francis dam, the State of California has assumed jurisdiction over the design, construction, and operation of dams in California to prevent failure and to safeguard life and protect property. The California Department of Water Resources, Division of Safety of Dams is the regulatory agency charged with that mission. Refer to Section 4.3 Geology, Soils, and Seismicity regulatory framework discussion, for information about the Division's jurisdiction and legislative mandate. The Project will be required to meet the design, construction, and operational standards of safety established by the Division. Adherence to these standards greatly reduces the probability of dam failure and is protective of public safety (Head 1996).

California has the most stringent dam safety design and construction review standards in the country. The requirements for siting, engineering, construction, and monitoring of dams and reservoirs are continually improved as knowledge of how and why dams fail increases. Since the Division of Safety of Dams was established, three notable dam failures have occurred in California. These are discussed below. One of the three (Baldwin Hills Reservoir) resulted in loss of life.

Subsequent to the major earthquake damage at the Lower Van Norman Dam in 1971, the Division of Safety of Dams began a seismic rehabilitation program wherein existing dams, including those built before 1929, are inspected for earthquake resistance and remedial action is ordered if necessary. Division of Safety of Dams may order dam owners to reduce the volume of water stored in a reservoir, to drain reservoirs completely, or to develop and implement a seismic reinforcement plan. New dams are designed to withstand the maximum expected earthquake forces calculated for the proposed site.

Several dams were damaged during the 1989 Loma Prieta earthquake (magnitude 7.1). Austrian Dam, which impounds Lake Elsman west of San Jose, sustained significant damage. This dam was built in 1949 and since the earthquake has been rehabilitated. Many of the reservoirs in California were at low levels during the late 1980s due to a

prolonged drought. None of the dams that were damaged during the Loma Prieta Earthquake failed catastrophically, no uncontrolled releases of water occurred, and no loss of life resulted (Harder, no date).

Damage to earthen dams in California is often associated with poor operation and maintenance of dam facilities or with strong earthquake-induced ground shaking affecting older dams that have not been designed to modern standards. The risk of dam failure is highest in older dams built to lower design standards that have not been upgraded for seismic safety and when dams are poorly designed, constructed, operated, or maintained. Lack of proper maintenance and monitoring or inappropriate modifications to older structures are often contributing factors in dam failure (Jansen 1988). Maintenance, surveillance, and preparedness for emergencies are recognized as important activities that insure the safety of dams.

During operation, the reservoirs will be visually inspected on a regular basis to ensure that the embankments, control structures, access roads, and monitoring instrumentation are maintained. Impediments will be removed from the spillway and other control structures as soon as they are observed.

Seven of the reservoir sites, except Tolay and Sears Point, are located in small watersheds that have a drainage area of less than three square miles. Reservoirs located within larger watersheds, Tolay (5.3 square miles) and Sears Point (9.5 square miles) are designed with drainage diversion facilities that allow the major portion of the watershed runoff to be collected and conveyed to Tolay Creek downstream of the dams. The drainage diversion facilities effectively reduce runoff inputs into the reservoir. The reservoirs' spillways have been designed to accommodate the probable maximum flood[1], and 15 feet of freeboard (storage capacity which is not used for normal operations) between the dam spillway elevation and the crest of the dam has been included as a design feature.

Prior to dam construction, alluvium and colluvium will be excavated from the footprint of the dam and dam structures will be founded on bedrock (refer to the Chapter 3, Description of Existing System and Alternatives and Section 4.3, Geology, Soils, and Seismicity for a discussion of reservoir construction methods and potential impacts). Embankments will be designed to key into the foundation and structures will be designed to withstand the maximum anticipated ground acceleration at the site.

The dam and reservoir design will eliminate the possibility of failure by the major causes of dam failure. Overtopping will be preempted because dams will be sited in small tributary watersheds and spillways will be sized to accommodate the probable maximum flood. The possibility of foundation failure would be reduced by construction on a bedrock foundation and installation of an internal drainage system. Modern design and

[1] The Maximum Probable Flood (MPF) is a design flood frequency that is determined using statistical methods. The MPF Value should represent the largest flow that the reservoir spillway is likely to receive. The value is determined by using maximum historical precipitation values and determining the maximum runoff at the peak of the hydrograph.

construction, bedrock foundation[2], and conservative freeboard[3] would preempt serious earthquake damage. The Division of Safety of Dams requires appropriate instrumentation and monitoring and submittal of annual reports.

A probability analysis performed for a planned reservoir in Southern California *(The Reliability Analysis for a Major Dam Project)* indicates that the probability of failure of that dam was small (one in a billion). However, no similar analysis has been performed for the dams proposed for this Project and there remains a possibility that dam failure could occur and that inundation of areas downstream of the dam could result.

As discussed in Measure 2.2.14, the State requires that an inundation map be prepared for any dam which either is 25 feet or more in height or impounds 50 acre feet or more of water (California Water Code, §8589.5). The map is submitted by the dam owner to the Office of Emergency Services for review and approval. Following approval, the Office of Emergency Services transmits the map to the appropriate local government, which is required to produce evacuation plans within six months.

HYDROLOGIC AND HYDRAULIC ANALYSIS

To meet Office of Emergency Services requirements, hydrologic and hydraulic analysis was performed to estimate the approximate depth of flooding and approximate limits of inundation caused by a main dam break at each of ten proposed reservoir sites. For each reservoir, five breaching alternatives were analyzed; 15 minute failure of the full dam; 3 hour failure of the full dam; 15 minute failure of part of the dam; 3 hour failure of part of the dam; and 12 hour failure of part of the dam. It was assumed that, for purposes of these analyses, the initial water level in each reservoir was at the spillway crest elevation. The peak stage elevations, flooding depths, and inundation limits were calculated using the flood hydrograph computer model HEC-1 developed by the U.S. Army Corps of Engineers. Because the spillway for each dam would be designed to handle the Probable Maximum Flood, it was assumed that the dams would not be overtopped during the Probable Maximum Flood. Therefore, an overtopping analysis was not conducted.

At several sites there are one or more supplementary side dams in addition to the main dam. However, only the main dam was analyzed (except at Tolay Confined where the back dam was also analyzed) since failure of these back dams would result in the largest flood levels.

Based on the modeling results for each reservoir, the flood inundation limit for the catastrophic case scenario (failure of the full dam within 15 minutes) for each reservoir was plotted on USGS base maps. The flood inundation limits for the catastrophic for each reservoir are:

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[2] A bedrock foundation prevents damage from liquefaction.

[3] Adequate freeboard would allow the reservoir to safely retain the maximum storage capacity even if earthquake-induced settlement were to occur.

Tolay Extended

The Tolay Extended main dam would be sited on Tolay Creek southeast of the intersection of Highway 116 and Lakeville Highway. Discharge from the reservoir would flow down Tolay Creek to San Pablo Bay. The worst case scenario dam break would cause Tolay Creek to flood buildings in the vicinity of Sears Point and scattered buildings along Highway 121 and on Tubbs Island. State Highways 37 and 121, which are important transportation corridors, could be inundated. The estimated maximum water level at Sears Point would be 11 feet.

Adobe Road

The Adobe Road dam would be sited on Washington Creek upstream of the City of Petaluma. Discharge from the reservoir would flow down Washington Creek through Petaluma to the Petaluma River. A 15 minute dam failure would cause the inundation of most of Petaluma between Ely Road and the Petaluma River. Numerous public facilities, including schools, fire stations, one airport, and drinking water supplies are situated within the inundation area of the Adobe Road reservoir. The City of Petaluma's water tanks and the Old Adobe School, located near the intersection of Adobe Road and East Washington Boulevard, lie in the center of the flood inundation area and would be the first facilities reached by the flood waters. The estimated maximum water depth would range between 7 feet and 17 feet within Petaluma.

Tolay Confined

The Tolay Confined main dam would be sited in the same location as the Tolay Extended dam. Discharge and flooding would be similar, but the estimated maximum water level at Sears Point would be 12 feet.

Tolay Confined Back Dam

In addition to the analysis conducted for the main dams, an analysis was conducted for the Tolay Confined back dam. The discharge would backup beyond the headwaters of Tolay Creek and flow down a creek along the south side of Adobe Road and down to the Petaluma River near Browns Lane and Lakeville Highway. Also, the water would flow over a saddle north of Cannon Lane and into a tributary of Stage Gulch Creek. Most of the flooding would be limited to areas adjacent to the two creeks. However, several buildings near the Lakeville School would also be flooded.

Lakeville Hillside

The Lakeville Hillside dam would be sited on a tributary of the Petaluma River near Lakeville Highway and Hog Island. Discharge from the reservoir would flow down the tributary into the Petaluma River and from there into San Pablo Bay. The 15-minute dam break scenario would cause flooding between Lakeville Highway and the Petaluma River. No towns would be inundated and few buildings would be flooded. The estimated maximum water depth would be 30 feet at Lakeville Highway.

Sears Point

The Sears Point dam would be sited on Tolay Creek northwest of the intersection of Highways 37 and 121. Discharge from the reservoir would flow down Tolay Creek to San Pablo Bay. The worst case scenario dam break would cause Tolay Creek to flood buildings in the vicinity of Sears Point and scattered buildings along Highway 121 and on Tubbs Island. State Highways 37 and 121, which are important transportation corridors, could be inundated. The estimated maximum water level at Sears Point would be less than 5 feet.

Two Rock

The Two Rock dam would be sited a tributary of Stemple Creek north of Two Rock in the Roblar de la Miseria. Discharge from the reservoir would flow down the tributary into the main branch of Stemple Creek near Two Rock. From there, the water would flow through Marin County into the Estero de San Antonio to Bodega Bay. The worst case scenario dam break would cause Stemple Creek to flood the town of Two Rock. The flood waters would also back up Stemple Creek and would flood scattered buildings near Two Rock School. The Two Rock School and the Two Rock Fire Station lie on the edge of the flood inundation. Portions of the Coast Guard Reservation also appear to lie in the flood inundation area of the Two Rock Reservoir. The flood waters would back up several tributaries to Stemple Creek and Estero de San Antonio and would flood several buildings between Two Rock and Bodega Bay. The estimated maximum water depth at Two Rock would be 80 feet.

Bloomfield

The Bloomfield dam would be sited on a tributary of Americano Creek northwest of the town of Bloomfield. Discharge from the reservoir would flow down the tributary to the main branch of Americano Creek. From there, the discharge would flow down past the town to Bodega Bay. The dam break scenario would cause Americano Creek to inundate the town of Valley Ford. The flood waters would also back up into Americano Creek, Bloomfield Creek, and Ebabias Creek, as well as several other tributaries to Americano Creek. The backup along Americano Creek and Bloomfield Creek would inundate most of the town of Bloomfield. The Valley Ford and Bloomfield Fire Stations are the major public facilities that lie within the flood inundation area. There are other buildings scattered along Americano Creek that would be inundated. The estimated maximum water depth would be 13 feet at Valley Ford and 20 feet at Bloomfield.

Carroll Road

The Carroll Road dam would be sited on a tributary of Americano Creek between the towns of Bloomfield and Valley Ford. Discharge from the reservoir would flow down the tributary to the main branch of Americano Creek. From there, the discharge would flow down past Valley Ford to Bodega Bay. The 15 minute dam break scenario would cause Americano Creek to inundate the town of Valley Ford. The flood waters would

also back up Americano Creek, Bloomfield Creek, and Ebabias Creek, as well as several other tributaries to Americano Creek. The backup along Americano Creek and Bloomfield Creek would inundate most of the town of Bloomfield. The Valley Ford and Bloomfield Fire Stations are the major public facilities that lie within the flood inundation area. There are other buildings scattered along Americano Creek that would be inundated. The estimated maximum water depth would be 17 feet at Valley Ford and 26 feet at Bloomfield.

Valley Ford

The Valley Ford dam would be sited on a tributary of Americano Creek in the Canada de Pogolimi area northeast of Valley Ford. Discharge from the reservoir would flow down the tributary to the main branch of Americano Creek. From there, the discharge would flow down past Valley Ford to Bodega Bay. The 15 minute dam break scenario would cause Americano Creek to inundate the town of Valley Ford. The flood waters would also back up Estero Americano Creek, Bloomfield Creek, and Ebabias Creek, as well as several other tributaries to Estero Americano Creek. The backup along Estero Americano Creek and Bloomfield Creek would inundate part of the town of Bloomfield. The Valley Ford and Bloomfield Fire Stations are the major public facilities that lie within the flood inundation area. There are other buildings scattered along Americano Creek that would be inundated. The estimated water depth would be approximately 15 feet at Valley Ford and approximately 17 feet at Bloomfield.

Huntley

The Huntley dam would be sited on a tributary of Stemple Creek along Martinoni Road near the Sonoma-Marin County line. Discharge from the reservoir would flow down the tributary into Marin County and to the main branch of Stemple Creek. From there, the water would flow into Estero de San Antonio to Bodega Bay. The worst case scenario dam break would cause the Estero de San Antonio to back up to Fallon. The flood waters would also back up Stemple Creek and would flood scattered buildings near Two Rock School. The flood waters would also back up several tributaries to Stemple Creek and Estero de San Antonio and would flood several buildings between the Huntley dam and Bodega Bay. Portions of the Coast Guard Reservation also appear to lie in the flood inundation area of the Huntley reservoir. The estimated maximum water depth would be 76 feet at Fallon - Two Rock Road and 61 feet near Fallon.

Additional information about the analyses conducted may be found in the Technical Memorandum, *Dam Break Inundation Analysis* (Dames & Moore 1995), contained in Appendix J-1.

EFFECTS OF INUNDATION

In the event of inundation from dam failure, significant and widespread damage to property is likely within the areas of inundation. Within this area there would also be the possibility of personal injury and loss of life, the magnitude of which would be dependent

on the amount of warning before the dam failure, and the success of the evacuation procedures.

In addition to these effects on public safety, other effects would be likely to occur in the event of inundation from dam failure.

- Surface Water Hydrology - Streambank erosion in the event of a dam failure has not been quantified, but is assumed to be significant.

- Groundwater - Dam failure would release large quantities of reclaimed water, but would occur over a very short duration. Reclaimed water may pond in small depressions downstream of the dam, but most would enter a drainage and be carried out of the vicinity. The short duration of ponding would not significantly affect groundwater quality for nitrate.

- Surface Water Quality - If dam failure occurs, a large volume of water with an elevated ammonia, hydrogen sulfide, or cyanide concentration may be released to the streams below the dam.

- Terrestrial and Aquatic Biological Resources - Dam failure at any of the reservoir sites would result in inundation of large downstream areas and probable destruction of terrestrial and aquatic vegetation and wildlife habitat, and may impact endangered, threatened, or rare terrestrial wildlife or plant species in association with drainages downstream from a dam site.

- Jurisdictional Wetlands Resources - Dam failures at storage sites would result in inundation of streams below the dam site, scouring of stream channels, destruction of riparian vegetation and other wetland vegetation, and deposition of sediment from the reservoir into wetlands.

- Transportation - Inundation from dam failure would be likely to damage roads downstream of the dam.

- Public Services, Utilities, and Recreation - Inundation from dam failure would be likely to damage infrastructure downstream from the dam and would have a significant impact on emergency services. In the event of damage to infrastructure such as water and sewer mains, and gas, electricity and communications lines, these services could be disrupted for varying lengths of time until repairs could be made.

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Robert Duchek, Harland Bartholomew & Associates, Inc.
Sandia Potter, Parsons Engineering Science, Inc.

Reviewers

Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Anders J. Hauge, Harland Bartholomew & Associates, Inc.

References

HBA Team Documents

Dames & Moore. 1995. *Dam Break Inundation Analysis.* (Appendix J-1).

Other References

Harder, Leslie, F. *Performance of Earth Dams During the Loma Prieta Earthquake.* California Department of Water Resources.

Jansen, R.B. 1988. *Dam Safety in America,* Hydro Review, pp. 10-20. June.

Kollgaard, E. B., and Chadwick, W. L., editors. 1988. *Development of Dam Engineering in the United States.* Pergamon Press.

Consultation and Coordination

Persons Contacted

Head, James, Engineer, Department of Water Resources, Division of Safety of Dams, personal communication, February 2, 1996.

Correspondence

None.

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5 NEPA/CEQA REQUIRED SECTIONS

5.1 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The relationship between local short-term use of the environment and the maintenance and enhancement of long-term productivity often entails a balancing of social, economic, and environmental impacts over time. In some cases, a relatively short-term benefit may have adverse long-term effects, with the possibility that future generations may be burdened with unwarranted social and environmental costs. It is also possible to have long-term benefits at the expense of short-term costs. Balancing of such impacts from this Project is the responsibility of the City of Santa Rosa and U.S. Army Corps of Engineers as part of their policy-making and regulatory functions.

Short-term impacts of the Project include construction dust and noise, erosion potential, loss of wetlands, and road closure.

Long-term benefits of the Project include the beneficial use of reclaimed water for nonpotable uses such as agricultural and urban irrigation. Long-term impacts to health and safety, as evaluated in Section 4.7, Public Health and Safety, are unlikely due to the level of treatment that the reclaimed water receives. However, there may be long-term impacts that are currently unknown at this time, such as impacts from estrogen-like compounds as stated in Section 4.7.

Additionally, if one of alternatives 2-5 is not implemented, the Subregional System will not be able to accommodate the long-term growth planned in the approved General Plans of the Subregional System member cities.

The Project is occurring at this time rather than in the future, to comply with the City of Santa Rosa's National Pollutant Discharge Elimination System (NPDES) permit. The Subregional System has not conformed to its current permit due to its weather-dependence. This Project will allow the Subregional System to meet the Regional Board's reliability requirements and existing and future capacity needs, no matter what weather conditions occur.

5.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Alternative 1 - No Action (No Project) Alternative

The No Action Alternative will have no irreversible and irretrievable commitment of resources. The Alternative will maintain the wastewater system at approximately its current level.

Alternatives 2 and 3 - South and West County Alternatives

Alternatives 2 and 3 will result in construction activities that will entail the commitment of natural resources, energy resources, and human resources. The permanent commitment of resources will include: the land required for the reservoir, pump stations, and the pipelines; the fuel required to transport construction vehicles and operate machinery; and the fill required for dam construction.

It is unlikely that the land required for the reservoir will ever be converted back to its agricultural or pastoral state once constructed. However, most of the pipeline alignments are located along roadways and once the pipelines are constructed, the roads will revert back to their current state.

Alternative 4 - Geysers Recharge Alternative

Alternative 4 will result in construction activities that will entail the commitment of natural resources, energy resources, and human resources. The permanent commitment of resources will include: the land required for the tank sites, pump stations, and the pipeline; the fuel required to transport construction vehicles and operate machinery; and the electricity required to operate the pumps to deliver the reclaimed water to the geysers steamfield.

It is unlikely that the land required for the tank sites and pump stations will ever be converted back to its current state once constructed. However, the pipeline to the geysers reserve is located along a roadway and once the pipelines are constructed, the road will revert back to their current state.

Alternative 5 - Discharge Alternative

Discharge directly to the Russian River will result in construction activities that will utilize natural resources. Discharge to the Laguna de Santa Rosa does not involve construction or the commitment of resources. The land required for the outfall on the Russian River is a permanent commitment, but the pipeline route will revert back to its current state.

5.3 GROWTH-INDUCING IMPACTS OF THE PROJECT ALTERNATIVES

Growth inducement is defined by the CEQA Guidelines as the fostering of economic or population growth, or the construction of new housing. Growth inducement may result from direct employment, population, or housing growth; secondary or indirect growth; or provision of new infrastructure which will remove obstacles to population growth.

To examine growth inducement, the Project's effect has been evaluated on the following growth factors and their relationship to the growth defined in the region's General Plans:

- Population;
- Employment;
- Housing demand; and
- Infrastructure.

Evaluation Criteria with Point of Significance

Growth inducement is frequently measured against the growth authorized by a local General Plan. General Plans set forth goals, objectives and policies to guide decisions about the future growth of local jurisdictions. These policies must, by law, take account of existing and projected economic and social conditions, as well as the desires of the community. As such, General Plans embody a community's understanding of existing conditions and its aspirations for the future.

General Plan law requires that all of the elements of a General Plan be consistent with one another. The land use policies in a General Plan define the amount, location, intensity, and character of development that may occur. The development potentials established by land use policies provide, in turn, the basis for infrastructure and public facilities needs, including sewer, water and road systems. Plans for these facilities must, according to state law, reflect the growth potential of General Plan land use policies.

The Project has been sized to provide treatment and disposal capacity to accommodate the land uses designated by the General Plans of cities which are members of the Subregional System. The buildout development estimates were based on the General Plans adopted as of April 1994. The buildout estimates used in this EIR/EIS were reviewed by the Planning Department of each city in the service area. The estimates presented in this document reflect the responses of each city. No attempt was made to develop the population and dwelling unit projections for each of the General Plans using actual planning categories and densities. Instead, the population and dwelling unit projections presented in the Plans were used. These projections were modified only if requested by the Planning Department staff of each city. Table 5.3-1 provides the results of these responses, and provides a comparison to ABAG projections.

Table 5.3-1

Population, Housing Units, and Employment Data for Subregional System

Category	1980[1]	1990[1]	1995[1]	2000[1]	2010[1]	Buildout[2]
Population	135,599	177,657	196,800	212,900	243,626	236,966
Persons per Household	2.53	2.53	2.56	2.57	2.54	2.45
Occupied Housing Units	53,630	70,237	76,830	82,680	96,050	96,835
Total Employment	65,270	99,640	106,600	122,900	157,040	127,431
Employment Breakdown						
Agriculture and Mining	2,037	2,150	2,100	2,250	2,230	n/a
Manufacturing and Wholesale	12,251	17,860	19,170	22,300	31,410	n/a
Retail	13,526	20,940	21,170	24,390	30,250	n/a
Service	16,857	29,780	36,420	41,940	54,250	n/a
Other	20,599	28,910	27,740	32,110	38,900	n/a

Source: Economic and Planning Systems, inc., Nov. 1995

1. Based on ABAG projections.
2. Based on General Plan projections. Buildout in different member entities may occur before or after 2010.

Chapter 3, Description of Existing System and Alternatives, presents the process by which the Project has been sized to accommodate the growth projected by the General Plans of each member entity of the Subregional System. As an example, the following factors were used in sizing the Project:

- General Plan development capacity (as defined by each city);
- Wastewater use factors per household and per worker;
- Water conservation efforts;
- Average persons per household; and
- Water use by industries.

Table 5.3-2

Evaluation Criteria with Point of Significance - Growth Inducement

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. The Project may cause the population to increase so that it exceeds the growth provided by the General Plans for the same time period.	New population that exceeds the General Plan projections of the cities and County	Any such exceedance	The General Plans of the cities and County
2. The Project may cause the employment to increase so that it exceeds the growth projected by ABAG for the same time period.	New employment that exceeds the ABAG projections	Any such exceedance	The General Plans of the cities and County
3. The Project may cause housing demand to increase so that it exceeds the growth provided by the General Plans for the same time period.	New housing units required that exceed the General Plan projections of the cities and County	Any such exceedence	The General Plans of the cities and County
4. Provision of infrastructure improvements as part of the Project may stimulate growth.	No point of significance due to disagreement among experts -- see text below		

Source: EPS, Harland Bartholomew & Associates, Inc. 1995

Infrastructure

There is a general consensus that a lack of infrastructure can limit growth and development. There is, however, a great deal of uncertainty about how public infrastructure affects the economics of growth, and the extent to which the provision of infrastructure can actually induce economic expansion.

In order to provide a basis for evaluating the growth-inducing impacts of the Project, a thorough review of the literature on this issue was conducted. The following is a summary of the key issues identified in the literature.

The literature on the growth effects of infrastructure has been produced principally by two academic and professional disciplines: urban planning and regional economics. Planning literature generally holds that infrastructure may determine the location of development, but not necessarily stimulate the economic demand for it. The regional economic literature takes a more rigorous statistical approach to the question and is ambiguous in its conclusions. Each of these approaches to the issue is discussed in detail below.

The Planning Perspective

Simply stated, the planning perspective is that infrastructure is a primary location decision factor that affects the selection of specific communities and development sites *within* a region (Bamberger, Blazar and Peterson 1985). Planners maintain that inter-regional location decisions are based more on factors such as labor force, climate, and market proximity. This conclusion is consistent with earlier work which holds that "...infrastructure merely concentrates growth which might otherwise have been located elsewhere in the region" (Council on Environmental Quality by Urban Systems Research & Engineering, Inc. 1976). The planners also conclude that there is a large degree of uncertainty about the economic returns of infrastructure (Bamberger, Blazar and Peterson 1985).

The Regional Economics Perspective

Regional economists are concerned with the economic effects of infrastructure as it relates to economic development. Public investment in infrastructure has long been an accepted means of attempting to foster economic development; thus, there has been at least the presumption that public infrastructure can stimulate private production. Yet, the literature reveals that little is known about the actual economic effects of infrastructure investment. Attempts to verify and measure these effects through rigorous statistical analysis have only been undertaken fairly recently.

Some of the earliest contemporary work done on this subject suggests that economic growth is largely a result of private investment, stemming from favorable economic geography, that is, locational and natural resource advantages of particular places (Hansen 1965). It is theorized that the investment of private capital stimulates the demand for public infrastructure which in turn leads to more growth.

In testing the effects of public investment in infrastructure improvements on economic growth, regional economists identify three types of regions: congested, intermediate and lagging. Each type corresponds to a stage of development and is distinct with respect to the economic effects that are induced by infrastructure investment. Studies have concluded that public infrastructure investment will stimulate growth in intermediate and congested regions, but not in lagging regions

(Hansen 1965). This finding follows from the conclusion that growth is not induced primarily by infrastructure, but rather stems from the favorable attributes of the region. Intermediate and congested regions are already experiencing growth due to other economic advantages, and additional infrastructure capacity allows more businesses to capitalize on those assets. It is important to note that these studies refer to a situation where external or General Fund monies are used for public *investment* in infrastructure, rather than public *financing* of infrastructure through monthly service charges and demand fees assessed to users.

This theory was tested statistically by using time series data by region for Mexico (Looney and Frederiksen 1979). The statistical analysis tentatively confirmed the theory for Mexico; each measure of infrastructure was statistically significant in explaining differences in gross domestic product growth in intermediate regions, but not in lagging regions.

These findings have also been reconfirmed by a number of subsequent statistical analyses of empirical data. In 1986, the Federal Reserve Bank of Cleveland analyzed data for 38 metropolitan areas from 1958 to 1981, and concluded that public infrastructure investment significantly affects manufacturing output, but much less than do private capital and labor inputs. It was concluded that public capital stock affects economic activity in a variety of ways -- by influencing the locational decisions of businesses and households, by increasing the agglomeration economies of regions, and by entering into firms' production functions as an unpaid factor.

In attempting to assess the relative effect of different types of infrastructure on growth, studies indicate that certain types of infrastructure, including transportation and communication, have a larger effect on economic growth than do other types of infrastructure (Dahlenberg and Eberts 1988). Furthermore, research indicates that public investment stimulates private investment, both in local economies and at the national level.

Summary of the Literature

The following six points summarize the conclusions in the literature and will be used in our analysis to determine if the infrastructure provided by the Project is indeed growth inducing.

- The lack of adequate infrastructure is a constraint to economic development.
- The provision of infrastructure can have a major effect on the location, timing, and pattern of development within a region.

- Though public investment in infrastructure is an accepted means of attempting to foster economic development, empirical research yields ambiguous conclusions as to the effectiveness of such investment.

- Infrastructure, by itself, is not sufficient to induce economic growth; other favorable economic factors must be present, and are generally more important.

- Certain regions, notably those that are older, larger, or more congested, are more likely to benefit economically from infrastructure investment than rural, lagging or newer regions.

- Certain types of infrastructure, notably transportation and communications, may have a more stimulating effect on growth than other types.

Analysis of Growth-Inducing Factors

The economic model presented in Section 4.18, Socio-economics, projects the total employment to be expected from the direct and indirect impacts of the Project alternatives (see Table 4.18-17). Of this total employment, some employees will be supplied by the existing local work force. The remaining employment will require new workers and their households to reside in the region. Expected population, dwelling unit, and employment increases and decreases for the Project alternatives are shown in Table 5.3-3.

Table 5.3-3

Employment, Population, and Housing Demand Increase (Decrease)

Alternative	Increase in Total Employment	Increase in Dwelling Units	Increase in Population
Alt 1 - No Action	<27,100>	<16,940>	<43,020>
Alt 2A - Tolay Extended	3,550	2,220	5,630
Alt 2B - Adobe Rd/Lakeville	3,520	2,200	5,680
Alt 2C - Tolay Confined	3,480	2,170	5,520
Alt 2D - Sears Pt/Lakeville	3,400	2,130	5,400
Alt 3A - Two Rock	3,650	2,280	5,790
Alt 3B - Bloomfield	3,610	2,250	5,720
Alt 3C - Carroll Road	3,640	2.270	5,770
Alt 3D - Valley Ford	3,620	2,270	5,760
Alt 3E - Huntley	3,630	2,270	5,770
Alt 4 - Geysers Recharge	<1,120>	<700>	<1,780>

Table 5.3-3

Employment, Population, and Housing Demand Increase (Decrease)

Alternative	Increase in Total Employment	Increase in Dwelling Units	Increase in Population
Alt 5A - Discharge to Russian River	<40>	<30>	<70>
Alt 5B - Discharge to Laguna	<20>	<10>	<25>

Source: EPS, Harland Bartholomew & Associates, Inc. 1995

Notes: 1. ABAG Projections 94 and General Plans for all cities

The expected growth in Sonoma County from 1995 to buildout shown in Table 5.3-4. In summary, projected growth is:

- Employment 78,300
- Dwelling units 25,900
- Population 44,800

Criterion 1. The Project may cause the population to increase so that it exceeds the growth provided by the General Plans for the same time period.

Additional population is small compared to the growth projected in Sonoma County. None of the alternatives is considered growth inducing with regard to population.

Criterion 2. The Project may cause employment to increase so that it exceeds the growth projected by ABAG for the same time period.

New employees will be a small portion of the employment growth projected by ABAG. None of the alternatives is considered growth inducing with regard to employment.

ABAG projects a decrease in employment in the Agriculture and Mining sector of the economy starting in the year 2000 (see Table 5.3-4). Portions of the indirect employment growth as well as all of the direct employment growth from the reclamation alternatives will increase employment in the Agriculture and Mining sector, reducing this trend or even reversing it.

Table 5.3-4

Population, Housing Units, and Employment Projections for Sonoma County

Sonoma County	1980	1990	1995	2000	2010	Buildout[2]
Population	293,396	380,558	423,700	459,500	528,700	468,540
Persons per Household	2.56	2.55	2.6	2.58	2.53	2.48
Occupied Housing Units	114,475	149,011	163,130	177,940	208,870	189,000
Total Employment	103,356	153,600	162,730	190,260	240,990	241,000
Employment Breakdown						
Agriculture and Mining	6,589	6,840	7,010	7,340	7,130	n/a
Manufacturing and Wholesale	20,879	29,310	30,880	38,290	52,570	n/a
Retail	21,691	31,970	32,190	36,720	45,710	n/a
Service	26,050	45,290	54,010	62,100	80,630	n/a
Other	28,147	40,190	38,640	45,810	54,950	n/a

Source: Association of Bay Area Governments, Projections '94; Economic and Planning Systems, inc., Nov. 1995

2. Buildout for some jurisdictions may occur before 2010.

Criterion 3. The Project may cause housing demand to increase so that it exceeds the growth provided by the General Plans for the same time period.

Required housing units comprise a small portion of the projected dwelling unit growth provided by the General Plans. None of the alternatives is considered growth inducing with regard to housing demand.

Criterion 4. Provision of infrastructure improvements as part of the Project may stimulate growth.

The primary types of infrastructure that are potentially growth inducing are transportation, communications, water supply facilities, and sewage treatment capacity. The Project alternatives supply only minimal transportation improvements (widening of Pine Flat Road for the Geysers Recharge Alternative). No communications facilities are supplied by the Project. Minor water supply facilities will be provided as a mitigation for groundwater impacts. The only substantive expansion of infrastructure is the sewage treatment capacity provided.

Provision of New Water Supply

The potable water supply which may be provided downgradient of a reservoir if a reclamation alternative is chosen is described in mitigation measure 2.3.12 in Chapter 2. If groundwater at existing or future well sites becomes degraded due to this Project, an alternate potable water supply will be provided by the City of

Santa Rosa via a small potable water line laid in the main pipeline trench from the Laguna Plant to the following parcels within the 20 percent mixing zone contamination zone, should monitoring indicate that the aquifer has became degraded:

1) Existing parcels with existing wells;

2) Existing vacant parcels which could receive a building permit; and

3) New parcels which are legally created according to existing zoning and General Plan designations and which could receive a building permit.

Table 5.3-5 shows the number of parcels that could be served by a new potable water supply at each reservoir site. For existing parcels with existing wells (category 1), no new houses will be built or permitted. For vacant parcels or newly created parcels (categories 2 and 3), new houses could be built, but only in accordance with existing zoning and general plans. Because of this compliance with existing General Plan growth capacity, these potential new houses are considered growth-accommodating rather than growth-inducing. At maximum, 84 new parcels could receive an alternate potable water supply (see Appendix T-1, Existing Vacant Parcels and Potential New Parcels which may Receive New Potable Water Supply as a Result of Mitigation Measure 2.3.12)

Table 5.3-5

Parcels Which May Receive New Potable Supply

Alternative	Existing Parcels with Wells (Category 1)	Vacant Parcels (Category 2)	Potential New Parcels (Category 3)
2A - Tolay Extended	16	0	12
2B - Adobe Rd./Lakeville	25	5	79
2C - Tolay Confined	16	0	12
2D - Sears Pt./Lakeville	20	0	9
3A - Two Rock	33	7	6
3B - Bloomfield	20	0	0
3C - Carroll Rd	8	0	1
3D - Valley Ford	3	0	1
3E - Huntley	20	0	14

Source: Harland Bartholomew & Associates, Inc. 1996

Provision of New Sewage Treatment Capacity

The new capacity supplied by this Project responds directly to the growth approved in each of the member jurisdictions' General Plans. Capacity will increase from 18 mgd to 21 mgd average dry weather flow.

In response to the previous discussion regarding investment in infrastructure improvements under Evaluation Criteria, the following findings may be applied in the Santa Rosa/Sonoma County regional economy:

- *The lack of adequate infrastructure is a constraint to economic development.* In the Santa Rosa/Sonoma County area, the lack of adequate wastewater disposal will preclude future development.

- *The provision of infrastructure can have a major effect on the location and timing of development within a region.* In Sonoma County, if a wastewater disposal Project is not implemented in the short-term, the region will not be able to accommodate the projected market demand for housing and commercial development.

- *Public investment in infrastructure is an accepted means of attempting to foster economic development.* Because the Bay Area economy as a whole is growing, investment in infrastructure is not necessary to foster growth in Sonoma County. In this manner, the Project is growth accommodating rather than growth inducing.

- *Infrastructure, by itself, is not sufficient to induce economic growth; other favorable economic factors must be present, and are generally more important.* Adequate supply of housing, labor, transportation capacity, public services, market demand, and other factors must be in place for the community to capture future economic growth. This is the case in Sonoma County.

- *Certain regions, notably those that are older, larger, or more congested, are more likely to benefit economically from infrastructure investment than rural, lagging or newer regions.* The degree to which infrastructure improvements stimulate growth depends on the economic attributes of the region. The Santa Rosa and Sonoma County areas are vibrant economies that are experiencing strong, diversified economic growth and may therefore experience the stimulation of growth described in these empirical economic studies. ' These studies, however, describe a situation where external or General Fund monies are used to stimulate growth through investment in infrastructure. The situation in the Subregional System is different in that the City will provide a financing mechanism through issuance of tax-exempt municipal revenue bonds, but new and existing users are expected to pay for

100percent of the Project. It is therefore questionable to what extent these studies apply to the Project.

- *Certain types of infrastructure, notably transportation and communications, may have a more stimulating effect on growth than other types.* The quality of infrastructure has become extremely important in stimulating economic growth as the economy has become more service-based. In Sonoma County, as well as other sub-markets of the Bay Area, firms and households give higher weight to the quality of the transportation and communication systems than wastewater treatment systems when making location decisions.

There is not a clear agreement among experts nor does the analysis presented here provide a clear cut determination whether the Project Alternatives (excluding the No Action Alternative) are indeed growth inducing due to provision of infrastructure. Certainly, a primary obstacle to growth is being removed by provision of the infrastructure improvements. However, the Project is not driving the growth. The healthy regional economy, local resources, and existing labor force, together with the desire of the member communities as expressed in the General Plans, are responsible for the economic growth of the region. From this perspective, the Project accommodates existing growth trends rather than induces growth.

5.4 SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACTS

Table 5.4-1 identifies impacts that will be significant even after mitigation. These impacts have been minimized to the extent possible, but will still exceed points of significance.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
Land Use														
1.5.3. The storage reservoir component may be an incompatible land use type in a designated quarry area.						●								2.4.1. Removal of aggregate resources prior to construction.
Agriculture														
2.5.1. The storage reservoir component may cause loss of farmland.		●	●	●		●								No feasible mitigation has been identified.
2.5.2. The storage reservoir component may cause Williamson Act contracts to be canceled.							●			●				No feasible mitigation has been identified.
2.6.1. The pump station component may cause loss of farmland.		●	●	●	●	●	●	●	●	●	●			No feasible mitigation has been identified.
Geology, Soils, and Seismicity														
3.4.1. The pipeline component may be located within an area of unstable slope conditions.											●			2.3.4. Slope Stabilization Design . 2.3.7. Slope Monitoring and Response System. 2.3.8. Earthquake Preparedness and Emergency Response Plan.
3.4.2. The pipeline component may be subject to ground rupture due to location near the surface trace of an active fault.		●	●	●	●	●	●	●	●	●	●			2.3.8. Earthquake Preparedness and Emergency Response Plan.
3.5.1. The storage reservoir component may be located within an area of unstable slope conditions.		●	●	●	●									2.3.4. Slope Stabilization Design. 2.4.2. Remove weak surficial deposits from reservoir footprint.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
Surface Water Hydrology														
4.4C. The Project plus cumulative projects may cause a cumulative increase in the maximum flood elevation in the Russian River.	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	2.5.10. Discharge prohibition during flood state is proposed to mitigate for the project's contribution to a flooding impact.
Surface Water Quality														
6.5.3. Salinity, ammonia, dissolved oxygen, planktonic algae, benthic algae, and metals. The storage reservoir component may cause special-site criteria to be exceeded.						●	●	●	●	●				No feasible mitigation has been identified.
6.7.3. Salinity, ammonia, dissolved oxygen, planktonic algae, benthic algae, and metals. The agricultural irrigation may cause the special site criterion to be exceeded.						●	●	●	●	●				No feasible mitigation has been identified.
6.9.1. Conductivity. Discharge component may cause numeric-based criteria to be exceeded.												●		No feasible mitigation has been identified.
6.9.1. Cyanide. Discharge component may cause numeric-based criteria to be exceeded.	●													
6.9.1. Dissolved oxygen. Discharge component may cause numeric-based criteria to be exceeded.													●	No feasible mitigation has been identified.
6.9.2. Algal growth. Design discharge component may cause narrative-based criteria to be exceeded.	●	●	●	●	●	●	●	●	●	●	●	●	●	2.5.4 Discharge Operations.
6.9.2. Turbidity. Discharge scenarios may cause narrative-based criteria to be exceeded.												●	●	2.5.4 Discharge Operations.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
6.9.2. Turbidity (beneficial). Discharge scenarios may cause narrative-based criteria to be exceeded.	●													
6.9.2. Waste Reduction Strategy - Ammonia-Nitrogen. Discharge scenarios may cause narrative-based criteria to be exceeded.	●													
6.9.2. Waste Reduction Strategy - Total Nitrogen. Discharge scenarios may cause narrative-based criteria to be exceeded.	●													
6.9.2. Toxicity. Discharge component may cause narrative-based criteria to be exceeded.	●													
Terrestrial Biological Resources														
8.4C. The Project plus cumulative projects may cause permanent loss of sensitive terrestrial wildlife habitat.		●	●	●	●	●	●	●	●	●				No feasible mitigation has been identified.
8.7C. The Project plus cumulative projects may result in ecological risk to terrestrial plant and wildlife populations (i.e., acute or chronic toxicity and bioaccumulation).	●													2.4.16. Ecological Risk Monitoring and Source Control Program.
Aquatic Biological Resources														
9.5.6. The storage reservoir component may cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary.						●	●	●	●	●				No feasible mitigation has been identified.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
9.7.6. The storage reservoir component may cause a change in the physical condition of aquatic habitat in the Estero Americano or the Estero de San Antonio within the Gulf of the Farallones National Marine Sanctuary.						●	●	●	●	●				No feasible mitigation has been identified.
Transportation														
11.4.1. Traffic from construction or operations of the pipeline component may cause congestion along access roads		●	●	●	●	●	●	●	●	●	●			No feasible mitigation has been identified.
11.4.2. Lane closures due to construction of the pipeline component may delay traffic, delay transit services, restrict access, increase hazards, and reroute traffic, including emergency vehicles.		●	●	●	●	●	●	●	●	●	●	●		No feasible mitigation has been identified.
11.4.4. The pipeline component may cause damage to public or private roadbeds.											●			No feasible mitigation has been identified.
11.5.1. Traffic from construction or operation of the storage reservoir component may cause congestion on access roads.		●	●	●	●	●	●	●	●	●				No feasible mitigation has been identified.
11.8.1. Traffic from construction of the geysers steamfield component may cause congestion on access roads.											●			No feasible mitigation has been identified.
Air Quality														
12.2.5. The headworks expansion component may cause odors.	●	●	●	●	●	●	●	●	●	●	●	●	●	No feasible mitigation has been identified.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
12.4.1. The pipeline component may exceed emission threshold levels.		●	●	●	●									2.4.11 Dust Control Program. 2.4.10 Vehicle and Equipment Exhaust Control Program.
12.5.1. The storage reservoir component may exceed emission threshold levels.		●	●	●	●	●	●	●	●	●				2.4.10 Vehicle and Equipment Exhaust Control Program. 2.4.11 Dust Control Program.
12.8.1. The geysers steamfield component may exceed emission threshold levels.											●			2.4.10 Vehicle and Equipment Exhaust Control Program.
Noise														
13.4.1. Construction of pipeline component may expose the public to high noise levels.		●	●	●	●	●	●	●	●	●	●	●		2.4.9. Construction Noise Control Measures.
13.4.3. Construction of the pipeline component may cause high noise levels from the construction traffic.		●	●	●	●	●	●	●	●	●	●	●		2.4.9. Construction Noise Control Measures.
13.5.1. Construction of the storage reservoir component may expose the public to high noise levels.			●		●	●				●				2.4.9. Construction Noise Control Measures.
13.5.3. Construction of the storage reservoir component may cause high noise levels from the construction traffic.		●	●	●	●	●	●	●	●	●				2.4.9. Construction Noise Control Measures.
13.6.1. Construction of the pump station component may expose the public to high noise levels.		●	●	●	●	●	●	●	●	●	●			2.4.9. Construction Noise Control Measures.
13.6.2. Operation of the pump station component may expose the public to high noise levels.		●	●	●	●	●	●	●	●	●	●			2.3.17. Incorporate noise control measures into the final design of the pump station.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
13.7.1. Construction of the agricultural irrigation component may expose the public to high noise levels.		●	●	●	●	●	●	●	●	●				2.4.9. Construction Noise Control Measures.
13.8.3. Construction of the Geysers steamfield component may cause high noise levels from construction traffic.											●			No feasible mitigation has been identified.
Visual Resources														
14.4.5. The pipeline component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.											●			2.3.9. Adjust pipeline alignments. 2.3.10. Limit construction disturbance.
14.5.3. The storage reservoir component may be inconsistent with the County Open Space Element regarding Scenic Corridors.		●	●	●	●		●	●	●					2.4.6. Screen concrete diversion channels, pump stations, and other facilities. 2.4.7. Establish tree screening. 2.4.8. Revegetate face of reservoir dam.
14.5.5. The storage reservoir component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.					●									2.4.6. Screen concrete diversion channels, pump stations, and other facilities. 2.4.7. Establish tree screening. 2.4.8. Revegetate face of reservoir dam.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
14.5.6. The Storage reservoir component may cause an adverse effect on foreground or middleground views from one or more private residences.		●	●	●	●	●	●	●	●					2.4.6. Screen concrete diversion channels, pump stations, and other facilities. 2.4.7. Establish tree screening. 2.4.8. Revegetate face of reservoir dam.
14.6.2. The pump station component may be inconsistent with the Sonoma County General Plan Open Space Element regarding Scenic Landscape Units.											●			2.4.6. Screen concrete diversion channels, pump stations, and other facilities.
14.6.3. The pump station component may be inconsistent with the County Open Space Element regarding Scenic Corridors.		●	●	●	●	●	●	●	●	●	●			2.4.6. Screen concrete diversion channels, pump stations, and other facilities.
14.6.4. The pump station component may be inconsistent with minimum building setbacks for structures along Sonoma County designated scenic corridors.		●	●	●	●	●	●	●	●	●	●			2.4.6. Screen concrete diversion channels, pump stations, and other facilities.
14.6.5. The pump station component may cause adverse effects on foreground or middleground views from a high volume travelway, recreation use area, or other public use area.		●	●	●	●	●	●	●	●	●	●			2.4.6. Screen concrete diversion channels, pump stations, and other facilities.
14.6.6. The pump station component may cause an adverse effect on foreground or middleground views from one or more private residences.		●	●	●	●	●	●	●	●	●	●			2.4.6. Screen concrete diversion channels, pump stations, and other facilities.

Table 5.4-1

Summary of Significant and Unavoidable Adverse Impacts

Impact	No Action	South County Irrigation				West County Irrigation					Geysers	Discharge		Mitigation Measures
	1	2A	2B	2C	2D	3A	3B	3C	3D	3E	4	5A	5B	
Public Services, Utilities and Recreation														
16.1.1. The No Action Alternative may increase demand for police, fire, parks, and recreation facilities, water, sewage treatment and disposal, or solid waste to such a degree that accepted service standards are not maintained.	●													None.
Socio-economics														
18.1. The Project may increase the service charge for wastewater.		●	●	●	●	●	●	●	●	●	●			No feasible mitigation has been identified.
18.2. The Project may result in loss of homes due to construction of facilities.		●	●			●		●	●	●				No feasible mitigation has been identified.

Note: No mitigation is proposed for the significant impacts of the No Action Alternative.

Level of Significance:

● Significant impact before and after mitigation

Alternatives:

1
2A No Action (No Project)
2B Tolay Extended
2C Adobe Road/Lakeville Hillside
Tolay Confined

Alternatives:

2D Sears Point/Lakeville Hillside
3A Two Rock
3B Bloomfield
3C Carroll Road
3D Valley Ford
3E Huntley
4 Geysers Recharge
5A Discharge to Russian River
5B Discharge to the Laguna

5.5 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

Selection of the Environmentally Superior Alternative

The California Environmental Quality Act requires the identification of an Environmentally Superior Alternative; that is, the alternative which has no significant effect or has the least significant effect on the environment. For reference, significance is determined based on substantial or potentially substantial adverse changes of any of the physical environmental conditions due to the Project. The degree of change is evaluated against existing environmental conditions.

The environmentally superior alternative is Alternative 5B, the Laguna Discharge Alternative. This Alternative cause the least change on the environment when compared with the other alternatives. This Alternative does not impact wetlands. Construction of facilities occurs only at the existing Laguna Plant headworks, where new pumps will be installed. No other construction is required because the outfall piping and discharge valves exist and will not be modified. The physical change that occurs is the discharge of additional volumes of water into the Laguna de Santa Rosa and Russian River at low flow conditions. The annual discharge of reclaimed water is 4,640 million gallons. Since the discharge valve sizes are not modified, the maximum volume of water discharged during higher flows of the Russian River does not increase over existing conditions. This Alternative discharges to the Laguna, which then reaches the Russian River. The majority of this water came from the Russian River upstream of the discharge. The constituents of the reclaimed water being discharged are different than water removed from the Russian River at the Sonoma County Water intakes. The unavoidable effects of Laguna Discharge include a further decrease of dissolved oxygen compared to the existing problem in the Laguna, and an increase in biostimulatory substances, as measured by benthic and planktonic algae, in the Laguna de Santa Rosa and Russian River.

All but one of these unavoidable impacts occur in less than one month every eight years. The unavoidable impact on benthic algae occurs in the lower-most quarter-mile reach of Santa Rosa Creek more frequently, however beneficial impacts on algae will occur more frequently than adverse impacts. With implementation of mitigation and cumulative projects (including nitrogen load reduction throughout the Laguna). Alternative 5B will have a less than significant impact.

The No Action Alternative is similar to Alternative 5B in that it uses the existing piping and valves to discharge to the Laguna. The No Action Alternative has greater water quality impacts because it has the highest annual discharge to the Russian River and does not provide mitigation provided by other alternatives. The No Action Alternative not only impacts biostimulatory substances and dissolved oxygen similarly to the Laguna

Discharge, but also causes exceedence of standards for cyanide and toxicity, and non-attainment of the Regional Board's Waste Reduction Strategy.

Alternative 5A, discharge to the Russian River, will require the construction of seven miles of pipeline to the Russian River and a discharge structure within the River, requiring the filling of wetlands. The volumes of water delivered to the Russian River are the same as Alternative 5B.

The reclamation alternatives (alternatives 2 and 3) and the Geysers Recharge Alternative (Alternative 4) require physical changes to the existing environment. The reclamation alternatives require the construction of one or more reservoirs providing up to 4.5 billion gallons of storage, require the fill of wetlands, require up to 22 miles of pipeline to transport reclaimed water to the reservoir, require up to 45 miles of pipeline with up to 19 pump stations to distribute the water to irrigation areas, and up to 6,000 acres of agricultural or fallow land that will be potentially converted to irrigated crops. The Geysers Recharge Alternative requires the construction of 32 miles of pipeline, construction of four large pump stations, two large storage tanks to deliver the water to the geysers steamfield for injection and construction of pipelines in the steamfields.

Environmental effects have not been weighed or ranked against another in this analysis. The change to the existing environment has simply been analyzed. Agency and public comment to the City of Santa Rosa during their evaluation of this document is welcome.

Although Alternative 5B is considered environmentally superior (as defined above), any conclusion regarding the environmentally superior alternative should not be confused with an analysis of how each alternative may achieve the Project's purpose and need.. This Draft EIR/EIS has noted beneficial effects of the alternatives, including increased prime farmland, generation of electricity, and economic stimulation. The City will consider and weigh these benefits and the environmental effects against the purpose and need of the Project during the selection of the preferred Project.

Selection of the Environmentally Preferable Alternative

The National Environmental Policy Act requires the identification of the Environmentally Preferable Alternative from the range of alternatives considered in the Record of Decision. The environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources. Section 101 (b) further states "---to the end that the Nation may --

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The National Environmental Policy Act requires the federal agencies to select an environmentally preferable alternative. The environmentally preferable alternative is the one which the Corps of Engineers believes will fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. The environmentally preferable Project does not have to be the environmentally superior alternative but must meet the Project's purpose and need (Chapter 1.1). The Corps must consider, in addition to physical changes to the existing environment, the effects of socio-economics and compliance with the adopted purpose and need.

At this time the Corps has not selected the environmentally preferable alternative. After certification of the Final EIR, the City will consider and select its preferred alternative. At that time, the Final EIS will be prepared which will identify the environmentally preferable alternative and preferred alternative.

PREPARERS, REFERENCES, AND CONSULTATION AND COORDINATION

Preparers

Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Patricia I. Collins, Harland Bartholomew & Associates, Inc.
Maile A. Deppe, Harland Bartholomew & Associates, Inc.
Chuck Teller, Economic & Planning Systems.

Reviewers

Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.

References

HBA Team Documents

None.

Other References

Association of Bay Area Governments (ABAG). 1994. *Projections '94.*

Bamberger, Rita, William A. Blazar, and George E. Peterson. 1985. *Infrastructure Support for Economic Development.* Planning Advisory Service Reports. September.

Dahlenberg, Douglas, and Randall W. Eberts. 1988. *Public Infrastructure and Economic Development.* Economic Commentary, Federal Reserve Bank of Cleveland. January 15.

Hansen, Niles M.,ed. 1972. *Unbalanced Growth and Regional Development.* Western Economic Journal, Vol. 4.

Looney, Robert, and Peter Frederiksen. 1981. *The Regional Impact of Infrastructure Investment in Mexico.* Regional Studies, vol. 15, no. 4.

Urban Systems Research & Engineering, Inc. 1976. Council on Environmental Quality.

Consultation and Coordination

Persons Contacted

None.

Correspondence

None.

Glossary

The Glossary is based on definitions provided by the Office of Planning and Research (OPR), the American Planning Association (APA), the California Environmental Quality Act (CEQA), and the National Environmental Policy Act (NEPA).

Abbreviations

ABAG: Association of Bay Area Governments
ADT: Average daily trips made by vehicles or persons in a 24-hour period
ADWF: Average Dry Weather flow
AF: Acre-foot
AGS: Annual Grassland
BAAQMD: Bay Area Air Quality Management District
BACT: Best Available Control Technology
BPU: Board of Public Utilities
CARB: California Air Resources Board
CAS: California Academy of Sciences
CC&Rs: Covenants, Conditions, and Restrictions
CDF: California Department of Forestry and Fire Protection
CDSD: California Division of Safety of Dams
CEC: California Energy Resources Conservation and Development commission
CEQA: California Environmental Quality Act
CFD: A Mello-Roos Community Facilities District
CFPD: Cotati Fire Protection District
CFS: Cubic Feet Per Second
CIP: Capital Improvements Program
CMP: Congestion Management Plan
CNEL: Community Noise Equivalent Level
CNPS: California Native Plant Society
CORP: U.S. Army, Corps of Engineers
COG: Council of Governments
CPD: Cotati Police Department
CPUC: California Public Utilities Commission
DBH: Diameter at Breast Height
DFG: California Department of Fish and Game
DHS: Department of Health Services
EIR: Environmental Impact Report (State)
EIS: Environmental Impact Statement (Federal)
EPA: Environmental Protection Agency
FAR: Floor Area Ratio
FEMA: Federal Emergency Management Agency
FHWA: Federal Highway Administration
FIR: Fiscal Impact Report
FIRM: Flood Insurance Rate Map
FmHA: Farmers Home Administration
FTE: Full-Time Equivalent
GMI: Gross Monthly Income
HCD: Housing and Community Development Department of the State of California.
HOV: High Occupancy Vehicle
HUD: U.S. Dept. of Housing and Urban Development
JPA: Joint Powers Authority
kWh: Kilowatt Hours
LAFCo: Local Agency Formation Commission
LOS: Level of Service
LRT: Light-duty Rail Transit
MGD: Million Gallons per day
NEPA: National Environmental Policy Act
NOAA: National Oceanic and Atmospheric Administration
NOI: Notice of Intent
NOP: Notice of Preparation
NPDES: National Pollutant Discharge Elimination System

O&M:	Operating and Maintenance
OPR:	Office of Planning and Research, State of California
PPT:	Parts per Thousand
PUD:	Planned Unit Development
ROG:	Reactive Organic Compounds
RWQCB:	Regional Water Quality Control Board
SCWA:	Sonoma County Water Agency
SIP:	State Implementation Plan
SRPD:	Santa Rosa Police Department
SWRCB:	State Water Resources Control Board
TDM:	Transportation Demand Management
TDR:	Transfer of Development Rights
TDS:	Total Dissolved Solids
THMs:	Trihalomethanes
TSM:	Transportation Systems Management
UBC:	Uniform Building Code
UG/L:	Micrograms per Liter
UHC:	Uniform Housing Code
UMTA:	Urban Mass Transportation Administration
USFWS:	U.S. Fish and Wildlife Service
V/C:	Volume-to-Capacity Ratio
VMT:	Vehicle Miles Traveled
VOC:	Volatile Organic Compound
WWTP:	Wastewater Treatment Plant

A

AB2588 Emission Inventory

A list of pollutants emitted into a community's atmosphere in amount per day or year by type of source, as required by Assembly Bill 2588.

Accelerograph

An instrument for measuring ground acceleration (e.g. a seismic event).

Acceptable Risk

A hazard which is deemed to be a tolerable exposure to danger given the expected benefits to be obtained. Different levels of acceptable risk may be assigned according to the potential danger and the criticalness of the threatened structure. The levels may range from "near zero" for nuclear plants and natural gas transmission lines to "moderate" for open space, ranches and low-intensity warehouse uses.

Access/Egress

The ability to enter a site from a roadway and exit a site onto a roadway by motorized vehicle.

Acculturation

The adoption by one society of a trait or traits from another society.

Acre-foot (AF)

The volume of water (325,851 gallons) that would cover one acre to a depth of one foot.

Acres, Gross

The entire acreage of a site. Most communities calculate gross acreage to the centerline of proposed bounding streets and to the edge of the right-of-way of existing or dedicated streets.

Acres, Net

The portion of a site that can actually be built upon. The following generally are not included in the net acreage of a site: public or private road rights-of-way, public open space, and flood ways.

Activated sludge

By-product of the sewage treatment process. sewage Sediment that contains a heavy growth of microorganisms, resulting from vigorous aeration.

Active Solar System

A system that uses a mechanical device, such as pumps or fans run by electricity in addition to solar energy, to transport air or water between a solar collector and the interior of a building for heating or cooling. (See "Passive Solar System.")

Adaptive Reuse

The conversion of obsolescent or historic buildings from their original or most recent use to a new use. For example, the conversion of former hospital or school buildings to residential use, or the conversion of an historic single-family home to office use.

Adobe

Sun-dried mudbrick.

Adverse Impact

A negative consequence for the physical, social, or economic environment resulting from an action or project.

Affordable Housing

Housing capable of being purchased or rented by a household with very low, low, or moderate income, based on a household's ability to make monthly payments necessary to obtain housing. Housing is considered affordable when a household pays less than 30 percent of its gross monthly income (GMI) for housing including utilities.

Agency

The governmental entity, department, office, or administrative unit responsible for carrying out regulations.

Aggregate material

Composed of mineral materials, such as sand and stone; often used in making concrete.

Agricultural Preserve

Land designated for agriculture or conservation. (See "Williamson Act.")

Agriculture

Use of land for the production of food and fiber, including the growing of crops and/or the grazing of animals on natural prime or improved pasture land.

Agriculture-related Business

Feed mills, dairy supplies, poultry processing, creameries, auction yards, veterinarians and other businesses supporting local agriculture.

Air Basin

A division of California established by the Air Resources Board, based on meteorological and geographical conditions.

Air District

A local agency charged with controlling pollutants discharged into the atmosphere within its region.

A

Air Pollutant

Any substance in air that could, if in high enough concentration, harm humans, animals, vegetation or material.

Air Pollution

Concentrations of substances found in the atmosphere which exceed naturally occurring quantities and are undesirable or harmful in some way.

Air Quality Standard

The prescribed level of a pollutant in the outside air that cannot be exceeded during a specific time. Established for both federal and state governments.

Airport-related Use

A use which supports airport operations including, but not limited to, aircraft repair and maintenance, flight instruction, and aircraft chartering.

Air Rights

The right granted by a property owner to a buyer to use space above an existing right-of-way or other site, usually for development.

Air Toxins

See Hazardous Air Pollutants.

Alkali

Salts left behind on the soil surface as water evaporates.

Alley

A narrow service way, either public or private, which provides a permanently reserved but secondary means of public access not intended for general traffic circulation. Alleys typically are located along rear property lines.

Alluvial

Referring to soils deposited by stream action.

Alluvium

Soil material (as clay or gravel) deposited by running water.

Alquist

Priolo Special Studies Zones Act- A California State Law adopted in 1972 to protect people and property from damage from fault rupture hazards. Establishes zones along active faults and applies land use restrictions for structures for human occupancy.

Alternative

A potential solution to the Project objective of beneficial reuse of reclaimed water. Both CEQA and NEPA require that a "reasonable range" of Project alternatives be evaluated.

Ambient Air

Outside air.

Ambient

Surrounding on all sides; used to describe measurements of existing conditions with respect to traffic, noise, air and other environments.

Anadramous fish

Any species that lives as an adult in the ocean and returns to freshwater to spawn (e.g. steelhead, salmon, striped bass, American shad).

Anadramous salmonids

Fish resembling or characteristic of a salmon, migrating up rivers from the sea to breed in fresh water.

Andesite

A dark-colored, fine-grained extrusive igneous rock (volcanic).

Annex, *v.*

To incorporate a land area into an existing district or municipality, with a resulting change in the boundaries of the annexing jurisdiction.

Anti-degradation Policy

Federal regulations (40 CFR 131.12) require that states have a policy that allows degradation only if existing uses (e.g., fish spawning, municipal supply) would be maintained and where such degradation is necessary to accommodate important economic or social development .

Apartment

(1) One or more rooms of a building used as a place to live, in a building containing at least one other unit used for the same purpose. (2) A separate suite, not owner occupied, which includes kitchen facilities and is designed for and rented as the home, residence, or sleeping place of one or more persons living as a single housekeeping unit.

Appeal, v.

When a person believes a decision was made in error, an appeal may be filed so that a higher decision making body can review the case.

Approach Zone

The air space at each end of a landing strip that defines the glide path or approach path of an aircraft and which should be free from obstruction.

A

Aquifer

An underground, water-bearing layer of earth, porous rock, sand, or gravel, through which water can seep or be held in natural storage. Aquifers generally hold sufficient water to yield economically significant quantities to wells, springs, etc.

Aquifer Storage and Recovery

Injection of water or reclaimed water into an aquifer for storage and later recovery.

Arable

Fit for or cultivated by plowing. Suitable for crops.

Archaeological

Relating to the material remains of past human life, culture, or activities.

Architectural Control; Architectural Review

Regulations and procedures requiring the exterior design of structures to be suitable, harmonious, and in keeping with the general appearance, historic character, and/or style of surrounding areas. A process used to exercise control over the design of buildings and their settings. (See "Design Review.")

Area of Direct Impact

Area that only includes the construction boundary zones of the proposed Project components.

Area of Indirect Impact

Area that encompasses the watersheds potentially affected by Project components such as storage reservoirs, discharge, and agricultural irrigation areas.

Armoring

In a river bed, a phenomenon resulting from fine sediments being washed out, leaving a surface layer of gravel, cobbles and boulders which prevent erosion of the river bed except during the largest floods.

Arterial

Medium-speed (30-40 mph), medium-capacity (10,000-35,000 average daily trips) roadway which provides intra-community travel and access to the county-wide highway system. Access to community arterials should be provided at collector roads and local streets, but direct access from parcels to existing arterials is common.

Artesian

An aquifer in which water is confined under hydrostatic pressure between layers of impermeable material. Wells tapping into an artesian stratum will flow naturally without the use of pumps. (See "Aquifer.")

Arthropod

Any invertebrate of the phylum Arthropoda, which includes insects and spiders, among others.

Artifact

Any product of human cultural activity; more specifically, any tools, weapons, artworks, etc., found in archaeological contexts.

Artifactua

Having to do with artifacts.

Assemblage

A group of objects, such as artifacts, of different types found in close association with each other.

Assessment District

See "Benefit Assessment District."

Atmosphere

The layer of gases (air) that surrounds the earth.

Attainment

Describes an area where pollutant levels are as good as or better than standards.

Attenuate

In hydrology, to spread a give flood event over a longer period of time. This results in a reduction of the peak streamflow rate.

Attraction flows

Pulses of high flow from the rivermouth which are sufficient to break open the sandbar and attract steelhead from the ocean into freshwater.

Average dry weather flow

Average Dry Weather Flow (ADWF), is the average daily flowrate of sewage entering a treatment plant which is the result of the domestic, commercial and industrial use of water during the dry or non-rainy season. ADWF is often considered the "base flow" of the wastewater. The ADWF is typically used to size sewage treatment facilities.

Avocational

A subordinate occupation pursued especially for pleasure.

B

Backdam

A dam placed upstream of a main dam to prevent flooding of a portion of the watershed.

Background View Range

Viewing distances to landscape features (or changes) greater than 3 miles.

Basalt

A dark fine-grained igneous rock.

Base Flood

In any given year, a 100-year flood that has 1% likelihood of occurring, and is recognized as a standard for acceptable risk.

Bed and Breakfast

Usually a dwelling unit, but sometimes a small hotel, which provides lodging and breakfast for temporary overnight occupants, for compensation.

Bed load

Soil, gravel, rock or other material rolled along the bottom of a stream by moving water, as contrasted with sediment carried in suspension above the stream bed (see Suspended load).

Benthic Algae

Micro-organisms that live at the bottom of a body of water.

Biconically

Refers to an object drilled from two opposing sides until the object is completely perforated.

Biface

A stone tool that has been flaked on both sides.

Bikeways

A term that encompasses bicycle lanes, bicycle paths, and bicycle routes.

Bioaccumulation

The net accumulation of a chemical by an organism as a result of uptake from all routes of exposure (inhalation, dermal absorption, ingestion).

Biodegradation

The process in which a substance is naturally decomposed into harmless elements.

Biological Assessment

Report required by the USFWS under Section 7(c) of the Federal Endangered Species Act if listed species or critical habitat may be present in the area affected by any major construction activity as defined in Part 404.02.

Biomass

Plant material, used for the production of such things as fuel alcohol and non-chemical fertilizers. Biomass sources may be plants grown especially for that purpose or waste products from livestock, harvesting, milling, or from agricultural production or processing.

Biosolids

Organic waste material.

Biotic Community

A group of living organisms characterized by a distinctive combination of both animal and plant species in a particular habitat.

Blank

An intermediate manufacturing stage in the production of stone tools.

Blue schist

A strongly foliated crystalline metamorphic rock containing the blue to blue-black glaucophane mineral. Blue schist is formed in high pressure and low temperature environments typical of converging continental plate margins.

Bond

An interest-bearing promise to pay a stipulated sum of money, with the principal amount due on a specific date. Funds raised through the sale of bonds can be used for various public purposes.

Borrow area

A pre-designated area which will be utilized to provide the basic fill material for construction of the dam.

Brackish Water

A mixture of sea water and fresh water.

Brood

Fish born in the same year.

Buffer Zone

An area of land separating two distinct land uses that acts to soften or mitigate the effects of one land use on the other.

Building

Any structure used or intended for supporting or sheltering any use or occupancy.

Buildout; Build-out

Development of land to its full potential or theoretical capacity as permitted under current or

proposed planning or zoning designations. (See "Carrying Capacity 3").

Business Services

A subcategory of commercial land use which permits establishments primarily engaged in rendering services to other business establishments on a fee or contract basis, such as advertising and mailing; building maintenance; personnel and employment services; management and consulting services; protective services; equipment rental and leasing; photo finishing; copying and printing; travel; office supply; and similar services.

B

California Air Resources Board (CARB)

The State of California's agency responsible for air pollution control.

California Clean Air Act

The legislation that is the legal basis for the clean air program in California.

California Environmental Quality Act (CEQA)

A State law requiring State and local agencies to regulate activities with consideration for environmental protection. If a proposed activity has the potential for a significant adverse environmental impact, an Environmental Impact Report (EIR) must be prepared and certified as to its adequacy before taking action on the proposed project. General Plans require the preparation of a "program EIR."

California Occupational Safety and Health Administration (Cal-OSHA)

The branch of California government responsible for ensuring safety in the workplace.

Caltrans

California Department of Transportation.

Capital Improvements Program (CIP)

A program, administered by a city or county government and reviewed by its planning commission, which schedules permanent improvements, usually for a minimum of five years in the future, to fit the projected fiscal capability of the local jurisdiction. The program generally is reviewed annually, for conformance to and consistency with the general plan.

Carbon Dioxide

A colorless, odorless, non-poison gas that is a normal part of the atmosphere.

Carbon Monoxide

A colorless, odorless, highly poisonous gas produced by automobiles and other machines with internal combustion engines that imperfectly burn fossil fuels such as oil and gas.

Carcinogenic

Causing cancer.

Carrying Capacity

Used in determining the potential of an area to absorb development: (1) the level of land use, human activity, or development for a specific area that can be accommodated permanently without an irreversible change in the quality of air, water, land, or plant and animal habitats. (2) The upper limits of development beyond which the quality of human life, health, welfare, safety, or community character within an area will be impaired. (3) The maximum level of development allowable under current zoning. (See "Buildout.")

Cathodic

Creation of negative electrons or electrodes to repel positively charged particles.

Cenozoic

Geologic era from approximately 65 million years ago to the present. The Cenozoic era is divided into two periods: the Tertiary and Quaternary.

Census

The official decennial enumeration of the population conducted by the federal government.

Central Business District (CBD)

The major commercial downtown center of a community. General guidelines for delineating a downtown area are defined by the U.S. Census of Retail Trade, with specific boundaries being set by the local municipality.

Channelization

(1) The straightening and/or deepening of a watercourse for purposes of storm-runoff control or ease of navigation. Channelization often includes lining of stream banks with a retaining material such as concrete. (2) At the intersection of roadways, the directional separation of traffic lanes through the use of curbs or raised islands which limit the paths that vehicles may take through the intersection.

Character

Special physical characteristics of a structure or area that set it apart from its surroundings and contribute to its individuality.

Charmstones

An elongate, ground and often polished stone artifact, normally 5 to 20 cm in length, fashioned in a spindle, ovoid, phallic, plumb bob, or other shape. Their function as hunting charms, bolas stones, shamanistic gear, and so forth, is uncertain.

Chert

A hard, dense microcrystalline or cryptocrystalline sedimentary rock, comprised chiefly of quartz.

Chert

A fine-grained rock composed primarily of silica.

Cinnabar

Mercuric sulfide, occurring naturally as a red ore. It was occasionally used as a coloring matter.

Circulation Element

One of the seven State-mandated elements of a local general plan, it contains adopted goals, policies and implementation programs for the planning and management of existing and proposed thoroughfares, transportation routes, and terminals, as well as local public utilities and facilities, all correlated with the land use element of the general plan.

City

City, with a capital "C," generally refers to the government or administration of a city. City, with a lower case "c" may mean any city, or may refer to the geographical area of a city (*e.g.*, the city's bikeway system.)

Clarifier

A sedimentation basin used to settle solids out of the wastewater during the treatment process.

Clean Air Plan

A plan developed by an Air District for the purpose of meeting an air quality standard.

Clearing

The removal of trees and brush from an area such as a construction site or reservoir inundation area. For construction projects, clearing typically refers to a removal of all standing brush or trees two inches or greater in diameter at a point six inches above the ground, or any vegetation greater than six feet in height.

Clear Zone

That section of an approach zone of an airport where the plane defining the glide path is 50 feet or less above the center-line of the runway. The clear zone ends where the height of the glide path above ground level is above 50 feet. Land use under the clear zone is restricted.

Climax community

A more or less stable biotic community.

CO

Carbon monoxide; a gaseous compound containing one molecule of carbon and one of oxygen.

Coagulated wastewater

Oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable chemicals or other effective methods.

Coastal Dune

Vegetation community found grown on the sandy dunes just inland from the coast.

Coastal Program

Local Coastal Programs (LCP's) are the specific long-term management plans prepared for each of California's coastal cities and counties for its section of coast. Each LCP consists of a land use plan, zoning ordinances, and other implementing actions.

Coastal Zone

Defined by the federal Coastal Zone Management Act as the coastal waters and the adjacent shorelines, strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands , transitional and intertidal areas, salt marshes, wetlands, and beaches.

Coliform bacteria

Any of a number of bacilli (bacteria) that are normally present in the colon and that indicate fecal contamination when found in a water supply.

Collector

Relatively-low-speed (25-30 mph), relatively-low-volume (5,000-20,000 average daily trips) street which provides circulation within and between neighborhoods. Collectors usually serve short trips and are intended for collecting trips from local streets and distributing them to the arterial network.

Colluvium

A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity.

Colon bacillus

Found normally in all vertebrate intestinal tracts and occasionally virulent, causing pyelitis or infantile diarrhea.

Commercial

A land use classification which permits facilities for the buying and selling of commodities and services.

Community Care Facility

Elderly housing licensed by the State Health and Welfare Agency, Department of Social Services, typically for residents who are frail and need supervision. Services normally include three meals daily, housekeeping, security and emergency

C

response, a full activities program, supervision in the dispensing of medicine, personal services such as assistance in grooming and bathing, but no nursing care. Sometimes referred to as residential care or personal care. (See "Congregate Care.")

Community Facilities District

Under the Mello-Roos Community Facilities Act of 1982 (Government Code Section 53311 *et seq*), a legislative body may create within its jurisdiction a special district that can issue tax-exempt bonds for the planning, design, acquisition, construction, and/or operation of public facilities, as well as provide public services to district residents. Special tax assessments levied by the district are used to repay the bonds.

Community Noise Equivalent Level (CNEL)

A 24-hour energy equivalent level derived from a variety of single-noise events, with weighting factors of 5 and 10 dBA applied to the evening (7:00 to 10:00 pm) and nighttime (10:00 pm to 7:00 am) periods, respectively, to allow for the greater sensitivity to noise during these hours.

Community Park

Land with full public access intended to provide recreation opportunities beyond those supplied by neighborhood parks. Community parks are larger in scale than neighborhood parks but smaller than regional parks.

Community Separator Area

A classification of Open Space defined in the Sonoma County General Plan which is rural land intended to provide visual relief between identifiable cities and communities. These lands are not necessarily scenic in their own right, but impose development restrictions to function as buffers to prevent continuous, corridor-style urbanization patterns.

Commute-shed

The area from which people do or might commute from their homes to a specific workplace destination, given specific assumptions about maximum travel time or distance.

Components

Individual Project elements that make up the system proposed to accomplish the Project objective.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA)

This law authorizes the Federal government to clean up abandoned hazardous waste sites and to otherwise protect the public health and environment from the hazards presented by such sites.

Condensate

Fluid formed by condensation of super-heated (geothermal) steam when pressure and temperature are decreased in the power generation process.

Conductivity

A measure of the ability of a given substance to conduct an electric current.

Congestion Management Plan (CMP)

A mechanism employing growth management techniques, including traffic level of service requirements, development mitigation programs, transportation systems management, and capital improvement programming, for the purpose of controlling and/or reducing the cumulative regional traffic impacts of development. AB 1791, effective August 1, 1990, requires all cities, and counties that include urbanized areas, to adopt and annually update a Congestion Management Plan.

Congregate Care

Apartment housing, usually for seniors, in a group setting that includes independent living and sleeping accommodations in conjunction with shared dining and recreational facilities. (See "Community Care Facility.")

Conjunctive use

The coordinated use of various water sources, such as surface water, groundwater and desalinated seawater, managed so that the benefit from the overall water resource system is maximized. Conjunctive operation provides a greater sustained yield from a system than would otherwise be possible, usually at a lower cost.

Conservation

The management of natural resources to prevent waste, destruction, or neglect. The state mandates that a Conservation Element be included in the general plan.

Conservation Element

One of the seven State-mandated elements of a local general plan, it contains adopted goals, policies and implementation programs for the conservation, development, and use of natural resources including water and its hydraulic force, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources.

Consistent

Free from variation or contradiction. Programs in the General Plan are to be consistent, not contradictory or preferential. State law requires consistency between a general plan and implementation measures such as the zoning ordinance.

Contaminants

Constituents that cause a substance to become inferior or impure.

Contingency Plan

Refer to Section 3.3. A plan designed to reduce the incidences of discharges to the Russian River above the design discharge rate.

Cooperating Agency

Any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency (NEPA).

Core

A lump of stone from which flakes or blades have been removed. Sometimes a core is merely the by-product of toolmaking, but it may also be shaped and modified to serve as an implement in its own right. An object, such as a handaxe, made in this way is a core tool.

Corrosivity

The tendency for a material to be eaten away by chemical action.

County

County, with a capital "C," generally refers to the government or administration of a county. County, with a lower case "c" may mean any county, or may refer to the geographical area of a county (*e.g.*, the county's road system.)

Covenants, Conditions, and Restrictions (CC&Rs)

A term used to describe restrictive limitations which may be placed on property and its use, and which usually are made a condition of holding title or lease.

Creeks

Water course smaller than a river.

Criteria Pollutant

Pollutants for which characteristics and potential health and welfare effects have been documented and the EPA has set standards for these pollutants based on the information. Pollutants considered criteria are ozone, carbon monoxide, particulate mater, sulfur dioxide, lead, and nitrogen oxide.

Criterion

A standard upon which a judgment or decision may be based. (See "Standards.")

Cryptosporidium

Parasite causing a more severe intestinal illness than Giardia with fewer remedies.

Cubic Foot per Second (cfs)The rate of flow equivalent to one cubic foot, about 7-1/2 gallons, passing a point during one second (approximately 450 gallons/minute).

Cul-de-sac

A short street or alley with only a single means of ingress and egress at one end and with a large turnaround at its other end.

Cumulative Impact

As used in CEQA, the total impact resulting from the accumulated impacts of individual projects or programs over time.

C

dB

Decibel; a unit used to express the relative intensity of a sound as it is heard by the human ear.

dBA

The "A-weighted" scale for measuring sound in decibels; weighs or reduces the effects of low and high frequencies in order to simulate human hearing. Every increase of 10 dBA doubles the perceived loudness though the noise is actually ten times more intense.

Decision-Making Body

Any person or group of people within a public agency permitted by law to approve or disapprove the project at issue.(CEQA)

Dedication

The turning over by an owner or developer of private land for public use, and the acceptance of land for such use by the governmental agency having jurisdiction over the public function for which it will be used. Dedications for roads, parks, school sites, or other public uses often are made conditions for approval of a development by a city or county.

Dedication, In lieu of

Cash payments which may be required of an owner or developer as a substitute for a dedication of land, usually calculated in dollars per lot, and referred to as in lieu fees or in lieu contributions.

Demand Fee

The initial charge for the connection to the existing sewer system for additional sewer capacity, typically charged to new development at the time of connection. The demand fees are intended to fund the proportional share of capital costs attributable to new residential and commercial development to help fund the expansion of regional sewer facilities.

Density, Residential

The number of permanent residential dwelling units per acre of land. Densities specified in the General Plan may be expressed in units per gross acre or per net developable acre. (See "Acres, Gross," and "Developable Acres, Net.")

Density Bonus

The allocation of development rights that allow a parcel to accommodate additional square footage or additional residential units beyond the maximum for which the parcel is zoned, usually in exchange for the provision or preservation of an amenity at the same site or at another location. Under California law, a housing development that provides 20% of its units for lower income households, or 10% of its units for very low-income households, or 50% of its units for seniors, is entitled to a density bonus. (See "Development Rights, Transfer of.")

Density, Control of

A limitation on the occupancy of land. Density can be controlled through zoning in the following ways: use restrictions, minimum lot-size requirements, floor area ratios, land use-intensity ratios, setback and yard requirements, minimum house-size requirements, ratios comparing number and types of housing units to land area, limits on units per acre, and other means. Allowable density often serves as the major distinction between residential districts.

Density Transfer

A way of retaining open space by concentrating densities—usually in compact areas adjacent to existing urbanization and utilities—while leaving unchanged historic, sensitive, or hazardous areas. In some jurisdictions, for example, developers can buy development rights of properties targeted for public open space and transfer the additional density to the base number of units permitted in the zone in which they propose to develop.

Department of Toxic Substances Control (DTSC)

A department within the California EPA that is responsible for overseeing the cleanup of hazardous waste sites and for monitoring and regulating hazardous waste transportation, treatment, storage and disposal.

Desiccation

The act of drying-up.

Design Discharge Rate

The maximum monthly discharge rate, as a percentage of Russian River flow, during normal operations.

Designated Scenic Highway

In this study, a highway that is officially designated by Caltrans or Sonoma County as passing through an area of particularly high scenic quality.

Design Review; Design Control

The comprehensive evaluation of a development and its impact on neighboring properties and the

community as a whole, from the standpoint of site and landscape design, architecture, materials, colors, lighting, and signs, in accordance with a set of adopted criteria and standards. "Design Control" requires that certain specific things be done and that other things not be done. Design Control language is most often found within a zoning ordinance. "Design Review" usually refers to a system set up outside of the zoning ordinance, whereby projects are reviewed against certain standards and criteria by a specially established design review board or committee. (See "Architectural Control.")

Detention Dam/Basin/Pond

Dams may be classified according to the broad function they serve, such as storage, diversion, or detention. Detention dams are constructed to retard flood runoff and minimize the effect of sudden floods. Detention dams fall into two main types. In one type, the water is temporarily stored, and released through an outlet structure at a rate that will not exceed the carrying capacity of the channel downstream. Often, the basins are planted with grass and used for open space or recreation in periods of dry weather. The other type, most often called a **Retention Pond**, allow for water to be held as long as possible and may or may not allow for the controlled release of water. In some cases, the water is allowed to seep into the permeable banks or gravel strata in the foundation. This latter type is sometimes called a **Water-Spreading Dam** or **Dike** because its main purpose is to recharge the underground water supply. Detention dams are also constructed to trap sediment. These are often called Debris Dams.

Detrital

Small particles of rock broken away from a mass.

Developable Land

Land that is suitable as a location for structures and that can be developed free of hazards to, and without disruption of, or significant impact on, natural resource areas.

Developer

An individual who or business that prepares raw land for the construction of buildings or causes to be built physical building space for use primarily by others, and in which the preparation of the land or the creation of the building space is in itself a business and is not incidental to another business or activity.

Development

The physical extension and/or construction of urban land uses. Development activities include: subdivision of land; construction or alteration of structures, roads, utilities, and other facilities; installation of septic systems; grading; deposit of refuse, debris, or fill materials; and clearing of natural vegetative cover (with the exception of agricultural activities). Routine repair and maintenance activities are exempted.

Development Fee

(See "Impact Fee.")

Development Rights

The right to develop land by a land owner who maintains fee-simple ownership over the land or by a party other than the owner who has obtained the rights to develop. Such rights usually are expressed in terms of density allowed under existing zoning. For example, one development right may equal one unit of housing or may equal a specific number of square feet of gross floor area in one or more specified zone districts. (See "Interest, Fee" and "Interest, Less-than-fee," and "Development Rights, Transfer of [TDR].")

Development Rights, Transfer of (TDR)

Also known as "Transfer of Development Credits," a program which can relocate potential development from areas where proposed land use or environmental impacts are considered undesirable (the "donor" site) to another ("receiver") site chosen on the basis of its ability to accommodate additional units of development beyond that for which it was zoned, with minimal environmental, social, and aesthetic impacts. (See "Development Rights.")

Dinoflagellates

Red Tides.

Discharge

The volume of water in a stream or river passing through a cross-section of the channel in a given period of time, usually expressed in cubic meters per second.

Discretionary Decision

As used in CEQA, an action taken by a governmental agency which calls for the exercise of

judgment in deciding whether to approve and/or how to carry out a project.

Disinfection

Treatment using a method such as chlorination to remove reduction of viable sewage-borne virus and other disease-causing microorganisms.

Disinfection by-products (DBPs)

Chemicals that are produced as a result of the water disinfection process. Chloroform is a common DBP of drinking water supplies that is produced when chlorine, used in the disinfection process, combines with organic matter in the water.

Dissolved oxygen

Free, uncombined oxygen molecules dissolved in water.

Distribution System

A pipe network which distributed water to water users.

District

(1) An area of a city or county that has a unique character identifiable as different from surrounding areas because of distinctive architecture, streets, geographic features, culture, landmarks, activities, or land uses. (2) A portion of the territory of a city or county within which uniform zoning regulations and requirements apply; a zone.

Diversion

The direction of water in a stream away from its natural course (*i.e.*, as in a diversion that removes water from a stream for human use).

Diversity

Differences among otherwise similar elements that give them unique forms and qualities (*e.g.*, housing diversity can be achieved by differences in unit size, tenure, or cost).

Downgradient

A falling slope, either above surface or subsurface.

Drawdown

A decrease in the elevation of the water table of an aquifer in response to pumping.

Drought-tolerant species

Plants that are tolerant of low soil moisture conditions for extended periods of time.

Dwelling Unit

A room or group of rooms (including sleeping, eating, cooking, and sanitation facilities, but not more than one kitchen), which constitutes an independent housekeeping unit, occupied or intended for occupancy by one household on a long-term basis.

Easement

Usually the right to use property owned by another for specific purposes or to gain access to another property. For example, utility companies often have easements on the private property of individuals to be able to install and maintain utility facilities.

Easement, Conservation

A tool for acquiring open space with less than full-fee purchase, whereby a public agency buys only certain specific rights from the land owner. These may be positive rights (providing the public with the opportunity to hunt, fish, hike, or ride over the land) or they may be restrictive rights(limiting the uses to which the land owner may devote the land in the future.)

Easement, Scenic

A tool that allows a public agency to use an owner's land for scenic enhancement, such as roadside landscaping or vista preservation.

Ecology

The interrelationship of living things to one another and their environment; the study of such interrelationships.

Economic Base

Economic Base theory essentially holds that the structure of the economy is made up of two broad classes of productive effort—basic activities which produce and distribute goods and services for export to firms and individuals outside a defined localized economic area, and nonbasic activities whose goods and services are consumed at home within the boundaries of the local economic area. Viewed another way, basic activity exports goods and services and brings new dollars into the area; non-basic activity recirculates dollars within the area. This distinction holds that the reason for the growth of a particular region is its capacity to provide the means of payment for raw materials, food, and services which the region cannot produce itself and also support the nonbasic activities which are principally local in productive scope and market area. (See "Industry, Basic" and "Industry, Non-basic.")

Ecosystem

An interacting system formed by a biotic community and its physical environment.

Effluent

Wastewater or other liquid - raw, partially or completely treated - flowing from a basin, treatment process, or treatment plant.

Emergency

A sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. "Emergency" includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage (CEQA).

Embankment dam

A dam made of earth fill, with a rock face, blocking a natural drainage or valley.

Eminent Domain

The right of a public entity to acquire private property for public use by condemnation, and the payment of just compensation.

Emission Factor

The amount of specific pollutant emitted from each type of polluting source in relation to a unit quantity of material handled, processed, or burned.

Emission Standard

The maximum amount of pollutant legally permitted to be discharged from a single source, either mobile or stationary.

Endangered Species

A species of animal or plant is considered to be endangered when its prospects for survival and reproduction are in immediate jeopardy from one or more causes.

Energy Dissipation Structure

Structure constructed along the dam spillway to slow the flow of water passing through the spillway. The structure consists of rock lining the natural creek channel, approximately 25 feet wide and up to 300 feet long.

Enhance, *v.*

To improve existing conditions by increasing the quantity or quality of beneficial uses or features.

Enteric virus

A virus that normally inhabits the intestinal tract of animals.

E

Environment

CEQA defines environment as "the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, mineral, flora, fauna, noise, and objects of historic or aesthetic significance."

Environmental estrogens

Any of a number of chemicals of anthropogenic origin that mimic or disrupt the endocrine hormone systems of animals, including humans.

Environmental Impact Report (EIR)

A report required of general plans by the California Environmental Quality Act and which assesses all the environmental characteristics of an area and determines what effects or impacts will result if the area is altered or disturbed by a proposed action. (See "California Environmental Quality Act.")

Environmental Protection Agency

The federal agency in charge of controlling air pollution.

EIR Certification

EIR adoption by a governing agency accepting the document as being complete, accurate, and encompassing.

Environmental Impact Statement (EIS)

Under the National Environmental Policy Act, a statement on the effect of development proposals and other major actions which significantly affect the environment.

Environmentally Sensitive Areas

Those areas of the environment, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historical or aesthetic significance, which would be significantly impacted either directly or indirectly by man-made devices.

Environmentally Sensitive Lands

Those lands whose watershed characteristics; slop; geologic features; vicinity to wetlands, stream zone, or water edge; and land stability make them sensitive and would be significantly affected either directly or indirectly by man-made devices.

Epicentral

Pertaining to the epicenter, or the point on the earth's surface directly above the focus of an earthquake.

Erosion

(1) The loosening and transportation of rock and soil debris by wind, rain, or running water. (2) The gradual wearing away of the upper layers of earth.

Estrogenic Compounds

Compounds that have or mimic the female hormone estrogen. These compounds are suspected to have the potential to disrupt the endocrine system of terrestrial and aquatic life.

Estuary

A partially enclosed body of water which contains a mixture of freshwater from land drainage and tidal sea water, such as a river mouth or coastal bay.

Ethnographic

Having to do with the study of living human groups or the study of recent, historically documented groups.

Ethnography

Study of individual cultures.

Eutrophic

Water rich in dissolved nutrients but deficient in oxygen.

Evaluation Criteria

See Criterion.

Evaporation

To expel moisture from.

Evapotranspiration

The loss of water from the soil by both evaporation and by transpiration from the plants growing thereon.

Exaction

A contribution or payment required as an authorized precondition for receiving a development permit; usually refers to mandatory dedication (or fee in lieu of dedication) requirements found in many subdivision regulations.

Expansive Soils

Soils which swell when they absorb water and shrink as they dry.

Extractable storage

Aquifer storage that can be physically removed.

Facade

The principal face or front of a building.

Farmers Home Administration (FmHA)

A federal agency providing loans and grants for improvement projects and low-income housing in rural areas.

Farmland

Refers to eight classifications of land mapped by the U.S. Department of Agriculture Soil Conservation Service. The five agricultural classifications defined below--except Grazing Land--do not include publicly owned lands for which there is an adopted policy preventing agricultural use.

Prime Farmland

Land which has the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed, including water management, according to current farming methods. Prime Farmland must have been used for the production of irrigated crops within the last three years.

Farmland of Statewide Importance

Land other than Prime Farmland which has a good combination of physical and chemical characteristics for the production of crops. It must have been used for the production of irrigated crops within the last three years.

Unique Farmland

Land which does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, that is currently used for the production of specific high economic value crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to current farming methods. Examples of such crops may include oranges, olives, avocados, rice, grapes, and cut flowers.

Farmland of Local Importance

Land other than Prime Farmland, Farmland of Statewide Importance, or Unique Farmland that is either currently producing crops, or that has the capability of production. This land may be important to the local economy due to its productivity.

Grazing Land

Land on which the existing vegetation, whether grown naturally or through management, is suitable for grazing or browsing of livestock. This classification does not include land previously designated as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance, and heavily brushed, timbered, excessively steep, or rocky lands which restrict the access and movement of livestock.

F

Fast Track

Barely meeting due process of law requirements; moving so fast that all information is sporadic, incomprehensible, and incomplete.

Fault

A fracture in the earth's crust forming a boundary between rock masses that have been displaced relative to one another.

Faunal

Animal remains from archaeological sites that illustrate past hunting and dietary practices.

Feasible

Capable of being done, executed, or managed successfully from the standpoint of the physical and/or financial abilities of the implementer(s).

Feasible, Technically

Capable of being implemented because the industrial, mechanical, or application technology exists.

Federal Clean Air Act

The federal legislation that is the legal basis for the national clean air program.

Fill Material

Any material placed in an area to increase surface elevation.

Filtered Effluent

An oxidized, coagulated, clarified wastewater that has been passed through a filter media to produce an average turbidity of 2 ntu or less.

Finding(s)

The result(s) of an investigation and the basis upon which decisions are made. Findings are used by

government agents and bodies to justify action taken by the entity.

Fingerling steelhead

Juvenile steelhead which are about 75 mm in length and usually less than 1 year old.

Fire Hazard Zone

An area where, due to slope, fuel, weather, or other fire-related conditions, the potential loss of life and property from a fire necessitates special fire protection measures and planning before development occurs.

Fire-resistive

Able to withstand specified temperatures for a certain period of time, such as a one-hour fire wall; not fireproof.

Fiscal Impact Analysis

A projection of the direct public costs and revenues resulting from population or employment change to the local jurisdiction(s) in which the change is taking place. Enables local governments to evaluate relative fiscal merits of general plans, specific plans, or projects.

Fiscal year

The period from July 1st of one calendar year to June 30th of the following calendar year.

Flake

A fragment removed from a larger stone (the core or nucleus) by percussion or pressure, which leaves characteristics marks on both the core and flake. Flakes often served as blanks from which more complex artifacts, or flake tools, could be made.

Flood, 100-Year

The magnitude of a flood expected to occur on the average every 100 years, based on historical data. The 100-year flood has a 1/100, or one percent, chance of occurring in any given year.

Flood Insurance Rate Map (FIRM)

For each community, the official map on which the Federal Insurance Administration has delineated areas of special flood hazard and the risk premium zones applicable to that community.

Flooding

Act of overflowing or inundating a normally dry area with water.

Flood Plain

The relatively level land area on either side of the banks of a stream regularly subject to flooding. That part of the flood plain subject to a one percent chance of flooding in any given year is designated as an "area of special flood hazard" by the Federal Insurance Administration.

Flood Plain Fringe

All land between the floodway and the upper elevation of the 100-year flood.

Floodway

The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the "base flood" without cumulatively increasing the water surface elevation more than one foot. No development is allowed in floodways.

Forb

Broad-leafed, annual or herbaceous perennial plant species.

Foreground View Range

Viewing distances to landscape features (or changes) within 0 to ½ mile.

Freeway

A high-speed, high-capacity, limited-access transportation facility serving regional and county-wide travel. Such roads are free of tolls, as contrasted with "turnpikes" or other "toll roads" now being introduced into Southern California. Freeways generally are used for long trips between major land use generators. At Level of Service "E," they carry approximately 1,875 vehicles per lane per hour, in both directions. Major streets cross at a different grade level.

Friable

A rock or mineral that is easily crumbled.

Friction Factor

Constraint applied in a traffic model to introduce an approximation of conditions that exist on streets in the city or county. These conditions reduce the speed of traffic and the desirability of specific links in the network upon which the traffic model distributes trips. Examples are frequency of low-speed curves, frequency of driveways, narrowness of lanes, and lack of turning lanes at intersections.

Fry

Very small, recently-hatched steelhead. The term is commonly applied to fish up to about a month old and 1-1/2 inches long.

F

G

Gable

The triangular part of the end of a building formed by the sides of the roof sloping from the ridgepole down to the eaves.

General Plan

A compendium of city or county policies regarding long-term development, in the form of maps and accompanying text. The General Plan is a legal document required of each local agency by the State of California Government Code Section 65301 and adopted by the City Council or Board of Supervisors. In California, the General Plan has 7 mandatory elements (Circulation, Conservation, Housing, Land Use, Noise, Open Space, Safety and Seismic Safety) and may include any number of optional elements (such as Air Quality, Economic Development, Hazardous Waste, and Parks and Recreation). The General Plan may also be called a "City Plan," "Comprehensive Plan," or "Master Plan."

Geoarchaeological

The investigation of the relationship between archaeological and geological processes.

Geologic Review

The analysis of geologic hazards, including all potential seismic hazards, surface ruptures, liquefaction, landsliding, mudsliding, and the potential for erosion and sedimentation.

Geological

Pertaining to geology - materials processes, products and history of the earth.

Geomorphic

Of, or pertaining to, the figure of the earth or the from of its surface.

Geothermal Energy

Electricity produced by converting heat from naturally occurring steam and hot water from the earth's interior.

Giardia

Parasite causing severe intestinal illness.

Goal

A general, overall, and ultimate purpose, aim, or end toward which the City or County will direct effort.

Grading

To alter the topography or slope of an area through the use of construction equipment, such as bulldozers.

Granitic rocks

Of, or pertaining to, or composed of, granite or granite-like rock.

Granny Flat

(See "Second Unit.")

Greenbelt

An area of parks or undeveloped open space surrounding or passing through a community.

Greenstone

A compact dark-green altered or metamorphosed basic igneous rock.

Groundshaking

Movement of the earth's surface resulting from an earthquake.

Groundwater

Water under the earth's surface, often confined to aquifers capable of supplying wells and springs.

Groundwater basin

An interrelated set of water-bearing strata of permeable rock, sand, or gravel.

Groundwater hydrology

The study of occurrence, distribution, character, and movement of water below the surface of the earth (synonymous with the term "Hydrogeology")

Groundwater Mounding

A rise in groundwater levels around a central point.

Groundwater Recharge

The natural process of infiltration and percolation of rainwater from land areas or streams through permeable soils into water-holding rocks which provide underground storage ("aquifers").

Growth Inducing

An action that would result in, or lead to, an increase in population of a given area.

Growth Management

The use by a community of a wide range of techniques in combination to determine the amount, type, and rate of development desired by the community and to channel that growth into designated areas. Growth management policies can be implemented through growth rates, zoning, capital improvement programs, public facilities

ordinances, urban limit lines, standards for levels of service, and other programs. (See "Congestion Management Plan.")

Grubbing

The removal of stumps, roots and brush from an area that has been cleared, as for a construction site or reservoir inundation area.

Guidelines

General statements of policy direction around which specific details may be later established.

H

Habitat

The physical location or type of environment in which an organism or biological population lives or occurs.

Handicapped

A person determined to have a physical impairment or mental disorder expected to be of long or indefinite duration. Many such impairments or disorders are of such a nature that a person's ability to live independently can be improved by appropriate housing conditions.

Handstone

A smooth stone tool held in the hand and used to crush grain or seeds on a mortar.

Hazardous Air Pollutants (HAPs)

Pollutants that may present a threat of adverse health or environmental effects. Criteria air pollutants cannot be listed as HAPs unless they meet certain conditions.

Hazardous Material

Any substance that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. The term includes, but is not limited to, hazardous substances and hazardous wastes.

Hazardous Materials Management Plan (HMMP)

An inventory of hazardous materials, as defined by state law, that are used to aid emergency response planning. HMMPs are usually administered by local fire departments.

Health Risk Assessment

Evaluation of the potential health risks to the public associated with exposure to reclaimed water from the Laguna Wastewater Treatment Plant.

Heterotrophic bacteria

Any bacteria that requires organic compounds for its principal food source.

High Occupancy Vehicle (HOV)

Any vehicle other than a driver-only automobile (*e.g.*, a vanpool, a bus, or two or more persons to a car).

High Volume Travelway

In this study, state highways and 2-lane country highways serving direct connections with settlements named on USGS quad maps and Amtrak.

Highway

High-speed, high-capacity, limited-access transportation facility serving regional and county-wide travel. Highways may cross at a different grade level.

Historic; Historical

An historic building or site is one that is noteworthy for its significance in local, state, or national history or culture, its architecture or design, or its works of art, memorabilia, or artifacts.

Historic Architectural

The study of architectural resources that are older than 45 years.

Historic Preservation

The preservation of historically significant structures and neighborhoods until such time as, and in order to facilitate, restoration and rehabilitation of the building(s) to a former condition.

Historic Vernacular Landscape

A geographic area that historically has been used by people, or shaped or modified by human activity, occupancy, or intervention, and that possess a significant concentration, linkage, or continuity of areas of land use, vegetation, buildings and structures, roads and waterways, and natural features.

Holocene

The time from the end of the Pleistocene Ice Age (ca. 8300 B.C.) to the present day.

hop kilns

A furnace or oven designed to dry or bake hops.

Hopper

A conical, primarily basketry, container with not bottom, often either glued to the mortar or pressed against it during

Hostelry

Inn, hotel.

Housefloor

Compacted earth, hearths, and/or other associated features representing the floor of a structure.

Household

All those persons—related or unrelated—who occupy a single housing unit. (See "Family.")

Household Income Category

As used to classify households for the purpose of determining housing needs, the following categories are defined based upon DOF median income data:

Very Low Income Household

Income not exceeding 50 percent of the median family income of the area.

Other Low Income Household

Income between 50 and 80 percent of the median family income of the area.

Moderate Income Household

Income between 80 and 120 percent of the median family income of the area.

Above Moderate Income Household

Income above median family income of the area.

Households, Number of

The count of all year-round housing units occupied by one or more persons. The concept of *household* is important because the formation of new households generates the demand for housing. Each new household formed creates the need for one additional housing unit or requires that one existing housing unit be shared by two households. Thus, household formation can continue to take place even without an increase in population, thereby increasing the demand for housing.

Housing and Community Development Department of the State of California (HCD)

The State agency that has principal responsibility for assessing, planning for, and assisting communities to meet the needs of low- and moderate-income households.

Housing Element

One of the seven State-mandated elements of a local general plan, it assesses the existing and projected housing needs of all economic segments of the community, identifies potential sites adequate to provide the amount and kind of housing needed, and contains adopted goals, policies, and implementation programs for the preservation, improvement, and development of housing. Under State law, Housing Elements must be updated every five years.

Housing and Urban Development, U.S. Department of (HUD)

A cabinet-level department of the federal government which administers housing and community development programs.

H

Housing Unit

The place of permanent or customary abode of a person or family. A housing unit may be a single-family dwelling, a multi-family dwelling, a condominium, a modular home, a mobile home, a cooperative, or any other residential unit considered real property under State law. A housing unit has, at least, cooking facilities, a bathroom, and a place to sleep. It also is a dwelling that cannot be moved without substantial damage or unreasonable cost. (See "Dwelling Unit," "Family," and "Household.")

Human Environment

"Human Environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment (NEPA).

Hydraulic conductivity

A measure of the ease with which groundwater moves through an aquifer.

Hydraulic Loading Rate

Refers to the amount of water that is applied to soils. Normally measured as rates of flow that is applied to soils. Normally measured as rates of flow such as millions of gallons per day. Rate refers to a time measurement of amount of water being applied to a given area.

Hydrocarbons

A family of compounds containing carbon and hydrogen in various combinations. They are emitted into the atmosphere from manufacturing, storage and handling, or combustion of petroleum products and through natural processes. Certain hydrocarbons interact with nitrogen oxides in the presence of intense sunlight to form photochemical air pollution.

Hydrogeologic

Of, or pertaining to, the study of the waters of the earth.

Hydrothermal

Of or pertaining to hot water, to the action of hot water, or to the mineralogical products of this action.

Hypolimnetic

Referring to the cool, deeper portions of a stratified lake or reservoir which are below the metalimnion.

H

Identity

A consistent quality that makes a city, place, area, or building unique and gives it a distinguishing character.

Igneous Rocks

Crystalline or glassy rocks that have solidified from a molten magma; the magma may pour out onto the surface of the earth (such as lava) or may cool at depths below the surface (such as granite).

Image

The mental picture or impression of a city or place taken from memory and held in common by members of the community.

Impact

The effect of any direct man-made actions or indirect repercussions of man-made actions on existing physical, social, or economic conditions.

Impact Fee

A fee, also called a development fee, levied on the developer of a project by a city, county, or other public agency as compensation for otherwise-unmitigated impacts the project will produce. California Government Code Section 66000, *et seq*, specifies that development fees shall not exceed the estimated reasonable cost of providing the service for which the fee is charged. To lawfully impose a development fee, the public agency must verify its method of calculation and document proper restrictions on use of the fund.

Impervious Surface

Surface through which water cannot penetrate, such as roof, road, sidewalk, and paved parking lot. The amount of impervious surface increases with development and establishes the need for drainage facilities to carry the increased runoff.

Implementation

Actions, procedures, programs, or techniques that carry out policies.

Improvement

The addition of one or more structures or utilities on a parcel of land.

Incorporation

Creation of a new city.

Incubation

The process of referring to the development of fish eggs before they hatch into alevins.

Induced Seismicity

The potential for an action to cause an increase in the number of earthquakes or the magnitude of an earthquake.

Industrial

The manufacture, production, and processing of consumer goods. Industrial is often divided into "heavy industrial" uses, such as construction yards, quarrying, and factories; and "light industrial" uses, such as research and development and less intensive warehousing and manufacturing.

Industry, Basic

The segment of economic activity that brings dollars to a region from other areas. Traditional examples are manufacturing, mining and agriculture. The products of all of these activities are exported (sold) to other regions. The money thus brought into the local economy is used to purchase locally-provided goods and services as well as items that are not available locally and that must be imported from other regions. Other, less traditional examples of basic industry are tourism, higher education, and retirement activities that also bring new money into a region.

Industry, Non-basic

The segment of economic activity that is supported by the circulation of dollars within a region. Examples are the wholesale, retail, and service functions that supply goods and services to local sources of demand such as businesses, public agencies, and households.

Influent Pump

Pump that moves untreated sewage (influent) to treatment plant facilities.

Infrastructure

Public services and facilities, such as sewage-disposal systems, water-supply systems, other utility systems, and roads.

Initial Study

A preliminary analysis prepared by the Lead Agency to determine whether an EIR or a Negative Declaration must be prepared or to identify the significant environmental effects to be analyzed in an EIR. (CEQA)

Inland Surface Waters Plan

California's water quality control plan for inland surface waters. Proposes to control discharge of wastewater to inland surface waters and to support reuse of reclaimed water with reasonable water quality objectives. Adopted April 1991. Sacramento County Superior Court issued tentative decision invalidating this plan. Plan will continue to be valid until final judgment is reached.

Institutional Use

(1) Publicly or privately owned and operated activities such as hospitals, museums, and schools; (2) churches and other religious organizations; and (3) other nonprofit activities of a welfare, educational, or philanthropic nature that can not be considered a residential, commercial, or industrial activity.

Inter-agency

Indicates cooperation between or among two or more discrete agencies in regard to a specific program.

Interest, Fee

Entitles a land owner to exercise complete control over use of land, subject only to government land use regulations.

Interest, Less-than-fee

The purchase of interest in land rather than outright ownership; includes the purchase of development rights via conservation, open space, or scenic easements. (See "Development Rights," "Easement, Scenic," "Lease," and "Leasehold Interest.")

Intermittent Stream

A stream that normally flows for at least thirty (30) days after the last major rain of the season and is dry a large part of the year.

Internal Combustion Engine

An engine in which both the heat energy and the ensuing mechanical energy are produced inside the engine.

Inundate

To cover with or as if with a flood; overflow.

Inversion

A layer of warmer air over a layer of cooler air.

Issues

Important unsettled community matters or problems that are identified in a community's general plan and dealt with by the plan's goals, objectives, policies, plan proposals, and implementation programs.

Jobs/Housing Balance; Jobs/Housing Ratio

The availability of affordable housing for employees. The jobs/housing ratio divides the number of jobs in an area by the number of employed residents. A ratio of 1.0 indicates a balance. A ratio greater than 1.0 indicates a net in-commute; less than 1.0 indicates a net out-commute.

Joint Powers Authority (JPA)

A legal arrangement that enables two or more units of government to share authority in order to plan and carry out a specific program or set of programs that serves both units.

Jurisdictional wetlands

Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3). These wetlands must meet specific criteria for hydrophytic vegetation, hydric soils, and wetland hydrology as defined in the Corps' 1987 Wetland Delineation Manual, to be classified as a jurisdictional wetland.

Juvenile steelhead

Small steelhead, less than one year old. Also called young-of-the year.

Kelts

Adult steelhead which have spawned and are migrating back to the ocean.

K

Kilowatt(Kw)

One thousand watts

Kilowatt-hours (Kwh)

A measure of work performed. It is the equivalent of using 1,000 watts of electrical power over a one-hour period. Burning ten 100-watt light bulbs for one hour uses one kilowatt hour of electricity.

LAFCO

Stands for "Local Agency Formation Commission." This agency is responsible for processing and regulating annexations, and incorporations. It is empowered to approve, disapprove or conditionally approve such proposals. Also responsible for setting spheres of influence.

Lagoon

A body of shallow water, separated from the sea by a narrow strip of land and possessing a restricted connection with the sea.

Laguna de Santa Rosa

Floodplain along the Russian River that characteristically floods every other year, forming a small, temporary lake.

Lanceolate

Narrow and tapering like the head of a lance.

Land Banking

The purchase of land by a local government for use or resale at a later date. "Banked lands" have been used for development of low- and moderate-income housing, expansion of parks, and development of industrial and commercial centers. Federal rail-banking law allows railroads to bank unused rail corridors for future rail use while allowing interim use as trails.

Landlocked

Referring to a steelhead population or individual who cannot emigrate to the ocean due to an impassable barrier.

Landmark

(1) Refers to a building, site, object, structure, or significant tree, having historical, architectural, social, or cultural significance and marked for preservation by the local, state, or federal government. (2) A visually prominent or outstanding structure or natural feature that functions as a point of orientation or identification.

Landscaping

Planting—including trees, shrubs, and ground covers—suitably designed, selected, installed, and maintained as to enhance a site or roadway permanently.

Landslide

A general term for the downslope transport, under gravitational influence, of soil or rocks.

Land Use

The occupation or utilization of land or water area for any human activity or any purpose defined in the General Plan.

Land Use Element

A required element of the General Plan that uses text and maps to designate the future use or reuse of land within a given jurisdiction's planning area. The land use element serves as a guide to the structuring of zoning and subdivision controls, urban renewal and capital improvements programs, and to official decisions regarding the distribution and intensity of development and the location of public facilities and open space. (See "Mandatory Elements.")

Land Use Regulation

A term encompassing the regulation of land in general and often used to mean those regulations incorporated in the General Plan, as distinct from zoning regulations (which are more specific).

Lateral Spread

A dominantly horizontal displacement of flat-lying alluvial material towards an open or "free" face, such as a steep bank or stream channel.

LD-50

Lethal dose; the amount of exposure to a toxin that results in the death of one-half (50%) of the exposed population.

L_{dn}

Day-Night Average Sound Level. The A-weighted average sound level for a given area (measured in decibels) during a 24-hour period with a 10 dB weighting applied to night-time sound levels. The L_{dn} is approximately numerically equal to the CNEL for most environmental settings.

Leachfields

Subsurface soil absorption system used to dispose of septic tank effluent in the soil mantle.

Lead Agency

The public agency which has the principal responsibility for carrying out or approving a project which may have a significant effect upon the environment (CEQA).

L

Lease

A contractual agreement by which an owner of real property (the lessor) gives the right of possession to another (a lessee) for a specified period of time (term) and for a specified consideration (rent).

Leasehold Interest

(1) The interest which the lessee has in the value of the lease itself in condemnation award determination. (2) The difference between the total remaining rent under the lease and the rent the lessee would currently pay for similar space for the same time period.

L_{eq}

The energy equivalent level, defined as the average sound level on the basis of sound energy (or sound pressure squared). The L_{eq} is a "dosage" type measure and is the basis for the descriptors used in current standards, such as the 24-hour CNEL used by the State of California.

Legal Non-Conforming Use

A lawful use existing on the effective date of a zoning ordinance restriction and continuing since that date in non conformance to the restriction.

Level of Service (LOS)

(1) A scale that measures the amount of traffic a roadway may be capable of handling on a roadway or at the intersection of roadways. Levels range from A to F, with A representing the highest level of service, as follows:

Level of Service A

Indicates a relatively free flow of traffic, with little or no limitation on vehicle movement or speed.

Level of Service B

Describes a steady flow of traffic, with only slight delays in vehicle movement and speed. All queues clear in a single signal cycle.

Level of Service C

Denotes a reasonably steady, high-volume flow of traffic, with some limitations on movement and speed, and occasional backups on critical approaches.

Level of Service D

The level where traffic nears an unstable flow. Intersections still function, but short queues develop and cars may have to wait through one cycle during short peaks.

Level of Service E

Traffic characterized by slow movement and frequent (although momentary) stoppages. This type of congestion is considered severe, but is not uncommon at peak traffic hours, with frequent stopping, long-standing queues, and blocked intersections.

Level of Service F

Describes unsatisfactory stop-and-go traffic characterized by "traffic jams" and stoppages of long duration. Vehicles at signalized intersections usually have to wait through one or more signal changes, and "upstream" intersections may be blocked by the long queues.

(2) Some communities in California are developing standards for levels of service relating to municipal functions such as police, fire, and library service. These standards are incorporated in the General Plan or in separate "Level of Service Plans."

Level of Significance

The significance of an environmental impact: No impact, Less than Significant, or Significant (as measured by the evaluation criteria).

Linguistics

A subdiscipline of anthropology that emphasizes the relationships between cultural behavior and language.

Liquefaction

The transformation of loose water-saturated granular materials (such as sand or silt) from a solid into a liquid state; a result of increased pore pressure and reduced effective stress. A type of ground failure that can occur during an earthquake.

Lithic

Having to do with stone.

Lithologic

Of, or pertaining to, the physical character of a rock, generally as determined without the aid of a microscope.

Local agency

Any public agency other than a state agency, board, or commission. For purposes of this division, a redevelopment agency and a Local Agency Formation Commission are local agencies, and neither is a state agency, board, or commission (CEQA).

Local Agency Formation Commission (LAFCo)

A five- or seven-member commission within each county that reviews and evaluates all proposals for formation of special districts, incorporation of cities, annexation to special districts or cities, consolidation of districts, and merger of districts with cities. Each county's LAFCo is empowered to approve, disapprove, or conditionally approve such proposals. The LAFCo members generally include two county supervisors, two city council members, and one member representing the general public. Some LAFCos include two representatives of special districts.

Long-term yield

The amount of water that can be withdrawn from an aquifer without causing long-term decline in the water table or piezometric surface. Long-term yield is roughly equal to the net recharge rate of the aquifer.

Lot

(See "Site.")

M

Macrophytes

Any plant species that can be readily observed without the aid of optical magnification. This includes all vascular plants, mosses, and large algae.

Magnesite

Native magnesium carbonate, $MgCO_3$, a mineral occurring usually in white, compact masses.

Maintenance Plan

A plan developed by an Air District for the purpose of maintaining air quality standards in areas with levels already below standards.

Managed Wetland

Water impoundments that are designed and operated to maximize their value as habitat for migratory waterfowl

Mandatory Element

A component of the General Plan mandated by State law, California State law requires that a General Plan include elements dealing with seven subjects—circulation, conservation, housing, land use, noise, open space, and safety—and specifies to various degrees the information to be incorporated in each element. (See "Land Use Element.")

Marsh

A plant community characterized by the presence of saturated soils and herbaceous wetland vegetation. Plant composition varies depending on the level of saturation and the salinity of the water.

Maximum Probable Flood

A flood that may be expected from the most severe combination of critical meteorlogic and hydrologic conditions that are reasonably possible in the region.

May

That which is permissible.

Maximum Contaminant Levels (MCLs)

Enforceable numerical limits set by California (California EPA) and the Federal government (EPA) that restrict the concentration of specific contaminants in drinking water delivered to any user of a public water system. Primary drinking water standards are based on health effects of contaminants, taking cost and feasibility of treatment techniques into account. Secondary drinking water standards are based on cosmetic (such as skin or tooth discoloration) and aesthetic effects (such as taste, odor or color).

Megawatt(MW)

One million watts, or one thousand kilowatts.

Melange

A mappable body of rock that includes fragments and blocks of all sizes embedded in a fragmented and generally sheared matrix.

Mello-Roos Bonds

Locally issued bonds that are repaid by a special tax imposed on property owners within a "community facilities" district established by a governmental entity. The bond proceeds can be used for public improvements and for a limited number of services. Named after the program's legislative authors.

Mercalli Scale

An arbitrary scale of earthquake intensity, ranging from I (detectable only instrumentally) to XII (causing almost total destruction).

Mercalli Intensity Scale

A subjective measure of the observed effects (human reactions, structural damage, geologic effects) of an earthquake. Expressed in Roman numerals from I to XII.

Merger (District)

Elimination of a special district by transferring its service responsibilities to a city government. The merging district's territory must be totally included inside the city.

Mesozoic

Geologic era from approximately 225 to 65 million years before present. The Mesozoic era is divided into three periods.

Metamorphic Rocks

Rocks which are changed by the action of heat and/or pressure below the earth's surface. Changes brought about by metamorphism can be in the rock's mineral composition, texture and structure.

Meteorology

The study of the atmosphere and its phenomena, including weather and climate.

Methemoglobinemia

A chemically-induced illness of infants, commonly referred to as blue baby syndrome,

wherein nitrate uptake from food and/or water results in reduced oxygen transport from lungs to tissues, resulting in a bluish tint to the skin.

Microclimate

The climate of a small, distinct area, such as a city street or a building's courtyard; can be favorably altered through functional landscaping, architecture, or other design features.

Microgram

1/1,000,000 of a gram.

Midden

A heap or stratum of refuse (broken pots and tools, ashes, food remains, et) normally found on the site of an ancient settlement.

Middleground View Range

Viewing distances to landscape features (or changes) within ½ to 3 miles.

Migration Corridor

Route utilized by fish and wildlife to travel between different ranges of their total habitat.

Millingslab

An amorphous or roughly shaped stone slab upon which seeds and other plant products are ground with the aide of a handstone.

Millingstone

See millingslab.

Mineral Resource

Land on which known deposits of commercially viable mineral or aggregate deposits exist. This designation is applied to sites determined by the State Division of Mines and Geology as being a resource of regional significance, and is intended to help maintain the quarrying operations and protect them from encroachment of incompatible land uses.

Minimize, *v.*

To reduce or lessen, but not necessarily to eliminate.

Mining

The act or process of extracting resources, such as coal, oil, or minerals, from the earth.

Ministerial (Administrative) Decision

An action taken by a governmental agency which follows established procedures and rules and does not call for the exercise of judgment in deciding whether to approve a project.

Mitigate, *v.*

To ameliorate, alleviate, or avoid to the extent reasonably feasible.

Mitigation Measure

A change in the Project designed to avoid, minimize, rectify, reduce, or compensate for a significant impact.

Mixed-use

Properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with significant functional interrelationships and a coherent physical design. A "single site" may include contiguous properties.

Mortar

A stone or wooden receptacle with a cup-shaped depression, generally used for processing plant foods (such as acorns); usually used with a pestle.

Most Probable Number (MPN)

A unit of measurement of the quantity of organisms (usually bacteria, such as coliforms) in a water supply.

Multiple Family Building

A detached building designed and used exclusively as a dwelling by three or more families occupying separate suites.

Multiplier Effect

The recalculation of money through the economy multiplies its impact on jobs and income. For example, money paid as salaries to industrial and office workers is spent on housing, food, clothes and other locally-available goods and services. This spending creates jobs in housing construction, retail stores (*e.g.*, grocery and drug stores) and professional offices. The wage paid to workers in those industries is again re-spent, creating still more jobs. Overall, one job in basic industry is estimated to create approximately one more job in non-basic industry.

Must

That which is mandatory.

M

N

National Ambient Air Quality Standards

The prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

National Environmental Policy Act (NEPA)

An act passed in 1974 establishing federal legislation for national environmental policy, a council on environmental quality, and the requirements for environmental impact statements.

National Flood Insurance Program

A federal program which authorizes the sale of federally subsidized flood insurance in communities where such flood insurance is not available privately.

National Historic Preservation Act

A 1966 federal law that established a National Register of Historic Places and the Advisory Council on Historic Preservation, and which authorized grants-in-aid for preserving historic properties.

National Pollution Discharge Elimination System (NPDES)

A system of permits and licensing administered by the EPA to monitor and control wastewater discharges.

National Priority List (NPL)

A list of the highest priority sites in the EPA's hazardous waste site cleanup effort.

National Register of Historic Places

The official list, established by the National Historic Preservation Act, of sites, districts, buildings, structures, and objects significant in the nation's history or whose artistic or architectural value is unique.

Native Species

A species that has historically occurred in a particular area.

Natural State

The condition existing prior to development.

Necessary

Essential or required.

Need

A condition requiring supply or relief. The City or County may act upon findings of need within or on behalf of the community.

Negative Declaration

A written statement briefly describing the reasons that a proposed project will not have a significant effect on the environment and does not require the preparation of an environmental impact report (CEQA).

Neighborhood Park

City- or county-owned land intended to serve the recreation needs of people living or working within one-half mile radius of the park.

Nitrogen Oxide(s)

A reddish brown gas that is a byproduct of combustion and ozone formation processes. Often referred to as NOX, this gas gives smog its "dirty air" appearance.

No Action

Required alternative to be evaluated under NEPA, where the proposed project would not take place and the resulting environmental effects from taking no action would serve as a baseline from which to compare the proposed project or alternatives.

No-flow periods

Periods when streamflow is non-existent.

No Project

Required alternative to be evaluated under CEQA. Refer to No Action.

Noise

Any sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. Noise, simply, is "unwanted sound."

Noise Attenuation

Reduction of the level of a noise source using a substance, material, or surface, such as earth berms and/or solid concrete walls.

Noise Contour

A line connecting points of equal noise level as measured on the same scale. Noise levels greater than the 60 L_{dn} contour (measured in dBA) require noise attenuation in residential development.

Noise Element

One of the seven State-mandated elements of a local general plan, it assesses noise levels of highways and freeways, local arterials, railroads,

airports, local industrial plants, and other ground stationary sources, and adopts goals, policies, and implementation programs to reduce the community's exposure to noise.

Non-attainment

The condition of not achieving a desired or required level of performance. Frequently used in reference to air quality.

Non-conforming Use

A use which was valid when brought into existence, but by subsequent regulation becomes no longer conforming. "Non-conforming use" is a generic term and includes (1) non-conforming structures (by virtue of size, type of construction, location on land, or proximity to other structures), (2) non-conforming use of a conforming building, (3) non-conforming use of a non-conforming building, and (4) non-conforming use of land. Thus, any use lawfully existing on any piece of property that is inconsistent with a new or amended General Plan, and that in turn is a violation of a zoning ordinance amendment subsequently adopted in conformance with the General Plan, will be a non-conforming use. Typically, non-conforming uses are permitted to continue for a designated period of time, subject to certain restrictions.

Non-native Species

A species that has been introduced to a particular area.

Nonpotable

Not suitable for drinking by humans.

Notice (of Hearing)

A legal document announcing the opportunity for the public to present their views to an official representative or board of a public agency concerning an official action pending before the agency.

Notice of Completion

A brief notice filed with OPR by a lead Agency as soon as it has completed a draft EIR and is prepared to send out copies for review (CEQA).

Notice of Determination

A brief notice to be filed by a public agency after it approves or determines to carry our a project which is subject to the requirements of CEQA.

Notice of Exemption

A brief notice which may be filed by a public agency after it has decided to carry out or approve a project and has determined that the project is exempt from CEQA as being ministerial, categorically exempt, an emergency, or subject to another exemption from CEQA. Such a notice may also be filed by an applicant where such a determination has been made by a public agency which must approve the project (CEQA).

Notice of Intent

A notice that an environmental impact statement will be prepared and considered (NEPA).

Notice of Preparation

A brief notice sent by a Lead Agency to notify the Responsible Agencies, Trustee Agencies, and involved federal agencies that the Lead Agency plans to prepare an EIR for the project. The purpose of the notice is to solicit guidance from these agencies as to the scope and content of the environmental information to be included in the EIR. Public agencies are free to develop their own formats for this notice.

NOx

Nitrogen oxide.

Null Zone

Area of greatest algal productivity.

Nutrients

Nitrogen and phosphorus in reclaimed water. These elements are required for plant/crop growth and are often applied in fertilizer form.

N

Objective

A specific statement of desired future condition toward which the City or County will expend effort in the context of striving to achieve a broader goal. An objective should be achievable and, where possible, should be measurable and time-specific. The State Government Code (§65302) requires that general plans spell out the "objectives," principles, standards, and proposals of the general plan. "The addition of 100 units of affordable housing by 1995" is an example of an objective.

Obsidian

A natural glass found in restricted volcanic areas. It is usually gray to black and semi-transparent. It was very popular for flaking into tools. Spectrographic analysis of trace elements now allows most of the sources to be distinguished, so that patterns of trade can be traced.

Office Use

The use of land by general business offices, medical and professional offices, administrative or headquarters offices for large wholesaling or manufacturing operations, and research and development.

Official County Scenic Highway

A segment of state highway identified in the Master Plan of State Highways Eligible for Official Scenic Highway Designation and designated by the Director of the Department of Transportation (Caltrans).

Offset

The horizontal component of displacement on a fault, measures perpendicular to the disrupted horizon.

Open Space Element

One of the seven State-mandated elements of a local general plan, it contains an inventory of privately and publicly owned open-space lands, and adopted goals, policies, and implementation programs for the preservation, protection, and management of open space lands.

Open Space Land

Any parcel or area of land or water which is essentially unimproved and devoted to an open space use for the purposes of (1) the preservation of natural resources, (2) the managed production of resources, (3) outdoor recreation, or (4) public health and safety.

Operation and Maintenance

Ongoing Project activities that follow the construction phase.

Orchard

A group of fruit or nut trees, either small and diverse and grown for home use, or large and uniform (*i.e.*, of one variety) and cultivated for revenue. Such a collection must be planted, managed and renewed by the householder or farmer and should not be confused with a naturally occurring grove. Citrus and nut plantations are customarily called groves.

Ordinance

A law or regulation set forth and adopted by a governmental authority, usually a city or county.

Organic Material

See Organic Waste.

Organic Waste

Waste material which comes mainly from animal or vegetable sources. Organic waste generally can be consumed by bacteria and other small organisms.

Outdoor Recreation Use

A privately or publicly owned or operated use providing facilities for outdoor recreation activities.

Outer Approach Zone

Airspace in which an air-traffic controller initiates radar monitoring for incoming flights approaching an airport.

Outfall Structure

A pipe which discharges treated wastewater into a water body, such as a river, lake, bay, or ocean.

Overlay

A land use designation on the Land Use Map, or a zoning designation on a zoning map, which modifies the basic underlying designation in some specific manner.

Overstory

The tall, woody trees which provide the upper canopy of foliage in a forest and generally shade lower levels.

Oxidized wastewater

Wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

Ozone

A tri-atomic form of oxygen (O3) created naturally in the upper atmosphere by a photochemical reaction with solar ultraviolet radiation. In the lower atmosphere, ozone is a recognized air pollutant that is not emitted directly into the environment, but is formed by complex chemical reactions between oxides of nitrogen and reactive organic compounds in the presence of sunlight, and becomes a major agent in the formation of smog.

Paleontology

The study of forms of life existing in other geologic periods, as represented by fossil animals and plants.

P

Parcel

A lot, or contiguous group of lots, in single ownership or under single control, usually considered a unit for purposes of development.

Parks

Open space lands whose primary purpose is recreation. (See "Open Space Land," "Community Park," and "Neighborhood Park.")

Particulate Matter

A particle of solid or liquid matter, soot, dust, aerosols, fumes and mists.

Passive Solar System

A system that distributes collected heat via direct transfer from a thermal mass rather than mechanical power. Passive systems rely on building design and materials to collect and store heat and to create natural ventilation for cooling. (See "Active Solar System.")

Pathogen

Disease-causing microorganism.

Pathogenic Organisms

Disease causing organisms.

Pathogenic Viruses

Disease causing viruses.

Peak Hour/Peak Period

For any given roadway, a daily period during which traffic volume is highest, usually occurring in the morning and evening commute periods. Where "F" Levels of Service are encountered, the "peak hour" may stretch into a "peak period" of several hours' duration.

Peak Wet Weather Flow

Peak Wet Weather Flow (PWWF), is the peak or maximum flowrate which occurs during the rainy season, as the result of infiltration of rainwater into leaky sewer joints or inflow of rainwater into the sewer from flooded manholes or illegal stormwater connections. It includes the Average Dry Weather Flow (ADWF) plus the effect of rainwater. PWWF, in relation to the ADWF, is roughly a function of the age and size of the sewer system; but there are no fixed peaking factors for a given size or age of system. Peaking factors are typically expressed as single digit multipliers of the ADWF; and the larger the system, the smaller the multiplier. The peaking factor multiplier must be determined by measurement of the particular system in question. For Santa Rosa, the peaking factor is believed to be in the lower single digit range; i.e., the PWWF is probably 3 or 4 times the ADWF. The PWWF is typically used to size sewage pipelines and pumping facilities and storage facilities.

Performance Standards

Zoning regulations that permit uses based on a particular set of standards of operation rather than on particular type of use. Performance standards provide specific criteria limiting noise, air pollution, emissions, odors, vibration, dust, dirt, glare, heat, fire hazards, wastes, traffic impacts, and visual impact of a use.

Personal Services

Services of a personal convenience nature, as opposed to products which are sold to individual consumers, as contrasted with companies. Personal services include barber and beauty shops, shoe and luggage repair, fortune tellers, photographers, laundry and cleaning services and pick-up stations, copying, repair and fitting of clothes, and similar services.

Pestle

An oblong implement used for pounding or grinding in a mortar.

pH

A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. [potential) (of) Hydrogen].

Photochemical

A chemical reaction occurring in the atmosphere caused by the interaction with sunlight.

Physical Diversity

A quality of a site, city, or region in which are found a variety of architectural styles, natural landscapes, and/or land uses.

Planktonic Algae

Small, floating plant life in aquatic ecosystems.

Plant Community

An assemblage of plants living together and interacting with each other in a common environment.

Plant Succession

The process of vegetational development whereby an area becomes successively occupied by different plant communities of higher ecological order.

PM_{10}

Particulate matter less than 10 microns in diameter which can be inhaled and are therefore considered hazardous to human health.

Point of Significance

Measurable point at which a potential environmental impact becomes significant.

Policy

A specific statement of principle or of guiding actions which implies clear commitment but is not mandatory. A general direction that a governmental agency sets to follow, in order to meet its goals and objectives before undertaking an action program. (See "Program.")

Polishing

Additional treatment of reclaimed water to improve its quality, which occurs after it leaves the treatment plant. Polishing may include natural processes such as wetlands.

Pollutant

Any introduced gas, liquid, or solid that makes a resource unfit for its normal or usual purpose.

Pollution

The presence of matter or energy whose nature, location, or quantity produces undesired environmental effects.

Pollution, Non-Point

Sources for pollution which are less definable and usually cover broad areas of land, such as agricultural land with fertilizers which are carried from the land by runoff, or automobiles.

Pollution, Point

In reference to water quality, a discrete source from which pollution is generated before it enters receiving waters, such as a sewer outfall, a smokestack, or an industrial waste pipe.

Potable

Suitable for consumption by humans.

Poverty Level

As used by the U.S. Census, families and unrelated individuals are classified as being above or below the poverty level based on a poverty index which provides a range of income cutoffs or "poverty thresholds" varying by size of family, number of children, and age of householder. The income cutoffs are updated each year to reflect the change in the Consumer Price Index.

Practicable

Capable of being put into practice, done, or accomplished.

Precipitation

The process by which atmospheric moisture is discharged (falls) onto a land or water surface. It includes snow, hail, and rain.

Precursor

A number of compounds that physically change in composition after being emitted into the air and eventually turn into air pollutants.

Preform

The preliminary form of a stone tool, from which the completed tool is shaped.

Prehistoric Archaeology

In North America, Prehistoric Archaeology is the study of archaeology in the time before Euroamerican contact.

Preserve, *n.*

An area in which beneficial uses in their present condition are protected; for example, a nature preserve or an agricultural preserve.

Preserve, *v.*

To keep safe from destruction or decay; to maintain or keep intact.

Presidio

A garrisoned place; a military post or fortified settlement in areas currently or originally under Spanish control.

Primary effluent

The effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter of settleable solids.

P

P

Primary Treatment

A wastewater treatment process that takes place in a rectangular or circular tank and allows those substances in wastewater that readily settle or float to be separated from the water being treated.

Prime Farmland

See Farmland.

Principle

An assumption, fundamental rule, or doctrine that will guide general plan policies, proposals, standards, and implementation measures. The State Government Code (§65302) requires that general plans spell out the objectives, "principles," standards, and proposals of the general plan. "Adjacent land uses should be compatible with one another" is an example of a principle.

Prior Converted Croplands

Croplands created on converted wetlands that were drained, dredged, filled, or otherwise manipulated, including the removal of woody vegetation, before December 23, 1985.

Professional Offices

A use providing professional or consulting services in the fields of law, medicine, architecture, design, engineering, accounting, and similar professions, but not including financial institutions or real estate or insurance offices.

Program

An action, activity, or strategy carried out in response to adopted policy to achieve a specific goal or objective. Policies and programs establish the "who," "how" and "when" for carrying out the "what" and "where" of goals and objectives.

Project

"Project" means the following:

a) Activities directly undertaken by any public agency.

b) Activities undertaken by a person which are supported in whole or in part through contracts, grants, subsidies, loans, or other forms of assistance from one or more public agencies.

c) Activities involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

Projectile Point

A chipped stone artifact used to tip an arrow, dart, lance, or spear.

Pro Rata

Refers to the proportionate distribution of something to some thing or some group, such as the cost of infrastructure improvements associated with new development apportioned to the users of the infrastructure on the basis of projected use.

Protect, *v.*

To maintain and preserve beneficial uses in their present condition as nearly as possible. (See "Enhance.")

Public agency

Any state agency, board, or commission, any county, city and county, city, regional agency, public district, redevelopment agency, or other political subdivision. (CEQA)

Public and Quasi-public Facilities

Institutional, academic, governmental and community service uses, either publicly owned or operated by non-profit organizations.

Public Rights-of-Way

Strip of land or corridor that is occupied or intended to be occupied by certain transportation and public use facilities, such as roadways, trails, railroads, and utility lines.

Public Use Area

In this study, downtown areas, cemeteries, community centers, etc. which attract the public on a daily or regular basis.

Public Water System

A water system that provides piped water to the public for human consumption, which serves at least 15 connections or 25 individuals daily at least 60 days per year.

Pumping capacity

The capability of a well to produce water.

Pump Station

Above ground centrifugal or vertical turbine pumps utilized to pump treated effluent to a project component such as urban irrigation or agricultural irrigation.

Pyroclastic

Clastic rock material formed by volcanic eruption or aerial expulsion from a volcanic vent.

Quarry

Excavation area or open pit where stone or other aggregates are obtained.

Quicksilver

Mercury.

Q

Radiocarbon

Carbon^{14} is a radioactive isotope of C^{12} produced from Nitrogen^{14} in the atmosphere by cosmic radiation. Thereafter, it acts exactly like C^{12}, being taken into the organic compounds of all living matter. Determination of the radioactivity of carbon from a sample will reveal the proportion of C^{14} to C^{12}, and this will in turn, through the known rate of decay of C^{14}, give the age of, or more accurately the time elapsed since the death of, the sample.

Radionuclide

An atom which emits radiation resulting from changes in the nuclei of atoms of the element. Alpha particle emissions consist of two protons and two neutrons. Beta particle emissions are the ejection of an electron from the nucleus when a neutron decays into a proton and an electron.

Rapid Infiltration Basins

Basins for disposal of water by percolation into the soils below the basin.

Raptor

Name usually applied to any of the carnivorous (meat-eating) birds, such as hawks, eagles, falcons, vultures, and owls.

Rare or Endangered Species

A species of animal or plant listed in: Sections 670.2 or 670.5, Title 14, California Administrative Code; or Title 50, Code of Federal Regulations, Section 17.11 or Section 17.2, pursuant to the Federal Endangered Species Act designating species as rare, threatened, or endangered.

Raw Sewage

Untreated water carrying wastes from homes, as well as industrial and commercial uses.

Rearing habitat

Portions of stream which is used by juvenile steelhead while they reside in freshwater. Good quality habitat is characterized as having highly oxygenated water, summer water temperatures in the range of 55 to 65 deg F, a streambed covered with cobbles and boulders, turbulent flow conditions, water velocities of at least 0.5 feet per second, water depths greater than 0.5 feet, and vegetation or woody debris which hangs over or enters the water.

Recharge

The process by which an aquifer receives additional water from outside sources.

Reclaimed Water

Water which, as a result of treatment of wastewater is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

Reclamation

The recovery of subpotable or wastewater sources so as to substitute this supply for irrigation applications currently using potable supply.

Recreation, Active

A type of recreation or activity which requires the use of organized play areas including, but not limited to, softball, baseball, football and soccer fields, tennis and basketball courts and various forms of children's play equipment.

Recreation, Passive

Type of recreation or activity which does not require the use of organized play areas.

Recreation Use Area

In this study, designated recreation sites including recreation sites, parks, trails, or other areas managed for public reasons.

Recycle, *v.*

The process of extraction and reuse of materials from waste products.

Redesignation

The changing of an area from nonattainment to attainment or attainment to nonattainment.

Redevelop, *v.*

To demolish existing buildings; or to increase the overall floor area existing on a property; or both; irrespective of whether a change occurs in land use.

Regional

Pertaining to activities or economies at a scale greater than that of a single jurisdiction, and affecting a broad geographic area.

Regional Housing Needs Plan

A quantification by a COG or by HCD of existing and projected housing need, by household income group, for all localities within a region.

Regional Park

A park typically 150-500 acres in size focusing on activities and natural features not included in most

other types of parks and often based on a specific scenic or recreational opportunity.

Regional Water Quality Control Board

Regional agency, empowered by the California State Water Resources Control Board to enforce federal stormwater regulations addressing storm water discharges from municipal storm sewer systems and industrial activities.

Regulation

A rule or order prescribed for managing government.

Reliability

For the Project, system reliability is defined as the production of reclaimed water exceeding normal system capacity only one month in twenty.

Reservoir Footprint

Total surface area required for the reservoir and its associated structures (i.e. spillway, diversion structure, etc.).

Residential, Multiple Family

Usually three or more dwelling units on a single site, which may be in the same or separate buildings.

Residential, Single-Family

A single dwelling unit on a building site.

Resources, Non-renewable

Refers to natural resources, such as fossil fuels and natural gas, which, once used, cannot be replaced and used again.

Resource Conservation and Recovery Act (RCRA)

The Federal law regulating the handling (generation, treatment, storage, transport, and disposal) of hazardous waste. This statute seeks to regulate hazardous waste from "cradle to grave." California's RCRA program is administered by the DTSC within the California EPA.

Responsible Agency

A public agency, other than the Lead Agency which has responsibility for carrying out or approving a project. (CEQA)

Restore, *v.*

To renew, rebuild, or reconstruct to a former state.

Restrict, *v.*

To check, bound, or decrease the range, scope, or incidence of a particular condition.

Retention Basin/Retention Pond

(See "Detention Basin/Detention Pond.")

Retrofit, *v.*

To add materials and/or devices to an existing building or system to improve its operation or efficiency. Buildings have been retrofitted to use solar energy and to strengthen their ability to withstand earthquakes, for example.

Reuse

Utilization of reclaimed water for beneficial purposes such as urban and/or agricultural irrigation.

Rezoning

An amendment to the map and/or text of a zoning ordinance to effect a change in the nature, density, or intensity of uses allowed in a zoning district and/or on a designated parcel or land area.

Rhyolite

A light-colored, fine-grained extrusive igneous rock (volcanic).

Richter Scale

A measure of the size or energy release of an earthquake at its source. The scale is logarithmic; the wave amplitude of each number on the scale is 10 times greater than that of the previous whole number.

Rideshare

A travel mode other than driving alone, such as buses, rail transit, carpools, and vanpools.

Ridgeline

A line connecting the highest points along a ridge and separating drainage basins or small-scale drainage systems from one another.

Right-of-way

A strip of land occupied or intended to be occupied by certain transportation and public use facilities, such as roadways, railroads, and utility lines.

Riparian Corridor

Linear stretch of riparian lands adjacent to perennial and intermittent streams.

Riparian Lands

Riparian lands are comprised of the vegetative and wildlife areas adjacent to perennial and intermittent streams. Riparian areas are delineated

R

by the existence of plant species normally found near freshwater.

Risk Assessment

R

The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health by the presence or potential presence and/or use of pollutants.

Risk

The danger or degree of hazard or potential loss.

Roughness Coefficient

A number representing the frictional resistance of a surface to the flow of water; used in hydraulic computations.

Roundhouse

A large structure in each village, used by the people in conducting ceremonies and other village social activities.

Runoff

That portion of rain or snow which does not percolate into the ground and is discharged into streams instead.

Safety Element

One of the seven State-mandated elements of a local general plan, it contains adopted goals, policies, and implementation programs for the protection of the community from any unreasonable risks associated with seismic and geologic hazards, flooding, and wildland and urban fires. Many safety elements also incorporate a review of police needs, objectives, facilities, and services.

Salinity Levels

The level of salts in a body of water.

Salmonid

Referring to members of the fish family Salmonidae which includes salmon and trout species.

Sanitary Landfill

The controlled placement of municipal solid waste within a limited engineered area designed to control environmental degradation, followed by compaction and covering with a suitable thickness of earth and other containment material.

Sanitary Sewer

A system of subterranean conduits which carries refuse liquids or waste matter to a plant where the sewage is treated, as contrasted with storm drainage systems (which carry surface water) and septic tanks or leech fields (which hold refuse liquids and waste matter on-site). (See "Combined Sewer" and "Septic System.")

Scatters

In archaeology, refers to discrete groupings of artifacts (lithic, faunal, etc.) scattered over the ground surface.

Scenic Corridors

A highway, road, drive, or street that, in addition to its transportation function, provides opportunities for the enjoyment of natural and man-made scenic resources, and access or direct views to areas or scenes of exceptional beauty, or historic or cultural interest.

Scenic Highway Corridor

The area outside a highway right-of-way that is generally visible to persons traveling on the highway.

Scenic Highway/Scenic Route

A highway, road, drive, or street which, in addition to its transportation function, provides opportunities for the enjoyment of natural and man-made scenic resources and access or direct views to areas or scenes of exceptional beauty or historic or cultural interest. The aesthetic values of scenic routes often are protected and enhanced by regulations governing the development of property or the placement of outdoor advertising. Until the mid-1980s, general plans in California were required to include a Scenic Highways element.

Scenic Landscape Unit

A classification of Open Space defined in the Sonoma County General Plan intended to preserve land considered as a scenic resource. The scenic quality of these lands influence the quality of life of residents, and are important to tourism and the agricultural economy.

Scenic Resource

A specific landscape feature that is particularly striking or memorable. Landscape feature of high scenic quality include: Landform - steep (>60%) undulating/dissected slopes, distinctive rock outcrops, or pronounced ridgelines; Water - major bodies of water that provide reflective qualities and irregular shorelines, or major/permanent streams/rivers with diversity of meanders, flows, rapids, rock outcrops, or river-banks; Vegetation - mature stands of native or cultural species (oaks and eucalyptus) in natural groves or distinct planted patterns; Man-made Development - Historic structures.

schist

A metamorphic crystalline rock.

Scope

The total depth and breadth of issues and potential solutions to be evaluated for the EIR/EIS.

Scoping Phase

This phase involves identifying all potential solutions and issues for the EIR/EIS to consider.

Seawater intrusion

The phenomenon occurring when sea water invades a body of fresh water.

S

S

Second Unit

A Self-contained living unit, either attached to or detached from, and in addition to, the primary residential unit on a single lot. Sometimes called "Granny Flat".

Secondary sedimentation

The removal by gravity of settleable solids remaining in wastewater after biological treatment process.

Secondary Treatment

A wastewater treatment process used to convert dissolved or suspended materials into a form more readily separated from the water being treated. Usually the process follows primary treatment. The process commonly is a type of biological treatment process followed by secondary clarifiers that allow the solids to settle out from the water being treated.

Sediment

Mineral or organic matter deposited by water, air, or ice.

Sedimentary Rocks

material that has been deposited by water, ice, wind, or chemically precipitated in water. Sedimentary rocks are usually stratified into layers or beds.

Seep

To leak or ooze from the ground.

Seepage

The act or process of water leaking (seeping) from the ground to form a pool.

Seiche

A local rise and fall in the water level of a lake or other confined body of water. May occur as a result of ground shaking associated with seismic activity (earthquakes).

Seismic

Caused by or subject to earthquakes or earth vibrations.

Semisedentary

Not fully sedentary; in anthropology, refers to human groups that have no permanent communities or camps.

Septic System

A sewage-treatment system that includes a settling tank through which liquid sewage flows and in which solid sewage settles and is decomposed by bacteria in the absence of oxygen. Septic systems are often used for individual-home waste disposal where an urban sewer system is not available. (See "Sanitary Sewer.")

Serpentinite

A rock consisting almost wholly of serpentine-group minerals.

Service Charge

The service charge is the monthly charge to the user for sewer system service. This is an ongoing charge paid by both residential and commercial users to cover the operation and maintenance costs of the sewer system.

Setback

The horizontal distance between the property line and any structure.

Settlement

1. The drop in elevation of a ground surface caused by settling or compacting. 2. The gradual downward movement of an engineered structure due to compaction. Differential settlement is uneven settlement, where one part of a structure settles more or at a different rate than another part.

Sewage

The used water and solids from homes that flow to a treatment plant. The sewage is also referred to as wastewater.

Shall

That which is obligatory or necessary.

Shopping Center

A group of commercial establishments, planned, developed, owned, or managed as a unit, with common off-street parking provided on the site.

Should

Signifies a directive to be honored if at all possible.

Shouldered

Refers to the projection on an arrowhead or spearpoint near the base of the point but above the part that is attached to the shaft of the arrow or spear.

Sign

Any representation (written or pictorial) used to convey information, or to identify, announce, or otherwise direct attention to a business,

profession, commodity, service, or entertainment, and placed on, suspended from, or in any way attached to, any structure, vehicle, or feature of the natural or manmade landscape.

Significant

An impact which exceeds the evaluation criteria.

Significant Effect

A beneficial or detrimental impact on the environment. May include, but is not limited to, significant changes in an area's air, water, and land resources.

Siltation

(1) The accumulating deposition of eroded material. (2) The gradual filling in of streams and other bodies of water with silt.

Single-family Dwelling, Attached

A dwelling unit occupied or intended for occupancy by only one household that is structurally connected with at least one other such dwelling unit. (See "Townhouse.")

Single-family Dwelling, Detached

A dwelling unit occupied or intended for occupancy by only one household that is structurally independent from any other such dwelling unit or structure intended for residential or other use. (See "Family.")

Sinuous

Having many curves, bends, or turns.

Site

A parcel of land used or intended for one use or a group of uses and having frontage on a public or an approved private street. A lot. (See "Lot.")

Site Reconnaissance

Preliminary site visit to determine the extent of future needed studies and surveys.

Slope

Land gradient described as the vertical rise divided by the horizontal run, and expressed in percent.

Sloughs

A slow-moving creek in a marshland or tidal flat or an inlet from a river.

Smolts

Juvenile steelhead which have physiologically adapted to live in seawater and are actively emigrating from freshwater to the ocean.

Sociocultural

Of or involving both social and cultural factors.

Socio-political

Of or involving both social and political factors.

S

Soil

The unconsolidated material on the immediate surface of the earth created by natural forces that serves as natural medium for growing land plants.

Solar Access

The provision of direct sunlight to an area specified for solar energy collection when the sun's azimuth is within 45 degrees of true south.

Solar System, Active

A system using a mechanical device, such as a pump or a fan, and energy in addition to solar energy to transport a conductive medium (air or water) between a solar collector and the interior of a building for the purpose of heating or cooling.

Solar System, Passive

A system that uses direct heat transfer from thermal mass instead of mechanical power to distribute collected heat. Passive systems rely on building design and materials to collect and store heat and to create natural ventilation for cooling.

Solid Waste

Any unwanted or discarded material that is not a liquid or gas. Includes organic wastes, paper products, metals, glass, plastics, cloth, brick, rock, soil, leather, rubber, yard wastes, and wood, but does not include sewage and hazardous materials. Organic wastes and paper products comprise about 75 percent of typical urban solid waste.

Sorption

The process of taking up and holding a substance by absorption or adsorption.

Spawning

The reproductive act of male and female fish depositing and fertilizing eggs in a gravely nest.

Spawning habitat

Portions of the stream used by female steelhead for constructing her nest. Typically, these areas are located at the downstream end of pools, just upstream of where turbulent water flows through riffles. Good quality spawning habitat is characterized by appropriate sized gravel, water

velocities of a least 2 feet per second, and water depths of at least 1 foot.

Special-status Species

Species listed as rare, threatened, or endangered, under CEQA. A detailed definition is provided in Measure 2.2.5.

Specific Plan

Under Article 8 of the Government Code (§65450 *et seq*), a legal tool for detailed design and implementation of a defined portion of the area covered by a General Plan. A specific plan may include all detailed regulations, conditions, programs, and/or proposed legislation which may be necessary or convenient for the systematic implementation of any General Plan element(s).

Speed, Average

The sum of the speeds of the cars observed divided by the number of cars observed.

Sphere of Influence

The probable ultimate physical boundaries and service area of a local agency (city or district) as determined by the Local Agency Formation Commission (LAFCo) of the County.

Spillway

Concrete-lined chute extending from the top of the embankment dam down slope into a channel below the dam. It is intended to provide for emergency release of water only in the event of upstream flow from a severe storm entering the reservoir when it is full.

Spring (water)

Natural flow of water from the ground.

Standards

(1) A rule or measure establishing a level of quality or quantity that must be complied with or satisfied. The State Government Code (§65302) requires that general plans spell out the objectives, principles, "standards," and proposals of the general plan. Examples of standards might include the number of acres of park land per 1,000 population that the community will attempt to acquire and improve, or the "traffic Level of Service" (LOS) that the plan hopes to attain. (2) Requirements in a zoning ordinance that govern building and development as distinguished from use restrictions—for example, site-design regulations such as lot area, height limit, frontage, landscaping, and floor area ratio.

State Implementation Plan

EPA approved state plan for the establishment, regulation, and enforcement of air pollution standards.

State Small Water System

A water system that provides piped water to the public for human consumption which serves at least 5, but not more than 14, service connections and does not regularly serve more than 25 individuals daily for more than 60 days per year.

Storage capacity

The total water-bearing capacity of an aquifer or surface reservoir.

Storm Runoff

Surplus surface water generated by rainfall that does not seep into the earth but flows overland to flowing or stagnant bodies of water.

Stratum

More or less homogeneous or gradational material, visually separable from other levels by a discrete change in the character of the material being deposited or a sharp break in deposition (or both).

Streets, Local

(See " Streets, Minor.")

Streets, Major

The transportation network which includes a hierarchy of freeways, arterials, and collectors to service through traffic.

Streets, Minor

Local streets not shown on the Circulation Plan, Map, or Diagram, whose primary intended purpose is to provide access to fronting properties.

Streets, Through

Streets which extend continuously between other major streets in the community.

Structure

Anything constructed or erected which requires location on the ground (excluding swimming pools, fences, and walls used as fences).

Subdivision

The division of a tract of land into defined lots, either improved or unimproved, which can be separately conveyed by sale or lease, and which

can be altered or developed. "Subdivision" includes a condominium project as defined in Section 1350 of the California Civil Code.

Subdivision Map Act

Division 2 (Sections 66410 *et seq*) of the California Government code, this act vests in local legislative bodies the regulation and control of the design and improvement of subdivisions, including the requirement for tentative and final maps. (See "Subdivision.")

Subhorizontal

Almost horizontal.

Subparallel

Almost parallel

Subregional

Pertaining to a portion of a region. In this instance the term refers to towns presently utilizing the Laguna Treatment Plant. The City of Santa Rosa, Sebastopol, Cotati, Rohnert Park, and the South Park Sanitation District are included.

Subsidence

The gradual settling or sinking of an area with little or no horizontal motion. (See "Settlement.")

Subsidize

To assist by payment of a sum of money or by the granting of terms or favors that reduce the need for monetary expenditures. Housing subsidies may take the forms of mortgage interest deductions or tax credits from federal and/or state income taxes, sale or lease at less than market value of land to be used for the construction of housing, payments to supplement a minimum affordable rent, and the like.

Substantial

Considerable in importance, value, degree, or amount.

Superfund Amendment and Reauthorization Act of 1986 (SARA)

This law amends and extends the authority of the Federal government to clean up abandoned hazardous waste sites under CERCLA.

Surface Water Treatment Rule (STWR)

An amendment to the national primary drinking water regulations that stipulates that all surface water must be disinfected and must be filtered unless certain stringent water quality source requirements, disinfection, and site-specific conditions are met. The primary goal of the STWR is to prevent microbiological contamination of the nation's drinking water supplies.

Suspended Solids

(1) Solids that either float on the surface or are suspended in water, wastewater, or other liquids, and which are largely removable by laboratory filtering. (2) The quantity of material removed from wastewater in a laboratory test, as prescribed in Standard Methods for the Examination of Water and Wastewater and referred to as nonfilterable residue.

Swale

A slight depression, sometimes swampy, in the midst of generally level land.

Sweathouse

Usually a semi-subterranean structure in which the males from the village, after the age of puberty, met and practiced male-oriented activities, only one of which was the sweatbath.

S

Tax Increment

Additional tax revenues that result from increases in property values within a redevelopment area. State law permits the tax increment to be earmarked for redevelopment purposes but requires at least 20 percent to be used to increase and improve the community's supply of very low- and low-income housing.

Tectonic

Pertaining to the forces involved in, or the resulting structures, of mountain building.

Tertiary (or advanced treatment) Treatment

Removes specific contaminants to meet California standard for unrestricted use of reclaimed water. For reclamation in California, tertiary treatment processes must meet Reclamation criteria specified in Title 22 of the California Code of Regulations. Usually the process follows secondary and primary treatments. Also referred to as "filtered wastewater".

Thermal Mass

Large quantities of heavy or dense material with a high heat capacity, used in solar buildings to absorb heat, which is then stored and re-radiated as needed for heating and cooling.

Tidal Wetlands

Wetland areas directly adjacent to bodies of water influenced by tidal action.

Tier (Tiering)

The coverage of general matters and environmental effects in an environmental impact report prepared for a policy, plan, program or ordinance followed by narrower or site-specific environmental impact reports which incorporate by reference the discussion in any prior environmental impact report and which concentrate on the environmental effects which are from prior environmental impact reports.

Topography

Configuration of a surface, including its relief and the position of natural and man-made features.

Top Soil

The surface or upper layer of soil which generally contains most of the organic matter in the soil.

Tourism

The business of providing services for persons traveling for pleasure, tourism contributes to the vitality of the community by providing revenue to local business. Tourism can be measured through changes in the transient occupancy tax, or restaurant sales.

Toxicity

Toxic or poisonous quality; amount or potency of a toxic substance.

Trace Element

Element such as a metal that is found in low concentration relative to other constituents.

Traffic Model

A mathematical representation of traffic movement within an area or region based on observed relationships between the kind and intensity of development in specific areas. Many traffic models operate on the theory that trips are produced by persons living in residential areas and are attracted by various non-residential land uses. (See "Trip.")

Transit

The conveyance of persons or goods from one place to another by means of a local, public transportation system.

Transit-dependent

Refers to persons unable to operate automobiles or other motorized vehicles, or those who do not own motorized vehicles. Transit-dependent citizens must rely on transit, para-transit, or owners of private vehicles for transportation. Transit-dependent citizens include the young, the handicapped, the elderly, the poor, and those with prior violations in motor vehicle laws.

Transit, Public

A system of regularly-scheduled buses and/or trains available to the public on a fee-per-ride basis. Also called "Mass Transit."

Transition Zone

Controlled airspace extending upward from 700 or more feet above the ground wherein procedures for aircraft approach have been designated. The transition zone lies closer to an airport than the outer approach zone and outside of the inner

approach zone. (See "Approach Zone" and "Outer Approach Zone.")

Transitional Housing

Shelter provided to the homeless for an extended period, often as long as 18 months, and generally integrated with other social services and counseling programs to assist in the transition to self-sufficiency through the acquisition of a stable income and permanent housing. (See "Homeless" and "Emergency Shelter.")

Transportation Demand Management (TDM)

A strategy for reducing demand on the road system by reducing the number of vehicles using the roadways and/or increasing the number of persons per vehicle. TDM attempts to reduce the number of persons who drive alone on the roadway during the commute period and to increase the number in carpools, vanpools, buses and trains, walking, and biking. TDM can be an element of TSM (see below).

Transportation Systems Management (TSM)

A comprehensive strategy developed to address the problems caused by additional development, increasing trips, and a shortfall in transportation capacity. Transportation Systems Management focuses on more efficiently utilizing existing highway and transit systems rather than expanding them. TSM measures are characterized by their low cost and quick implementation time frame, such as computerized traffic signals, metered freeway ramps, and one-way streets.

Trees, Heritage

Trees planted by a group of citizens or by the City or County in commemoration of an event or in memory of a person figuring significantly in history.

Trees, Landmark

Trees whose size, visual impact, or association with a historically significant structure or event have led the City or County to designate them as landmarks.

Trees, Street

Trees strategically planted--usually in parkway strips, medians, or along streets--to enhance the visual quality of a street.

Tribelet

The basic, autonomous, self-governing, and independent sociopolitical group in aboriginal California.

Tributary Streams

Streams that feed into larger stream systems.

Trihalomethanes (THMs)

A group of organic chemicals (e.g., chloroform, dichlorobromform) that contain one carbon atom and any combination of three halogen atoms, primarily bromine or chlorine.

Trip

A one-way journey that proceeds from an origin to a destination via a single mode of transportation; the smallest unit of movement considered in transportation studies. Each trip has one "production end," (or origin—often from home, but not always), and one "attraction end," (destination). (See "Traffic Model.")

Trip Generation

The dynamics that account for people making trips in automobiles or by means of public transportation. Trip generation is the basis for estimating the level of use for a transportation system and the impact of additional development or transportation facilities on an existing, local transportation system. Trip generations of households are correlated with destinations that attract household members for specific purposes.

Truck Route

A path of circulation required for all vehicles exceeding set weight or axle limits, a truck route follows major arterials through commercial or industrial areas and avoids sensitive areas.

Tuff

A general term for all consolidated pyroclastic rocks.

Tule

A species of large bulrush, having slender, round, or triangular solid stems, found in lakes and marshes.

Turbidity

Cloudy or hazy appearance in a clear liquid caused by suspension of colloidal liquid droplets or fine solids

T

Ultra-Low Flow Devices

Ultra-low flush toilets: use no more than 1.6 gallons per flush; low-volume showerheads: use no more than 2.2 gallons per minute.

U

Unconsolidated

Not consolidated.

Unifacial

Referring to a stone tool that has been flaked on one side.

Uniform Building Code (UBC)

A national, standard building code which sets forth minimum standards for construction.

Uniform Housing Code (UHC)

State housing regulations governing the condition of habitable structures with regard to health and safety standards, and which provide for the conservation and rehabilitation of housing in accordance with the Uniform Building Code (UBC).

Unrestricted Use/nonrestricted Use

Should be at all times disinfected, oxidized, coagulated, clarified, filtered wastewater safe for use in recreational water sports, i.e., water-skiing, swimming, fishing, boating, etc. Tertiary treated wastewater, when properly diluted, is allowed to be introduced directly in to drinking water sources. Also safe to use for growing fruits and vegetables for raw consumption, i.e., zucchini, carrots, tomatoes, apples, oranges, etc.

Urban Boundary

A boundary, sometimes parcel specific, located to mark the outer limit beyond which urban development will not be allowed.

Urban Design

The attempt to give form, in terms of both beauty and function, to selected urban areas or to whole cities. Urban design is concerned with the location, mass, and design of various urban components and combines elements of urban planning, architecture, and landscape architecture.

Urban Irrigation

Utilization of irrigation for non-agricultural uses, such as golf courses, city parks, and schools.

Urban Limit Line

An area identified through official public policy, within which urban development will be allowed during a specified time period. Beyond this line, using a variety of growth management tools such as acreage zoning and limits on capital improvements, development is prohibited or strongly discouraged.

Urban Open Space

The absence of buildings or development, usually in well-defined volumes, within an urban environment.

Urban Services

Utilities (such as water, gas, electricity, and sewer) and public services (such as police, fire, schools, parks, and recreation) provided to an urbanized or urbanizing area.

Urban Sprawl

Haphazard growth or outward extension of a city resulting from uncontrolled or poorly managed development.

Use

The purpose for which a lot or structure is or may be leased, occupied, maintained, arranged, designed, intended, constructed, erected, moved, altered, and/or enlarged in accordance with the City's or County's zoning ordinance and General Plan land use designations.

Use, Non-conforming

(See "Non-conforming Use.")

Use Permit, Conditional

The discretionary and conditional review of an activity or function or operation on a site or in a building or facility.

Utility Corridors

Rights-of-way or easements for utility lines on either publicly or privately owned property. (See "Right-of-way" or "Easement.")

Vacant

Lands or buildings which are not actively used for any purpose.

Vadose Zone

Zone between the ground surface and the water table in which the pore spaces are not filled with water.

Variance

A departure from any provision of the zoning requirements for a specific parcel, except use, without changing the zoning ordinance or the underlying zoning of the parcel. A variance usually is granted only upon demonstration of hardship based on the peculiarity of the property in relation to other properties in the same zone district.

Vehicle-Miles Traveled (VMT)

A key measure of overall street and highway use. Reducing VMT is often a major objective in efforts to reduce vehicular congestion and achieve regional air quality goals.

Vernacular

In architecture, refers to the common, or regional character of a structure or building.

Vernal Pool

An herbaceous plant community created by seasonal ponding. Vernal pools support a unique assemblage of plants and wildlife adapted to temporary inundation.

Vertebrate Species

Any organism that possesses a spinal column (backbone).

View Obstruction

The amount of a scene view area that is blocked by landscape features or alterations including earthform, vegetation, or structures. View area is defined as the area of landscape (except sky) as shown in a photograph from the closes sensitive viewpoint, taken with a normal (50mm) lens. View obstruction is a function of distance. For this study, view obstruction, is considered significant when 15% or more of the scene is blocked from view.

Viewpoint

The point from which an area may be viewed.

Viewshed

The area within view from a defined observation point.

Viewshed Mapping

A computerized analysis of mapping the extent of geographic areas which can be seen from a particular viewpoint on the basis of topography, excepting vegetation or site structures.

Visual Contrast

Noticeable visual changes in a scene resulting from alterations of form, line, color, texture, and/or the scale of scene elements. For this study, strong visual contrast is defined by one or more of the following visual changes: regraded land forms are flat with little to no contour, line of major ridgelines are altered and are not consistent with surrounding ridgelines or minor ridgelines are eliminated; inconsistent color with adjacent landscape character; elimination of landscape texture created by exposed soil or removal of vegetation; form of project grossly exceeds scale of natural land forms.

Volatilization

The act of evaporating quickly at ordinary temperatures.

Volatile Organic Compounds

An organic compound that evaporates readily at normal temperatures.

V

W

Warehousing Use

A use engaged in storage, wholesale, and distribution of manufactured products, supplies, and equipment, excluding bulk storage of materials that are inflammable or explosive or that present hazards or conditions commonly recognized as offensive.

Waste Reduction Strategy

A plan developed by the North Coast Regional Board in compliance with Section 303(d) of the federal Clean Water Act to reduce total and ammonia nitrogen loads to the Laguna de Santa Rosa. An annual load reduction has been established for the Subregional System, urban runoff, and agriculture.

Wastewater

The used water and solids from a community that flow to a treatment plant. Storm water, surface water and groundwater infiltration also may be included in the wastewater that enters a plant.

Water Conservation

Reduction in water use that also reduces wastewater flows. Sustainable reductionism wastewater flows are achieved by water conservation measures that permanently increase efficiency of water use fixtures and processes. Example: installation of ultra-low flow toilets.

Watercourse

Natural or once natural flowing (perennially or intermittently) water including rivers, streams, and creeks. Includes natural waterways that have been channelized, but does not include manmade channels, ditches, and underground drainage and sewage systems.

Waters of the U.S.

All deep water habitats including lakes, rivers, streams, bays, and gulfs.

Watershed

The total area above a given point on a watercourse that contributes water to its flow; the entire region drained by a waterway or watercourse which drains into a lake, or reservoir.

Water table

The upper surface of the free groundwater reservoir below which spaces between the soil grains are completely filled with water.

Waterway

(See "Watercourse.")

Weir

A structure set in a stream or waterway for catching fish.

Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetland Delineation

The process or procedure by which the extent of wetland areas are defined.

Wetland Determination

The process or procedure by which an area is judged a wetland or non-wetland.

Williamson Act Contract

Known formally as the *California Land Conservation Act of 1965*, it was designed as an incentive to retain prime agricultural land and open space in agricultural use, thereby slowing its conversion to urban and suburban development. The program entails a ten-year contract between the City or County and an owner of land whereby the land is taxed on the basis of its agricultural use rather than its market value. The land becomes subject to certain enforceable restrictions, and certain conditions need to be met prior to approval of an agreement.

Z

Zone, Combining

A special purpose zone which is superimposed over the regular zoning map. Combining zones are used for a variety of purposes, such as airport compatibility, flood plain or wetlands protection, historic designation, or special parking regulations. Also called "overlay zone."

Zone, Interim

A zoning designation that temporarily reduces or freezes allowable development in an area until a permanent classification can be fixed; generally assigned during General Plan preparation to provide a basis for permanent zoning.

Zone, Traffic

In a mathematical traffic model the area to be studied is divided into zones, with each zone treated as producing and attracting trips. The production of trips by a zone is based on the number of trips to or from work or shopping, or other trips produced per dwelling unit.

Zoning

The division of a city or county by legislative regulations into areas, or zones, that specify allowable uses for real property and size restrictions for buildings within these areas; a program that implements policies of the General Plan.

Zoning Bonus

(See "Zoning, Incentive.")

Zoning District

A designated section of the city or county for which prescribed land use requirements and building and development standards are uniform.

Zoning Map

Government Code §65851 permits a legislative body to divide a county, a city, or portions thereof, into zones of the number, shape, and area it deems best suited to carry out the purposes of the zoning ordinance. These zones are delineated on a map or maps, called the Zoning Map.

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APPENDIX A RANGE OF DISCHARGE EVALUATION

INTRODUCTION

On April 18, 1995, the Santa Rosa City Council confirmed that four primary alternatives along with the No Action (No Project) Alternative were to be evaluated equally as Project alternatives for the purposes of the Santa Rosa Subregional Long-Term Wastewater Project EIR/EIS.

- Alternative 2: South County Reclamation, focusing on expansion of agricultural irrigation and associated reclaimed water storage in areas south of Santa Rosa. Four subalternatives have been defined for Alternative 2, differing mainly in the location of reclaimed water storage.

- Alternative 3: West County Reclamation, focusing on expansion of agricultural irrigation and associated reclaimed water storage in areas west of Santa Rosa. Five subalternatives have been defined for Alternative 3, differing mainly in the location of reclaimed water storage.

- Alternative 4: Geysers Recharge, focusing on injection of reclaimed water for recharge of the geysers steamfield located in the Mayacmas Mountains.

- Alternative 5: Discharge, focusing on the discharge of reclaimed water to the Russian River at a design discharge rate of 20% of river flow. Two subalternatives have been defined for Alternative 5, differing mainly in the location of the discharge point.

For the purpose of analyzing alternatives 2 and 3 in the Project EIR/EIS (except for Alternative 5), the discharge of reclaimed water to the Russian River was maintained at a maximum design rate of 1% of average monthly river flow. Under Alternative 4, discharge would be limited to peak weather events only. Thus, alternatives 2, 3, and 4 represent a design discharge to the Russian River a maximum of 1% of river flow, while Alternative 5 represents a design discharge to the Russian River 20% of river flow. Therefore, Alternatives 2 through 5 allow the impacts associated with the range of potential design discharge rates between 1% and 20% to be evaluated in the EIR/EIS.

As an additional means of evaluating the potential impacts associated with design discharge rates between 1% and 20%, this Appendix has been prepared to identify the changes in the Project's impacts resulting from design discharge rates of 5%, 10%, and 15% in relation to the 1% design discharge rate which was the basis for analysis of project impacts from alternatives 2 and 3. These rates were selected as benchmarks

between 1 and 20% to allow evaluation of a range of options as part of environmental review and Project selection. Selection of a Project by the City may involve a design discharge rate between 1% and 20%, different from the benchmarks (for example a 6% or a 12.5% discharge rate). The benchmark options are intended to provide a frame of reference for determining which discharge rate should be incorporated in the selected Project.

Consideration of the effects of the 5%, 10%, and 15% discharge options in this Appendix is limited to alternatives 2 and 3. Alternative 1, No Action, and Alternative 4, Geysers Recharge, by definition do not have discharge options, while Alternative 5 by definition has a 20% design discharge rate.

This Appendix is divided into four sections. The first section Storage and Irrigation Requirements, identifies the requirements for reclaimed water storage and agricultural irrigation under the 5%, 10%, and 15% discharge rates. The second section, Components and Alternatives, discusses the effect of the 5%, 10%, and 15% options on the characteristics of the alternatives and project components. The third section, Environmental Impacts, addresses the changes in Project impacts resulting from implementation of these options. The fourth section presents a summary of significant impacts for the 5%, 10%, and 15% options in relation to the 1% design discharge rate.

STORAGE AND IRRIGATION REQUIREMENTS

With a 5%, 10%, or 15% design discharge rate, the reclaimed water storage and agricultural irrigation requirements for both Alternative 2 and Alternative 3 would be reduced as shown in Tables 1 and 2. The reclaimed water storage requirement would be reduced by approximately 30% with a 5% discharge rate, by just over 50% with a 10% discharge rate, and by 75% with a 15% discharge rate.

Table 1

Annual Reclamation System Requirements

System Requirements[2]	Design Discharge Rate[3] 1%	5%	10%	15%	20%
South County					
Existing Storage (MG)	1,200	1,200	1,200	1,200	1,200
New Storage (MG)	4,000	2,900	1,900	1,000	0
Total Storage (MG)	5,200	4,100	3,100	2,200	1,200
Existing Irrigation Area (acres)	5,500	5,500	5,500	5,500	5,500
Urban Irrigation Area (acres)	400	400	400	400	100
Agricultural Irrigation Area (acres)	3,800	2,600	1,600	1,400	0
South County Total Irrigation Area (acres)	9,700	8,500	7,500	7,300	5,600
South County with Sebastopol					
Existing Storage (MG)	1,200	1,200	1,200	1,200	1,200
New Storage (MG)	4,000	2,900	1,900	1,000	0
Total Storage (MG)	5,200	4,100	3,100	2,200	1,200
Existing Irrigation Area (acres)	5,500	5,500	5,500	5,500	5,500
Urban Irrigation Area (acres)	400	400	400	400	100
South County Agricultural Irrigation Area (acres)	2,600	1,300	300	<300	0
Sebastopol Agricultural Irrigation Area (acres)	2,200	2,200	2,200	2,200	0
Total Irrigation Area (acres)	10,700	9,400	8,400	<8,400	5,600

Source: Parsons Engineering Science, Inc. 1996

Notes:

1. Based on average dry weather flow of 21 mgd.
2. System requirements are defined as the storage volume and irrigation area necessary to meet the reliability requirement. The reliability requirement is that reclaimed water production exceed normal system capacity only one month in twenty.
3. Design discharge rate as a percentage of Russian River flow.

Table 2

Annual Reclamation System Requirements

System Requirements[2]	Design Discharge Rate[3] 1%	5%	10%	15%	20%
West County					
Existing Storage (MG)	1,200	1,200	1,200	1,200	1,200
New Storage (MG)	4,000	2,900	1,900	1,000	0
Total Storage (MG)	5,200	4,100	3,100	2,200	1,200
Existing Irrigation Area (acres)	5,500	5,500	5,500	5,500	5,500
Urban Irrigation Area (acres)	400	400	400	400	100
West County Agricultural Irrigation Area (acres)	6,200	4,400	2,900	1,900	0
Total Irrigation Area (acres)	12,100	10,300	8,800	7,800	5,600
West County with Sebastopol					
Existing Storage (MG)	1,200	1,200	1,200	1,200	1,200
New Storage (MG)	4,000	2,900	1,900	1,000	0
Total Storage (MG)	5,200	4,100	3,100	2,200	1,200
Existing Irrigation Area (acres)	5,500	5,500	5,500	5,500	5,500
Urban Irrigation Area (acres)	400	400	400	400	100
West County Agricultural Irrigation Area (acres)	4,300	2,600	1,000	<1,000	0
Sebastopol Agricultural Irrigation Area (acres)	2,200	2,200	2,200	2,200	0
Total Irrigation Area (acres)	12,400	10,700	9,100	<9,100	5,600

Source: Parsons Engineering Science, Inc. 1996

Notes:
1. Based on average dry weather flow of 21 mgd.
2. System requirements are defined as the storage volume and irrigation area necessary to meet the reliability requirement. The reliability requirement is that reclaimed water production exceed normal system capacity only one month in twenty.
3. Design discharge rate as a percentage of Russian River flow.

COMPONENTS AND ALTERNATIVES

Based upon the storage and irrigation requirements for the 5%, 10%, and 15% discharge rates, an engineering determination was made of the effect on each of the Project components and on the feasibility of implementing each of the alternatives under Alternative 2 and Alternative 3.

In the EIR/EIS, in Alternative 2, four alternatives have been defined, while within Alternative 3, five alternatives have been defined.

- Alternative 2A. Reservoir Site: Tolay Extended;
- Alternative 2B. Reservoir Sites: Adobe Road and Lakeville Hillside;
- Alternative 2C. Reservoir Site: Tolay Confined;
- Alternative 2D. Reservoir Sites: Sears Point and Lakeville Hillside;
- Alternative 3A. Reservoir Site: Two Rock;
- Alternative 3B. Reservoir Site: Bloomfield;
- Alternative 3C. Reservoir Site: Carroll Road;
- Alternative 3D. Reservoir Site: Valley Ford; and
- Alternative 3E. Reservoir Site: Huntley.

Principal Project components that are common to both Alternative 2 and Alternative 3 are:

- Expansion of the headworks at the Laguna Plant;
- Urban irrigation in the Fountaingrove and Bennett Valley areas;
- A transport system, consisting of transmission pipelines and pump stations, to carry the reclaimed water to storage and irrigation sites; and
- Agricultural irrigation.

Based upon the storage requirements for the 5%, 10%, and 15% discharge rates, one alternative would be eliminated from consideration and two alternatives would be modified under one or more of the options.

- Alternative 2A: Downsizing the Tolay Expanded reservoir to the 1,900 MG capacity under the 10% option or the 1,000 MG capacity under the 15% option would result in a relatively large and shallow impoundment that would have a large "dead zone" (shallow and turbid water) not available to the outlet works and irrigation pump station. The shallow water would also be warmer than deeper reservoirs, and would aggravate the growth of algae in the reservoir.
  For these reasons, Alternative 2A is infeasible for a 10% or 15% discharge rate, and therefore has been eliminated for any further consideration for the 10% and 15% discharge rate. However, the Tolay Expanded reservoir could be reduced to a 2,900 MG capacity without these effects and therefore Alternative 2A would be retained for consideration at a 5% discharge rate.

- Alternatives 2B and 2D: Under the 5%, 10%, and 15% options, the reservoir storage component for Alternatives 2B and 2D would be modified. For these alternatives, the Lakeville Hillside reservoir site with a capacity of 1,000 MG was paired with the Adobe Road site (3,400 MG capacity) and the Sears Point site (3,000 MG capacity) to reach the necessary 4,000 MG storage capacity required for storage at the 1% design discharge rate.

  Under the 5% or 10% option, the reduced storage requirement (2,900 MG for the 5% option and 1,900 MG for the 10% option) means that the Lakeville Hillside reservoir is not needed, and therefore storage for Alternative 2B would consist only of the Adobe Road site, and storage for Alternative 2D would consist only of the Sears Point site. Under the 15% option, the storage requirement of 1,000 MG would allow any of the three sites to be used individually, so for this option Alternatives 2B and 2D would consist of the Adobe Road, Lakeville Hillside, or Sears Point site.

In addition to elimination of these reservoir sites, components considered under the 5%, 10%, and 15% options would be affected below.

Headworks Expansion

The headworks expansion, which involves the replacement of the existing influent pumps with higher capacity pumps will not change under the 5%, 10%, or 15% options, as the projected amount of influent entering the plant will not change.

Urban Irrigation

The urban irrigation component, which consists of replacement of existing water sources with reclaimed water at currently irrigated sites in the City of Santa Rosa will not change under the 5%, 10%, or 15% options.

Pipelines

The location and size of the pipelines to serve the urban irrigation sites will not change under the 5%, 10%, and 15% options. The location of pipelines to carry reclaimed water from the treatment plant to the reservoirs and from the reservoirs to the agricultural irrigation areas will not change, except that pipeline segments serving reservoirs under Alternatives 2A and 2D could be eliminated depending upon which reservoir site was chosen. The short pipeline segment from Old Lakeville Highway No. 3 to the Lakeville Hillside reservoir could be eliminated under the 5% and 10% options, and two of the pipelines serving the Lakeville Hillside, Adobe Road or Sears Point sites could be eliminated under the 15% options.

Pipeline sizes to the reservoirs would be reduced to account for the reduced volume (and flow rate) to be delivered to the reservoirs and irrigation areas. This reduction will not

result in a decrease in the width of the construction zone necessary for pipeline construction.

There will not necessarily be a reduction in the number or length of pipelines serving the agricultural irrigation areas. As indicated in the discussion of the agricultural irrigation component below, irrigation areas will not necessarily be reduced in geographic distribution, although the acreage needed for irrigation will be less under any of the discharge options. The pipelines for urban irrigation will not change under any of the options.

Storage Reservoirs

Under the 5%, 10%, and 15% options, the reduced reclaimed water storage requirement will result in a reduced reservoir size, including a lower water elevation, reduced water surface area, and a reduction in height of the main dams, as well as the back dams and saddle dams. However, because these reservoirs are to be constructed in valleys, the reduction in volume does not result in a proportional reduction in the dam height, surface water elevation, or surface area of the reservoir. These will change by only a few feet, even under the 15% option. Therefore there will not be any appreciable change in the construction zone area for any of the reservoirs due to the reduced storage volume. The diversion channels and other facilities for storm water drainage will not be altered under the 5%, 10%, or 15% options because these facilities are sized to deal with the storm water flows within the watershed and will not change as a result of reduced storage requirements. Because the location of the main dam will not be changed, the location of the access road will not be changed. Under the 10% and 15% option, the saddle dam for the Adobe Road reservoir will be eliminated.

Pump Stations

The number and location of pump stations to be considered under the 5%, 10%, and 15% options would not change, except that the pump station at the Lakeville Hillside reservoir site could be eliminated under the 5% and 10% options, and the pump stations at the Lakeville Hillside, Adobe Road, or Sears Point sites (both the reservoir pump stations and the storm water pump stations) could be eliminated under the 15% option.

Because less volume of water must be delivered from the Laguna Plant to the reservoirs and from the reservoirs to the irrigation areas, the capacity of the pump stations at the Laguna Plant and at the reservoirs will be reduced to about 70% for the 5% option, to about 50% for the 10% option, and to about 25% for the 15% option.

However, the amount of water to a given irrigation area might not be reduced under any option, even though the total volume of reclaimed water delivered for irrigation will be less. The booster pump stations serving the individual irrigation areas will not necessarily be reduced in size.

There would not necessarily be a reduction in the number of pump stations serving the agricultural irrigation areas. As indicated in the discussion of the agricultural irrigation component below, irrigation areas would not necessarily be reduced in geographic distribution, although the acreage needed for irrigation would be less under any of the discharge options.

Agricultural Irrigation

Although under the 5%, 10%, and 15% options the total acreage required for agricultural irrigation would be reduced the areas evaluated for potential agricultural irrigation would not be reduced. This is because it is not predictable which property owners will be willing to use reclaimed water. Consequently, the irrigation acreage evaluated must be larger than theoretically required. For the 5%, 10%, and 15% options, agricultural irrigation may occur in any of the areas listed for alternatives 2 and 3 in Chapter 3 of the EIR/EIS, Description of Existing System and Alternatives.

ENVIRONMENTAL IMPACTS

For each component, the changes identified in the previous section were evaluated to determine whether the impacts for the component will change from those identified for the 1% project. Socio-economic impacts, which were analyzed by alternative rather than by component are addressed at the end of this section.

Headworks Expansion

Under the 5%, 10%, and 15% options, there will be no change in this component and therefore there would be no change in the impacts from those identified for the 1% project.

Urban Irrigation

Under the 5%, 10%, and 15% options, there will be no change in this component and therefore there will be no change in the impacts from those identified for the 1% project.

Pipelines

Under the 5%, 10%, and 15% options for Alternatives 2B and 2D, elimination of the following pipeline segments will occur due to the elimination of the Adobe Road, Lakeville Hillside or Sears Point reservoirs.

- Adobe Road Reservoir
  - From Adobe Road cross country to the Adobe Road reservoir.

- Lakeville Hillside Reservoir
  - From Lakeville Highway along Old Lakeville Highway No. 3 and cross country to the Lakeville Hillside reservoir.

- Sears Point Reservoir
  - From Lakeville Highway along Cannon Lane and cross country to the Sears Point reservoir inlet (including a pipeline tunnel on the cross country segment).
  - From the Sears Point reservoir outlet cross country and along Highway 37 to Lakeville Highway.

This will result in a reduction in some impacts, but will not reduce any of the impacts identified for the 1% project to less than significant. Three categories of impacts are discussed below: less than significant, less than significant after mitigation, and significant.

Less than Significant Impacts

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are less than significant with a 1% project, and will be reduced by the elimination of the pipeline segments leading to one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options.

- Geology Impact 3.4.1: Unstable Slope Conditions. Pipelines in the South County are in areas of low risk of landslide, and impact will be further reduced.

- Surface Water Hydrology Impact 4.4.7: Flooding Due to Rupture of Pipelines. The elimination of pipeline segments will reduce impacts from rupture.

- Groundwater Impacts 5.4.1, 5.4.2 and 5.4.3: Degradation of Groundwater Quality and Groundwater Mounding. The elimination of pipeline segments will reduce the localized temporary impacts on ground water quality and water mounding due to pipeline rupture.

- Surface Water Quality Impacts 6.4.1, 6.4.2 and 6.4.4: Exceedence of Numeric-Based, Narrative-Based, and Sediment Criteria. The elimination of pipeline segments will reduce the localized temporary water quality impacts related to pipeline construction or pipeline rupture.

- Public Health and Safety Impact 7.4.1: Exposure to Chemicals, Radionuclides or Pathogens. The elimination of pipeline segments will reduce the localized impacts of exposure from runoff due to pipeline rupture.

- Public Health and Safety Impact 7.4.2: Construction within a Known Hazardous Waste site. The elimination of pipeline segments will eliminate potential exposure to hazardous waste along these pipelines.

- Public Health and Safety Impact 7.4.5: Exposure to a Flooding Hazard. The elimination of pipeline segments will reduce the localized impacts of exposure to flooding due to pipeline rupture.

- Energy Impact 17.4.1: Energy Requirements Exceeding Ability of Providers to Deliver. The elimination of pipeline will reduce the demand for energy.

Impacts Less than Significant After Mitigation

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are significant, but would be reduced to less than significant with mitigation, for the 1% project. With the elimination of pipeline segments leading to one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options, impacts will be reduced.

- Geology Impact 3.4.3: Liquefaction During an Earthquake. The amount of pipeline subject to damage from liquefaction during an earthquake due to locations in alluvial soils with shallow groundwater will be reduced.

- Geology Impact 3.4.7: Exposure to Damage Due to Expansive Soils. The amount of pipeline subject to damage from expansive soils could be reduced.

- Geology Impact 3.4.8: Exposure to Damage Due to Corrosive Soils. The amount of pipeline subject to damage from corrosive soils could be reduced.

- Jurisdictional Wetlands Resources Impact 10.4.1: Destruction of Wetlands. The elimination of pipeline segments eliminate the potential for destruction of wetlands along this segment.

- Visual Resource Impacts 14.4.2 and 14.4.3: Impacts on Scenic Landscape Units and Scenic Corridors. The elimination of Adobe Road or Lakeville Hillside pipeline segments will eliminate some impacts for Scenic Landscape Units as designated by Sonoma County. Elimination of the pipeline from the Sears Point reservoir along Highways 121 and 37 will result in the elimination of visual impacts along these Scenic Corridors designated by Sonoma County.

- Visual Resources Impact 14.4.6: Foreground Views from Private Residences. The elimination of pipeline may reduce the localized impacts on foreground views from private residences near reservoirs.

- Cultural Resource Impacts 15.4.1 and 2: Disturbance of Cultural Resources. The elimination of pipeline segments will eliminate any potential for disturbance to cultural resources, including unknown archaeological sites along these routes.

- Paleontologic Resources Impact 16.4.1: Disturbance of Paleontologic Resources. The elimination of the pipeline segments will eliminate any potential disturbance to unknown paleontological resources in the Petaluma Formation along these routes.

Impacts Significant After Mitigation

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are significant for the 1% project. They will be reduced by elimination of pipeline segments leading to one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options, but would still be significant.

- Transportation Impact 11.4.1: Congestion along Access Roads. The elimination of the pipeline segments will reduce the extent of roadways impacted by pipeline construction.

- Transportation Impact 11.4.2: Lane Closures. The elimination of pipeline segments, including the pipeline along Highways 121 and 37 from the Sears Point reservoir site under the 15% options for Alternative 2D would result in the elimination of these routes from the roadways impacted by lane closure.

- Air Quality Impact 12.4.1: Emissions That Exceed Threshold Levels. The elimination of pipeline may reduce the localized level of emissions generated by construction of the Project.

- Noise Impacts 13.4.1, 2 and 3: Exposure to High Noise Levels. The elimination of pipeline segments may reduce the localized level of noise generated by construction of the Project.

Impact Summary

No other impacts identified for the 1% project will be affected by the elimination of the pipelines to the Adobe Road, Lakeville Hillside, or Sears Point Reservoirs.

The reduction in pipeline size for transmission pipelines to the reservoir sites under the 5%, 10%, and 15% options will not result in a reduction in the width of the pipeline construction zone and therefore there will be no effect on impacts identified for the 1% project.

No additional impacts have been identified resulting from the elimination of the pipelines to the Adobe Road, Lakeville Hillside, or Sears Point Reservoirs, or from the reduction in transmission pipeline size.

Storage Reservoirs

Under the 5%, 10%, and 15% options for Alternatives 2B and 2D, the elimination of one of the reservoir sites (Adobe Road, Lakeville Hillside or Sears Point) from either of these Alternatives would result in a reduction in some impacts. Decreases in reservoir size will reduce the reservoir footprint, but because of reservoir geometry the water surface elevation will change by only a few feet. These changes will not reduce any of the impacts identified for the 1% project to less than significant. Some significant impacts at specific reservoir sites will, however, be eliminated. Three categories of impacts are discussed below: less than significant, less than significant after mitigation, and significant.

Less than Significant Impacts

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are less than significant with a 1% project, but would be reduced by the elimination of one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options.

- Geology Impact 3.5.3: Liquefaction During an Earthquake: The elimination of any reservoir, all of which are located in an area of low to moderate risk, will reduce the impact due to susceptibility to liquefaction under the 5%, 10% and 15% options.

- Geology Impact 3.5.8: Exposure to Damage Due to Corrosive Soils: The elimination of any reservoir, all of which are located in an area of low to moderate risk, will reduce the impact due to damage from corrosive soils.

- Surface Water Hydrology Impact 4.5.6: Streambank Erosion. The elimination of any reservoir will reduce the downstream impacts of erosion due to discharge of water from dam spillways or diversion structures, or from increased stream flow due to reservoir seepage.

- Groundwater Impact 5.5.3: Groundwater Mounding. The elimination of any reservoir will eliminate the potential for groundwater mounding within the vicinity of the site.

- Surface Water Quality Impacts 6.5.2 and 6.5.4: Exceedence of Narrative-Based and Sediment Criteria. Elimination of any reservoir will eliminate any impacts related to these criteria for that site.

- Terrestrial Biological Resources Impacts 8.5.2: Loss of CNPS Listed Plant Species. This impact will not be reduced because there are no listed species on the Adobe Road, Lakeville Hillside or Sears Point reservoir sites.

- Terrestrial Biological Resources Impact 8.5.4 and 8.5.5: Permanent Loss of Sensitive Terrestrial Wildlife Habitat and Permanent Loss of Sensitive Native Plant Communities. The elimination of the Lakeville Hillside reservoir site will eliminate impacts on 168 acres of Annual Grassland, 0.6 acres of Native Grassland and 11 acres of Valley Foothill Riparian habitat. Elimination of Adobe Road reservoir will eliminate impacts on 265 acres of Annual Grassland, 15.2 acres of Oak Woodland, and 61 acres of Valley Foothill Riparian habitat. Elimination of Sears Point reservoir will eliminate impacts to 388 acres of Annual Grassland, 5 acres of Oak Woodland, and 59 acres of Valley Foothill Riparian habitat.

- Terrestrial Biological Resources Impact 8.5.7: Ecological Risk to Terrestrial Plant and Wildlife Populations. The elimination of any reservoir will reduce impacts resulting from ecological risk.

- Air Quality Impact 12.5.5: Odors. The elimination of any reservoir will reduce the localized effect of odors generated by periodic draining of the reservoir.

- Energy Impact 17.5.1: Energy Requirements Exceeding Ability of Providers to Deliver. The elimination of any reservoir will reduce the demand for energy.

Impacts Less than Significant After Mitigation

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are significant, but would be reduced to less than significant with mitigation, for the 1% project. With the elimination of one of the reservoir sites under Alternatives 2B or 2D in the 5%, 10%, and 15% options, these impacts would be further reduced.

- Geology Impact 3.5.7: Exposure to Damage Due to Expansive Soils. All of the reservoir sites considered under Alternatives 2B and 2D (Adobe Road, Lakeville Hillside, and Sears Point) are located in areas of highly expansive soils. The elimination of a reservoir will reduce the impact because only one reservoir will be affected instead of two.

- Groundwater Impacts 5.5.1 and 2: Degradation of Groundwater Quality. The elimination of any reservoir will eliminate the potential impact on existing and future wells from reservoir seepage within the vicinity of the site.

- Groundwater Impacts 5.5.4 and 5.5.5: Lowering of Groundwater Levels. The elimination of a reservoir will eliminate the potential impact from lowering of groundwater levels within the vicinity of the site.

- Public Health and Safety Impact 7.5.1: Exposure to Chemicals, Radionuclides or Pathogens. The elimination of a reservoir will eliminate the impact on existing and future wells from seepage within the vicinity of that site.

- Public Health and Safety Impact 7.5.5: Exposure to a Flooding Hazard. The elimination of a reservoir will eliminate the potential flooding impact in the area below the reservoir due to a dam failure for that site.

- Public Health and Safety Impact 7.5.6: Increased Exposure to Disease Vectors. The elimination of any of the reservoir sites will result in the elimination of potential exposure to disease vectors (i.e. mosquitoes) in the vicinity of that site.

- Terrestrial Biological Resources Impact 8.5.3: Loss of Active Raptor Nest Sites. All reservoir sites have potential habitat for raptor nests, so elimination a reservoir will reduce this potential impact.

- Aquatic Biological Resources Impacts 9.5.1, 9.5.3, 9.5.4, and 9.5.5: Loss of Endangered Threatened or Rare Aquatic Wildlife or Plants or Their Habitats. Elimination of the Lakeville Hillside and Sears Point reservoir sites will eliminate impacts to sites where California red-legged frogs occur. The Lakeville, Adobe Road and Sears Point reservoir sites do not have Northwestern pond turtle habitat. None of these sites contains a sensitive aquatic plant community. Elimination of the Adobe Road site will avoid impacts to 7,000 linear feet of Warmwater B stream habitat. Elimination of the Sears Point site will avoid impacts to 5,200 linear feet of Warmwater A habitat and 13,100 feet of Warmwater B habitat. Elimination of the Lakeville Hillside site will avoid impacts to 10,100 feet of Warmwater B habitat.

- Aquatic Biological Resources Impact 9.5.8: Decrease in Streamflows Downstream of Dam Structures. All effects at the Adobe Road, Lakeville

Hillside and Sears Point reservoirs will be avoided if these sites were eliminated.

- Jurisdictional Wetlands Resource Impact 10.5.1: Destruction of Wetlands. The elimination of the Lakeville Hillside reservoir avoid impacts of 22 acres of wetlands; the elimination of the Adobe Road or Sears Point sites will result avoid impacts to 30 acres or 53 acres of wetlands respectively.

- Cultural Resources Impacts 15.5.1,2 and 3: Disturbance of Cultural and Paleontological Resources. The elimination a reservoir will result in avoiding any potential disturbance to known or unknown cultural resources on that site. The Adobe Road, Lakeville Hillside and Sears Point sites have 23, 10, and 18 known cultural sites respectively, and each has an unknown number of additional archaeological and paleontological sites.

Impacts Significant After Mitigation

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are significant for at least one of the reservoir sites for the 1% project. They will be reduced by elimination of reservoir sites under Alternatives 2B or 2D in the 5%, 10%, and 15% options, but would still be significant.

- Agriculture Impact 2.5.1: Loss of Farmland. Elimination of a reservoir would decrease the amount of agricultural land lost under these alternatives. The Lakeville Hillside reservoir site has 152 acres of grazing land. The Sears Point site includes 274 acres of grazing land, and the Adobe Road site contains 147 acres of grazing land and 38 acres of Farmland of Local Importance.

- Agriculture Impact 2.5.2: Cancellation of Williamson Act Contracts. The Lakeville Hillside reservoir site has 155 acres of land under Williamson Act. The Adobe Road reservoir site has 9 acres under Williamson Act Contract. The Sears Point site has no land in Williamson Act contracts.

- Geology Impact 3.5.1: Unstable Slope Conditions: All of the reservoir sites considered under Alternatives 2B and 2D (Adobe Road, Lakeville Hillside and Sears Point) are located in an area of high risk for potential landslide. With elimination of one reservoir, unstable slope conditions would need to be mitigated at one remaining reservoir instead of two.

- Surface Water Quality Impact 6.5.1: Exceedence of Numeric-Based Criteria for Ammonia, Dissolved Oxygen and Hydrogen Sulfide. The elimination of a reservoir would avoid the localized water quality impacts related to these criteria for the watershed in which that reservoir is located.

- Transportation Impact 11.5.1: Congestion along Access Roads. The elimination of any reservoir site will eliminate a roadway impacted by reservoir construction.

- Air Quality Impact 12.5.1: Emissions that Exceed Threshold Levels. The elimination of the need for two reservoirs under Alternative 2B and Alternative 2D will reduce the total level of sulfur dioxide and carbon monoxide impacts for these alternatives to less than significant. However, this will not the reduce the overall level of construction impact on air quality for these alternatives to less than significant because the construction of any reservoir will still result in significant impacts due to dust generation and nitrogen oxide emissions from construction equipment and vehicle trips.

- Noise Impacts 13.5.1 and 3: Exposure to High Noise Levels. The elimination of the Lakeville Hillside, Adobe Road or Sears Point reservoir will eliminate the localized effect of noise generated by construction of this reservoir.

- Visual Resources Impact 14.5.2: Impacts on Scenic Landscape Units. The elimination of the Adobe Road reservoir will result in avoiding an of adverse effects on a designated Scenic Landscape Unit for this alternative. This was considered to be a significant and unmitigable permanent impact for the 1% project due to loss of mature trees on the site.

- Visual Resources Impact 14.5.3: Impacts on Scenic Corridors. The elimination of the Adobe Road or Sears Point reservoir will avoid adverse effects on designated Scenic Corridors for these alternatives. This was considered to be a significant and unmitigable permanent impact for the 1% project due to view obstruction and loss of mature trees on the site.

- Visual Resources Impact 14.5.5: Impacts on High Volume Travelway or Public Use Area. The elimination of the Adobe Road or Sears Point reservoir will avoid adverse effects on a high volume travelway (views of the Adobe Road site from Washington Street in Petaluma) and a public use area (views of the Sears Point site from the Roche Winery) for these alternatives. This was considered to be a significant and unmitigable permanent impact for the Sears Point site under the 1% project due to view obstruction.

- Visual Resources Impact 14.5.6: Foreground Views from Private Residences. The elimination of the Adobe Road or Sears Point reservoir would avoid adverse effects on private residences. This was considered to be a significant and unmitigable permanent impact for both sites under the 1% project due to view obstruction. The elimination of the Lakeville

Hillside reservoir will avoid adverse effects on foreground views of this site from private residences due to visual contrast.

Impact Summary

No other impacts identified for the 1% project would be affected by the elimination of any of the reservoir sites.

The reduction in storage volume for other reservoir sites under both the 5%, 10%, and 15% options will not result in a reduction in the construction zone, and therefore there will have no effect on impacts identified for the 1% project for these sites. The resulting reduction in the dam heights, water surface areas, and water elevation will not be sufficient to affect the impacts identified for the 1% project.

No additional impacts have been identified resulting from either the elimination of the Lakeville Hillside, Adobe Road or Sears Point Reservoirs or the reduction in storage volume for the other reservoir sites.

Pump Stations

Under the 5%, 10%, and 15% options, the elimination of the pump station at any of the reservoir sites under Alternative 2B or 2D, and the reduction in the capacity of pump stations at the Laguna Plant and the reservoir sites will result in a reduction in some impacts, but will not reduce any of the impacts identified for the 1% project to less than significant. Three categories of impacts are discussed below: less than significant, less than significant after mitigation, and significant.

Less than Significant Impacts

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are less than significant with a 1% project, but will be reduced by the elimination of the pump stations at one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options.

- Geology Impact 3.6.1: Unstable Slope Conditions: The elimination of the pump station at a reservoir will reduce the low risk of damage from landslide.

- Geology Impact 3.6.3: Liquefaction During An Earthquake: The elimination of the pump station at a reservoir, which are located in areas of low to moderate risk, will reduce the impact due to susceptibility to liquefaction.

- Geology Impact 3.6.8: Exposure to Damage Due to Corrosive Soils: The elimination of the pump station at a reservoir, which are located in an area

of low to moderate risk, will reduce the impact due to damage from corrosive soils.

- Transportation Impact 11.6.1: Congestion along Access Roads. The elimination of the pump station at a reservoir will avoid construction traffic for that particular site.

- Air Quality Impact 12.6.1: Emissions That Exceed Threshold Levels. The elimination of any pump stations will eliminate construction emissions associated with the pump station.

- Visual Resource Impact 14.6.2: Impacts on High Volume Travelways. The elimination of the pump station at the Lakeville Hillside reservoir sites will avoid impacts for this pump station due to visual contrast. The following impact reduction applies to all reclamation alternatives.

- Energy Impact 18.6.1: Energy Requirements Exceeding Ability of Providers to Deliver. Reduction in pumping for the 5%, 10%, and 15% projects will also reduce the energy demand.

Impacts Less than Significant After Mitigation

Only impacts associated with alternatives 2B or 2D would be reduced. The following impacts are significant, but would be reduced to less than significant with mitigation, for the 1% project. With the elimination of pump stations at one of the reservoir sites under alternatives 2B or 2D in the 5%, 10%, and 15% options, these impacts would be reduced.

- Geology Impact 3.6.7: Exposure to Damage Due to Expansive Soils. Highly expansive soils are particularly common in the South County. The Lakeville Hillside reservoir, has one pump station, the Adobe Road site has two; and Sears Point has one pump station. Elimination of a reservoir will reduce the hazards at that site.

- Public Health and Safety Impact 7.6.2: Construction within a Known Hazardous Waste site. The elimination of pump stations at a reservoir will avoid potential exposure to hazardous waste for pump stations at that site.

- Visual Resource Impact 14.6.2: Impacts on Scenic Landscape Units. The elimination of pump stations at the Adobe Road and Lakeville Hillside reservoir sites will avoid impacts on Scenic Landscape Units as designated by Sonoma County.

- Cultural Resources Impacts 15.6.1 and 2: Disturbance of Cultural Resources. The elimination of the pump station at any of the reservoir sites

will avoid disturbance to known or unknown cultural resources on this site.

Impacts Significant After Mitigation

Only impacts associated with alternatives 2B or 2D will be reduced. The following impacts are significant for the 1% project. They will be reduced by elimination of pump stations at one of the reservoir sites under Alternatives 2B or 2D in the 5%, 10%, and 15% options, but would still be significant.

- Agriculture Impact 2.6.1: Loss of Farmland. Elimination of the pump station at any of the reservoir sites will reduce the amount of grazing land and other status farmland, but impacts will remain significant.

- Noise Impacts 13.6.1 and 13.6.3: Exposure to High Noise Levels. The elimination of pump stations at any of the reservoir sites will avoid the localized effect of noise generated by construction of those pump stations.

- Visual Resource Impact 14.6.3: Impacts on Scenic Corridors. The elimination of pump stations at the Adobe Road and Sears Point reservoir sites under Alternatives 2B or 2D would avoid impacts on Scenic Corridors designated by Sonoma County. Impacts for the Adobe Road pump station were considered to be less than significant impacts for the 1% project after mitigation. Impacts from the Sears Point pump station were considered to be significant and unmitigable due to the new electrical lines required for that pump station. Elimination of the Sears Point pump station will not affect the overall level of significance for alternatives 2B and 2D, because the Pump Station SBPS-10 sites will have significant unavoidable impacts on visual resources under these alternatives.

- Visual Resources Impact 14.6.6: Foreground Views from Private Residences. Impacts on Scenic Corridors. The elimination of pump stations at the Adobe Road Lakeville Hillside and Sears Point reservoir sites will avoid impacts on foreground views from private residences. Impacts for the Adobe Road and Lakeville Hillside pump station were considered to be less than significant impacts for the 1% project after mitigation. Impacts from the Sears Point pump station were considered to be significant and unmitigable due to the new electrical lines required for that pump station. Elimination of the Sears Point pump station will not affect the overall level of significance for alternatives 2B and 2D, because Pump Station SBPS-10 sites will have significant unavoidable impacts on visual resources under these alternatives.

The following impact reduction applies to all reclamation alternatives.

Noise Impacts 13.6.2. The reduction in the capacity of the pump stations at all reservoir sites and at the Laguna Plant will reduce the noise impacts within the vicinity of these pump stations. However, overall level of noise impact for all of the alternatives under Alternatives 2 and 3 will not be reduced to less than significant because the construction of the pump stations at the other reservoirs and Laguna Plant would still result in significant noise impacts, as will the construction and operation of the booster pump stations for all alternatives.

Impact Summary

No other impacts identified for the 1% project will be affected by the elimination of the pump station at any of the reservoir sites or by the reduction in capacity at other pump stations.

No additional impacts have been identified resulting from either the elimination of the pump stations or the reduction in pump station capacity.

Agricultural Irrigation

Under the 5%, 10%, and 15% options, there will be no change in the size or location of areas being considered for agricultural irrigation, and therefore there will be no change in impacts from those identified for the 1% project.

Since the amount of acreage to be irrigated under the 5%, 10% and 15% options is reduced from the 1% project, it is likely that the environmental impacts resulting from irrigation will also be reduced. However, because the actual properties to be irrigated are not known at this time for the 1% project or for the 5%, 10% and 15% options, it is not possible to determine the location or degree of reduced impacts. The reduction in irrigated acreage for Alternative 2, South County, will be approximately 30% under a 5% option, nearly 60% under a 10% option, and a bit over 60% with a 15% option. Acreage for Alternative 3, West County, will be reduced almost 30% for a 5% option, over 50% for the 10% option, and almost 70% for the 15% option. However, the reductions in impacts will not necessarily be reduced proportionately, and depending on the actual location and characteristics of the properties to be irrigated could be substantially more or less than the reduction in the total irrigation acreage.

The effect of agricultural irrigation associated with the 5 and 10% options on surface hydrology, surface water quality, and aquatic biological resources was evaluated based on how much land was irrigated and independent of what particular acreage was irrigated, as described in the *Water Quality and Flow Model for Irrigation/Storage Area Streams* technical report (RMA 1996), *Water Quality Impacts Analysis* technical report (Merritt Smith Consulting 1996), and the *Aquatic Biological Resources Impacts Analysis* technical report (Merritt Smith Consulting 1996). The following impacts will apply to all reclamation alternatives.

- Surface Hydrology Impact 4.7.5 and 6. Flooding and Stream Bank Erosion. Irrigation associated with the 1% project was found to have a less than significant impact. Reduced irrigation acreage will reduce any impact of irrigation on flooding and streambank erosion. Therefore, the impact of irrigation associated with the 5%, 10%, and 15% rates will also be less than significant.

- Surface Water Quality Impact 6.7.1. Exceedence of Numeric Criterion for Dissolved Copper. This impact was significant for irrigation acreage associated with the 1% project, but less than significant with mitigation. Mitigation included reducing irrigation acreage. Irrigation acreage associated with the 5%, 10%, and 15% discharge rates will have a less than significant impact on dissolved copper (Merritt Smith Consulting 1996b).

Discharge

Under the 5%, 10%, and 15% options, there would be no change from the 1% project in the size or location of the outfall structures on the Laguna. However, all of the options will substantially increase the amount of reclaimed water discharged to the Laguna. The average annual amount of reclaimed water discharged to the Laguna under the 5%, 10% and 15% options is shown in Table 3.

Table 3

Volume of Reclaimed Water Discharge

Design Discharge Rate (as a Proportion of Russian River Flow)	Average Volume of Reclaimed Water Discharged to Laguna (October - May 14)
1%	685 million gallons
5%	1,825 million gallons
10%	2,740 million gallons
15%	3,490 million gallons
No Project	3,245 million gallons
Existing Conditions	3,735 million gallons
20%	4,640 million gallons
The average volume of the Russian River from October 1 to May 14	341,000 million gallons

Source: Parsons Engineering Science, Inc. 1996

Specific impacts which will be affected by the increase in discharge of reclaimed water, as compared to the 1% design discharge are listed below. Reduction of impacts applies to all reclamation alternatives.

- Surface Water Hydrology Impacts 4.9.1 and 4.9.2: Streambank Erosion in the Laguna and the Russian River. While the stream power will increase under both the 5%, 10%, and 15% discharge options, the increase will be less than for the 20% design discharge rate under Alternative 5, which was considered to have a less than significant impact.

- Surface Water Quality Impacts 6.9.1 and 6.9.2: Exceedence of Numeric and Narrative Criteria. The discharge of additional quantities of reclaimed water to the Laguna under the 5%, 10%, and 15% options will result in the following changes in impacts as compared to those under the 1% project.

  - Dissolved Oxygen: The 5%, 10%, and 15% options will result in reductions in dissolved oxygen in the Laguna, compared to the 1% project. However, the analysis in the Water Quality Impacts Analysis technical report (Merritt Smith Consulting 1996) did not specifically evaluate the 15% option. This analysis showed that the impact of the 10% option will be less than significant, but the impact of the 20% option will be significant. Therefore, the reduction of dissolved oxygen caused by the

15% option is assumed to exceed the numeric-based criteria and therefore the impact will be considered significant.

- Cyanide: The 5%, 10%, and 15% options will result in increases in cyanide in the Laguna compared to the 1% project. For both the 10% and 15% options (but not the 5% option), the amount of total cyanide will exceed the numeric-based criteria and therefore the impact will be significant. However, with proposed mitigation (Implementing a Cyanide Source Control Program), the impact for both the 10% and 15% options will be reduced to less than significant.

- Biostimulatory Substances (Benthic and Planktonic Algae): The 5%, 10% and 15% options will result in increases over the 1% project in adverse impacts for one or more months of the years in both the Laguna and/or Santa Rosa Creek. These impacts are considered significant for all discharge options, and no mitigation has been identified that will reduce the impact to less than significant. The 5%, 10%, and 15% options will also result in decreases compared to the 1% project in the beneficial impacts during one or more months of the year for the Russian River as well as for the Laguna and Santa Rosa Creek. However, the beneficial impacts under the 5%, 10%, and 15% options will still be considered significant.

- Turbidity: The 5% and 10% options were determined to have a less than significant impact on turbidity, and the 20% Laguna discharge alternative (Alternative 5B) was found to have a significant impact on turbidity (Merritt Smith Consultants 1996b). The impact of the 15% option was not specifically evaluated, therefore the impact is assumed to be significant.

- Waste Reduction Strategy: The 5%, 10%, and 15% options would result in decreased ability (compared to the 1% project) to meet the Regional Board goal for reduction in total nitrogen and nitrogen-ammonia in both the Laguna and Santa Rosa Creek. These impacts are considered less than significant for the 5% option and significant for the 10% and 15% option. However, the proposed mitigation (Implementing a Total and Ammonia Nitrogen Source Control Program) will reduce the impact for the 10% and 15% option to less than significant.

- Toxicity: The 5% and 10% options were determined to have a less than significant impact on toxicity, and the 20% Laguna discharge alternative (Alternative 5B) was found to have a significant impact on toxicity (Merritt Smith Consultant 1996b). The impact of the 15% option was not specifically evaluated, interpolation suggests that the impact will be significant. Therefore, the impact of the 15% option is considered to be significant.

- Surface Water Quality Impact 6.9.4: Exceedence of Sediment Quality Criteria. The discharge of additional quantities of reclaimed water to the Laguna under the 5%, 10%, and 15% options will result in increases in the amount of acenaphthene, dieldrin, endrin, flouranthene, and phenathrene constituents in the sediment of receiving waters compared to the 1% project. However, the point of significance will not be exceeded for any of the discharge scenarios, and therefore the impact will be less than significant for the 5%, 10% and 15% options.

Additional information about the impacts of the 5%, 10% and 15% options on surface water quality can be found in the Water Quality Impacts Technical Report.

Socio-economics Impacts

Significant impacts were identified for Alternatives 2 and 3 related to increases in the service charge for wastewater and to loss of homes or agricultural buildings displaced by construction of the storage reservoirs.

Socio-economic Impact 18.1: Though reduced somewhat, service charge increases will probably remain significant for all reclamation alternatives.

Socio-Economic Impact 18.2: Loss of Homes. The elimination of the Adobe Road reservoir will avoid the loss of one house. This will reduce the impact for this alternative to less than significant. Neither of the other reservoirs which could be eliminated under the 5%, 10%, or 15% discharge options (Lakeville Hillside and Sears Point) involve the loss of houses. None of the other reservoir sites will be changed under the discharge options.

SUMMARY OF SIGNIFICANT IMPACTS

Table 4

Changes in Significant and Unavoidable Impacts
Under the 5%, 10%, and 15% Options

	2A	2B	2C	2D	3A	3B	3C	3D	3E
GEOLOGY, SOILS, AND SEISMICITY									
Storage Reservoirs									
3.5.1. Storage reservoirs may be located within an area of unstable slope conditions. South County reservoirs.		~	~						
SURFACE WATER QUALITY									
Discharge									
6.9.2. Biostimulatory Substances - Adverse. Design discharge component may cause narrative-based criteria to be exceeded.	#	#	#	#	#	#	#	#	#
6.9.2. Waste Reduction Strategy - Total Nitrogen - Adverse. Discharge scenarios may cause narrative-based criteria to be exceeded.	#[1]	#[1]	#[1]	#[1]	#[1]	#[1]	#[1]	#[1]	#[1]
TERRESTRIAL BIOLOGICAL RESOURCES									
8.4C. The Project plus cumulative projects may cause permanent loss of sensitive terrestrial wildlife habitat.	~	~	~	~	~	~	~	~	~
TRANSPORTATION									
Pipelines									
11.4.1. Project construction traffic may cause congestion on access roads.		~		~					
Storage Reservoirs									
11.5.1. Storage reservoir construction traffic may cause congestion in access roads.		~		~					
AIR QUALITY									
12.4.1. Emissions generated during pipeline construction may exceed threshold levels.	~	~	~	~					
NOISE									
Pipelines									
13.4.1. Construction of pipelines may expose the public to high noise levels.		~		~					

Table 4

Changes in Significant and Unavoidable Impacts Under the 5%, 10%, and 15% Options

	2A	2B	2C	2D	3A	3B	3C	3D	3E
13.4.3. Construction of the project may cause high noise levels from the construction traffic.		~		~					
Storage Reservoirs									
13.5.1. Construction of storage reservoirs may expose the public to high noise levels.		~		~					
13.5.3. Construction of the project may cause high noise levels from the construction traffic.		~		~					
Pump Stations									
13.6.1. Construction of pump stations may expose the public to high noise levels.		~		~					
13.6.2. Operation of pump stations may expose the public to high noise levels.		~		~					
VISUAL RESOURCES									
Storage Reservoirs									
14.5.6. Reservoir sites may cause an adverse effect on foreground or middleground views from one or more private residence.		~		~					
14.6.3. The pump station component may be inconsistent with the County Open Space Element regarding Scenic Corridors.				~					
14.6.3. The pump station component may cause an adverse effect in foreground views from one or more private residences.				~					
SOCIO-ECONOMICS									
18.1. The Project may increase the service charge for wastewater.		~		~					
18.2. The Project may result in loss of homes due to construction of facilities.		@							

Source: Harland Bartholomew & Associates, Inc. 1996

Notes:
1. 10% option only.
@ Reduction in impact changing the level of significance from significant unavoidable to less than significant.
~ Reduction in impact, but does not change the level of significance.
# Increase in impact for one or more components, but does not change level of significance for alternative.

REFERENCES

PREPARERS

Robert Duchek, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Parsons Engineering Science, Inc.
Rich Maurer, Parsons Engineering Science, Inc.

REVIEWERS

Anders J. Hauge, Harland Bartholomew & Associates, Inc.
Patricia I. Collins, Harland Bartholomew & Associates, Inc.

TEAM DOCUMENTS

Merritt Smith Consulting. 1996a. *Aquatic Biological Resources Impacts Analysis.*

Merritt Smith Consulting. 1996b. *Water Quality Impacts Analysis.*

OTHER REFERENCES

RMA. 1996. *Water Quality and Flow Model for Irrigation/Storage Area Streams.*

SUPPLEMENT NO. 1 - ALTERNATIVE PROJECTS CONSTRUCTION COST ESTIMATE

ALTERNATIVE PROJECTS CONSTRUCTION COST ESTIMATE

SUPPLEMENT NO. 1
5%, 10% AND 15% ALTERNATIVES 2 AND 3 PROJECTS

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT

Prepared for

City of Santa Rosa

and

U.S. Army Corps of Engineers

April 1996

Prepared by

PARSONS ENGINEERING SCIENCE, INC.
PLANNING · DESIGN · CONSTRUCTION MANAGEMENT
1301 MARINA VILLAGE PARKWAY, ALAMEDA, CA 94501 · 510/769-0100
OFFICES IN PRINCIPAL CITIES
723129/95-06

for

HARLAND BARTHOLOMEW AND ASSOCIATES, INC.

ALTERNATIVE PROJECTS CONSTRUCTION COST ESTIMATE

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1 INTRODUCTION AND COST ESTIMATE ASSUMPTIONS

The original Cost Estimate for alternative projects, issued in November, 1995, included Alternatives 2 and 3 projects limited to a 1% river discharge element. This Supplement No. 1 to the Cost Estimate presents the project costs for the Alternatives 2 and 3 projects with a 5%, 10% and 15% river discharge element. The cost estimates for alternative projects 4, 5A and 5B remain the same.

The several assumptions and criteria identified in the Introduction of the original cost estimate issued in November 1995 also apply to these cost estimates, with the following change:

- Projects 2E and 3F, which were based on using aquifer storage and recovery (ASR), have been deleted because the BPU dropped ASR from further consideration in January 1996.

In addition, several new assumptions and criteria were used in the cost estimates for the 5%, 10% and 15% Alternatives 2 and 3 projects because the storage requirements, piping and pumping requirements, and irrigation acreage requirements would be reduced from the original 1% projects. These assumptions and criteria are as follows:

ASSUMPTIONS AND CRITERIA FOR 5% PROJECT VERSUS 1% PROJECT

5% Storage

Required new storage volume = 2,900 MG (Ref. 1)

Reservoir dams can be built lower to obtain a smaller capacity reservoir versus that required for the 1% project (i.e., 4,000 MG). Cost curves presented in the Appendix of the Cost Estimate for the 1% project were used to estimate the reduced cost of the earthwork portion of the smaller reservoirs.

Two-reservoir combinations (proposed for Alternatives 2B and 2D for the 1% project) are not needed to meet this storage requirement. Therefore, a somewhat smaller Adobe Road reservoir (maximum effective capacity 3,400 MG) or Sears Point reservoir (maximum effective capacity 3,000 MG) could be built alone, without also building Lakeville reservoir (maximum effective capacity 1,000 MG), to satisfy the lower storage requirement. Hence, Lakeville reservoir would not be built for any 5% project.

Because the BPU eliminated ASR from further consideration in January 1996, Alternatives 2E and 3F are not included.

5% Irrigation Areas

Required new irrigation acres (Ref. 1):

a. 2,600 acres South County, or

b. 1,300 acres South County plus 2,200 acres Sebastopol, or

c. 4,400 acres West County, or

d. 2,600 acres West County plus 2,200 acres Sebastopol

Options a. and b. relate to the South County (Alternative 2) projects. Options c. and d. relate to the West County (Alternative 3) projects.

Option b. was rejected because it would not be practical or cost effective to build storage in South County and irrigate only 1,300 acres in this area. Irrigation supply for the Sebastopol area can more cost-effectively be served from existing Delta Pond. Option a. was used for South County (Alternative 2) project.

Option d. was rejected because it would not be practical or cost effective to build storage in West County and irrigate only 2,600 acres in this area, and also build the Sebastopol irrigation system. It would be more cost effective to maximize nearby acreage irrigated from a West County reservoir. Option c. was used for West County (Alternative 3) project.

Therefore, for all Alternative 2 and 3 projects the Sebastopol irrigation area will be deleted.

5% Pipelines

Pipelines would still serve the entire agricultural irrigation service areas, same as for 1% project, but pipeline sizes to these areas would be reduced to account for the reduced volume (and flowrate) to actually be delivered to the major irrigation areas.

Without employing additional KYPIPE modeling, the allowable reduction in pipeline sizes was estimated. For the 5% project, the total storage volume was reduced to about 70% of that for the 1% project (from 4,000 MG to 2,900 MG). The total volume must still be moved through pipelines from storage to irrigation in the same period of time (about 6 month irrigation season), it is desirable to limit pipeline friction losses to about the same level as for the 1% project, and the same alignments and lengths of pipeline were assumed for the 5% project as for the 1% project. Therefore, it was concluded that pipeline diameters could be shifted one standard size downward for the 5% project. This would result in less expensive pipelines, although they would supply the same service areas (with less water) as those for the 1% project.

Note that, for South County Alternatives 2B and 2D, Lakeville reservoir would not be built. However, for Alternative 2B (Adobe Road) and 2D (Sears Point) it is assumed that pipelines would still be built to Lakeville and Bayflats irrigation areas in the South County.

5% Pump Stations

Because for the 5% project as compared with the 1% project less volume of water would be in storage, less volume of water must be delivered to the irrigation areas. Therefore, the pipelines and main pump stations (which deliver water from the plant to storage, and from storage to the major irrigation areas) were downsized accordingly and, therefore, would cost less. For these pump stations (which would be reduced to about 70% of the capacity of the 1% project pump stations) the cost would be reduced to about 80% of that for the 1% project pump stations.

Within the irrigation areas, the farmers would rather irrigate less acreage (if less water is available) than apply less water to the same acreage. Therefore, for a modest reduction in available water (for the 5% project vs. the 1% project) it is assumed that the booster pump stations (which deliver water to specific irrigation subareas) would be sized about the same as for the 1% project and, therefore, would cost about the same.

The number of booster pump stations would be the same as for the 1% project, except that the Sebastopol irrigation system and booster pump stations would be deleted.

5% Urban Irrigation, Direct Discharge, Geysers Project, And Headworks Improvements

No changes from the 1% cost estimate.

5% Land Purchases

The cost of Alternatives 2B and 2D would be reduced by deletion of Lakeville reservoir site.

Assumptions And Criteria For 10% Project Versus 1% Project

10% Storage

Required new storage volume = 1,900 MG (Ref. 1)

Reservoir dams can be built lower to obtain smaller reservoir volumes versus those required for the 1% project (i.e., 4,000 MG). Cost curves presented in the Appendix of the Cost Estimate for the 1% project were used to estimate the reduced cost of the earthwork portion of the smaller reservoirs.

Downsizing Tolay A reservoir to this size would result in a relatively large and shallow impoundment that would have a relatively low dam in comparison with the other reservoirs. Although the construction cost would be the lowest for any reservoir of this size, for its capacity the land purchase cost and mitigation measures cost would be relatively high. In addition, the shallow reservoir would have a relatively large "dead zone" (shallow and turbid water) not available to the outlet works and irrigation pump station. The shallow water

would also be warmer than deeper reservoirs, and would aggravate the growth of algae. For these reasons, Alternative 2A (Tolay A) was dropped from consideration for a 10% project.

Two-reservoir combinations (proposed for Alternatives 2B and 2D for the 1% project) are not needed to meet this storage requirement. Therefore, a somewhat smaller Adobe Road reservoir (maximum effective capacity 3,400 MG) or Sears Point reservoir (maximum effective capacity 3,000 MG) could be built alone, without also building Lakeville reservoir (maximum effective capacity 1,000 MG), to satisfy the lower storage requirement. Hence, the Lakeville reservoir would not be built for any 10% project.

Because the BPU eliminated ASR from further consideration in January 1996, Alternatives 2E and 3F are not included.

10% Irrigation Areas

Required new irrigation acres (Ref. 1):

a. 1,600 acres South County, or

b. 300 acres South County plus 2,200 acres Sebastopol, or

c. 2,900 acres West County, or

d. 1,000 acres West County plus 2,200 acres Sebastopol

Options a. and b. relate to the South County (Alternative 2) projects. Options c. and d. relate to the West County (Alternative 3) projects.

Option b. was rejected because it would not be practical or cost effective to build storage in South County and irrigate only 300 acres in this area. Irrigation supply for the Sebastopol area can more cost-effectively be served from existing Delta Pond. Option a. was used for South County (Alternative 2) project.

Option d. was rejected because it would not be practical or cost effective to build storage in West County and irrigate only 1,000 acres in this area, and irrigation supply for Sebastopol irrigation can more cost-effectively be served from existing Delta Pond. Option c. was used for West County (Alternative 3) project.

10% Pipelines

Pipelines to agricultural irrigation areas would serve greatly reduced total acreage from the 1% project and, therefore, the pipeline sizes and lengths would be reduced to account for reduced total volume (and flowrate) to actually be delivered to the irrigation areas.

In addition, the lower acreage to be irrigated must be in the vicinity of the reservoir to be cost effective. Therefore, for South County project (Option a.) involving Sears Point reservoir, pipelines and irrigation acreage in 'East of Rohnert Park' and 'North of Petaluma' areas would

be deleted. For South County project (Option a.) involving Adobe Road reservoir, pipelines and irrigation acreage in 'Lakeville' and 'Bayflats' areas would be deleted.

For West County project (Option c.), pipelines and irrigation acreage in Americano Creek or Stemple Creek drainages would be deleted depending on location of the reservoir. For Bloomfield, Carroll Road or Valley Ford reservoirs (all in Americano Creek watershed, all pipelines and acreage in Stemple Creek watershed would be deleted. For Two Rock reservoir (in Stemple Creek watershed) all pipelines and acreage in Americano Creek watershed would be deleted. For Huntley reservoir (in Stemple Creek watershed, but supplied by pipeline passing through Americano watershed) irrigation of the farthest acreage from the reservoir, in both watersheds, would be deleted.

10% Pump Stations

Because (for the 10% project vs. the 1% project) less volume of water would be in storage, less volume of water must be delivered to the irrigation service areas. Therefore, the pipelines and main pump stations (which deliver water from the plant to storage, and from storage to the major irrigation areas) were downsized accordingly and, therefore, would cost less. For these pump stations (which would be reduced to about 50% of the capacity of the 1% project pump stations) the cost would be reduced to about 66% of that for the 1% project pump stations.

Within the irrigation areas, the farmers would rather irrigate less acreage (if less water is available) than apply less water to the same acreage. Therefore, for the substantial reduction in available water (for the 10% project vs. the 1% project) it is assumed that the booster pump stations (which deliver water to specific irrigation subareas) would be downsized accordingly (or eliminated) and, therefore, would cost less. For these pump stations (which would be reduced to about 70% of the capacity of the 1% project pump stations) the cost for the pump station and the electrical service would be reduced to about 80% of that for the 1% project pump stations.

The number of booster pump stations would be reduced from the 1% project because some irrigation subareas would be eliminated, and the Sebastopol irrigation system and booster pump stations would be deleted.

10% Urban Irrigation, Direct Discharge, Geysers Project, Headworks Improvements

No changes from the 1% cost estimate.

10% Land Purchases

The cost of Alternatives 2B and 2D would be reduced by deletion of Lakeville reservoir site.

ASSUMPTIONS AND CRITERIA FOR 15% PROJECT VERSUS 1% PROJECT

15% Storage

Required new storage volume = 1,000 MG (Ref. 2)

Reservoir dams can be built lower to obtain smaller reservoir volumes versus those required for the 1% project (i.e., 4,000 MG). Cost curves presented in the Appendix of the Cost Estimate for the 1% project were used to estimate the reduced cost of the earthwork portion of the smaller reservoirs.

For the same reasons given for the 10% project above, Tolay A reservoir and, therefore, Alternative 2A, was dropped from consideration for a 15% project.

Because of the clearly exorbitant cost for such a small volume reservoir, Tolay C and, therefore, Alternative 2C, was dropped from consideration for a 15% project.

Two-reservoir combinations (proposed for Alternatives 2B and 2D for the 1% project) are not needed to meet this storage requirement. Therefore, a somewhat smaller Adobe Road reservoir (maximum effective capacity 3,400 MG) or Sears Point reservoir (maximum effective capacity 3,000 MG) or even Lakeville reservoir (maximum effective capacity 1,000 MG) could be build alone to satisfy the lower storage requirement.

Because the BPU eliminated ASR from further consideration in January 1996, Alternatives 2E and 3F are not included.

The five west county reservoirs and alternative projects could be developed at the 15% project size.

15% Irrigation Areas

Required new irrigation acres (Ref. 2):

a. 1,400 acres South County, or

b. 300 acres South County plus 2,200 acres Sebastopol, or

c. 1,900 acres West County, or

d. 1,000 acres West County plus 2,200 acres Sebastopol

Options a. and b. relate to the South County (Alternative 2) projects. Options c. and d. relate to the West County (Alternative 3) projects.

Option b. was rejected because it would not be practical or cost effective to build storage in South County and irrigate less than 300 acres in this area (and irrigation water supply for Sebastopol irrigation could more cost-effectively come from existing Delta Pond if it is to be

irrigated at all). Therefore, Sebastopol irrigation area would be deleted. Option a. was used for South County (Alternative 2) project, for irrigation of acres nearest the reservoir.

Option d. was rejected because it would not be practical or cost effective to build storage in West County and irrigate less than 1,000 acres in this area (and irrigation water supply for Sebastopol irrigation could more cost-effectively come from existing Delta Pond if it is to be irrigated at all). Therefore, Sebastopol irrigation area would be deleted. Option c. was used for West County (Alternative 3) project, for irrigation of acres nearest the reservoir.

South County and West County agricultural irrigation areas would be confined to those areas of sufficient acreage closest to the respective reservoir for the alternative project. This would be defined by eliminating pipelines from portions of the irrigation service area proposed for the 1% project.

15% Pipelines

Pipelines to agricultural irrigation areas would serve greatly reduced total acreage from the 1% project and, therefore, the pipeline sizes and lengths would be reduced to account for reduced total volume (and flowrate) to actually be delivered to the irrigation areas.

In addition, the lower acreage to be irrigated must be in the vicinity of the reservoir to be cost effective. Therefore, for South County project (Option a.) involving Sears Point or Lakeville reservoir, pipelines and irrigation acreage in 'East of Rohnert Park' and 'North of Petaluma' areas would be deleted. For South County project (Option a.) involving Adobe Road reservoir, pipelines and irrigation acreage in 'Lakeville' and 'Bayflats' areas would be deleted. Because irrigation acreage for the South County projects is nearly the same as for the 10% projects, no additional pipelines were deleted.

For West County project (Option c.), yet more pipelines and irrigation acreage in Americano Creek or Stemple Creek drainages would be deleted depending on location of the reservoir. So, for Bloomfield, Carroll Road or Valley Ford reservoirs (all in Americano Creek watershed, all pipelines and acreage in Stemple Creek watershed would be deleted. For Two Rock reservoir (in Stemple Creek watershed) all pipelines and acreage in Americano Creek watershed would be deleted. For Huntley reservoir (in Stemple Creek watershed, but supplied by pipeline passing through Americano watershed) irrigation of the farthest acreage from the reservoir, in both watersheds, would be deleted.

15% Pump Stations

Because (for the 15% project vs. the 1% project) less volume of water would be in storage, less volume of water must be delivered to the irrigation service areas. Therefore, the pipelines and main pump stations (which deliver water from the plant to storage, and from storage to the major irrigation areas) were downsized accordingly and, therefore, would cost less. For these pump stations (which would be reduced to about 25% of the capacity of the 1% project pump stations) the cost would be reduced to about 50% of that for the 1% project pump stations.

It is assumed that irrigation booster pump stations would not be needed to serve the relatively few acres for the 15% projects. Therefore, all South County and West County booster pump stations would be deleted, and the Sebastopol irrigation system and booster pump stations would be deleted.

15% Urban Irrigation, Direct Discharge, Geysers Project, Headworks Improvements

No changes from the 1% cost estimate.

15% Land Purchases

The land purchase cost for Alternatives 2B and 2D would be reduced by the construction of only one reservoir instead of two.

Because most pump station sites would be deleted, the land purchase costs would be greatly reduced over that for the 1% project.

REFERENCES FOR COST ESTIMATE ASSUMPTIONS

(Ref. 1) From Technical Memorandum "Water Balance Model - Summary and Results," dated 26 September, 1995.

(Ref. 2) From water balance analysis completed for 15% Project, January 1996.

2 SUMMARY OF COST ESTIMATES

Figures 1 provides a graphical summary of the present worth value of each of the alternative projects, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects.

Figures 2 provides a graphical summary of the construction cost of each of the alternative projects, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects.

Figure 2.1, 2.5, 2.10, and 2.15 provide a graphical summary of the construction cost for each of the alternative projects, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects.

Tables 1.1, 1.5, 1.10, and 1.15 provide a summary of the construction cost, annual operations cost and present worth value of each of the alternative projects, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects.

Tables 2.1, 2.5, 2.10, and 2.15 provide a detail summary of the construction cost for each of the alternative projects, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects. Figures

Table 20.1, 20.5, 20.10, and 20.15 provides a summary of the projected annual operations costs for each alternative project, for the 1%, 5%, 10% and 15% river discharge options of Alternatives 2 and 3 projects.

Other tables, which provide background to the above summary tables, are available under separate cost estimate supplement appendix.

FIG 1 - 1%,5%,10%&15% PROJECTS

PRESENT WORTH COST COMPARISON

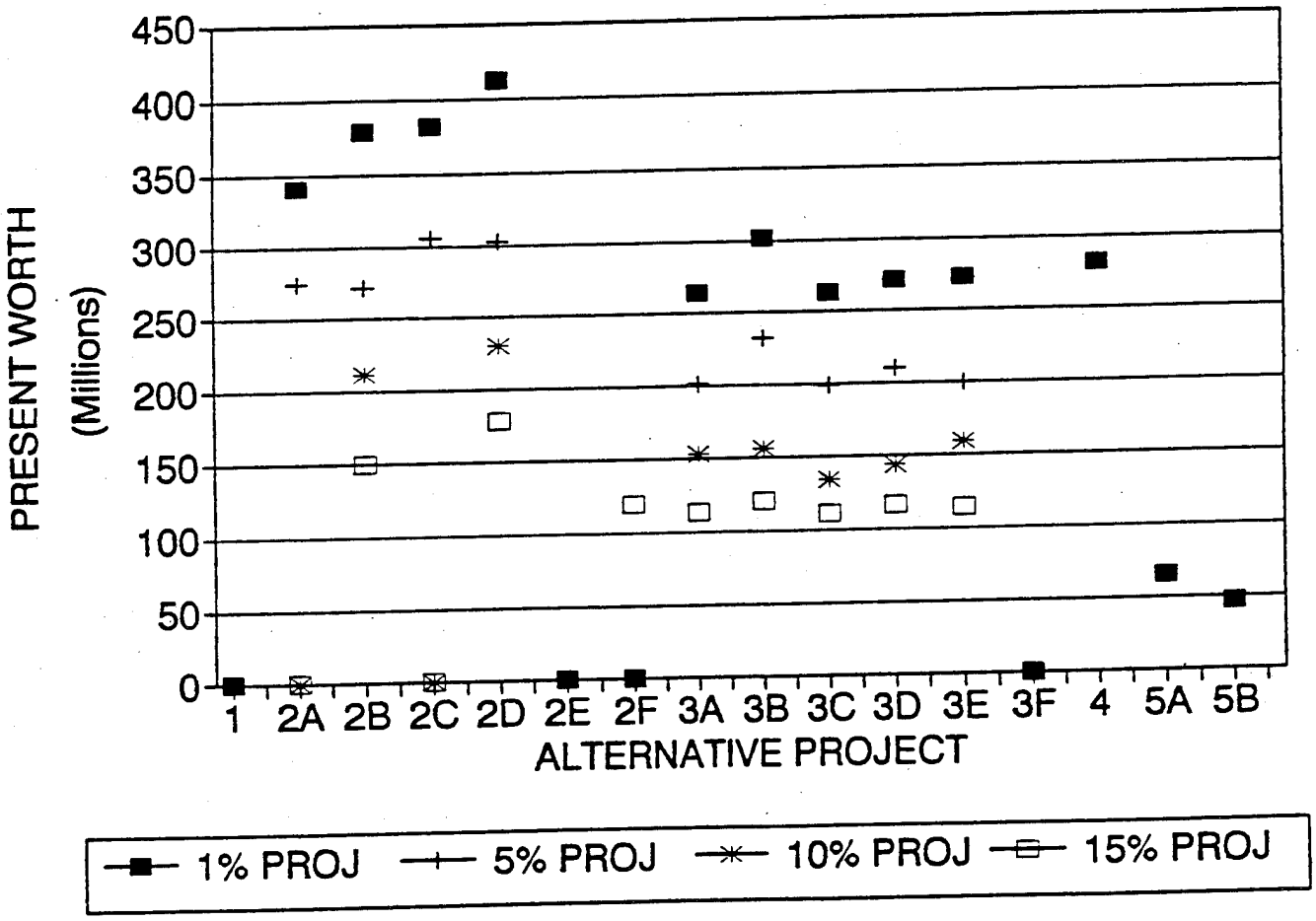

FIG 2 - 1%,5%,10%&15% PROJECTS
CONSTRUCTION COST COMPARISON

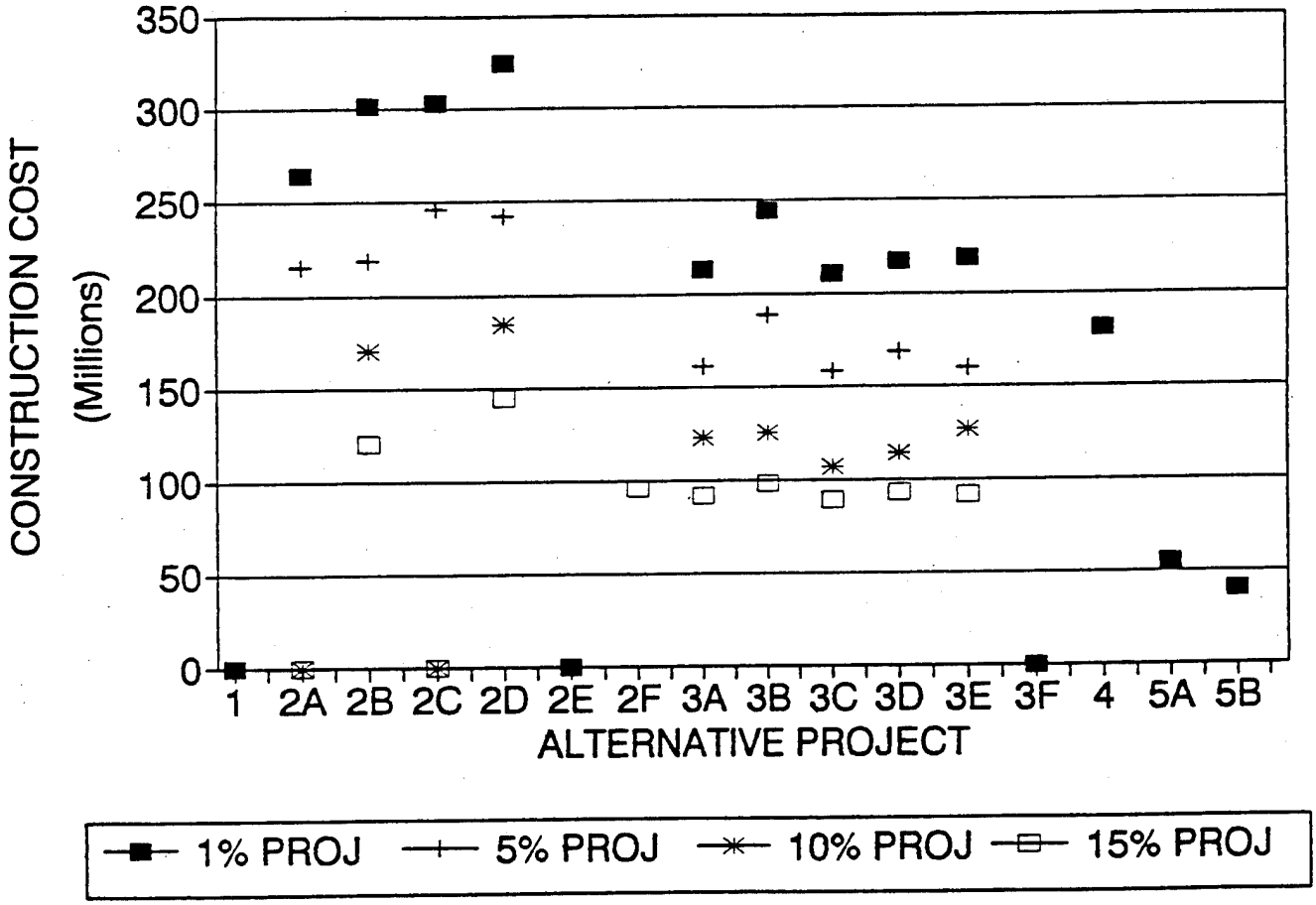

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FIGURE 2.1 1% PROJECT
CONSTRUCTION COST COMPARISON

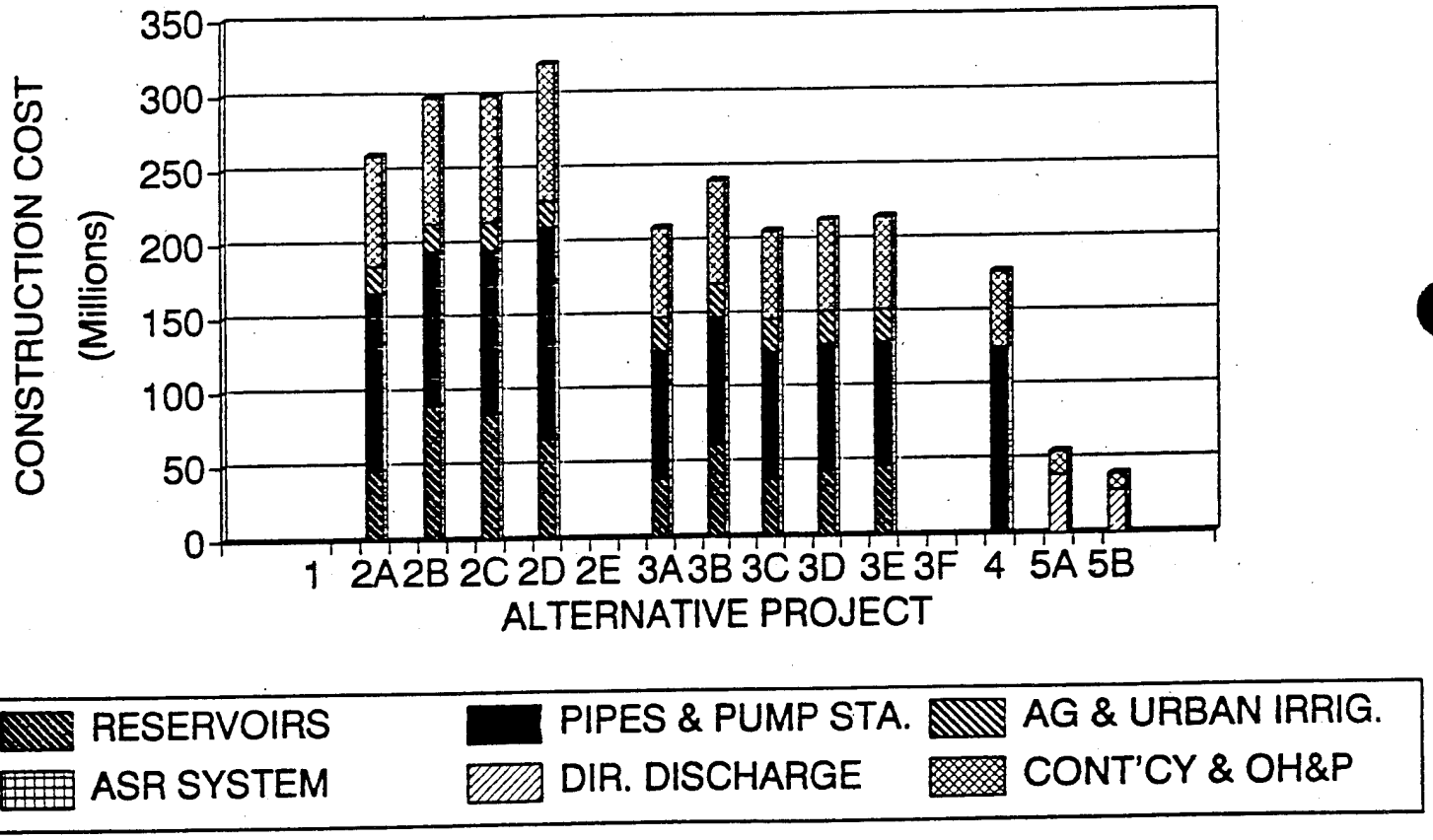

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FIGURE 2.5 5% PROJECT
CONSTRUCTION COST COMPARISON

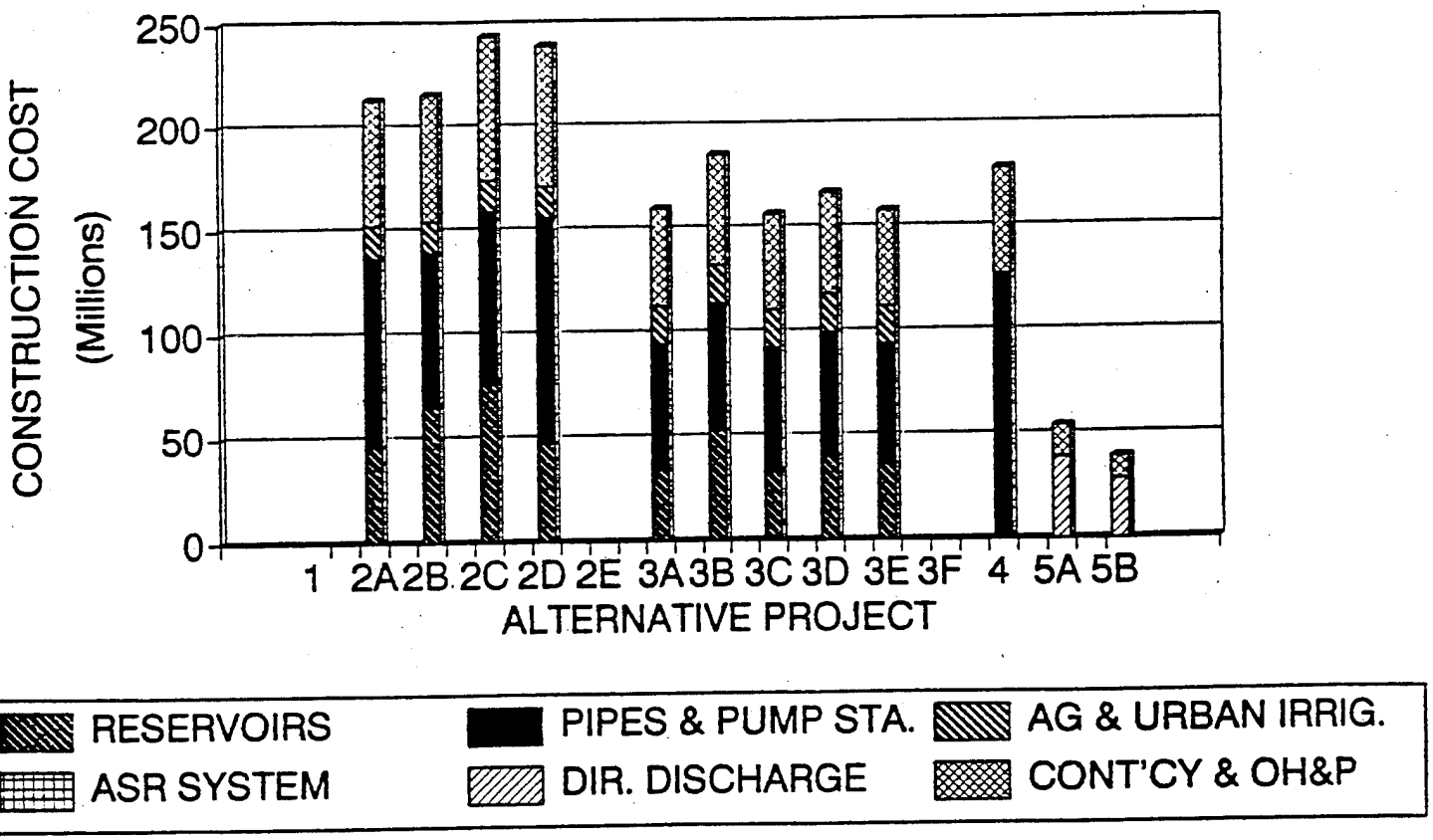

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FIGURE 2.10 10% PROJECT
CONSTRUCTION COST COMPARISON

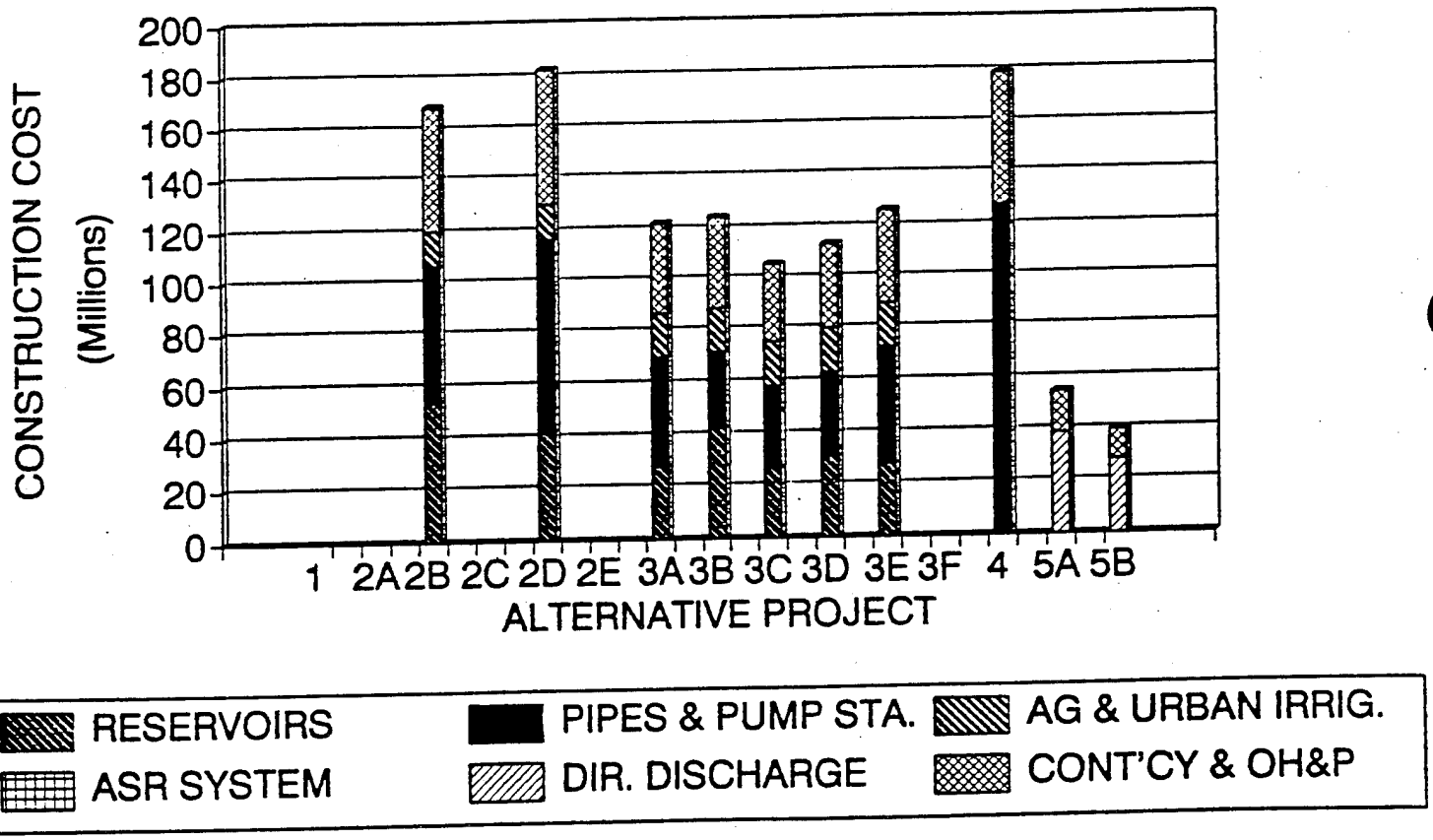

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FIGURE 2.15 15% PROJECT
CONSTRUCTION COST COMPARISON

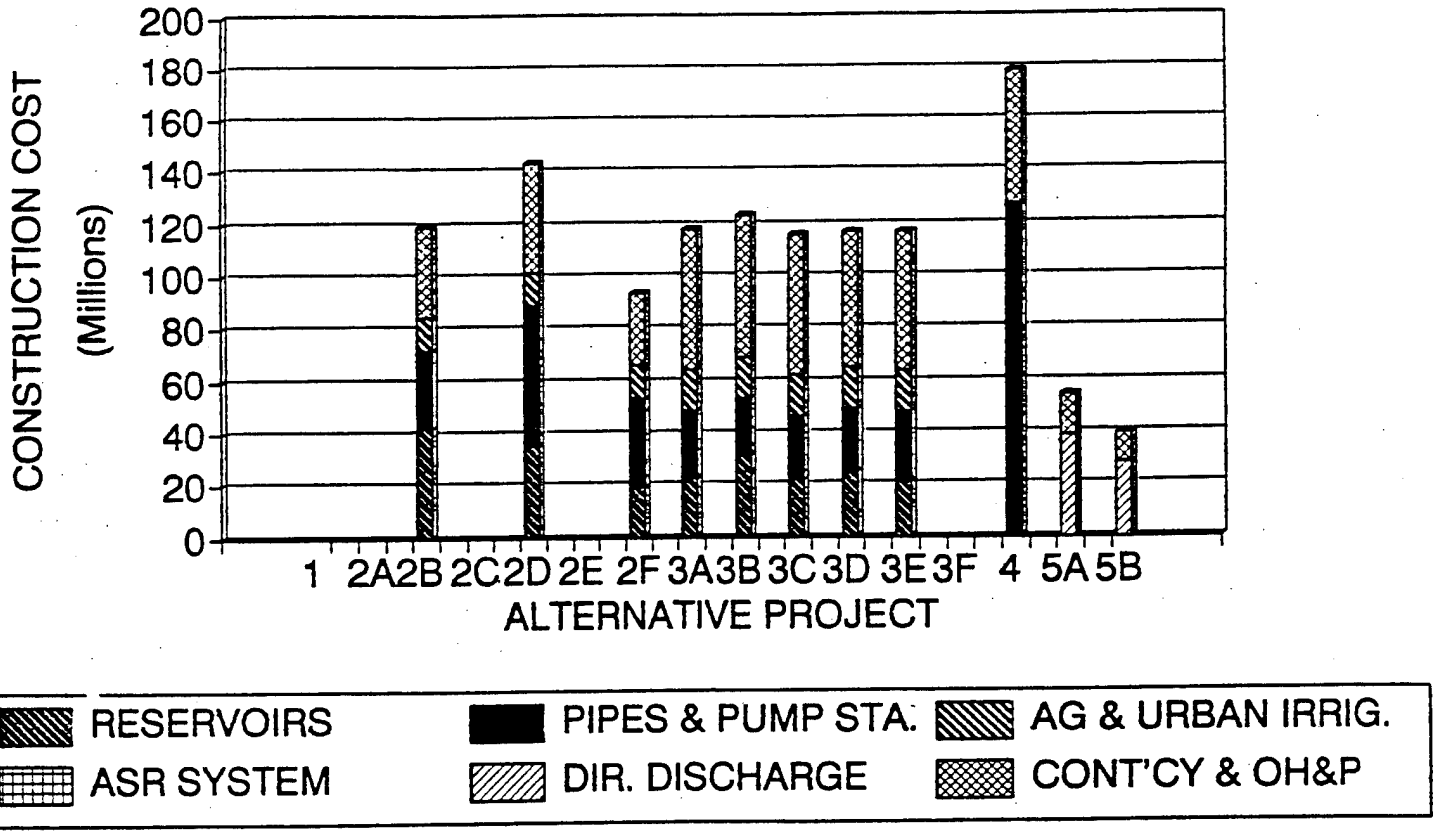

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TABLE 1.1

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
ALTERNATIVE PROJECTS COST ESTIMATE - SUMMARY
JUN 7, 1996 1% PROJECTS FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	CONSTRUCTION COST (TABLE 2) ($1,000)	ENGINEERING, ADMIN., LEGAL (15% OF CONST. COST) ($1,000)	LAND PURCHASE COST (TABLE 12) ($1,000)	PROJECT CAPITAL COST (CONSTR.+ ENGR. + LAND) ($1,000)	ANNUAL OPERATIONS AND MAINT. COST (TABLE 20) ($1,000)	TOTAL PROJECT PRESENT WORTH COST (1)(2)(3) ($1,000)	CONTINGENCY PLAN OPERATIONS EXPENSE (TABLE 30) ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$264,208	$39,631	$8,487	$312,326	$2,513	$340,014	$433
2B - ADOBE ROAD AND LAKEVILLE HILLSIDE	$302,158	$45,324	$4,734	$352,216	$2,411	$378,780	$437
2C - TOLAY C	$303,517	$45,528	$4,242	$353,287	$2,627	$382,231	$438
2D - SEARS POINT AND LAKEVILLE HILLSIDE	$324,206	$48,631	$3,883	$376,720	$3,153	$411,460	$558
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$212,554	$31,883	$1,973	$246,410	$1,648	$264,568	$297
3B - BLOOMFIELD	$244,175	$36,626	$1,858	$282,659	$1,745	$301,886	$297
3C - CARROLL ROAD	$210,043	$31,506	$1,907	$243,456	$1,753	$262,771	$297
3D - VALLEY FORD	$216,888	$32,533	$2,057	$251,478	$1,785	$271,145	$297
3E - HUNTLEY	$218,739	$32,811	$2,354	$253,904	$1,713	$272,778	$298
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$180,907	$27,136	$209	$208,252	$6,683	$281,885	$0
5A - DIRECT DISCHARGE TO TO RUSSIAN RIVER	$55,583	$8,337	$33	$63,953	$97	$65,022	$0
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$40,306	$6,046	$0	$46,352	$0	$46,352	$0

(1) ANNUAL O&M CAPITALIZED @ 6.5% INTEREST OVER 20 YEARS; PWF = 11.018

(2) DOES NOT INCLUDE CREDIT FOR ANNUAL REVENUE INCOME FROM SALE OF RECLAIMED WATER, OR VALUE OF CROPS PRODUCED DUE TO ALTERNATIVES 2A THROUGH 3F, OR VALUE OF SIGNIFICANT ELECTRICAL ENERGY PRODUCED DUE TO ALTERNATIVE 4.

(3) ASSUMES UNIFORM PUMPING ENERGY CONSUMPTION (AT DESIGN YEAR VALUE) AND ENERGY COST FOR 20 YEARS.

QCOSTTAB.1

PARSONS ENGINEERING SCIENCE, INC.

TABLE 1.5

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
ALTERNATIVE PROJECTS COST ESTIMATE - SUMMARY
APRIL 25, 1996 5% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	CONSTRUCTION COST (TABLE 2) ($1,000)	ENGINEERING, ADMIN., LEGAL (15% OF CONST. COST) ($1,000)	LAND PURCHASE COST (TABLE 12) ($1,000)	PROJECT CAPITAL COST (CONSTR.+ ENGR. + LAND) ($1,000)	ANNUAL OPERATIONS AND MAINT. COST (TABLE 20) ($1,000)	TOTAL PROJECT PRESENT WORTH COST (1)(2)(3) ($1,000)	CONTINGENCY PLAN OPERATIONS EXPENSE (TABLE 30) ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$215,036	$32,255	$8,487	$255,778	$1,673	$274,212	$433
2B - ADOBE ROAD	$218,233	$32,735	$2,906	$253,874	$1,618	$271,701	$437
2C - TOLAY C	$245,566	$36,835	$4,242	$286,643	$1,767	$306,112	$438
2D - SEARS POINT	$241,935	$36,290	$2,055	$280,280	$2,065	$303,032	$558
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$161,407	$24,211	$1,973	$187,591	$1,161	$200,383	$297
3B - BLOOMFIELD	$188,324	$28,249	$1,858	$218,431	$1,220	$231,873	$297
3C - CARROLL ROAD	$159,008	$23,851	$1,907	$184,766	$1,226	$198,274	$297
3D - VALLEY FORD	$168,844	$25,327	$2,057	$196,228	$1,246	$209,956	$297
3E - HUNTLEY	$160,094	$24,014	$2,354	$186,462	$1,196	$199,640	$298
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$180,907	$27,136	$209	$208,252	$6,651	$281,533	$0
5A - DIRECT DISCHARGE TO TO RUSSIAN RIVER	$55,583	$8,337	$33	$63,953	$97	$65,022	$0
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$40,306	$6,046	$0	$46,352	$0	$46,352	$0

(1) ANNUAL O&M CAPITALIZED @ 6.5% INTEREST OVER 20 YEARS; PWF = 11.018

(2) DOES NOT INCLUDE CREDIT FOR ANNUAL REVENUE INCOME FROM SALE OF RECLAIMED WATER, OR VALUE OF CROPS PRODUCED DUE TO ALTERNATIVES 2A THROUGH 3F, OR VALUE OF SIGNIFICANT ELECTRICAL ENERGY PRODUCED DUE TO ALTERNATIVE 4.

(3) ASSUMES UNIFORM PUMPING ENERGY CONSUMPTION (AT DESIGN YEAR VALUE) AND ENERGY COST FOR 20 YEARS.

PARSONS ENGINEERING SCIENCE, INC.

QCOST5%.1

TABLE 1.10

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
ALTERNATIVE PROJECTS COST ESTIMATE - SUMMARY
APRIL 25, 1996 10% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	CONSTRUCTION COST (TABLE 2) ($1,000)	ENGINEERING, ADMIN., LEGAL (15% OF CONST. COST) ($1,000)	LAND PURCHASE COST (TABLE 12) ($1,000)	PROJECT CAPITAL COST (CONSTR.+ ENGR. + LAND) ($1,000)	ANNUAL OPERATIONS AND MAINT. COST (TABLE 20) ($1,000)	TOTAL PROJECT PRESENT WORTH COST (1)(2)(3) ($1,000)	CONTINGENCY PLAN OPERATIONS EXPENSE (TABLE 30) ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$170,296	$25,544	$2,903	$198,743	$1,117	$211,051	$437
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$184,310	$27,647	$2,047	$214,004	$1,390	$229,319	$558
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$123,150	$18,473	$1,973	$143,596	$805	$152,465	$297
3B - BLOOMFIELD	$126,069	$18,910	$1,858	$146,837	$820	$155,872	$297
3C - CARROLL ROAD	$107,285	$16,093	$1,907	$125,285	$823	$134,353	$297
3D - VALLEY FORD	$114,547	$17,182	$2,057	$133,786	$837	$143,008	$297
3E - HUNTLEY	$127,834	$19,175	$2,354	$149,363	$845	$158,673	$298
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$180,907	$27,136	$209	$208,252	$6,651	$281,533	$0
5A - DIRECT DISCHARGE TO TO RUSSIAN RIVER	$55,583	$8,337	$33	$63,953	$97	$65,022	$0
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$40,306	$6,046	$0	$46,352	$0	$46,352	$0

(1) ANNUAL O&M CAPITALIZED @ 6.5% INTEREST OVER 20 YEARS; PWF = 11.018

(2) DOES NOT INCLUDE CREDIT FOR ANNUAL REVENUE INCOME FROM SALE OF RECLAIMED WATER, OR VALUE OF CROPS PRODUCED DUE TO ALTERNATIVES 2A THROUGH 3F, OR VALUE OF SIGNIFICANT ELECTRICAL ENERGY PRODUCED DUE TO ALTERNATIVE 4.

(3) ASSUMES UNIFORM PUMPING ENERGY CONSUMPTION (AT DESIGN YEAR VALUE) AND ENERGY COST FOR 20 YEARS.

PARSONS ENGINEERING SCIENCE, INC.

QCOST10%.1

TABLE 1.15

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
ALTERNATIVE PROJECTS COST ESTIMATE - SUMMARY
APRIL 27, 1996 15% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	CONSTRUCTION COST (TABLE 2) ($1,000)	ENGINEERING, ADMIN., LEGAL (15% OF CONST. COST) ($1,000)	LAND PURCHASE COST (TABLE 12) ($1,000)	PROJECT CAPITAL COST (CONSTR. + ENGR. + LAND) ($1,000)	ANNUAL OPERATIONS AND MAINT. COST (TABLE 20) ($1,000)	TOTAL PROJECT PRESENT WORTH COST (1)(2)(3) ($1,000)	CONTINGENCY PLAN OPERATIONS EXPENSE (TABLE 30) ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$121,339	$18,201	$2,900	$142,440	$661	$149,723	$437
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$145,258	$21,789	$2,045	$169,092	$795	$177,851	$558
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
2F - LAKEVILLE	$96,058	$14,409	$1,174	$111,641	$700	$119,353	$500
3A - TWO ROCK	$91,736	$13,760	$1,973	$107,469	$512	$113,111	$297
3B - BLOOMFIELD	$98,385	$14,758	$1,858	$115,001	$524	$120,774	$297
3C - CARROLL ROAD	$89,440	$13,416	$1,907	$104,763	$531	$110,614	$297
3D - VALLEY FORD	$93,916	$14,087	$2,057	$110,060	$536	$115,966	$297
3E - HUNTLEY	$91,973	$13,796	$2,354	$108,123	$533	$113,996	$298
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$180,907	$27,136	$209	$208,252	$6,651	$281,533	$0
5A - DIRECT DISCHARGE TO TO RUSSIAN RIVER	$55,583	$8,337	$33	$63,953	$97	$65,022	$0
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$40,306	$6,046	$0	$46,352	$0	$46,352	$0

(1) ANNUAL O&M CAPITALIZED @ 6.5% INTEREST OVER 20 YEARS; PWF = 11.018

(2) DOES NOT INCLUDE CREDIT FOR ANNUAL REVENUE INCOME FROM SALE OF RECLAIMED WATER, OR VALUE OF CROPS PRODUCED DUE TO ALTERNATIVES 2A THROUGH 3F, OR VALUE OF SIGNIFICANT ELECTRICAL ENERGY PRODUCED DUE TO ALTERNATIVE 4.

(3) ASSUMES UNIFORM PUMPING ENERGY CONSUMPTION (AT DESIGN YEAR VALUE) AND ENERGY COST FOR 20 YEARS.

(4) ANNUAL OPERATIONS EXPENSES AND CONTINGENCY PLAN EXPENSES WERE ESTIMATED FOR ALTERNATIVE 2F.

PARSONS ENGINEERING SCIENCE, INC.

QCOST15%.1

TABLE 2.1

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
CONSTRUCTION COST ESTIMATE - SUMMARY TABLE
MAIN FACILITIES AND COMPONENTS
JUN 7, 1996 1% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIRS (TABLE 3) ($1,000)	PIPELINES (TABLE 4) ($1,000)	PUMP STATIONS (TABLE 5) ($1,000)	AGRICULTURAL IRRIGATION AREAS (TABLE 6) ($1,000)	URBAN IRRIGATION (TABLE 7) ($1,000)	ASR SYSTEM (TABLE 8) ($1,000)	DIRECT DISCHARGE (TABLE 9) ($1,000)	UTILITY SERVICES (TABLE 10) ($1,000)	HEADWORKS IMPROVEMENTS (TABLE 11) ($1,000)	SUBTOTAL CONSTRUCTION COST ($1,000)	CONSTRUCTION CONTINGENCY (25% OF SUBTOTAL) ($1,000)	CONTRACTOR'S EXPENSES, OH&P (15% OF SUBTOTAL) ($1,000)	TOTAL PROJECT CONSTRUCTION COST ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$46,364	$66,492	$36,820	$8,352	$12,812	$0	$0	$17,090	$790	$188,720	$47,180	$28,308	$264,208
2B - ADOBE ROAD AND LAKEVILLE HILLSIDE	$71,078 $19,164	$52,504	$39,065	$8,352	$12,812	$0	$0	$12,082	$790	$215,827	$53,957	$32,374	$302,158
2C - TOLAY C	$84,159	$60,228	$38,306	$8,352	$12,812	$0	$0	$12,151	$790	$216,798	$54,200	$32,520	$303,517
2D - SEARS POINT AND LAKEVILLE HILLSIDE	$47,649 $19,164	$68,348	$52,403	$8,352	$12,812	$0	$0	$22,058	$790	$231,576	$57,894	$34,736	$324,206
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$39,684	$51,280	$28,025	$12,152	$12,812	$0	$0	$7,081	$790	$151,824	$37,956	$22,774	$212,554
3B - BLOOMFIELD	$62,231	$49,030	$30,325	$12,152	$12,812	$0	$0	$7,071	$790	$174,411	$43,603	$26,162	$244,175
3C - CARROLL ROAD	$38,418	$48,335	$30,492	$12,152	$12,812	$0	$0	$7,032	$790	$150,031	$37,508	$22,505	$210,043
3D - VALLEY FORD	$43,268	$47,852	$30,992	$12,152	$12,812	$0	$0	$7,034	$790	$154,920	$38,730	$23,238	$216,888
3E - HUNTLEY	$46,853	$46,590	$30,018	$12,152	$12,812	$0	$0	$7,027	$790	$156,242	$39,061	$23,436	$218,739
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$76,399	$36,985	$0	$0	$0	$0	$15,045	$790	$129,219	$32,305	$19,383	$180,907
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0		$0	$0	$0	$0	$38,912	$0	$790	$39,702	$9,926	$5,955	$55,583
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$28,000	$0	$790	$28,790	$7,198	$4,319	$40,306

COSTS BASIS IS SEPT 1995 ENR CONSTRUCTION COST (SAN FRANCISCO) INDEX = APPROX. 6500.

QCOSTTAB.2

PARSONS ENGINEERING SCIENCE, INC.

TABLE 2.5

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
CONSTRUCTION COST ESTIMATE - SUMMARY TABLE
MAIN FACILITIES AND COMPONENTS
MAR 5, 1996 5% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIRS (TABLE 3) ($1,000)	PIPELINES (TABLE 4) ($1,000)	PUMP STATIONS (TABLE 5) ($1,000)	AGRICULTURAL IRRIGATION AREAS (TABLE 6) ($1,000)	URBAN IRRIGATION (TABLE 7) ($1,000)	ASR SYSTEM (TABLE 8) ($1,000)	DIRECT DISCHARGE (TABLE 9) ($1,000)	UTILITY SERVICES (TABLE 10) ($1,000)	HEADWORKS IMPROVEMENTS (TABLE 11) ($1,000)	SUBTOTAL CONSTRUCTION COST ($1,000)	CONSTRUCTION CONTINGENCY (25% OF SUBTOTAL) ($1,000)	CONTRACTOR'S EXPENSES, OH&P (15% OF SUBTOTAL) ($1,000)	TOTAL PROJECT CONSTRUCTION COST ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$45,924	$47,800	$25,225	$3,956	$12,812	$0	$0	$17,090	$790	$153,597	$38,399	$23,040	$215,036
2B - ADOBE ROAD	$65,391	$36,700	$24,170	$3,956	$12,812	$0	$0	$12,062	$790	$155,881	$38,970	$23,382	$218,233
2C - TOLAY C	$75,910	$43,100	$26,685	$3,956	$12,812	$0	$0	$12,151	$790	$175,404	$43,851	$26,311	$245,566
2D - SEARS POINT	$46,725	$49,700	$36,770	$3,956	$12,812	$0	$0	$22,058	$790	$172,811	$43,203	$25,922	$241,935
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$33,818	$36,000	$17,540	$7,250	$12,812	$0	$0	$7,081	$790	$115,291	$28,823	$17,294	$161,407
3B - BLOOMFIELD	$52,554	$34,700	$19,340	$7,250	$12,812	$0	$0	$7,071	$790	$134,517	$33,629	$20,178	$188,324
3C - CARROLL ROAD	$32,446	$33,700	$19,547	$7,250	$12,812	$0	$0	$7,032	$790	$113,577	$28,394	$17,037	$159,008
3D - VALLEY FORD	$39,570	$33,200	$19,947	$7,250	$12,812	$0	$0	$7,034	$790	$120,603	$30,151	$18,090	$168,844
3E - HUNTLEY	$35,841	$31,600	$19,033	$7,250	$12,812	$0	$0	$7,027	$790	$114,353	$28,588	$17,153	$160,094
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$76,399	$36,985	$0	$0	$0	$0	$15,045	$790	$129,219	$32,305	$19,383	$180,907
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0	-	$0	$0	$0	$0	$36,912	$0	$790	$39,702	$9,926	$5,955	$55,583
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$28,000	$0	$790	$28,790	$7,198	$4,319	$40,306

COSTS BASIS IS SEPT 1995 ENR CONSTRUCTION COST (SAN FRANCISCO) INDEX = APPROX. 6500.

QCOST5%.2

PARSONS ENGINEERING SCIENCE, INC.

TABLE 2.10

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
CONSTRUCTION COST ESTIMATE - SUMMARY TABLE
MAIN FACILITIES AND COMPONENTS
MAR 7, 1996 10% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIRS (TABLE 3) ($1,000)	PIPELINES (TABLE 4) ($1,000)	PUMP STATIONS (TABLE 5) ($1,000)	AGRICULTURAL IRRIGATION AREAS (TABLE 6) ($1,000)	URBAN IRRIGATION (TABLE 7) ($1,000)	ASR SYSTEM (TABLE 8) ($1,000)	DIRECT DISCHARGE (TABLE 9) ($1,000)	UTILITY SERVICES (TABLE 10) ($1,000)	HEADWORKS IMPROVEMENTS (TABLE 11) ($1,000)	SUBTOTAL CONSTRUCTION COST ($1,000)	CONSTRUCTION CONTINGENCY (25% OF SUBTOTAL) ($1,000)	CONTRACTOR'S EXPENSES, OH&P (15% OF SUBTOTAL) ($1,000)	TOTAL PROJECT CONSTRUCTION COST ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$53,607	$18,109	$22,370	$1,880	$12,812	$0	$0	$12,082	$790	$121,640	$30,410	$18,246	$170,296
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$41,787	$34,743	$17,570	$1,880	$12,812	$0	$0	$22,058	$790	$131,650	$32,913	$19,748	$184,310
2E - ASR	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$27,547	$20,987	$13,240	$5,507	$12,812	$0	$0	$7,081	$790	$87,964	$21,991	$13,195	$123,150
3B - BLOOMFIELD	$42,300	$12,129	$9,440	$5,507	$12,812	$0	$0	$7,071	$790	$90,049	$22,512	$13,507	$126,069
3C - CARROLL ROAD	$26,660	$14,384	$9,447	$5,507	$12,812	$0	$0	$7,032	$790	$76,632	$19,158	$11,495	$107,285
3D - VALLEY FORD	$31,336	$14,491	$9,847	$5,507	$12,812	$0	$0	$7,034	$790	$81,819	$20,455	$12,273	$114,547
3E - HUNTLEY	$27,608	$22,233	$15,333	$5,507	$12,812	$0	$0	$7,027	$790	$91,310	$22,828	$13,697	$127,834
3F - ASR	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$76,399	$36,985	$0	$0	$0	$0	$15,045	$790	$129,219	$32,305	$19,383	$180,907
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0		$0	$0	$0	$0	$38,912	$0	$790	$39,702	$9,926	$5,955	$55,583
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$28,000	$0	$790	$28,790	$7,198	$4,319	$40,306

COSTS BASIS IS SEPT 1995 ENR CONSTRUCTION COST (SAN FRANCISCO) INDEX = APPROX. 6500.

QCOST10%.2

PARSONS ENGINEERING SCIENCE, INC.

TABLE 2.15

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
CONSTRUCTION COST ESTIMATE - SUMMARY TABLE
MAIN FACILITIES AND COMPONENTS
MAR 5, 1996 15% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIRS (TABLE 3) ($1,000)	PIPELINES (TABLE 4) ($1,000)	PUMP STATIONS (TABLE 5) ($1,000)	AGRICULTURAL IRRIGATION AREAS (TABLE 6) ($1,000)	URBAN IRRIGATION (TABLE 7) ($1,000)	ASR SYSTEM (TABLE 8) ($1,000)	DIRECT DISCHARGE (TABLE 9) ($1,000)	UTILITY SERVICES (TABLE 10) ($1,000)	HEADWORKS IMPROVEMENTS (TABLE 11) ($1,000)	SUBTOTAL CONSTRUCTION COST ($1,000)	CONSTRUCTION CONTINGENCY (25% OF SUBTOTAL) ($1,000)	CONTRACTOR'S EXPENSES, OH&P (15% OF SUBTOTAL) ($1,000)	TOTAL PROJECT CONSTRUCTION COST ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$42,197	$14,408	$7,758	$1,681	$12,812	$0	$0	$7,027	$790	$86,671	$21,668	$13,001	$121,339
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$35,531	$26,584	$9,352	$1,681	$12,812	$0	$0	$17,006	$790	$103,756	$25,939	$15,563	$145,258
2E - ASR	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2F - LAKEVILLE	$19,164	$19,939	$7,220	$1,681	$12,812	$0	$0	$7,007	$790	$68,613	$17,153	$10,292	$96,058
3A - TWO ROCK	$22,160	$12,112	$6,320	$4,276	$12,812	$0	$0	$7,056	$790	$65,526	$16,382	$9,829	$91,736
3B - BLOOMFIELD	$30,953	$6,928	$7,470	$4,276	$12,812	$0	$0	$7,046	$790	$70,275	$17,569	$10,541	$98,385
3C - CARROLL ROAD	$21,728	$9,803	$7,470	$4,276	$12,812	$0	$0	$7,007	$790	$63,886	$15,972	$9,583	$89,440
3D - VALLEY FORD	$24,941	$9,535	$7,720	$4,276	$12,812	$0	$0	$7,009	$790	$67,083	$16,771	$10,062	$93,916
3E - HUNTLEY	$20,703	$12,762	$7,345	$4,276	$12,812	$0	$0	$7,007	$790	$65,695	$16,424	$9,854	$91,973
3F - ASR	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$76,399	$36,985	$0	$0	$0	$0	$15,045	$790	$129,219	$32,305	$19,383	$180,907
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0		$0	$0	$0	$0	$38,912	$0	$790	$39,702	$9,926	$5,955	$55,583
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$28,000	$0	$790	$28,790	$7,198	$4,319	$40,306

COSTS BASIS IS SEPT 1995 ENR CONSTRUCTION COST (SAN FRANCISCO) INDEX = APPROX. 6500.

QCOST15%.2

PARSONS ENGINEERING SCIENCE, INC.

TABLE 20.5

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
OPERATIONS AND MAINTENANCE COSTS - SUMMARY
APRIL 29, 1996 5% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIR MAINTENANCE COSTS (TABLE 20.1) ($1,000)	PIPELINE MAINTENANCE COSTS (TABLE 20.2) ($1,000)	PUMPING EQUIPMENT MAINTENANCE COSTS (TABLE 20.3) ($1,000)	IRRIGATION AREAS O&M AND MONITORING COSTS (TABLE 6.2) ($1,000) (1)(2)(3)	ASR WELLS MAINTENANCE COSTS (TABLE 20.5) ($1,000)	PUMPING POWER ANNUAL COSTS (TABLE 20.7) ($1,000)	TOTAL ANNUAL O&M COSTS ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$22	$57	$130	$205	$0	$1,259	$1,673
2B - ADOBE ROAD	$22	$55	$178	$205	$0	$1,158	$1,618
2C - TOLAY C	$22	$56	$194	$205	$0	$1,290	$1,767
2D - SEARS POINT	$22	$58	$178	$205	$0	$1,602	$2,065
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$20	$58	$146	$205	$0	$732	$1,161
3B - BLOOMFIELD	$20	$60	$146	$205	$0	$789	$1,220
3C - CARROLL ROAD	$20	$58	$154	$205	$0	$789	$1,226
3D - VALLEY FORD	$20	$58	$154	$205	$0	$809	$1,246
3E - HUNTLEY	$20	$58	$138	$205	$0	$775	$1,196
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$31	$37	$0	$0	$6,583	$6,651 (5)
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0	$20	$8	$0	$0	$69	$97
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$0

(1) BASED ON QUESTA ENGINEERING ESTIMATE OF ANNUAL OPERATIONS COSTS. COSTS FOR FIRST FIVE YEARS OF IRRIGATION SYSTEM IMPLEMENTATION AND DEVELOPMENT ARE INCLUDED IN TABLE 6 AS CAPITAL COSTS.

(2) INCLUDES NO INCENTIVE PAYMENTS TO FARMERS TO TAKE RECLAIMED WATER.

(3) ASSUMES NO ANNUAL COSTS FOR REPLACEMENT OF ON-FARM IRRIGATION PIPING.

(4) ASSUMES URBAN IRRIGATION PROJECTS FOR ALTERNATIVES 2A THRU 3F ONLY.

(5) ANNUAL COST IF IGNORE VALUE OF INCREASED GEYSERS ENERGY PRODUCTION. SEE TABLE 20.7.

(6) ANNUAL PUMPING COST BASED ON THE RATIO OF IRRIGATED ACRES FOR 5% PROJECT TO 1% PROJECT.

QOMCOST5.20

TABLE 20.10

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
OPERATIONS AND MAINTENANCE COSTS - SUMMARY
APRIL 15, 1996 10% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIR MAINTENANCE COSTS (TABLE 20.1) ($1,000)	PIPELINE MAINTENANCE COSTS (TABLE 20.2) ($1,000)	PUMPING EQUIPMENT MAINTENANCE COSTS (TABLE 20.3) ($1,000)	IRRIGATION AREAS O&M AND MONITORING COSTS (TABLE 6.2) ($1,000) (1)(2)(3)	ASR WELLS MAINTENANCE COSTS (TABLE 20.5) ($1,000)	PUMPING POWER ANNUAL COSTS (TABLE 20.7) ($1,000)	TOTAL ANNUAL O&M COSTS ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$22	$29	$89	$205	$0	$772	$1,117
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$22	$38	$57	$205	$0	$1,068	$1,390
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$20	$35	$57	$205	$0	$488	$805
3B - BLOOMFIELD	$20	$20	$49	$205	$0	$526	$820
3C - CARROLL ROAD	$20	$23	$49	$205	$0	$526	$823
3D - VALLEY FORD	$20	$24	$49	$205	$0	$539	$837
3E - HUNTLEY	$20	$38	$65	$205	$0	$517	$845
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$31	$37	$0	$0	$6,583	$6,651 (5)
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0	$20	$8	$0	$0	$69	$97
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$0

(1) BASED ON QUESTA ENGINEERING ESTIMATE OF ANNUAL OPERATIONS COSTS. COSTS FOR FIRST FIVE YEARS OF IRRIGATION SYSTEM IMPLEMENTATION AND DEVELOPMENT ARE INCLUDED IN TABLE 6 AS CAPITAL COSTS.

(2) INCLUDES NO INCENTIVE PAYMENTS TO FARMERS TO TAKE RECLAIMED WATER.

(3) ASSUMES NO ANNUAL COSTS FOR REPLACEMENT OF ON-FARM IRRIGATION PIPING.

(4) ASSUMES URBAN IRRIGATION PROJECTS FOR ALTERNATIVES 2A THRU 3F ONLY.

(5) ANNUAL COST IF IGNORE VALUE OF INCREASED GEYSERS ENERGY PRODUCTION. SEE TABLE 20.7.

(6) ANNUAL PUMPING COST BASED ON THE RATIO OF IRRIGATED ACRES FOR 10% PROJECT TO 1% PROJECT.

QOMCST10.20

TABLE 20.15

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT
OPERATIONS AND MAINTENANCE COSTS - SUMMARY
APRIL 15, 1996 15% PROJECT FOR ALTERNATIVES 2 AND 3

ALTERNATIVE PROJECT	RESERVOIR MAINTENANCE COSTS (TABLE 20.1) ($1,000)	PIPELINE MAINTENANCE COSTS (TABLE 20.2) ($1,000)	PUMPING EQUIPMENT MAINTENANCE COSTS (TABLE 20.3) ($1,000)	IRRIGATION AREAS O&M AND MONITORING COSTS (TABLE 6.2) ($1,000) (1)(2)(3)	ASR WELLS MAINTENANCE COSTS (TABLE 20.5) ($1,000)	PUMPING POWER ANNUAL COSTS (TABLE 20.7) ($1,000)	TOTAL ANNUAL O&M COSTS ($1,000)
1 - NO PROJECT	$0	$0	$0	$0	$0	$0	$0
2A - TOLAY A	$0	$0	$0	$0	$0	$0	$0
2B - ADOBE ROAD	$22	$29	$57	$205	$0	$348	$661
2C - TOLAY C	$0	$0	$0	$0	$0	$0	$0
2D - SEARS POINT	$22	$38	$49	$205	$0	$481	$795
2E - ASR + SMALLER TOLAY	$0	$0	$0	$0	$0	$0	$0
3A - TWO ROCK	$20	$19	$49	$205	$0	$219	$512
3B - BLOOMFIELD	$20	$13	$49	$205	$0	$237	$524
3C - CARROLL ROAD	$20	$20	$49	$205	$0	$237	$531
3D - VALLEY FORD	$20	$19	$49	$205	$0	$243	$536
3E - HUNTLEY	$20	$26	$49	$205	$0	$233	$533
3F - ASR + SMALLER TWO ROCK	$0	$0	$0	$0	$0	$0	$0
4 - GEYSERS RECHARGE	$0	$31	$37	$0	$0	$6,583	$6,651 (5)
5A - DIRECT DISCHARGE TO RUSSIAN RIVER	$0	$20	$8	$0	$0	$69	$97
5B - DIRECT DISCHARGE TO LAGUNA CREEKS	$0	$0	$0	$0	$0	$0	$0

(1) BASED ON QUESTA ENGINEERING ESTIMATE OF ANNUAL OPERATIONS COSTS. COSTS FOR FIRST FIVE YEARS OF IRRIGATION SYSTEM IMPLEMENTATION AND DEVELOPMENT ARE INCLUDED IN TABLE 6 AS CAPITAL COSTS.

(2) INCLUDES NO INCENTIVE PAYMENTS TO FARMERS TO TAKE RECLAIMED WATER.

(3) ASSUMES NO ANNUAL COSTS FOR REPLACEMENT OF ON-FARM IRRIGATION PIPING.

(4) ASSUMES URBAN IRRIGATION PROJECTS FOR ALTERNATIVES 2A THRU 3F ONLY.

(5) ANNUAL COST IF IGNORE VALUE OF INCREASED GEYSERS ENERGY PRODUCTION. SEE TABLE 20.7.

(6) ANNUAL PUMPING COST BASED ON THE RATIO OF IRRIGATED ACRES FOR 15% PROJECT TO 1% PROJECT.

QOMCST15.20

3 CONCLUSION

Several observations and conclusions can be drawn by review of the figures based on the tables presented in this Cost Estimate Supplement.

- The relative position of the alternatives on Figure 1 is nearly identical to the relative positions on Figure 2, indicating that construction cost dominates the present worth value of the projects. This is true except for Alternative 4.

- Note that Alternative 4 is about equivalent in present worth value to the average of the 1% West County alternatives; whereas, from Figure 2, the construction cost of Alternative 4 is closer to that of the 5% West County alternatives. This reflects the substantially higher operations and maintenance cost (primarily due to higher pumping costs) for Alternative 4 in relation to the other projects.

- Once the river discharge allowance exceeds about 6%, Alternative 4 becomes the most expensive project. Alternative 4 is more expensive than any 10% or 15% project.

- Note the change in cost for any given alternative as the river discharge allowance is increased from 1% to 5% to 10% and then to 15% of river flowrate.

- For the 10% and 15% alternative projects, Alternatives 2A and 2C are deleted due to the very shallow and uneconomical condition of the Tolay reservoirs.

- Alternative projects 2E and 3F have been deleted due to the BPU dropping the ASR component in January 1996.

- The West County alternatives have consistently less cost than the South County alternatives.

- For the 15% river discharge option, a new Alternative 2F is proposed because Lakeville reservoir alone would satisfy the storage requirement. The construction cost of Alternative 2F is the least costly South County alternative, and is nearly equivalent to the West County alternatives.

- The 5% South County alternatives 2A through 2D are nearly equivalent in cost to the 1% West County alternatives.

- The 10% South County alternatives 2A through 2D are nearly equivalent in cost to the 5% West County alternatives.

- The 15% South County alternatives 2A through 2D are nearly equivalent in cost to the 10% West County alternatives.

- Alternative 2D is always the most expensive Alternatives 2 or 3 project.
- Alternative 3C is always the least expensive Alternatives 2 or 3 project.
- Direct river discharge Alternative 5B is always the least expensive project.

APPENDIX B LIST OF PREPARERS

PROJECT MANAGEMENT

Anders J. Hauge, Project Manager, Harland Bartholomew & Associates, Inc.
Robin P. Cort, Ph.D., Technical Manager, Parsons Engineering Science, Inc.
Patricia I. Collins, Project Manager for the EIR/EIS, Harland Bartholomew & Associates, Inc.
Maile Deppe, Assistant Project Manager, Harland Bartholomew & Associates, Inc.
Dave Giudice, Assistant Project Manager, Harland Bartholomew & Associates, Inc.
Benjamin Keasler, Assistant Project Manager, Harland Bartholomew & Associates, Inc.
Philip Boyle, Assistant Project Manager, Harland Bartholomew & Associates, Inc.

LEAD AGENCY REPRESENTATIVES

U.S. Army Corps of Engineers

Wade Eakle, Ecologist

City of Santa Rosa

Edwin H. Brauner, Assistant City Manager
Dan Carlson, Technical Manager
Marie Meredith, Senior Planner

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Elisa M. Aguilar	Harland Bartholomew & Associates	A.A. Santa Barbara Business College, Santa Maria	10
Sam Bacchini, Jr.	Harland Bartholomew & Associates	B.A. Zoology, University of California, Davis	6
Deborah Bainbridge	Sycamore Environmental Consultants	B.S. Chemistry, Troy State University, Troy A.A. General Education, Shasta College, Redding	2
Li A. Boccia	Parsons Engineering Science	M.A. Government (Urban and Regional Planning), George Washington University, Washington D.C.	12
Philip F. Boyle	Harland Bartholomew & Associates.	B.S. Environmental Studies and Planning, Sonoma State University	3
Lynn Brittan	Questa Engineering Corporation	B.S. Soils, University of California, Berkeley	38
Dennis J. Brown, Ph.D.	Parsons Engineering Science	Ph.D. Biology, University of California, Santa Cruz M.S. Horticulture, University of Maryland, College Park	9
Jody L. Brown	Harland Bartholomew & Associates	Ph.C. Anthropology, University of Michigan, Ann Arbor M.A. Anthropology, University of Michigan, Ann Arbor B.A. Anthropology, University of California, Berkeley	14
Robert G. Brueck	Harland Bartholomew & Associates	B.S. Design w/emphasis in Urban Planning, Arizona State University, College of Architecture Design, Tempe	7
Antonio S. Buangan	Rust Environment & Infrastructure	B.S. Mining Engineering, Mapua Institute of Technology, Philippines	30

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
James W. Buell, Ph.D.	Buell & Associates, Inc.	Ph.D. Biology University of Oregon B.A. Biology Occidental College, Los Angeles	15
Sean K. Bui	Parsons Engineering Science	B.S. Electrical Engineering, California State University, Northridge	6
Mike Bumgardner	Harland Bartholomew & Associates	B.S. Ecology, University of California, Davis M.S. Ecology, University of California, Davis (Candidate)	9
Marlan Coe	Parsons Engineering Science	B.S. Cartography, Brigham Young University	
Patricia I. Collins	Harland Bartholomew & Associates	M.S. Environmental Health Sciences, University of California, Berkeley B.A. Ecology, University of California, Berkeley	16
Marcie L. Commins	Merritt Smith Consulting	Ph.D. University of California, Davis	23
Wendy L. Corpening	W. L. Corpening & Associates		19
Robin P. Cort, Ph.D.	Parsons Engineering Science	Ph.D. Ecology, State University of New York, Stoney Brook B.S. Biology, Stetson University, Daland	16
John Cummings, Ph.D.	EcoSys Consulting	Ph.D. University of California, Berkeley	10+
Gregg A. Cummins	Dames & Moore	M.S. Environmental Engineering, San Jose State University B.S. Civil Engineering, University of California, Berkeley	7

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Glenn D. Dearth	Dames & Moore	B.S. Civil Engineering, Oregon State University	12
Maile Deppe	Harland Bartholomew & Associates	B.S. Environmental Planning/ Management, University of California, Davis	6
David Diamond	Parsons Engineering Science	Ph.D. Geology, University of California, Los Angeles	12
Malcolm C. Drummond	Harland Bartholomew & Associates	B.S. Urban Planning, Michigan State University, East Lansing	40
Robert A. Duchek	Harland Bartholomew & Associates	B.S. Political Science, Michigan State University	25
Ivy R. Edmonds	Parsons Engineering Science	B.S. Meteorology, San Jose State University	9
Molly Enloe-Mason	Harland Bartholomew & Associates	B.S. Environmental and Systematic Biology, California Polytechnic State University, San Luis Obispo	6
April A. Fallon	Dames & Moore	M.S. Environmental Engineering, California State University, Sacramento B.S. Civil Engineering, University of California, Davis	6
Michael H. Fawcett, Ph.D.	Merritt Smith Consulting	Ph.D. Ecology, University of California, Santa Barbara M.A. Ecology, University of California, Santa Barbara B.A. Ecology, University of California, Santa Barbara	28
Bryan Ferguson	Harland Bartholomew & Associates	B.A. Architecture, California Polytechnic State University, San Luis Obispo	7

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Seana L. S. Gause	Sonoma State University Anthropological Studies Center	M.A. Cultural Resources Management, Sonoma State University B.A. Anthropology, Sonoma State University	6
Bob Gearhart, Ph.D.	Humboldt State University	Ph.D. Civil Engineering, University of Oklahoma M.S. Civil Engineering B.S. Biology, Math, North Texas State Univ.	28
Christian Gerike	Sonoma State University Anthropological Studies Center	M.A. Cultural Resources Management, Sonoma State University B.A. Anthropology, Sonoma State University	16
Areg Gharabegian	Parsons Engineering Science	M.S. Mechanical Engineering, George Washington University, Washington, D. C. B.S. Mechanical Engineering, Shiraz University, Shiraz, Iran Business Management Certificate, Orange Coast College	17
Dave Giudice	Harland Bartholomew & Associates.	B.S. City/Regional Planning, California Polytechnic State University, San Luis Obispo	3
Daniel F. Grayuski	Harland Bartholomew & Associates	B.A. Behavioral and Social Sciences Graduate Study in Urban and Regional Planning/Transportation, University of Maryland	11

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Roger Greensfelder, Ph.D.	Greensfelder & Associates	Ph.D. Geophysics, Stanford University M.S. Geology, University of Nevada, Reno B.A. Geophysics, University of California, Berkeley	31
Mark Grismer	University of California Davis	Ph.D. Agricultural Engineering, Colorado State University, M.S. Civil Engineering, Oregon State	12
Thomas Grovhoug	Larry Walker Associates	M.S. Civil Engineering, University of California Davis B.S. Civil Engineering, University of California Davis	21
Kevin Gusé	Harland Bartholomew & Associates	M.S. Ecology, University of California, Davis B.S. Zoology, University of California, Davis	10
Howard D. Hahn	Dames & Moore	M.S. Landscape Architecture, Kansas State University B.A. General Studies (Environmental Studies), University of Kansas A.A. Engineering, Hutchinson Community College	11
John M. Hake	Parsons Engineering Science	M.S. Civil Engineering, University of California, Berkeley B.S. Economics, Middlebury College, Vermont	10
Gary W. Halsey	Parsons Engineering Science	B.S. Biology, University of Delaware, B.S. Physical Geography, University of Delaware,	20

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Norman N. Hantzsche	Questa Engineering Corporation	M.S. Civil Engineering, University of California, Davis B.S. Civil Engineering, Stanford University	23
Anders J. Hauge	Harland Bartholomew & Associates	B.S. City and Regional Planning, California Polytechnic State University, San Luis Obispo	25
Margaret Henderson	Questa Engineering Corporation	B.S. Plant and Soil Biology, University of California, Berkeley	23
Matthew G. Huismann	Questa Engineering Corporation	B.S. Earth Science, University of California, Santa Cruz	2
Joyce G. Hunting	Harland Bartholomew & Associates	M.S. Advanced Candidate Biological Sciences, California State University, Sacramento B.A. Biology and Zoology, Humboldt State University, Arcata	14
Sonia Jacques	Economic & Planning Systems	M.A. Public Policy & Administration, University Of Wisconsin, Madison M.S. Agriculture Economics, University Of Wisconsin, Madison B.S. Economics, University of London, England	13
Katherine Johnson	Sonoma State University Anthropological Studies Center	M.A. History, Sonoma State University B.A. History, Sonoma State University	13
William Kanemoto	William Kanemoto Associates	M.A. Landscape Architecture, University of Michigan	12+

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Patrick F. Kaspari	Dames & Moore	M.S. Civil Engineering, Environmental and Water Resources Emphasis, University of California, Berkeley B.S. Chemical Engineering, University of North Dakota	2
Benjamin P. Keasler	Harland Bartholomew & Associates	B.S. Natural Resource Management, California Polytechnic State University at San Luis Obispo	4
Frederick C. Kintzer	Parsons Engineering Science	M.S. Geology, California State University, Hayward B.A. Geology, University of California, Berkeley	23
Stanley H. Kline	Rust Environment & Infrastructure	M.S. Geotechnical Engineering, University of California, Berkeley B.S. Civil Engineering, Oregon State University, Corvallis	19
Wirt Lanning	Harland Bartholomew & Associates	B.S. Ecology & Systematic Biology, California Polytechnic State University, San Luis Obispo	3
Jessica LeVeen	Economic & Planning Systems	B.A. Urban Studies and Planning, University of California, San Diego	3
Cynthia L. Little	Sycamore Environmental Consultants		15
Jeffery J. Little	Sycamore Environmental Consultants	A.A. Business, Sacramento City College	6

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
R. John Little, Ph.D.	Sycamore Environmental Consultants	Ph.D. Botany, Claremont Graduate School, Claremont M.A. Biology, California State University, Fullerton B.A. Botany, University of Utah, Salt Lake City	20
Richard W. Maddox	Merritt Smith Consulting	B.A. Environmental Science, Lawrence University, Wisconsin	4
Vern Marble, Ph.D.	Questa Engineering Corporation	Ph.D. Plant Physiology, University of California, Davis M.S. Agronomy Soils Plant Breeding, Utah State University B.S. Agronomy and Chemistry, Utah State University	39
Richard C. Maurer	Parsons Engineering Science	M.S. Civil Engineering (Environmental), California State University, San Jose B.S. Mechanical Engineering, California State University, Long Beach	18
Peter Menth	Harland Bartholomew & Associates	B.S. Fisheries & Wildlife Biology, University of California, Davis	3
Doug Moore	West Yost & Associates	M.S. Civil Engineering, University of California, Davis B.S. Geology, University of Oregon	3
Kevin Needham	Parsons Engineering Science	B.S. Civil Engineering, New Mexico State University	3

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Randy M. Palachek	Parsons Engineering Science	M.S. Aquatic Toxicology, Southwest Texas State University, San Marcos B.S. Fisheries Science, Texas A & M University, College Station	11
Dennis J. Papilion	Dames & Moore	B.S. Landscape Architecture, Colorado State University	10
Jeffrey H. Peters	Questa Engineering Corporation	M.S. Soil Science, University of California, Davis B.S. Resource Management, University of California, Davis	23
Sandia M. Potter	Parsons Engineering Science	M.S. Environmental Systems, Applied Geology, Humbolt State University	8
Adrian Praetzellis, Ph.D.	Sonoma State University Anthropological Studies Center	Ph.D. Anthropology, University of California, Berkeley M.A. Anthropology, University of California, Berkeley B.A. Anthropology, Sonoma State University	24
Joseph A. Ramos	Parsons Engineering Science	M.S. Architecture California Polytechnic State University, San Luis Obispo B.S. Natural Resources Management, California Polytechnic State University, San Luis Obispo	8
Joseph Richenberger	Parsons Engineering Science	M.S. Civil Engineering	30+
Ramona Robison	Harland Bartholomew & Associates	B.A. Botany, University of California, Davis	5

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
James C. Roth, Ph.D.	Merritt Smith Consulting	Ph.D. Limnology /Fisheries, University of Michigan M.S. Zoology / Limnology. Virginia Polytechnical Institute B.S. Biology, University of Wisconsin, Oshkosh	35
Carlos Victoria-Rueda, Ph.D.	Parsons Engineering Science	Ph.D. Environmental Engineering, Texas A & M University M.S. Biology, Texas A & M University B.S. Biology, University of Bogota, Columbia	12
Randall M. Schock	Parsons Engineering Science	B.S. Forestry and Natural Resources Management, California Polytechnic State University, San Luis Obispo	6
Bahman Sheikh, Ph.D.	Parsons Engineering Science	Ph.D. Soil Science, University of California, Davis M.S. Irrigation, University of California, Davis	29
Stephen Sheppard	EDAW	Ph.D. Environmental Planning, University of California, Berkeley M.S. Forestry, University of British Columbia, Vancouver. B.A. Agriculture and Forest Science, Oxford, England	20
Dave W. Smith, Ph. D.	Merritt Smith Consulting	Ph.D. Engineering Science, Applied Ecology, University of California, Berkeley	17
Randall D. Smith	Questa Engineering Corporation	B.S. Plant and Soil Biology, University of California, Berkeley	6

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Suzanne Stewart	Sonoma State University Anthropological Studies Center	M.A. Cultural Resources Management, Anthropology, Sonoma State University, B.A. Anthropology, Sonoma State University,	17+
Linda Stone	Parsons Engineering Science	M.S. Environmental Systems/Geology, Humbolt State University, California	13
Carl A. Tagler	W. L. Corpening & Associates		
Chuck Teller	Economic & Planning Systems	M.S. City & Regional Planning, University of North Carolina, Chapel Hill B.S. Conservation Resource Studies, University of California, Berkeley	9
Sydney A. Temple	Questa Engineering Corporation	B.S. Geology, University of California, Santa Cruz	7
Nicolas Trifiro	Harland Bartholomew & Associates	B.S. City/Regional Planning, California Polytechnic State University, San Luis Obispo	1
Jessamy Zagel Trisler	Parsons Engineering Science	B.S. Civil Engineering, Christian Brothers College, Memphis	8
Nannie R. Turrell	Parsons Engineering Science	B.A. Landscape Architecture, University of Oregon, Eugene	14
Kris Waltersdorph	Harland Bartholomew & Associates	B.A. English Literature, University of Washington	7
Theresa Fortner Ward	Sycamore Environmental Consultants	B.S. Biological Sciences, California State University, Sacramento A.S. Science, Yuba College, Linda	2

Table 1

List of Preparers

Name	Company	Degree(s)	Years Experience
Frank B. Wein, A.I.C.P.	Harland Bartholomew & Associates	M.A., Urban & Regional Planning, University of Southern California B.A. Urban Studies, California State University, Northridge	20
Dennis W. Worrel	Parsons Engineering Science	B.S. Range Management, Humboldt State University, Arcata	24
James A. Yost	West Yost & Associates	M.S. Civil Engineering, University of California, Davis B.S. Civil Engineering, University of California, Davis	22
David Ziegler	Ziegler Tech	M.S. Environmental Engineering, Stanford University B.S. Mechanical Engineering, Purdue University	22

APPENDIX C PUBLIC NOTIFICATION

TABLE 1: LIST OF INDIVIDUALS WHO RECEIVED THE SCOPING REPORT

William & Nancy Adams
Brenda Adelman
Ellen Akers
Bob Anderson
Elizabeth Anthony
David Asimov
Philip Badal
Tom Bahning
David Bannister
R E Bartley
Leon & Nadine Beck
Fred Beeman
Terry Bell
Kenneth & Vivian Bens Hower
Rosemary Benz
Clara & V N Berednarski
Phil Bertoli
Charles Bishop
Charles Black
Shepherd Bliss
Nichae Blume
Loretta Borges
Johanna Brandriff
Emmert Briggs
Ernie & Colleen Briggs
Virginia Broonback
John Brown
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David Burbank
Zach Burt
Sue Buxton
John Calomiris
Marci Camacho
Sarah Cameron
Andrew & Beverly Camozzi Jr
Richard Charter
Ellen & Chris Cheek
John Chiappe
Floyd Christensen
John Colomiris
Dean Cooley
Ed Cooper
Martin Coorpender
Kim Cordell
Doug Crae
Lynn Crescione
John Cummings
Suzanne Curtiss
Carole D'alessio
Zoe Dagan
Stan & Russell Denner
Gary Deweese
Duane Dewitt
William & Mary Diaz-Romero
Jim Dickinson
Mary & Eugene Donatelli
Maxim Durnez
Gene Dyrhaug
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H M Eichstaedt
Thomas Ells
Megan Eoyang
Lee Erickson
Erika Floric
Lawrence Foltzer
Hope Foote
Tom Foster
Ken Fox
Eric Fritsch
Rue Furch
Christian Gerike
Pauline Gilbert
Howard Gilstrap
Frank & Bea Glazier
Katherine Gledhill
Laura Graham
Charles Green
Mark Green
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Stan Griffin
Jim Groom
Betty Guggolz
Douglas Hackley
Alan Haramati
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Dennis Harter
Ellen Hawkins
Joel Hedgpeth
Hamilton & Margaret Hess
Brian Hines
James Hollibaugh
Tim Hollibaugh
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Wayne Hubbard
Brian Hunter
Kerrie Imperatria
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Bill Jahn
Geoff Johnson
Leigh Jordan
Michelle Julene
Michael Jump
Kathy Kenney-Baskin
Steve Klausner
Ben Kor
Bill Kortum
Margaret Kullberg
Jeanne Levin
Jerome Levine
Bill Linker

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Eli Lopez
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Monica Maguire
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Jeff Marmer
Ann Maurice
Georgianna Mccarty
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Robert Miller
Lou Molinari
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Krista Rector
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Susan Stompe
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Martin Strain
Jony & Marlene Strehl
Anne Strolecker
Eric Sunswheat
Len Swenson
E Barbara Taylor
Joe & Kathy Tresch
Ed Ueber
James Valtine
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Bill & Janet Walton
Elizabeth Whitmore
Pat Wiggins
Ken Wilson
Trish Wilson
Farrel Winter
Dale Wright
Denise Wright
Tom Yarish
Betty Young

TABLE 2: LIST OF INDIVIDUALS NOTIFIED OF THE DRAFT EIR/EIS AVAILABILITY

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Terese Abelli
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James & Yoko Acheson
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William & Nancy Adams
Ellen & Bill Adamson
Tom Adamson
Brenda Adelman
Ben Adelmann
Val Aggio
Ellen Akers
Ronald Akers
Donovan Akita
Edna Albertson
Americo Albini
Louis Albini
Shirley Albrecht
Angella Allard
Bobby Allen
Ladason Allen
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Ray Ankaitis
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Elizabeth Anthony
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John Azevedo
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Burch Bachtold
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Bruce Baird
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John & Terri Balletto

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David Bannister
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Lois Barclay
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Carolyne Baresin
Carole Barlas
Carole Barlas
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Verna Beatty
Tony Beaudoin
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Steve Beck
R W Beck & Associates
Lynette Becker
Laura Beckman
Fred Beeman
Freda Beffia
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Ezelina Belford
Nancy Beliveau
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Clinton Bell
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Joel Bellagio
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Aduardo & Louisa Bello
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Rick Bennett
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Tom Crane
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Carole D'alessio

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Maron Danon
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Grant Davis
Jeff Dawson
Alan Day
Dick Day
Julian Day
Salvstore Day
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Sara Devlin
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Lawrence Foltzer
Calvin Fong

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Ethan Foote
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Chris Garcia
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Miguel Garcia
Rosalio & Elvira Garduno
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Linda Good
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Margret Graham
Andrea Granahan
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Richard & Faith Gray
Anna Green
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Forrest Green
Margaret Green
Mark Green
Russell Green
Sid Greenberg
M Alexander Greene
Anne Greenfield
Devon Greensweig
Mary Greer
Louise Gregg
John Gregori
Martin Gregori
William Gregory
Jim Gremel
Peter Grenell
Chester Greppi
Martin Griffin
Stan Griffin
Robert Griffith
Florence Griswold
Carol Groo

Jim Groom
Ed Grossi
James Grossi
W H Groth
Gary Grutkowski
Lloyd Guccione
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Ritz Guggiana
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Bill Haigwood
Peter Hain
Clo Hair
Dave Hale
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Thomas & Theresa Hale Jr
Howard Hall
Joyce Hall
Sam Hall

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Louise Hallquist
John Hamann
Gail & David Hamilton
Jane Hamilton
Bonnie Hanchett
Elizabeth Hanlein
Marie Hannan
Stephen Hansel
Alvin Hansen
Dan Hansen
David Hansen
Fred Hansen
Alan Haramati
James Harberson
Bob Harder
G K Hardt
Tom Hargis
Ralph Harmon
Joe & Dorothy Harn
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Craig Harrington
Jerry Harrington
Mark Harrington
Leonard & Bernice Harris
Marsden Harris
Kathleen Harrison
John Hart
Kathryn Hart
Dennis Harter
Phyllis Hartley
Kay Hartman
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Cathy Harvey
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Eric Hauser
Lisa Havens
John Hawkey
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Eva Hawkins
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Merle Hayes
Frank Haymaker
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Constance Headrick
Virginia Hechman
Joel Hedgpeth
Allan Hedin
Bob Heffel
Gary & Mary Heil
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Maren Heinze
Barbara Heisler
Alan Helfen
Christie Heller
Rachel Helm
Sidney Hendricks
Dorothy Henning
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Herman Hernandez
Nadine Herold
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Merrill Herring
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Hamilton & Margaret Hess
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Tina Highnote
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Glenn Hill
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