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COUNTY OF SAN BERNARDINO

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Grounds Management
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TRANSPORTATION/FLOOD CONTROL-SURVEYOR
GIMS
WASTE SYSTEM DIVISION

March 7, 2000

VIA FACSIMILE AND FEDERAL EXPRESS

Mr. Jack Safely
Metropolitan Water District of Southern California
Water Resources Management Group
P.O. Box 54153
Los Angeles, CA 90054-0153

R3

Mr. James Williams
U.S. Bureau of Land Management
California Desert District
6221 Box Springs Boulevard
Riverside, CA 92507-0714

Re: Comments on DEIR/DEIS for Cadiz Groundwater Storage and Dry-Year County of San Bernardino's Supply Program (SCH No. 99021039)

Dear Messrs. Safely and Williams:

This letter is submitted on behalf of the County of San Bernardino ("County"), and provides comments regarding the Draft Environmental Impact Report/Draft Environmental Impact Statement for the Cadiz Groundwater Storage and Dry-Year Supply Program ("DEIR/DEIS"). In particular, these comments primarily address the insufficiency of the DEIR/DEIS to support any decision by the Metropolitan Water District of Southern California ("MWD") and the Bureau of Land Management ("BLM" to proceed with the Cadiz Groundwater Storage and Dry-Year Supply Program ("Cadiz Project" or "Project"). The County appreciates this opportunity to comment on the DEIR/DEIS.

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The County has several areas of concern with the proposed project. These were initially identified in the County's comment letter dated March 29, 1999 on the Notice of Preparation/Notice of Intent for the DEIR/DEIS. The County would again like to restate that it is particularly concerned with the proposed extraction of indigenous (native) groundwater from the aquifer that underlies the project site. The County's General Plan Goals and Policies seek to promote sound groundwater practices and protection of the groundwater resource through the application of principles of sustained safe yield and protection of groundwater quality. The issues addressed by the General Plan are at the very heart of the matter regarding this project. R3-1

The County has devoted considerable time and effort in the review of the DEIR/DEIS for the Cadiz Project, including the use of outside technical experts to assist in the review. As you know, the County has also met with MWD and Cadiz Inc. representatives on several occasions. Based on a thorough review by both County staff and its technical experts, the County has concluded that the technical analysis used to support assertions in the DEIR/DEIS regarding groundwater recharge is fundamentally flawed. Because the issue of natural recharge provides the underpinnings of the part of the project related to extraction of native water, the County believes that the flawed technical analysis for this part of the project renders the document inadequate for compliance with both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). R3-2

At the outset, it should be noted that County representatives and its technical consultants have been meeting with MWD representatives and its technical consultants in an effort to develop and agree upon an appropriate groundwater management and mitigation plan together with a Memorandum of Understanding (MOU), by and between the County and the MWD which would ensure that the groundwater management and mitigation measures are implemented. The County anticipates that the concerns and R3-3

comments set forth in this letter will be appropriately addressed and resolved with the development of an agreed upon groundwater management and mitigation monitoring plan. If so, and other non-water mitigation measures are forthcoming, the County anticipates that its technical objections will be addressed. However, since these objectives have not yet been achieved, it is necessary to communicate the full scope of the County's concerns. R3-3

The technical analysis conducted by MWD relies on a methodology that the consulting firm of GeoScience used to validate groundwater recharge estimates. It overestimates natural recharge based on inappropriate methodology and errors in the generation of rainfall infiltration rates to groundwater. The resulting calculations by have overestimated natural recharge in the arid environment where the project is located. Separate, independent review by the U.S. Geological Survey, Desert Hydrology Study Team on behalf of the BLM and the Natural Park Service (NPS), concluded that natural recharge was overestimated by GeoScience by a range of five (5) to twenty-five (25) times greater than that which occurs in desert groundwater basins elsewhere in the Mojave Desert and in Nevada and Arizona. The County's technical expert team has independently reached similar conclusions. The erroneous assumption, of approximately 30,000 acre-feet per year of natural recharge used in this DEIR/DEIS, therefore fundamentally invalidates the stated conclusions of no impact. R3-4

The attached detailed comments point out the technical flaws in the water resources section, while other comments address various conclusionary statements, which are based on the invalid conclusions presented in the water resources section, and which appear throughout the document. In addition to the technical critique of the groundwater analysis, additional comments are offered on other sections of the document in an attempt to assist the MWD and the BLM in developing an DEIR/DEIS that could ultimately be revised to produce an environmental assessment that could meet the test of adequate R3-5

disclosure and analysis that is consistent with the statutes, regulations and case law for CEQA and NEPA. R3-5

The County's major concerns are summarized as follows: R3-6

1. The descriptions of the project, project objective, and the purpose and need for the Cadiz Project are often confusing, misleading, incomplete, and insufficient for informed decision-making, and therefore, are not adequate for the purposes of the CEQA or the NEPA.

2. The discussion of alternatives and the feasibility of alternatives is not adequate to comply with CEQA and NEPA. R3-7

3. The DEIR/DEIS fails to adequately analyze the full range of potential impacts of the Cadiz Project. In this regard, the DEIR/DEIS overstates the amount of recharge that will occur in the area of the Cadiz Project. As a result, the DEIR/DEIS underestimates the extent of the impacts on the environment of extraction of water from the Cadiz Project, and is inadequate for purposes of CEQA and NEPA. Further, the DEIR/DEIS fails to fully consider the growth inducing impacts of increasing the water supply. R3-8 R3-9

4. The DEIR/DEIS fails to adequately explain the mitigation measures that are proposed to eliminate significant impacts on the environment. In this regard, the DEIR/DEIS makes reference to a Mitigation Monitoring Plan, which will be adopted in conjunction with the findings required under CEQA, at the time MWD's Board considers certification of the Final EIR. However, this Mitigation Monitoring Plan is not set forth in the DEIR/DEIS, although collaborative efforts have been made to develop one, and are R3-10

still on-going. At this time, however, the DEIR/DEIS is insufficient for informed decision-making and not adequate for purposes of CEQA and NEPA. R3-10

More detailed discussion of the foregoing concerns, plus additional comments, are attached hereto as Attachment 1. These comments are organized as general comments on each chapter of the DEIR/DEIS, followed by specific comments on each chapter. These comments are based, in part, upon a thorough review and analysis of the DEIR/DEIS performed by hydrology and hydrogeology experts retained by the County to review the DEIR/DEIS. (Copies of the comments prepared by these experts are attached hereto as Attachment 2, and are incorporated herein by reference.)

Although the County has identified some technical issues with the "storage" portion of the project, we believe that storage alone should be considered by MWD contingent upon its own economic feasibility analysis. The DEIR/DEIS leads the reader to conclude that, based on the evaluation of a storage only operational scenario, this alternative is not cost effective, although verbal indications to the contrary have been offered by MWD project managers. R3-11

The DEIR/DEIS has proven to be deficient as an informational document. The DEIR/DEIS fails to provide an accurate and adequate description of the Project. In addition, the DEIR/DEIS particularly fails to identify and discuss numerous significant impacts to groundwater resources, and fails to consider a reasonable range of alternatives designed to avoid or reduce the Project's significant environmental impacts. As demonstrated by the foregoing comments, significant new information should be added to the DEIR/DEIS before it complies with the requirements of CEQA and NEPA. As a result of these flaws to the R3-12 R3-13

DEIR/DEIS, the document should be withdrawn, amended, and then recirculated for further public review and comment in accordance with the requirements of CEQA and NEPA.[1] R3-13

The County appreciates your consideration of these comments.

Cordially yours,

JOHN GOSS
Assistant County Administrator

[1] As previously noted, the County anticipates that it will be able to reach an agreement (MOU) with the MWD which provides for the implementation of an appropriate groundwater management and mitigation plan. If an agreement is reached, the County anticipates that its objections will be addressed.

ATTACHMENT 1

I. SECTION 2.0: ASSESSMENT OF PROJECT NEED AND PURPOSE

R3-14

Under NEPA's requirements, the "purpose and need" section of an EIS shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." (40 C.F.R. §1502.13.) Courts have upheld the "purpose and need" section of an EIS where it is reasonable. (*See Muckleshoot Indian Tribe* v. *U.S. Forest Service* (9th Cir. 1999) 177 F.3d 800, 813; *Carmel-By-The-Sea* v. *U.S. Dept. of Transp.* (9th Cir. 1997) 123 F.3d 1142, 1155; *Citizens Against Burlington* v. *Busey* (1991) 938 F.2d 190, 196.) However, project goals may not be too narrowly defined. "The stated goal of a project necessarily dictates the range of reasonable" alternatives and an agency cannot define its objectives in unreasonably narrow terms." (*Carmel-By-The-Sea, supra,* at p.1155, *citing Citizens Against Burlington, supra,* at p. 196; *see also Simmons* v. *United States Army Corps. of Engineers* (7th Cir. 1997) 120 F.3d 664, 670 [vacating a dam permit where the Army Corps. of Engineers unreasonably defined the general need and purpose of the subject overall water supply project].)

Like *Simmons,* the DEIR/DEIS violates NEPA because the narrow description of the project purpose and need excludes viable alternatives. As the court did in *Simmons,* the County has "read between the lines" in determining how the purpose and need are defined in the DEIR/DEIS for the Project. On the one hand, the DEIR/DEIS states the project need is "to meet part of the need for supplemental dry-year supply in Metropolitan's six-county service area. . . ." (DEIR/DEIS, at p. ES-2.) On its face, this purpose is reasonable and laudable. However, later in the DEIR/DEIS, the general need is qualified by five "screening criteria" (DEIR/DEIS, at p. 3-11.) The effect of these criteria is to eliminate ten out of the thirteen potential alternatives, leaving only four alternatives -- all variations of the water storage and indigenous groundwater extraction project. (DEIR/DEIS, at p. 4-2.) As discussed below regarding the alternatives analysis, this subtle narrowing of the purpose and need of the project assured that some form of the indigenous groundwater extraction project would result from the screening criteria. This self-fulfilling prophecy is precisely the sort of mischief that the *Simmons* case disallowed

R3-14

because it violates NEPA and its implementing regulations, 40 C.F.R. §1502.13 and 1502.14.

R3-15

II. SECTION 3.0: FORMULATION AND EVALUATION OF ALTERNATIVES

A. General Comments

Under CEQA, an EIR must provide a selection and discussion of alternatives that foster informed decision-making and informed public participation. The alternative discussion must contain a range of reasonable alternatives that could feasibly attain the project's basic objectives. (Pub. Res. Code § 21100(d); CEQA Guidelines, § 15126(d).) CEQA requires that an EIR describe a reasonable range of alternatives to the proposed project, or to the location of the project. (CEQA Guidelines, §15126(d); *Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553, 556.) "One of [an EIR's] major functions . . . is to ensure that all reasonable alternatives to proposed projects are thoroughly assessed by the responsible official." (*Id., citing Wildlife Alive* v. *Chickering* (1976) 18 Cal.3d 190, 197; accord *Laurel Heights Improvement Assn.* v. *Regents of the Univ. of California* (1988) 47 Cal.3d 376, 400; *Bowman* v. *City of Petaluma* (1986) 185 Cal.App.3d 1065, 1083-1085.) The burden of identifying and evaluating alternatives rests with the agency, not the public. (*Laurel Heights,* 47 Cal.3d at 405-406.)

The alternative discussion must focus on alternatives that either eliminate adverse impacts or reduce them to insignificance, even if they would to some degree impede the project's objectives. (CEQA Guidelines, §15126(d)(3).) Thus, an EIR's alternatives should be developed to "avoid or substantially lessen" a project's significant environmental effects. (Pub. Resources Code, §21002; CEQA Guidelines, §15226(d)(5).)

An EIR's consideration of a reasonable range of alternatives to the project, or to the location of the project, must focus on alternatives which: (1) offer substantial environmental

advantages over the project proposal (Pub. Resources Code, §21002); and (2) may be feasibly accomplished in a successful manner" considering the economic, environmental, social and technological factors involved. (Pub. Resources Code, §21061.1; CEQA Guidelines, §15364.) The range of alternatives must be sufficient "to permit a reasonable choice of alternatives so far as environmental aspects are concerned." (*San Bernardino Valley Audubon Society* v. *County of San Bernardino* (1984) 155 Cal.App.3d 738, 750.)

R3-15

As demonstrated below, the DEIR/DEIS's discussion of alternatives fails to meet the requirement of a reasonable range of alternatives that lessen the Project's significant environmental impacts. The DEIR/DEIS's failure to include a reasonable range of alternatives limits informed decision-making and informed public participation. Further, the DEIR/DEIS fails to adequately explain how some of the evaluating criteria were measured and weighted to identify the preferred alternative.

R3-16

The presentation of alternatives to the proposed project is a confusing and convoluted explanation that results in what appears to be a pre-destined, "self-fulfilling prophecy" approach to identifying the Preferred Alternative to meet the requirements of NEPA. Section 3.9, "Selection of the Preferred Alternative," in fact, identifies what appears to be merely a preferred route option, "the Eastern Alternative" (at page 3-40) rather than explicitly identifying what is in fact, the combined Cadiz Storage and Transfer Project as the Dry-Year Supply Preferred Project Alternative. Section 3 lays out a confusing process of alternative formulation and evaluation that includes three "steps," two "phases," a sub-process of "screening-level alternatives" and evaluation criteria with quantitative weights assigned. The "phased" analysis was further complicated with the introduction of nine possible operational scenarios which consider varying combinations of combined storage and transfer. Prior to completing a full evaluation of the alternatives "carried forward for detailed analysis," the DEIR/DEIS mysteriously combines the only two individual project-level alternatives that are presented in a forthright manner. The third project-level alternative that was carried forward

R3-17

R3-18

for detailed evaluation was, in fact, dismissed from detailed evaluation. The Storage Project and the Transfer Project were inexplicably merged into a single project alternative without the benefit of, ostensibly, the more rigorous evaluation that was applied to the pipeline routine options, i.e., the Eastern Alternative, the Western Alternative and the Combination Alternative. R3-18

This section of the DEIR/DEIS presents an elaborate process that is fatally flawed because it relies on the pre-determined conclusion that there is approximately 30,000 acre-feet per year of natural recharge to the basin. The Storage and Transfer Alternatives were combined under the assumption that the analysis of project impact to groundwater resources was not significant and based on the unknown economic criteria that MWD used to evaluate the operational scenarios (at page 3-19). The action combining these two alternatives into one functional alternative, thereby eliminating a detailed evaluation of each of the alternatives, is not explained and appears arbitrary. Each of the two alternatives, the Storage Project and the Transfer Project, should have been evaluated as separate stand alone alternatives – just as was implied in the text contained in Section 3.5.4 (at page 3-16). This constitutes a substantial deficiency in the DEIR/DEIS. R3-19

The assessment presented in this section is incomplete and deficient for at least two reasons: first, the formulation of alternatives includes an irrational incorporation of an offsite alternative (Hayfield), which is coincidentally the only viable offsite alternative, that has already undergone separate CEQA review and is currently being implemented; and second, the use of an evaluation process that appears to be based on criteria that include a fatal and flawed environmental determinate of project feasibility, specifically hydrologic impacts on the natural groundwater regime. R3-20 R3-21

The DEIR/DEIS incorrectly discusses the Hayfield project in an attempt to meet the regulatory requirement of alternatives formulation. The implication is that Hayfield can substitute for the proposed project to reduce project impacts when it is presented in Section 3.4 at page 3-5. However, an inexplicable contradiction appears further in the R3-22

document at page 3-17 (Section 3.5.4, "Alternatives Carried Forward for Detailed Analysis"), the DEIR/DEIS indicates that "The environmental effects of the Hayfield Project have been analyzed in a separate document and the Hayfield Project is currently being implemented." The DEIR/DEIS states (at page 3-16) that "three alternatives were carried forward for project-level formulation and evaluation." This is patently misleading in that the Hayfield Project is immediately dismissed on the following page as being assessed in a separate document and presently being implemented. The approach used in the DEIR/DEIS which addresses the Hayfield Project as both a project alternative and as a project that is considered as closely related, past, present and reasonably foreseeable future projects defies reason. The Hayfield Project appears to be nothing more than a "strawman alternative" that is either deceptive or meaningless or both. What is most disturbing about the treatment of the Hayfield Project is that it is the only offsite alternative that was presented by MWD as having any merit. R3-22

The result of this flawed analysis is that only two groundwater supply alternatives received detailed evaluation, specifically, the Cadiz Groundwater Storage Project and the Cadiz Valley Dry-Year Transfer Project.

B. Specific Comments

Section 3.1

R3-23

Initially, MWD considered proposals received by MWD from various public agencies to develop the alternatives available for meeting MWD's objectives. As discussed above, the burden of identifying alternatives rests with the agency, not the public. (*Laurel Heights*, 47 Cal.3d at 405-406.) Therefore, MWD has the responsibility to identify other alternative methods of meeting its water supply objectives. Because

R3-23

MWD failed to develop its own alternative methods of meeting its water supply objectives, the DEIR/DEIS's consideration of alternatives is inadequate and incomplete.

Section 3.3

In the initial consideration of project objectives, MWD failed to identify as an objective MWD's goals of providing a water supply through the year 2020. (DEIR/DEIS at p. ES-1; DEIR/DEIS at p. 1-5; DEIR/DEIS at p. 3-2.) In this regard, the DEIR/DEIS fails to consider whether the alternatives will meet this goal and MWD's consideration of the initial potential alternatives is inadequate.

R3-24

Section 3.7.1

R3-25

The DEIR/DEIS states that only one site is feasible for the location of spreading basins and wellfield. In this regard, the DEIR/DEIS fails to adequately consider alternative locations for the spreading basins and wellfield, and the consideration of alternatives is, therefore, inadequate. MWD independently determined the most feasible site for the spreading basins and wellfield, without fully disclosing to the public what the alternative sites are and without full analysis in the DEIR/DEIS of the impacts of using alternative sites. Even though the DEIR/DEIS identifies three potential sites for the spreading basins and wellfield, the DEIR/DEIS concludes that the Fenner Valley is the best location for the spreading basins and wellfield without including a complete analysis of desirability or the environmental impacts of this site. The public, therefore, is unable to evaluate whether the Fenner Valley is indeed the most desirable location for the spreading basins and wellfield. For example, the public is not informed of the relative recharge rates of various spreading basin locations, or of the geologic and hydrologic characteristics of alternative spreading basin locations. Because the DEIR/DEIS fails to analyze alternative locations of the spreading basins and wellfield, it contains an

R3-25

inadequate analysis of the alternative sites available for the spreading basins and wellfield.

Section 3.7.2

R3-26

The DEIR/DEIS also concludes, without sufficient analysis, that only two pumping station sites are desirable. As discussed above, regarding section 3.7.1, this determination that only two pumping sites are feasible is made without a complete analysis, and the public is unable to determine if these two locations are in fact the only feasible alternatives. The discussion of alternative pumping stations is incomplete to allow the public to analyze the impacts of the various alternatives.

Section 3.7.5

R3-27

This section discusses the detailed evaluation of project-level alternatives by identifying 27 parameters used for quantitative evaluation of the practicability and environmental/social impacts of each alternative. However, several of these 27 parameters are not adequately explained, and fail to inform the public of how the parameter was measured to assess impacts.

The DEIR/DEIS's description of how particular parameters of the project level alternatives were measured is inadequate. The DEIR/DEIS fails to explain the methods used to evaluate these parameters, and the public, therefore, cannot evaluate whether these parameters were adequately considered, and whether the impacts of each alternative on these parameters was properly analyzed.

Section 3.8.3

See discussion below regarding Section 4.8.

III. SECTION 4.0: DESCRIPTION OF PROJECT ALTERNATIVES

A. General Comments

R3-28

The discussion of the No Action Alternative is inadequate for purposes of CEQA. The No Action Alternative provides the environmental baseline from which to evaluate the Project and alternatives. The No Project Alternative must include two components. First, it must include an analysis of existing environmental conditions. (CEQA Guidelines, § 15126(d)(4).) CEQA requires comparison with pre-project conditions to provide a uniform baseline for assessing the project's impacts. (*County of Inyo v. City of Los Angeles* (1981) 124 Cal.App.3d 1, 9.) Second, the No Action Alternative must include a discussion of what would reasonably be expected to occur under existing plans in the foreseeable future if the project is not approved. (CEQA Guidelines, § 15126(d)(4).) The DEIR/DEIS's discussion of the No Action Alternative is inadequate because it does not fully discuss existing environmental conditions, and is not described in sufficient detail.

B. Specific Comments

Sections 4.2.3, 4.3.3, and 4.4.3

R3-29

With regard to the description of construction of the water conveyance facilities for each alternative, the DEIR/DEIS states that "general assumptions were made about the soil/rock material type, extent of groundwater infiltration and special facilities." (DEIR/DEIS at pp. 4-7, 4-14, 4-21.) However, the DEIR/DEIS does not disclose what the general assumptions are. Therefore, the public is not adequately informed of the

nature and extent of the impact of construction of the water conveyance facilities on the surrounding environment. The DEIR/DEIS does not fully explain the assumptions made when evaluating construction of the water conveyance facilities, and is therefore inadequate. R3-29

Section 4.6.1

See discussion above regarding Section 3.7.1.

Section 4.6.2

See discussion above regarding Section 3.7.1.

Section 4.8

CEQA requires that the No Action Alternative include an analysis of existing environmental conditions. (CEQA Guidelines, § 15126(d)(4).) In this regard, the No Action Alternative does not discuss existing environmental conditions, but instead only discusses what may occur if the Project is not approved. The discussion of the No Action Alternative is, therefore, inadequate for purposes of CEQA. R3-30

IV. SECTION 5.0: AFFECTED ENVIRONMENT, IMPACTS AND MITIGATION

Section 5.1 R3-31

The DEIR/DEIS is deficient for its failure to disclose and evaluate groundwater withdrawals and potential significant groundwater declines associated with the ultimate

buildout of 9,600 acres of agricultural designated land owned by Cadiz Inc. The DEIR/DEIS acknowledges that the County certified an EIR in 1993 and approved a project [a General Plan Amendment(sic).] that could allow up to 9,600 acres of agricultural development in the Cadiz Valley. The DEIR/DEIS is inadequate; however, due to its failure to identify and disclose the groundwater consumption associated with full implementation of the agricultural project. For example, the DEIR/DEIS ignores the basic project impacts of prolonged groundwater withdrawals to support the irrigation of agricultural crops. The 1993 certified EIR also disclosed that a wide range of natural recharge estimates exist for the underlying aquifer. The lower end of the range was 1,500 acre-feet per year (AYF) of recharge compared to the 20,000 (AYF) asserted by Cadiz Inc. The current recharge reported in the DEIR/DEIS, 30,000 AYF is 50% more than that asserted by Cadiz in 1993. The County's 1993 EIR found that significant impacts to groundwater could occur at full agricultural production which would consume an estimated 40,000 AFY. The lack of disclosure and analysis of the combination of agricultural withdrawals and MWD withdrawals renders the conclusion at page 5-6 and 5-7 regarding impacts to agriculture inaccurate.

R3-31

The DEIR/DEIS at page 5-6 discloses only the current level of groundwater used by Cadiz Inc. and ignores the future needs of the agricultural operation as additional land is cultivated and irrigated. The DEIR/DEIS is misleading when it states that the withdrawal of indigenous groundwater for use by MWD is not anticipated to have a significant adverse impact on the availability of water for *existing* agricultural operations but then ignores the level of operation contemplated in the 1993 DEIR. The proposed extraction of indigenous groundwater for the Transfer Project could compound the effects of the agricultural operation thereby rendering future agriculture infeasible. The potential for significant overdraft of the groundwater basin by the combination of extractions of indigenous groundwater by both operations is a flaw in the analysis of potential impacts on agriculture.

R3-32

Section 5.2

Land Use, Planning and Policies. The County disagrees with the conclusion that there are no impacts to land use, planning and policies with regard to agricultural land uses in the Cadiz Valley. The discussion above demonstrates the failure to consider and analyze the impacts to groundwater resources from the Transfer Project, when combined with those identified for the agricultural development. Based on this lack of impact assessment and the questionable natural groundwater recharge rates estimated in the groundwater modeling performed by GeoScience, the proposed MWD project clearly causes potential significant impacts that are contrary to the County's General Plan "Natural Resources (Water) Management Policies" referenced by the DEIR/DEIS at page 5-15. The aforementioned impacts are inconsistent with the County's goals and policy to "Provide a balanced hydrological system in terms of withdrawal and replenishment of water from groundwater basins" (cited at page 5-15). The project will exceed the Threshold of Significance for the threshold of "Conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project (including, but not limited to General Plan, Specific Plan or Zoning Ordinance) adopted for the purpose of avoiding or mitigating an environmental effect" (ibid).

R3-33

R3-34

R3-35

The DEIR/DEIS also fails to acknowledge the indirect impacts to agricultural land uses caused by the substantial overdraft of native groundwater. The secondary effect of significant overdraft could either reduce water supplies for irrigation or it could cause a reduction of cultivated lands that would otherwise occur but for the MWD Transfer Project. The deficient impact analysis and inadequately substantiated conclusions regarding impacts to land use, planning and policies, renders the DEIR/DEIS inadequate.

R3-36

Section 5.4

R3-37

Topography, Geology, Seismicity and Soils: See Comments from Dr. John Foster, Professor of Geology, Cal State Fullerton, and Mr. Timothy J. Durbin, Consultants to San Bernardino County in the "Comments on Draft EIR/EIS Cadiz Groundwater Storage Project Cadiz and Fenner Valleys, San Bernardino County, California", February 21, 2000, which is attached hereto and incorporated herein by reference.

Section 5.5

A. General Comments

R3-38

Water Resources. The DEIR/DEIS is inadequate because it over-estimates the rate of natural groundwater recharge, which results in an inaccurate analysis of the impacts of the Project on water resources. As a result of this over-estimation, the DEIR/DEIS fails to disclose that the projected export of the indigenous groundwater will exceed the natural recharge of the basin, and will result in declining groundwater levels.

In addition, the DEIR/DEIS's discussion of mitigation measures to reduce the environmental impacts to a level of insignificance is inadequate and incomplete.

R3-39

B. Specific Comments – In addition to the comments found below, see "Comments on Draft EIR/EIS Cadiz Groundwater Storage Project Cadiz and Fenner Valleys, San Bernardino County, California", February 21, 2000, prepared by Dr. John Foster, Professor of Geology, Cal State Fullerton, and Mr. Timothy J. Durbin, consultants to San Bernardino County which is attached hereto and incorporated herein by reference.

R3-40

Section 5.5.1

The DEIR/DEIS states that groundwater recharge occurs from both surface runoff and percolation of precipitation. (DEIR/DEIS at p. 5-80.) However, the U.S. Geological Survey in the desert areas of Nevada has studied the recharge from the direct infiltration of precipitation extensively. Applying the method developed for estimating the proportion of precipitation that eventually becomes groundwater recharge to the Cadiz Project, the groundwater basin yields a natural groundwater recharge of a range of 1,000 - 10,000 AF, or an average of 5,000 acre-feet per year. This is considerably less than the value assumed in the DEIR/DEIS. R3-41

The Project proposes to export 2 million acre-feet of indigenous groundwater. (DEIR/DEIS at p. ES-5.) Assuming this 2 million acre-feet will be exported over the 50 year life of the Project, this is equivalent to an average annual export of 40,000 acre-feet per year over the Project life. If the natural recharge is 5,000 acre-feet per year, as discussed above, the project will export 1.75 million acre-feet of water in excess of the natural recharge, which will result in significant groundwater level declines. Due to the inaccurate estimate of the natural groundwater recharge, the DEIR/DEIS fails to accurately analyze the impacts of the Project on groundwater levels.

Section 5.5.3

R3-42

The groundwater model developed by MWD is inadequate and results in an improper assessment of the groundwater discharge to Bristol and Cadiz dry lakes. The natural recharge of the groundwater basin discharges as groundwater evaporation from the dry lakebed surfaces. However, this process is dependent on the groundwater levels beneath the dry lakebed surface. Under current conditions, the depth to the groundwater

table beneath Bristol and Cadiz dry lakes would be such that the cumulative lakebed evaporation would equal 5,000 acre-feet per year, i.e. the discharge would equal the natural recharge. The Project's groundwater exports would cause declines in the groundwater levels and gradually reduce the lakebed evaporation until it ceases. Cessation of lakebed evaporation occurs when the depth to the groundwater level is more than 10 feet below the lakebed surface. However, in the development of the groundwater model, the cessation of lakebed evaporation was assumed to occur at a depth of 100 feet. The model, therefore, is inadequate to evaluate the impacts of the Project on water resources. R3-42

Section 5.5.4

The discussion of impacts is inadequate for purposes of CEQA and NEPA. In this regard, the DEIR/DEIS states that the Project may impact various environmental resources, yet fails to fully evaluate these impacts. For example, the DEIR/DEIS states that the Project has the potential to impact the nearby community of Chambless and that such impacts are discussed later in the document. (DEIR/DEIS at p. 5.91.) The DEIR/DEIS, however, fails to describe those impacts in detail, and does not explain how the mitigation measures will affect those impacts. R3-43

The DEIR/DEIS also states that potential changes in groundwater quality may occur as a result of mixing Colorado River water with indigenous groundwater. (DEIR/DEIS at p. 5-94.) The DEIR/DEIS states that if undesirable levels of perchlorate, for example, are detected in the groundwater, the mitigation measures will be implemented, and therefore the impacts are not significant. (DEIR/DEIS at p.5-95.) However, implementing mitigation measures after undesirable levels of constituents are found does not reduce the impacts of the project to a level of insignificance. The proposed mitigation measures address the action that will be taken in the event a R3-44

significant environmental impact occurs, but do not render the impacts of the Project insignificant. R3-44

Section 5.7

Transportation: See memo from County Transportation/Flood Control Department attached hereto and incorporated herein by reference. R3-45

Section 5.8

Biological Rersources: See memo from the County Museum, Biological Sciences Section attached hereto and incorporated herein by reference. R3-46

Section 5.15

Cultural Resources: The Cultural Resources Section of the County Museum has reviewed this section of the DEIR/DEIS and concurs with the analysis, conclusions and mitigation. R3-47

Section 5.16

Paleontological Resources: See Comments from the County Museum, Geologic Sciences Section attached hereto and incorporated herein by reference. R3-48

V. SECTION 6.0: GROWTH INDUCEMENT IMPACTS R3-49

A. General Comments

The DEIR/DEIS is defective for its inadequate treatment of growth-inducing impacts. An EIR must include a separate discussion of the growth-inducing impacts of the project on the environment. (CEQA guidelines §15126(d).) Specifically, an EIR must:

> "Discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth (a major expansion of a wastewater treatment plant might, for example, allow for more construction in service areas). Increases in the population may tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. Also discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment." (CEQA Guidelines §15126.2(d).)

R3-49

As required by the Guidelines, the DEIR/DEIS does contain a separate section entitled "Growth Inducement Impacts" (Section 6.0). However, that section contains almost no substantive discussion of the growth-inducing impacts of the Project. Rather, Section 6.0 is substantially devoted to a description of various forecasts of area growth and development that had been made prior to the inception of the Project. The entire portion of the discussion that even pertains to the growth-inducing impacts of the Project, is comprised of conclusionary statements to the effect that the Project can have no growth inducing impact. This conclusion is patently false, both as a matter of fact and law. As a result, the DEIR/DEIS is totally deficient and fails to comply with both CEQA and NEPA.

R3-50

B. Specific Comments

Section 6.2

The DEIR/DEIS's analysis of the growth-inducing impacts of the Project is essentially comprised of: (1) a description of the background (i.e., pre-Project) growth/development forecasts of various public agencies (such as SCAG and SANBAG); and (2) a denial of the possibility that the Project could have growth-inducing effects. The DEIR/DEIS's treatment can be summarized by the following excerpts:

> "The growth projections [of SCAG and SANBAG] for Southern California anticipate and take into account the predictive adverse impacts of growth. In short, state and regional planning agencies project growth to occur despite shortfalls in water supply . . . SCAG and SANDAG [sic] implicitly recognize that the availability of infrastructure is not a primary factor that induces growth." (DEIR/DEIS at p.6-2.)

R3-50

> "[A]dvanced planning to meet projected needs of a growing population does not foster growth; its purpose is to ensure that existing levels of public service are not degraded as a result of growth." (Id.) "The Cadiz-Groundwater Storage and Dry-Year Supply Program responds to [SCAG and SANBAG] projections of growth and the anticipated demand for dry-year water supply . . ." (Id.)

> "The Cadiz Project would neither induce growth nor remove a constraint shown to limit growth." (DEIR/DEIS at p. 6-5.)

As these excerpts exemplify, the DEIR/DEIS treats the issue of growth-inducing impacts with a categorical denial of the general possibility of such impacts.

Sections 6.2-6.4

R3-51

Implicit to the above-referenced analysis is the further erroneous assumption that, as part of their growth forecasting activities, SCAG and/or SANBAG conducted some environmental review with respect to the subject forecasted growth/development, and that either of them ever exercised some kind of discretionary authority over it. The approach adopted by the DEIR/DEIS is contrary to law. The courts have squarely rejected the idea that a substantial increase in consumptive water supply is not an inducement to growth. "Making 17,000 a/yr. of water available for consumptive purposes removes a major barrier to growth and can virtually ensure development." (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, *citing City of Antioch v. City Council* (1986) 187 Cal.App.3d 1325, 1337.) The Project will make approximately 20,000 a/yr. available for consumptive purposes. Thus, whereas SCAG and SANBAG may have predicted continued regional growth and development, the Project "virtually ensures" it. However, despite this effect, if the Project is approved, no one will have analyzed the environmental impacts of the growth that it will assuredly induce. R3-51

The court in *County of Amador* considered and condemned a similarly defective process. There, the lead agency had approved a water project that was designed to meet an increased population, as was projected in a draft general plan. The court held:

> "Under the present scenario, no entity has contemplated the interrelationship of growth and water sources. Making 17,000 a/yr. of water available for consumptive purposes removes a major barrier to growth and can virtually ensure development. [Citation omitted.] By predicating a project on a draft general plan, without the benefit of a final expression of County policy, there is no guarantee that the inextricably linked issues of water supply and population growth will ever receive the appropriate environmental review. The County would have no reason to analyze what has become a nonexistent issue. Where, as here, there is a significant possibility, if not a probability, that there will be no analysis or

reasoned consideration of the adoption of a general plan that restricts growth to a level less than that which will require an additional 17,000 a/yr., which restrictions would require less water and perhaps effect a different impact on the environment, the CEQA process has been abused."
(*County of Amador v. El Dorado County Water Agency*, 76 Cal.App.4th 931.)

R3-51

As in *County of Amador,* CEQA and NEPA have been violated here because neither the MWD nor anyone else will have considered the environmental impacts associated with the growth and development that the availability of substantial supplies of new water makes inevitable. As a result, the DEIR/DEIS is legally defective and should not be certified.

VI. SECTION 7: CUMULATIVE IMPACTS

R3-52

The Cadiz Groundwater Project DEIR/DEIS is defective for its inadequate treatment of cumulative impacts. An EIR must include a separate discussion of the cumulative impacts of the project on the environment. CEQA guidelines §151 30

Unless cumulative impacts are analyzed, agencies tend to commit resources to a course of action before understanding its long-term impacts. Thus, a proper cumulative impacts analysis must be prepared "before a project gains irreversible momentum." *(City of Antioch v. City Council* (1986) 187 Cal.App.3.d 1325, 1333, citing *Bozung v. Local Agency Formation Commission* (1974) 13 Cal.3d 263,282.

As required by the Guidelines, the DEIR/DEIS does contain a separate section entitled "Cumulative Impacts" (Section 7.0). However, Section 7 completely misses the mark with regards to a meaningful assessment from a local context (the Cadiz-Fenner Valley). Instead of addressing the planned extraction of approximately 40,000 acre-feet

per year of local groundwater at full operational buildout by the approved agricultural operation of Cadiz Inc., the document erroneously states at pages 7-2 that "there are no locally planned, approved or reasonably anticipated land development projects in the vicinity of the Cadiz [Groundwater Storage, sic.] Project."" The fact that Cadiz Inc. is an acknowledged partner in the Cadiz Groundwater Storage Project, and that the 1993 EIR for the Cadiz Agricultural project was referenced in Section 5.2, "Land Use, Planning and Policies" at page 5-10, points to an obvious failing in this section to disclose the cumulative effect of the MWD Cadiz Groundwater Project when combined with the Cadiz Inc. agricultural operation. The failure to acknowledge the large amount of groundwater required to support the level of agricultural production addressed in the certified 1993 EIR is erroneous and appears to be an attempt to minimize the potential cumulative impacts on indigenous groundwater. The failure to disclose the potential extraction of native groundwater for agricultural purposes is further exacerbated by the substantial overestimates of natural recharge to the Cadiz Groundwater Basin. The conclusionary statements in Section 7.5.5, "Water Resources" asserting that the Cadiz Project would not cause any significant cumulative hydrologic impacts fails to recognize the potential impacts of the Cadiz Inc. agricultural operation, and are fundamentally flawed based on inaccurate methodology used in the hydrologic analysis reported in the technical appendices. These critical omissions result in a failure to analyze this potentially significant cumulative impact.

R3-52

R3-53

Similar to the section on growth inducement, the discussion in Section 7 is a superficial treatment of the cumulative impacts of the project from a regional context.. The DEIR/DEIS inappropriately limits the regional context to the "region of the Cadiz Project" (at page 7-1). The DEIR/DEIS states that "For purposes of cumulative analysis then, Metropolitan's Hayfield Groundwater Storage Project was considered the only other project in the region." (ibid) While we agree that the Hayfield project should be considered along with the Cadiz Project for assessment of its potential cumulative

impacts, the realm of cumulative issues goes far beyond the general area of the Cadiz-Fenner Valleys that the DEIR/DEIS has arbitrarily selected for analysis. The regional context, on the contrary, should include San Bernardino, Riverside and Imperial Counties, if not all of the Southern California area where MWD is implementing several regionally significant projects. The Inland Feeder Pipeline and the Eastside Reservoir are specific examples of regionally significant projects in San Bernardino and Riverside Counties that this DEIR/DEIS fails to acknowledge and consider in its cumulative impact analysis. R3-53

ATTACHMENT 2

"Comments on Draft EIR/EIS Cadiz Groundwater Storage Project Cadiz and Fenner Valleys, San Bernardino County, California", Prepared for: County of San Bernardino, February 21, 2000, Prepared by:Timothy J. Durbin, Timothy J. Durbin, Inc., and Dr. John Foster, Department of Geological Sciences, California State University, Fullerton R3-54

Interoffice Memo dated March 7, 2000 from Patrick J. Mead, P. E., Assistant Director Planning, Transportation/Flood Control Department. R3-55

Interoffice Memo dated February 22, 2000 from Robert L. McKernan, Senior Curator, Section of Biological Sciences, San Bernardino County Museum. R3-56

Interoffice Memo dated February 22, 2000 from Kathleen Springer, Senior Curator, Section of Geological Sciences, San Bernardino County Museum. R3-57

COMMENTS ON DRAFT EIR/EIS
CADIZ GROUNDWATER STORAGE PROJECT
CADIZ AND FENNER VALLEYS, SAN BERNARDINO COUNTY
CALIFORNIA

Prepared for:
County of San Bernardino
February 21, 2000

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COMMENTS ON DRAFT EIR/EIS
CADIZ GROUNDWATER STORAGE PROJECT
CADIZ AND FENNER VALLEYS, SAN BERNARDINO COUNTY
CALIFORNIA

Description of Project and the Environment

The Cadiz Valley Groundwater Storage Project is proposed to store water imported from the Colorado River through the Colorado Aqueduct. The imported water would be stored within the groundwater system that underlies Cadiz Valley. Water would be stored during periods of excess supply from the Colorado River. Subsequently, the stored groundwater would be extracted during periods of deficient supply from the Colorado River. Additionally, the project proposes to extract and export the natural groundwater supply of Cadiz Valley and adjacent Fenner Valley (Figure 1).

The Project facilities consist of recharge ponds, a pipeline, and wells. Recharge ponds would be used to infiltrate the water imported from the Colorado River. Water will be discharged into the ponds, where it will infiltrate into the pond beds and percolate downward to the groundwater table. These facilities will be designed to recharge as much as 145,000 acre-feet per year. Likewise, wells will be designed to extract as much as 145,000 acre-feet per year. The Project is proposed to extract groundwater in excess of the stored imported water. Over a 50-year period, the Project may extract 2 million acre-feet of groundwater in excess of the stored water. The excess withdrawal will be accommodated by more years of extraction and fewer years of recharging during the 50-year period.

The groundwater system that underlies Cadiz and Fenner Valleys occurs within alluvial deposits that have been derived from the erosion of the mountain ranges that surround the valleys. The Bullion, Bristol, Granite, Providence, New York, Piute, Old Woman, Iron, Coxcomb, and Sheep Hole Mountains are the principal ranges. These ranges form a topographically closed watershed that encompasses Cadiz and Fenner Valleys. The streamflow that is generated within the watershed flows not further than to either Bristol or Cadiz Lakes, which are dry lakes that occupy topographically low areas of the watershed.

The geologic formations that occur within the Cadiz-Fenner Valley watershed consist of consolidated rocks and alluvial deposits. The consolidated rocks form the mountain ranges, and underlie the valley-floor areas at depth. The alluvial deposits cover the valley-floor areas. The consolidated rocks include igneous, metamorphic, volcanic, and cemented sedimentary rocks. The alluvial deposits are unconsolidated, and include alluvial-fan and lake-bed deposits. The alluvial deposits are at least 1,500 feet in thickness, but locally may be considerably greater in thickness.

The alluvial deposits are the principal water-bearing formations within Cadiz and Fenner Valleys, and the Cadiz Valley Groundwater Storage Project proposes to store water in these deposits. Wells completed within the alluvial deposits yield 1,500 gallons

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per minute or more. However, the consolidated rocks practically are non-water-bearing formations, and wells completed in consolidated rocks generally have very low yields.

The source of groundwater within the alluvial deposits is the precipitation on the higher mountain areas within the watershed. Streamflow is generated from precipitation on mountain areas, and to a lesser degree on valley-floor areas. As the streamflow moves down a channel, part of the streamflow infiltrates into the streambed. Of the infiltrated streamflow, part evaporates from the streambed surface, but the remainder percolates downward to the groundwater table. While essentially no recharge occurs from the direct infiltration of precipitation on the valley-floor areas, some recharge does occur from the direct infiltration of precipitation on mountain areas. Recharge occurs in wet years when the infiltration exceeds the capacity of the native vegetation to consume the infiltrated water. Such recharge occurs in mountain areas because the precipitation in wet years is sufficiently high. Correspondingly, measurable recharge does not occur in valley-floor areas because the precipitation even in wet years is not sufficiently high. The average annual precipitation in the higher mountain areas ranges from 8 to 12 inches, but the average annual precipitation over most of the valley-floor area is less that 6 inches.

R3-58

In the absence of groundwater development, the natural recharge is balanced by discharge from the groundwater system. For the pre-development condition of the Cadiz-Fenner Valley groundwater system, the natural recharge discharges as evaporation from Cadiz and Bristol Lakes. The groundwater table beneath the lakes is near the lake-bed surface, and groundwater is discharged by evaporation from the lake-bed surface. Through capillarity, water rises from the groundwater-water table to the lake-bed surface. Depending on the texture of the lake-bed sediments, water can rise from several feet to as much as 10 feet above the groundwater table. Groundwater can rise higher in fine-grained sediments than in less fine-grained sediments. For a particular sediment and climatic condition, the evaporation rate at the lake-bed surface increases as the depth to the groundwater table decreases.

The balancing between natural recharge and discharge is accommodated by the depth to the groundwater table below the dry lakes. The recharge fills the groundwater system until groundwater evaporation occurs from the lake-bed surface. The groundwater table positions itself such that the evaporation from the lake-bed surface equals the natural recharge to the groundwater system. This is a long-term equilibrium state in which steady groundwater flows from the recharge areas to the discharge areas. Thus the long-term average groundwater discharge equals the average recharge. Additionally, long-term groundwater levels do not change, except for short-term fluctuations related to corresponding climatic variations.

With groundwater development, the pre-development equilibrium is disturbed. When groundwater is extracted and exported or consumed locally, the long-term effect is to reduce the natural groundwater discharge by evaporation from the Bristol and Cadiz Lake dry-bed surfaces. If the exportation or local consumption is less than the natural recharge to the groundwater system, the natural discharge will be reduced by the amount of the exportation or local consumption. Correspondingly, groundwater levels will be

lower than they were for the pre-development condition. However, after a transitional period measured in decades, a new equilibrium will be established. If the exportation or local consumption is greater than the natural recharge, the natural discharge will cease entirely. Additionally, groundwater levels will decline continually until the extraction ceases.

Given the principals described above, groundwater pumping from the Cadiz-Fenner Valley groundwater system, will have two environmental impacts. Firstly, groundwater levels will decline. Secondly, the natural groundwater discharge to the Bristol and Cadiz lake-bed surfaces will be reduced or eliminated. The consequences of these impacts depend on the location and magnitude of the extractions. If the extractions are large with respect to the natural groundwater recharge, the impacts will be widespread and large. The effect of reducing or eliminating the natural discharge from the lake-bed surfaces will be dried lake-bed sediments. The most likely consequence will be the generation of dust from the dried lake bed. The possible effect of widespread groundwater-level declines will be reduced spring discharges. Moyle (1967), Freiwald (1984), and Kohler (1983) identified a number of springs within the Cadiz-Fenner Valley watershed, which potentially could be impacted by groundwater extractions. R3-58

The Draft EIR/EIS does not address these issues. Nevertheless, they are critical issues with respect to assessing the environmental impacts of the Cadiz Valley Groundwater Storage Project. Until these issues are addressed, the draft assessment is substantially incomplete.

Natural Groundwater Recharge is Grossly Overestimated R3-59

The Draft EIR/EIS describes estimates of natural groundwater recharge that were prepared by GeoScience (1999). The estimates of the long-term average annual natural recharge have a range of about 20,000 to 70,000 acre-feet. However, in the development of a groundwater model, and the subsequent use of the model to evaluate the Project groundwater impacts, an average annual recharge of 50,000 acre-feet per year was used. In other words, the groundwater impacts of the Project are evaluated assuming that 50,000 acre-feet is the actual natural recharge. Because the assessment of impacts depends on the Project exports of native groundwater relative to the natural groundwater recharge, the recharge value used in the analysis of impacts is a critical assumption.

However, the recharge amount of 50,000 acre-fee per year is implausibly high. The true average annual natural groundwater recharge to the Cadiz-Fenner Valley groundwater system likely is in the range of 1,000 to 10,000 acre-feet, which represents the plausible range of possible actual recharge values. The expected average annual recharge is 5,000 acre-feet. The natural recharge used in the Draft EIR/EIS is 50 times larger than the lower end of the plausible range, it is 5 times the upper end, and it is 10 times the expected recharge.

My estimate of the actual recharge is based on the application of the Maxey-Eakin method for estimating natural groundwater recharge to desert groundwater basins. This is

a method that was developed collaboratively by the U. S. Geological Survey and the University of Nevada Desert Research Institute (Maxey and Eakin, 1949; and Maxey and Eakin, 1951). The method involves calculating the average annual recharge from the average annual precipitation on the mountain ranges enclosing the groundwater system. The precipitation on a typical mountain range varies with elevation. Precipitation is higher at a higher elevation than at a lower elevation. Correspondingly, contours of average annual precipitation over a mountain range tend to parallel the contours of elevation.

Based on the contours of average annual precipitation, the Maxey-Eakin method involves two steps. Firstly, the average annual volume of precipitation on the area bounded by particular contours is computed. For example, if the area between the contours representing 8 and 10 inches of precipitation is 10,000 acres, the volume of precipitation would be 7,500 acre feet, which is obtained by multiplying the acreage by the middle precipitation between the two contours. The middle precipitation is 9 inches or 0.75 feet. Secondly, the volume of precipitation is multiplied by the percentage of the average annual precipitation that is not consumed by vegetation or channel-bed evaporation. In the Maxey-Eakin method, the percentage is 3 percent. Correspondingly, the average annual natural groundwater recharge for the example is 225 acre-feet.

RB-59

Different percentages are applied to different precipitation ranges. The percentage is higher for a higher average annual precipitation. The particular percentages for the Maxey-Eakin method are listed in Table 1. For an average annual precipitation less than 8 inches, the percentage is zero, which indicates that essentially no groundwater recharge is produced from an area with such precipitation. For an average annual precipitation greater than 34 inches, the factor is 25 percent.

The percentages were developed by Maxey and Eakin (1949; and 1951) and Eakin and others (1951), but they have been refined by others over a 50-year period. The latest refinements have be made by Katzer and Donavan (2000) and Nichols (2000). The original and revised percentages were developed by calibrating the Maxey-Eakin method to groundwater basins for which the natural discharge and precipitation had been estimated with acceptable accuracy. With that information, the calibration process was to determine the percentages for different precipitation ranges such that the resulting Maxey-Eakin recharge best fit the estimated natural discharge. Over the years, the refinements to the Maxey-Eakin method have occurred, as better estimates of natural discharge have been made (Nichols, 1993; Nichols, 1994; Nichols, 2000; and Katzer and Donavan, 2000). A review of the reliability of the Maxey-Eakin method was made by Avon and Durbin (1994), which concluded that the method produced unbiased estimates of groundwater recharge with a coefficient of variation of about 30 percent.

The Maxey-Eakin method estimates the annual average groundwater recharge resulting from both the deep penetration of precipitation within the higher mountain-block areas and streamflow infiltration within valley-floor areas. Where the average annual precipitation on valley-floor areas is less than 8 inches the Maxey-Eakin recharge percentage is zero (Table 1). This is consistent with investigations within western Nevada

(Nichols, 1987; and Fisher, 1992), the Las Vegas area (Elzeftawy and Mifflin, 1984), and the Mojave Desert (Prudic, 1994). Additionally, more local work has been completed in Ward Valley, which is located immediately adjacent to Cadiz Valley. Ward Valley was the proposed site for the disposal of low-level radioactive waste. As part of the permit review for the Ward Valley site, a National Research Council committee examined whether groundwater recharge occurs from the direct infiltration of precipitation. The committee's conclusion was that significant recharge does not occur (National Research Council, 1995; and Mifflin, 1995).

Given the long acceptance of the Maxey-Eakin method, and its consistency with recent research results, I used the method to calculate the average annual natural groundwater recharge for the Cadiz-Fenner Valley watershed. The calculation was based on a map produced by GeoScience (1999) that shows contours of average annual precipitation for the watershed. The annual precipitation range is from less than 3 to slightly more than 12 inches. The acreages for one-inch precipitation bands are listed in Table 2. Additionally, the volume of average annual precipitation for each precipitation band, corresponding to the acreage in each band, is listed in Table 2. The total precipitation volume, on areas where the average annual precipitation is larger than 8 inches, is 170,000 acre-feet. The calculation was based additionally on the recharge percentages listed in Table 1, which indicates a recharge factor of 3 percent for precipitation in the range from 8 to 12 inches. The resulting average annual recharge is 5,000 acre-feet. However, Nichols (2000) suggests a recharge factor of about 1 percent. If that were the case, the resulting average annual recharge would be 1,700 acre-feet.

R3-59

GeoScience (1999) estimated the average annual natural recharge to be 50,000 acre-feet. While their report suggests a range of values, that is the value used to develop the groundwater model, which in turn was used to evaluate the groundwater impacts of the Project. The probability that the true recharge is actually 50,000 acre-feet is essentially zero. The implausibility of the higher recharge estimate is indicated by Figure 2, which shows the comparison of the GeoScience (1999) estimate with other recharge estimates. Handman and others (1990), Kirk and Campana (1990), Harrill (1980), Thomas and others (1989), and Dettinger (1989) used geochemical and groundwater-modeling methods to estimate groundwater recharge to basins within Nevada (Figure 3), and those estimates are plotted on Figure 2 with respect to the corresponding recharge estimate using the Maxey-Eakin method. Likewise, the GeoScience (1999) estimated of groundwater recharge is plotted on Figure 2. In contrast with the recharge estimates for other groundwater basins, the estimate of groundwater recharge by GeoScience (1999) for the Cadiz-Fenner groundwater system deviates significantly from its corresponding Maxey-Eakin recharge estimate. That deviation from the norm can be interpreted as indicating that either the Cadiz-Fenner watershed is fundamentally different from the Nevada basins or the recharge has been overestimated. The latter most likely is the case.

The Watershed Model was Applied so as to Produce a High Recharge Estimate

R3-60

GeoScience (1999) used a watershed model to estimate the natural recharge to the Cadiz-Fenner Valley groundwater system. The model was used to partition the precipitation on the watershed into runoff, evapotranspiration, and deep percolation. Using this modeling approach, the apparent assumption was made that the natural groundwater recharge equals the runoff plus the deep percolation. However, the treatment of the runoff in the analysis is unclear in the Draft EIR/EIS.

The assumption that all runoff becomes recharge is not valid for the Cadiz-Fenner Valley watershed. The runoff has three possible fates, and only one of those produces groundwater recharge. A significant component of runoff reaches Bristol and Cadiz lakes, where it evaporates. A component of runoff infiltrates into channel beds. Part of the infiltration is consumed by evaporation and other processes. However, some fraction of the infiltration becomes groundwater recharge. Consequently, even though GeoScience (1999) apparently assumed that all of the runoff becomes groundwater recharge, only part of the runoff actually becomes groundwater recharge. This is a critical conceptual omission in the development of the watershed model.

The assumption that all deep percolation becomes recharge is not valid for the Cadiz-Fenner Valley watershed. Deep percolation occurs within the mountain areas of the watershed. Where the precipitation is sufficiently high, the vegetation cover cannot consume all of the infiltrated precipitation, and the unconsumed portion of the precipitation percolates below the root zone. However, not all of that percolation becomes groundwater recharge within the valley-floor areas of the watershed. Owing to the hydrogeologic factors, the percolated water tends to move down the mountain slope. On the lower mountain slopes, especially where the slope is concave, the percolated water tends to come near the land surface of the mountain slope, where it is available for consumption by the vegetation cover. Consequently, only part of the initially unconsumed infiltration becomes groundwater recharge. This is a critical conceptual omission in the development of the watershed model.

The calculation of runoff within the watershed model is based on equations and parameter values taken from the County of San Bernardino hydrology manual. The hydrology manual was developed to regulate the design of stormwater facilities within the County. Accordingly, the focus of the manual is floodflows. Additionally, the floodflows computed using the procedures in the manual incorporate a safety factor, and the computed floodflows are larger than the expected value. Nevertheless, GeoScience (1999) uses the equations and parameter values from the hydrology manual to simulate both floodflows and the lower flows within the Cadiz-Fenner Valley watershed. This has the likely effect of over predicting average runoff.

The calculation of deep percolation within Cadiz-Fenner Valley watershed model involves subtracting the consumed soil water from the infiltrated water. A portion of precipitation infiltrates into the soil. A portion of the infiltrated water is consumed by the vegetation cover and other processes. The unconsumed soil water percolates below the

root zone. While the calculation of the deep percolation is mathematically simple, a considerable practical problem arises. The problem is that the consumption represent a large part of the infiltrated water, and small uncertainties in estimating the infiltration or consumption produce a large uncertainty in the estimate of deep percolation. For example, if the infiltration is represented by 100 units of water, the consumption would be perhaps 97 units of water. Correspondingly, the deep percolation would be 3 units of water. However, if the consumption were to be incorrectly estimated to be in error by about 10 percent or to be 87 units of water, the corresponding deep percolation would be 13 units of water. Consequently, a 10-percent error in estimating the actual consumption results in 430-percent error in estimating the deep percolation. R3-60

The watershed model as described in the Draft EIS/EIR is an unreliable tool for estimating the natural groundwater recharge for the Cadiz-Fenner Valley watershed. The model has deficiencies that would tend to overestimate the actual recharge. The model could be utilized if it were to be conceptually more complete and regionalized. Regionalization is the process of developing parameter values for the model that are applicable to the region surrounding the Cadiz-Fenner Valley watershed. This is accomplished by calibrating the model to a number of different watersheds where streamflow data has been collected, and then regionalizing the parameter values based on factors such as vegetation cover and geology.

A High Groundwater Recharge is not Supported by the Chloride Model

GeoScience (1999) used the chloride concentration in groundwater to estimate average annual recharge within the Fenner Valley. Because precipitation on the watershed is the source of the groundwater recharge, the source of chloride in groundwater is the chloride in precipitation. In the absence of physical or chemical sources or sinks for chloride within the watershed, the mass of chloride in the watershed precipitation is conserved within the groundwater system. Based on that conservation of chloride, GeoScience (1999) estimated the groundwater recharge by calculating the ratio of chloride in precipitation over the chloride in groundwater. That simple ratio represents the proportion of precipitation that becomes recharge. R3-61

This is a valid method (Dettinger, 1989), but it was misapplied to the Fenner Valley watershed. This is the case because chloride accumulates in the unsaturated zone of the valley-floor area (GeoScience ,1999). However, a critical assumption of the method is the absence of a chloride sink in the watershed. However, that assumption is not satisfied. The accumulation of chloride and other dissolved solids in the unsaturated zone has been observed in Cadiz Valley (GeoScience, 1999) and in neighboring Ward Valley (National Research Council, 1995).

Based on the chloride method, the Draft EIR/EIS reports groundwater recharge of 40,000 acre-feet per year for the Fenner Valley groundwater system. However, if the method had been applied correctly, the estimated recharge would have been about 2,000 acre-feet per year. Accordingly, the chloride method does not support a recharge of 50,000 acre-feet per year for the Cadiz-Fenner Valley groundwater system.

Groundwater Model is Invalid

A groundwater model was developed by GeoScience (1999) to assess the potential groundwater impacts of the Project. A groundwater model is a mathematical construct that represents the physics of groundwater systems in general, and particulars of a specific groundwater system. The model consists of a computer program and data files that are used as inputs to the computer program. The computer program represents the general physics of groundwater systems. The data files represent the particulars of the specific groundwater system being modeled. GeoScience (1999) used a computer program named MODFLOW, and they compiled data files to represent the Cadiz-Fenner Valley groundwater system. Using MODFLOW and the data files, they used the groundwater model to predict the future groundwater levels that would result from the operation of the Project.

R3-62

An important component of the development of a groundwater model for any groundwater system is the calibration of the groundwater model. Calibration is the process of making adjustments to a groundwater model such that the model reproduces historical conditions to some reasonable degree. The presumption is that a model that can reproduce past conditions can make reasonably accurate predictions of possible future conditions under some assumed scenario regarding the future. The implementation of the Project is such a scenario. The model calibration is analogous to the calibration of a market scale. An object of known weight is put on the scale, and the scale dial is adjusted such that it reads the known weight. Thereafter, if an object of unknown weight is placed on the scale, the scale will correctly indicate the weight of the object.

For the calibration of the groundwater model of the Cadiz-Fenner Valley groundwater system, the estimate of average annual natural recharge was used as the "object of know weight" in the model calibration. Based on an estimated annual recharge of 50,000 acre-feet, the representation of the groundwater transmissivity in the model was adjusted so that the model would reproduce the measured groundwater levels. The groundwater model then was used with the adjusted transmissivity to predict the groundwater levels that would occur with the implementation of the Project. The predictions were made with the assumption that, if the model could accurately reproduce historical conditions, then it could predict future groundwater levels with equal accuracy. However, the assumption is flawed, and the groundwater model cannot be used as a tool for evaluating project impacts.

The problem is the value of natural recharge used in the model calibration. An implausible recharge value of 50,000 acre-feet is used in the groundwater model. That leads to the assignment of implausible transmissivity values to the groundwater model, which in turn leads to implausible model predictions. The calibration process as conducted by GeoScience (1999) is equivalent to calibrating a scale with a 50-pound weight but assuming that the actual weight is 5 pounds. Clearly, a market scale calibrated as such cannot accurately weigh an object.

To demonstrate the inadequacy of the groundwater model developed by GeoScience (1999), I developed an alternative groundwater model. The groundwater model uses the computer program FEMFLOW3D (Durbin and Bond, 1998). The model is based on a mathematical formulation that allows an irregular geographic grid to represent a groundwater system. The grid for the Cadiz-Fenner Valley groundwater system is shown on Figure 4. Using a value of annual natural recharge of 5,000 acre-feet, the model was calibrated to fit groundwater levels listed by Moyle (1967), Koehler (1983), and Freiwald (1984). The resulting distribution of transmissivity is shown on Figure 5.

R3-62

The Draft EIR/EIS indicates that the Project will produce only small impacts on groundwater levels over the 50-year project life. However, the alternative groundwater model indicates the opposite. Using the alternative groundwater model to simulate Scenario 6, the change in groundwater levels resulting from the implementation of the Project is shown on Figures 5 through 13. These maps and graphs indicate that large regional changes in groundwater levels will occur throughout Cadiz and Fenner Valleys as a result of the Project. These results completely contradict those reported in the Draft EIR/EIS (GeoScience, 1999). The Draft EIR/EIS states that the long-term change in regional groundwater levels will be less than 1 foot below Bristol Lake. If the groundwater model developed by GeoScience (1999) had been correctly conceptualized and calibrated, the simulation results from that model would have been like those produced by the alternative model. Because it was incompletely conceptualized and incorrectly calibrated, the model simulations produce a meaningless assessment of the expected project impacts. Accordingly, the model simulations cannot be relied upon.

In previous work (Durbin, 1983; and Durbin, 1978), I have shown how errors in the estimate of groundwater recharge produce errors in the model predictions. The model calibration transfers errors in the recharge value into the model transmissivity. The resulting errors in the model transmissivity are then transferred into the predicted groundwater levels. Correspondingly, the reliability of the model predictions are linked to the reliability of the recharge estimate.

Project Impacts to Bristol and Cadiz Dry Lakes Inadequately and Incompletely Evaluated

R3-63

Under natural conditions, the groundwater recharge within the Cadiz-Fenner Valley watershed flows through the groundwater system and then discharges as groundwater evaporation for the Bristol and Cadiz lake-bed surfaces. That discharge in part maintains moisture within the lake-bed sediments. The moisture is maintained also by surface-water flooding, but the groundwater discharge most likely maintains a critical role. Additionally, groundwater may be the source of springs and may support phreatophytic vegetation. The occurrence of springs and phreatophytes along the margins of playas is a common occurrence, and it may be an occurrence near Bristol and Cadiz Lakes.

With groundwater development, the long-term effect of exporting native groundwater will be to reduce or eliminate the groundwater discharge to Bristol and Cadiz Lakes. This will have environmental impacts. Firstly, the lake-bed surface will dry, with the probable result that dust will be produced during winds. The Draft EIS/EIR does not address this possibility. Studies need to be conducted to develop an understanding of the drying that might occur and the effect that such drying might have on dust production. Secondly, if springs or phreatophytic vegetation occur along the lake-bed margins, the springs will dry and the vegetation will be destroyed. The Draft EIS/EIR does not address this possibility. More fundamentally, the Draft EIS/EIR has not inventoried the environmental resources associated with Bristol and Cadiz Lakes, which is required in order to evaluate impacts. R3-63

Project Impacts to Springs Inadequately and Incompletely Evaluated R3-64

Groundwater exports, whether less than or in excess of the natural recharge, will create groundwater declines throughout the Cadiz-Fenner Valley area. With sufficient time, even a small long-term decline near the extraction wells will spread throughout the groundwater system.

A number of springs occur within the Cadiz-Fenner Valley watershed. Some of these springs are associated with the groundwater system that underlies the valley-floor areas. This is the groundwater system that will be impacted by the extraction and exportation of native groundwater. The decline of groundwater levels may adversely impact some of springs. However, the Draft EIR/EIS does not address this possibility. More fundamentally, the Draft EIR/EIS has inventoried neither the springs nor the environmental resources associated with the springs. As an essential element of an environmental assessment, all of the springs in the Cadiz-Fenner Valley watershed should be surveyed.

Cumulative Impacts are not Addressed R3-65

The Draft EIR/EIS does not address the cumulative impacts of groundwater development. Groundwater currently is pumped for agricultural irrigation within Cadiz Valley. In recent years, the annual pumpage has been about 5,000 acre-feet (GeoScience, 1999). However, the annual pumpage may be expanded to 30,000 acre-feet (URS Consultants, 1993a and 1993b), if additional lands are irrigated. This is pumping in addition to that associated with the Cadiz Valley Groundwater Storage Project. The Project may extract and export as much as 2 million acre-feet of groundwater over a 50-year period. If the agricultural operation were to expand concurrently to the maximum acreage, the agricultural pumping would extract and consume as much as an additional 1.5 million acre-feet of groundwater over a 50-year period. Based on the alternative groundwater model, Figures 14 and 15 show the change in groundwater levels associated with the cumulative impact of the Project and continuing agricultural operations.

The Draft EIR/EIS does not consider the impacts of concurrent pumping for agricultural production and exportation. Nevertheless, an essential element of an

R3-65

environmental assessment is to consider these cumulative impacts. This would involve making simulations with a groundwater model.

The Draft EIR/EIS Should be Revised and Recirculated

The groundwater analysis DRAFT EIR/EIS is sufficiently deficient that the impacts of the Cadiz Valley Groundwater Storage Project are unknown. The groundwater analysis is based on a groundwater model. The conceptual errors and omissions regarding the groundwater model and its inputs are such that the model simulations most likely do not represent the actual Project impacts. The groundwater model needs to be reconstructed.

R3-66

Even with an adequate groundwater model, the model results cannot be interpreted without an adequate assessment of the environmental resources. Accordingly, additional work needs to be completed to inventory the Bristol and Cadiz Lakes. The possible existence of springs and phreatophytic vegetation needs to be identified. Dust production from the lake-bed surfaces and the possible impacts of groundwater pumping on that production needs to be understood. Additional work needs to be completed to inventory springs throughout the Cadiz-Fenner Valley watershed. The springs and the associated environmental resources need to be surveyed. The potential for impacts to the springs needs to be understood.

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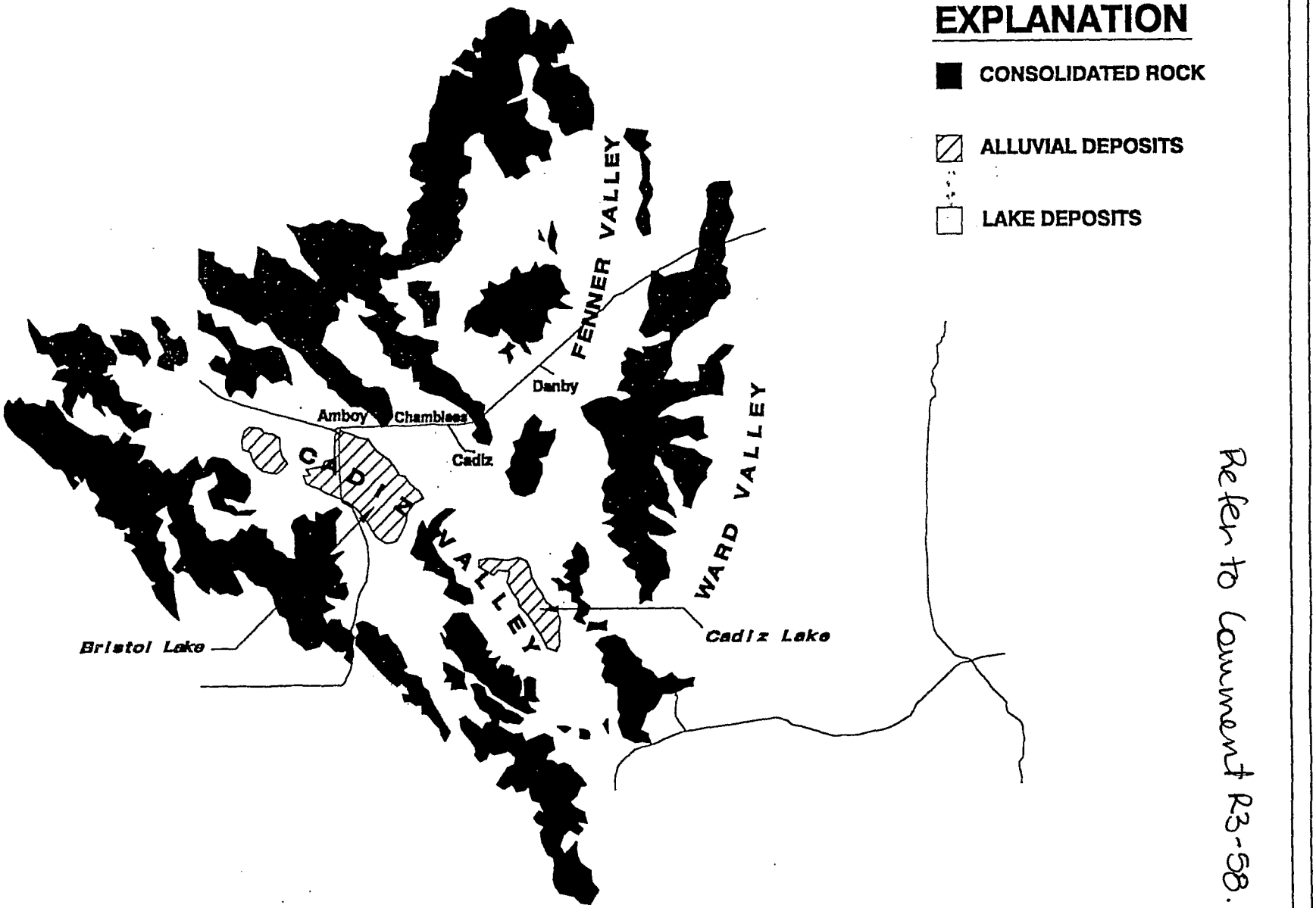
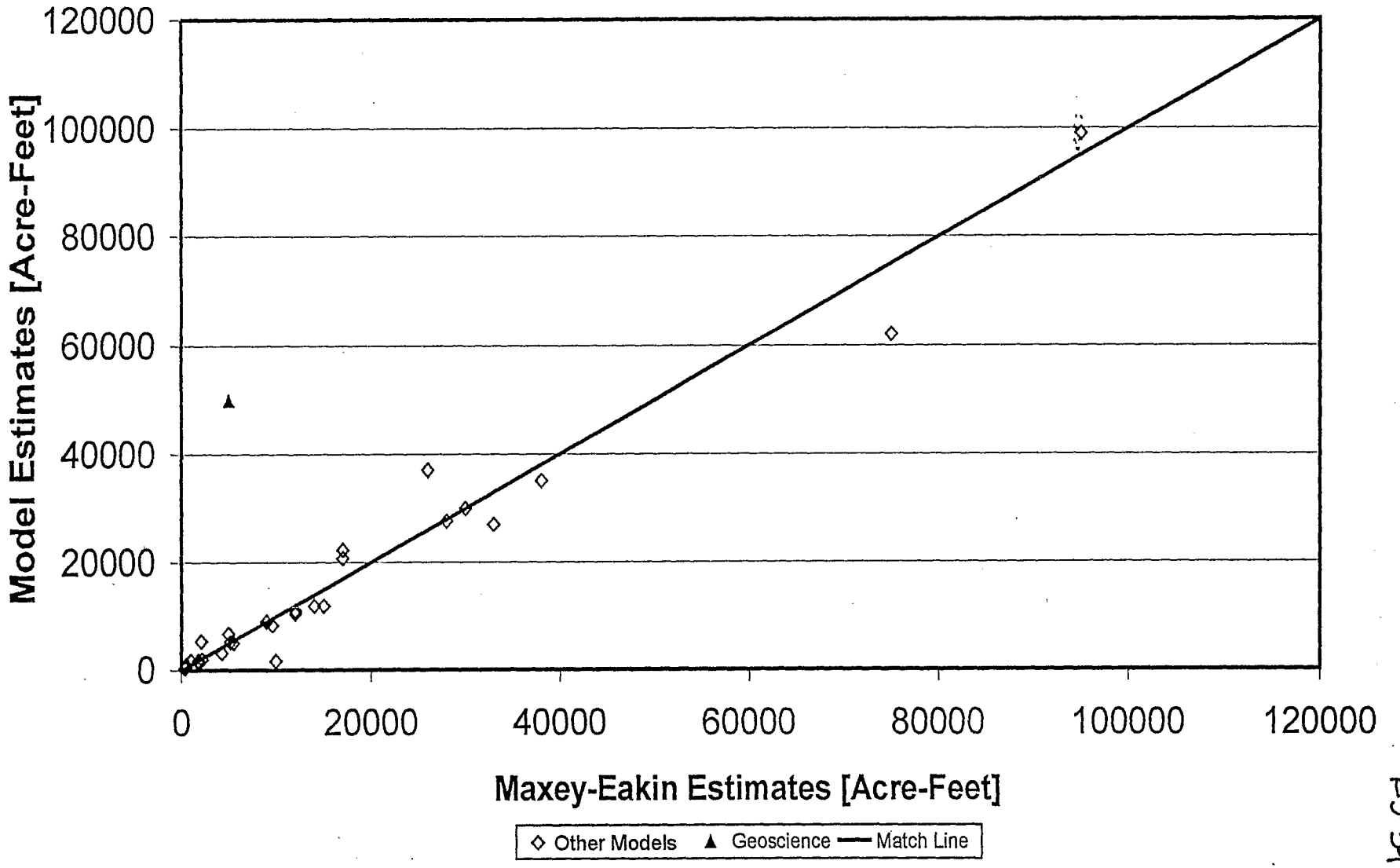


Refer to Comment R3-58.

C:\7600\CADIZ\FIGURES\FIGURE 1.DWG

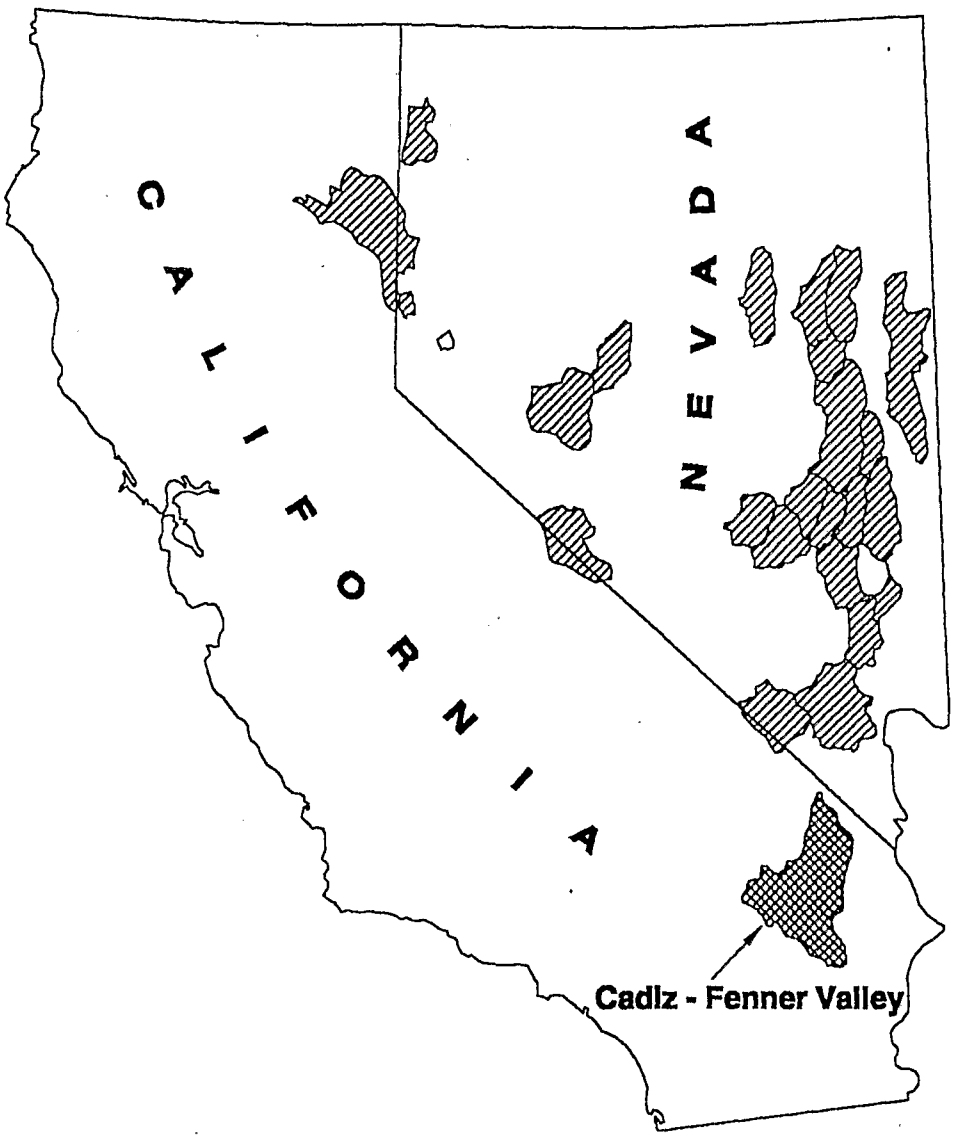
JOB NO. 7600	DATE: 02/28/00	GENERALIZED GEOLOGIC MAP OF CADIZ AND FENNER VALLEY	Figure 1
BY: TJD	DRAWN: DWD		
	REV:		



Refer to comment #3-59

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2.CDR

JOB NO.: 7600	DATE: 02/28/00	COMPARISON OF Maxey - Eakin RECHARGE ESTIMATES WITH GEOSCIENCE ESTIMATE	Figure 2
BY: TD	DRAWN: DWD		
	REV:		



EXPLANATION

- Cadiz - Fenner Valley
- Other Basins

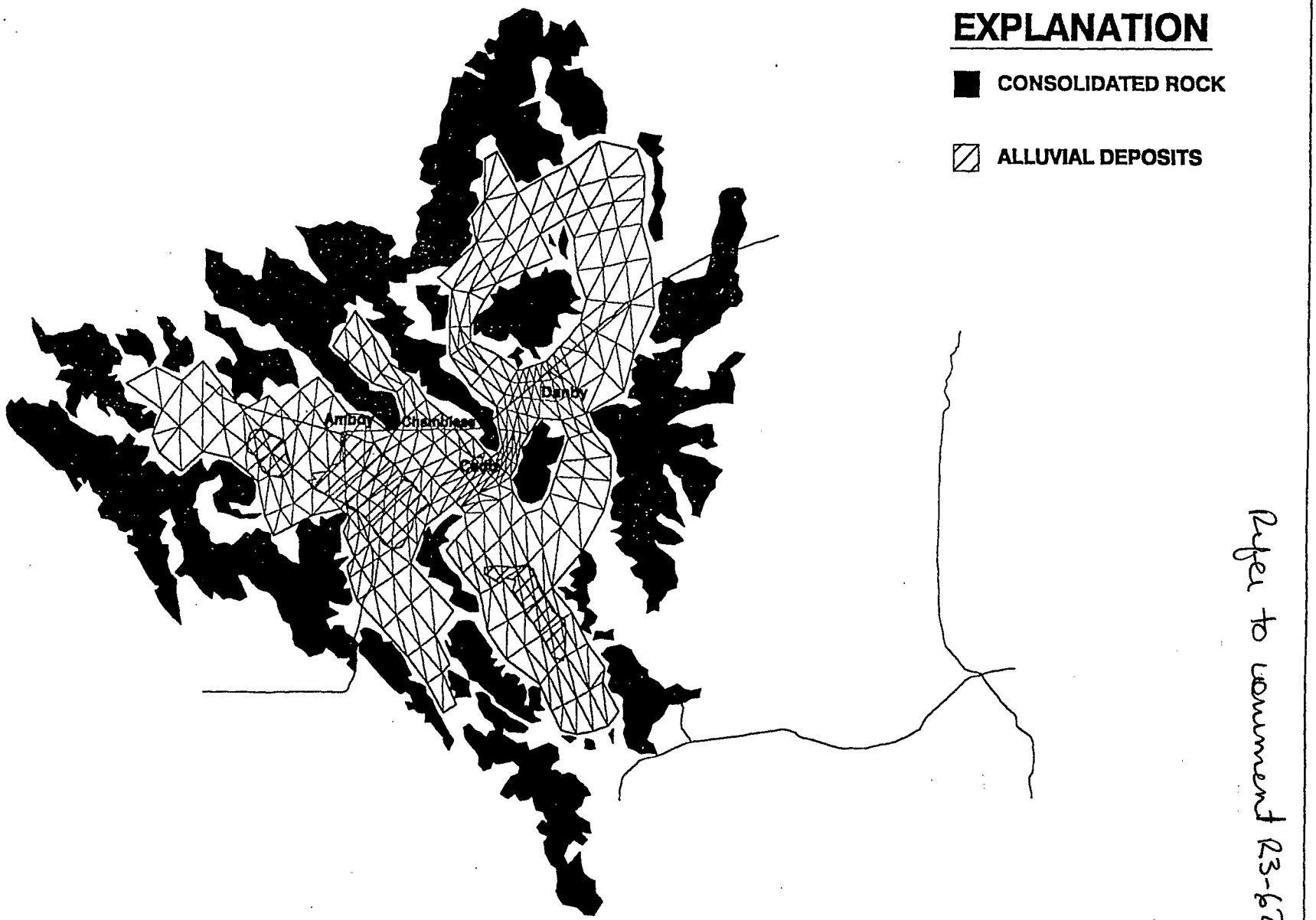
Refer to comment R3-59

JOB NO.	7600	DATE	02/28/2000
BY:	TJD	DRAWN:	DWD
		REV:	

BASINS WITH MAXEY-EAKIN RECHARGE ESTIMATES

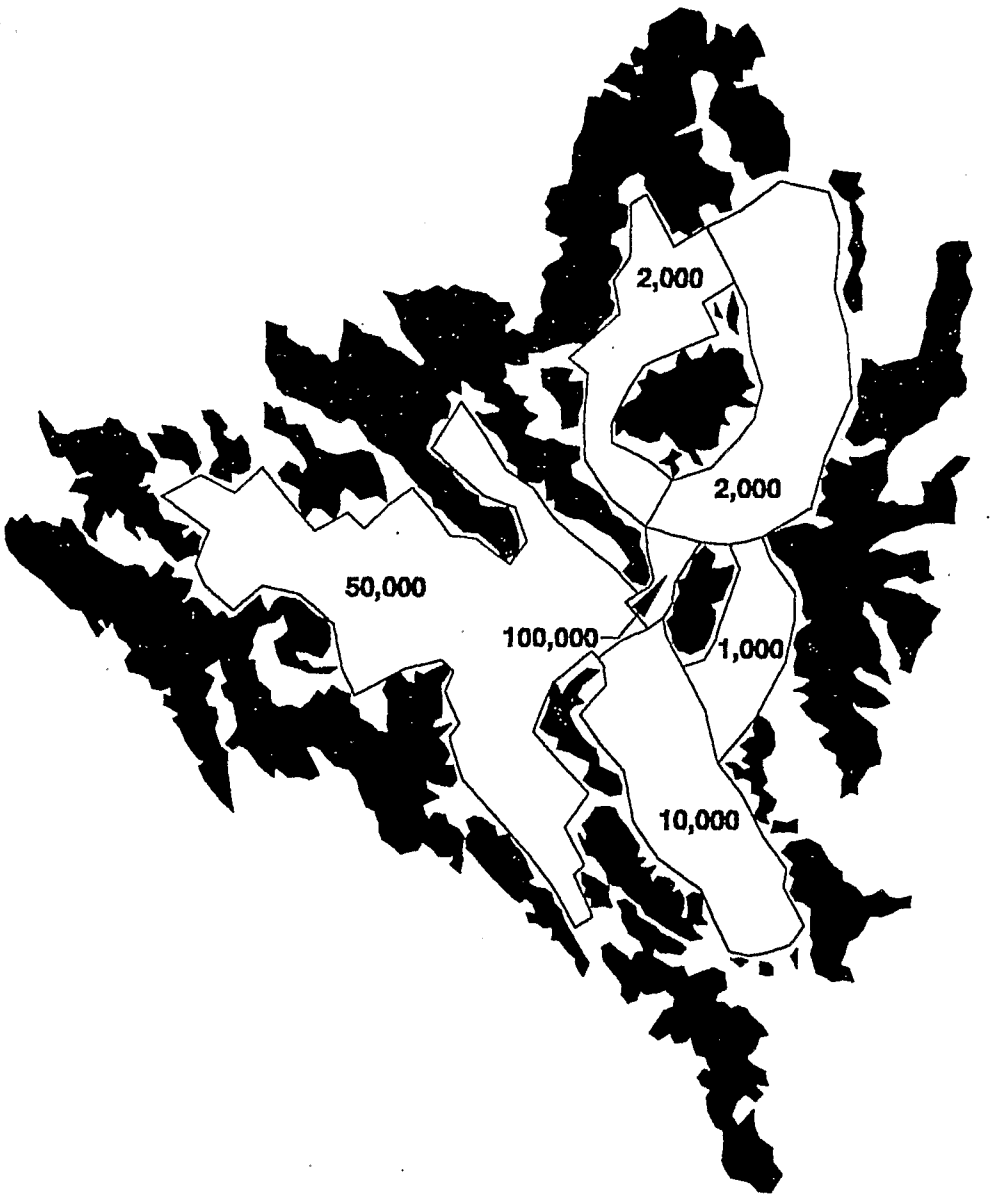
Figure 3

C:\7600\CADIZ\FIGURES\FIGURE_3.DWG



JOB NO. 7600	DATE: 02/28/00	GRID FOR ALTERNATIVE GROUNDWATER MODEL	Figure 4
BY: TJD	DRAWN: DWD		
	REV:		

G:\7600\CADIZ\FIGURES\FIGURE 4.DWG



EXPLANATION

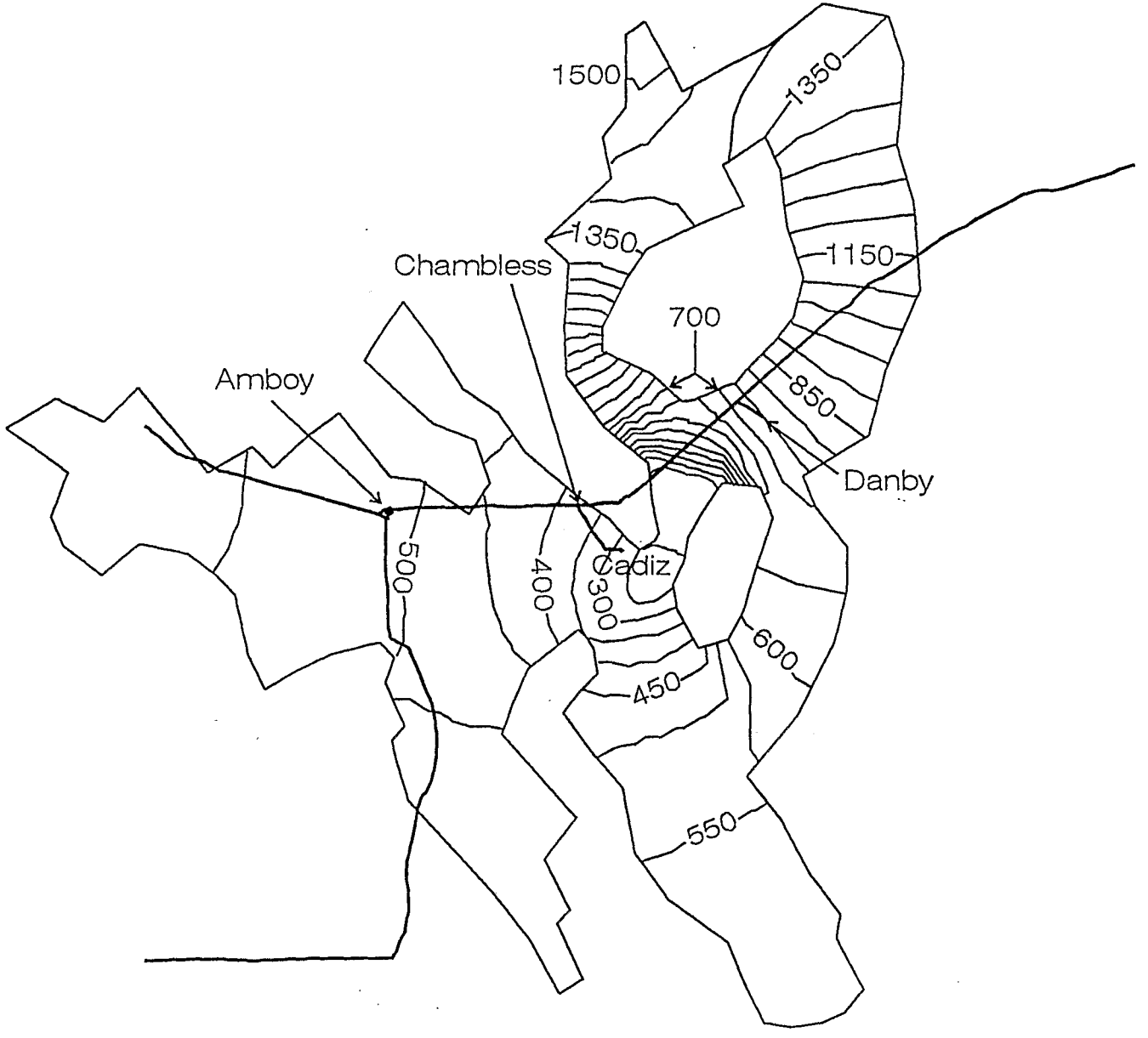
2,000 — TRANSSMISSIVITY, Number indicates transmissivity in feet squared per day.

——— Model Boundry

Refer to comment R3-62

C:\7600\CADIZ\FIGURES\FIGURE 5.DWG

JOB NO. 7600	DATE: 02/28/00	**CALIBRATED VALUES OF TRANSMISSIVITY FOR AN ALTERNATIVE GROUNDWATER MODEL**	**Figure 5**
BY: TJD	DRAWN: DWD		
	REV:		



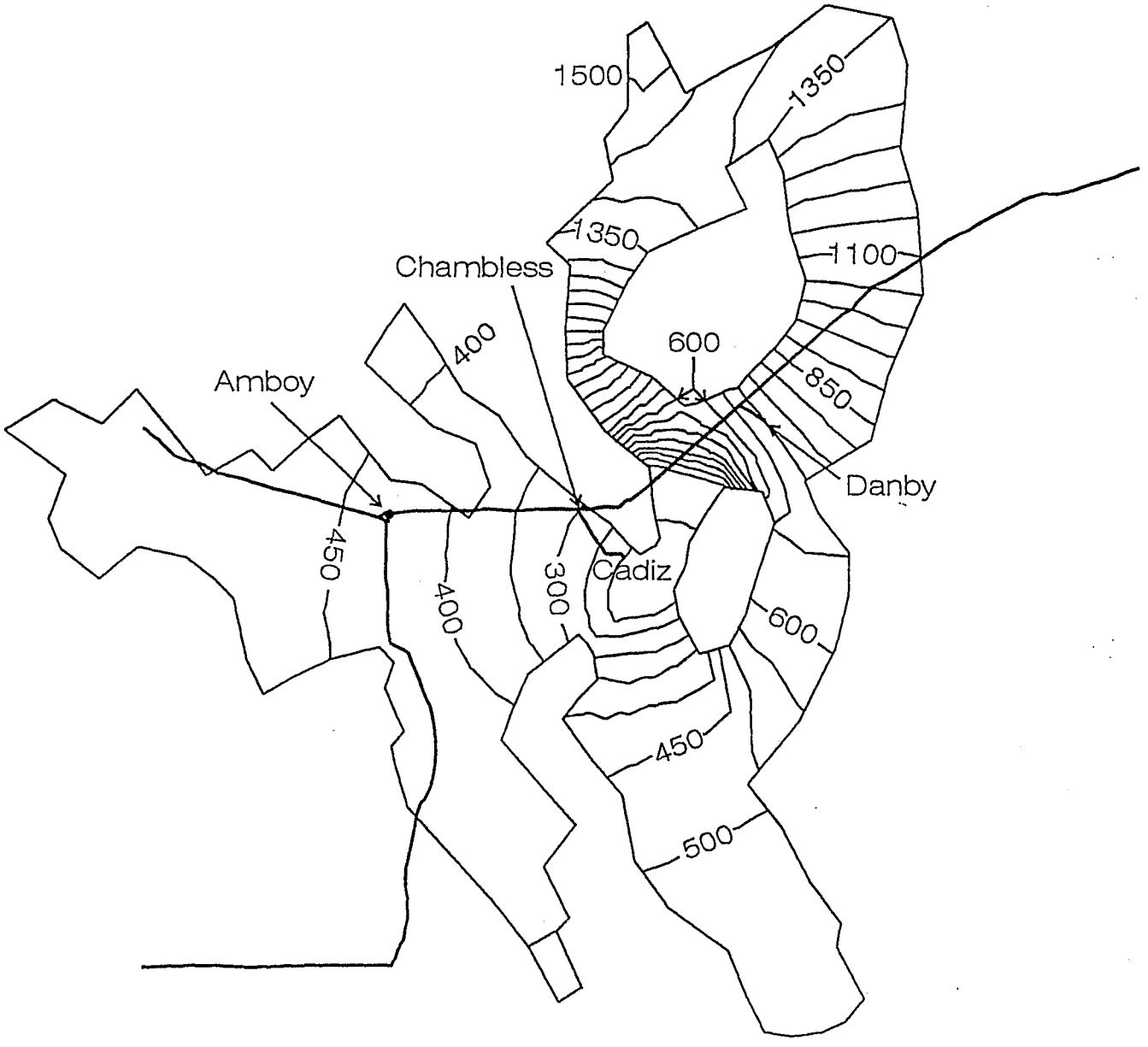
EXPLANATION

— 100 — WATER LEVEL CHANGE. Contour of change in groundwater level. Number indicates water-level decline in feet. All contours are in 50 foot intervals.

Refer to comment R3-62

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER LEVELS RESULTING FROM THE PROJECT AFTER 50 YEARS	Figure 6
BY: TD	DRAWN: DWD		
	REV:		

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR



EXPLANATION

— 100 — WATER LEVEL CHANGE. Contour of change in groundwater level. Number indicates water-level decline in feet. All contours are in 50 foot intervals.

Refer to Comment R3-62

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER LEVELS RESULTING FROM THE PROJECT AFTER 100 YEARS	Figure 7
BY: TD	DRAWN: DWD		
	REV:		

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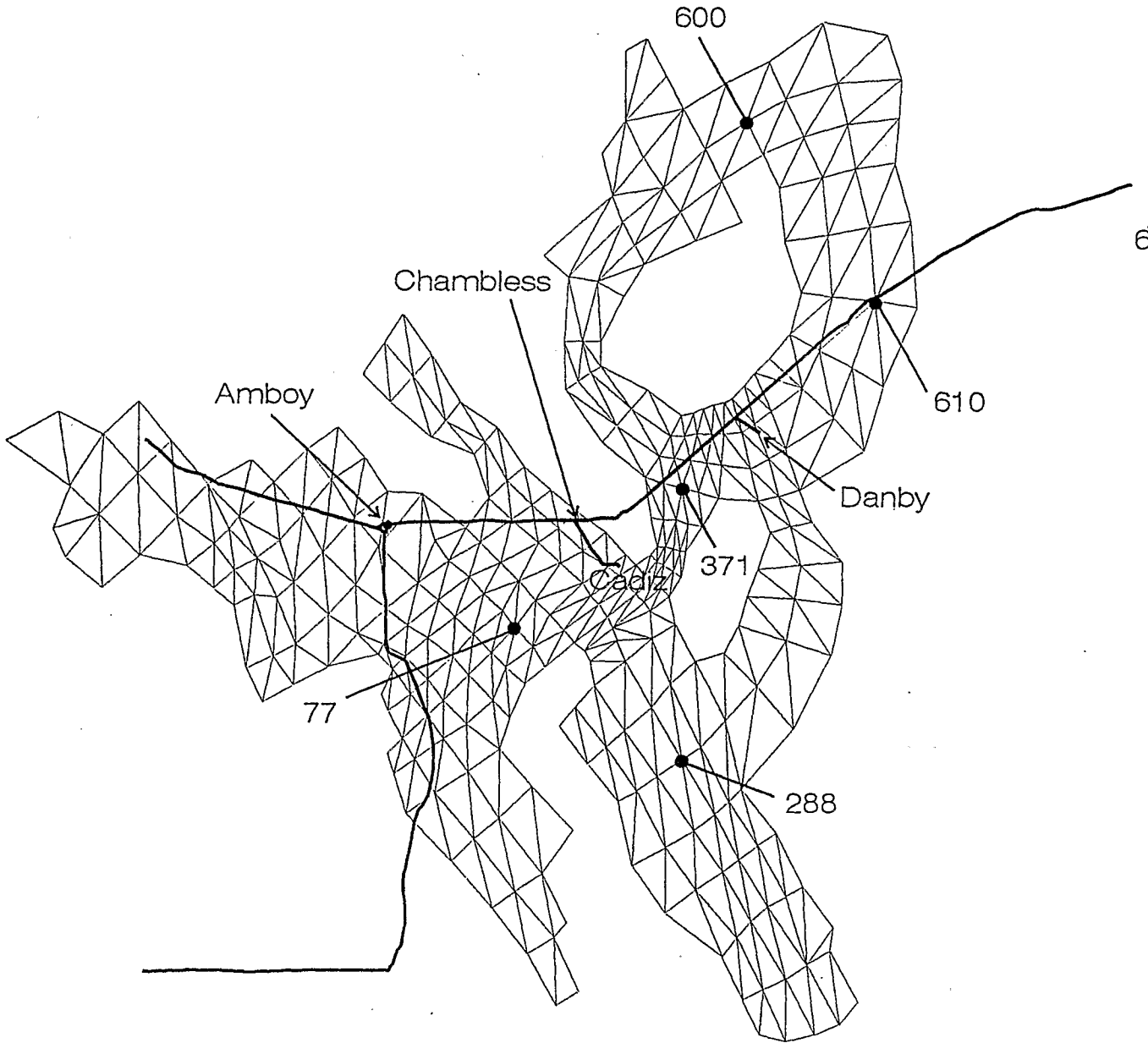

Refer to comment R3-62

JOB NO.: 7600	DATE: 02/28/00	LOCATION REPRESENTED BY HYDROGRAPHS	Figure 8
BY: TD	DRAWN: DWD		
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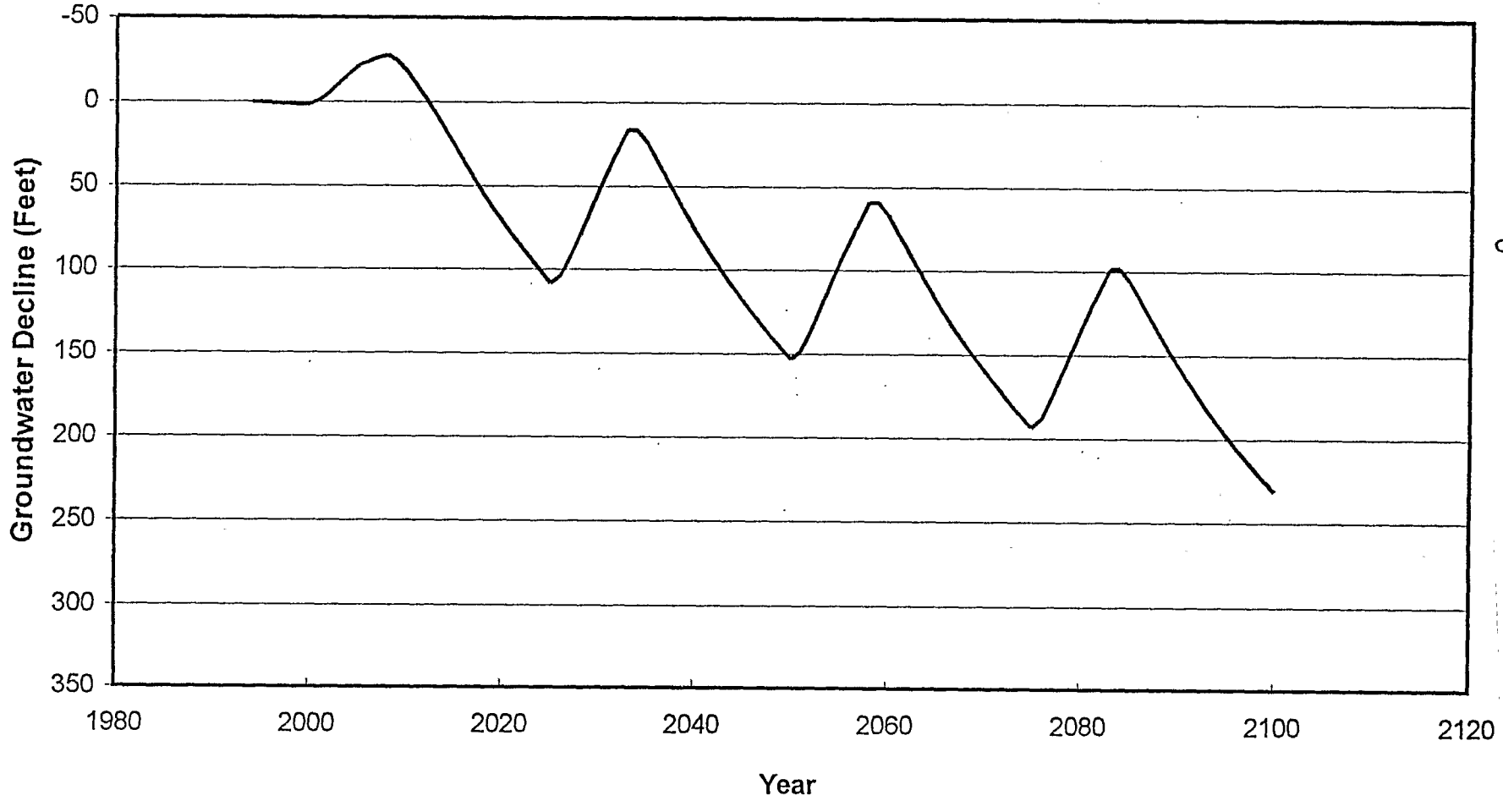
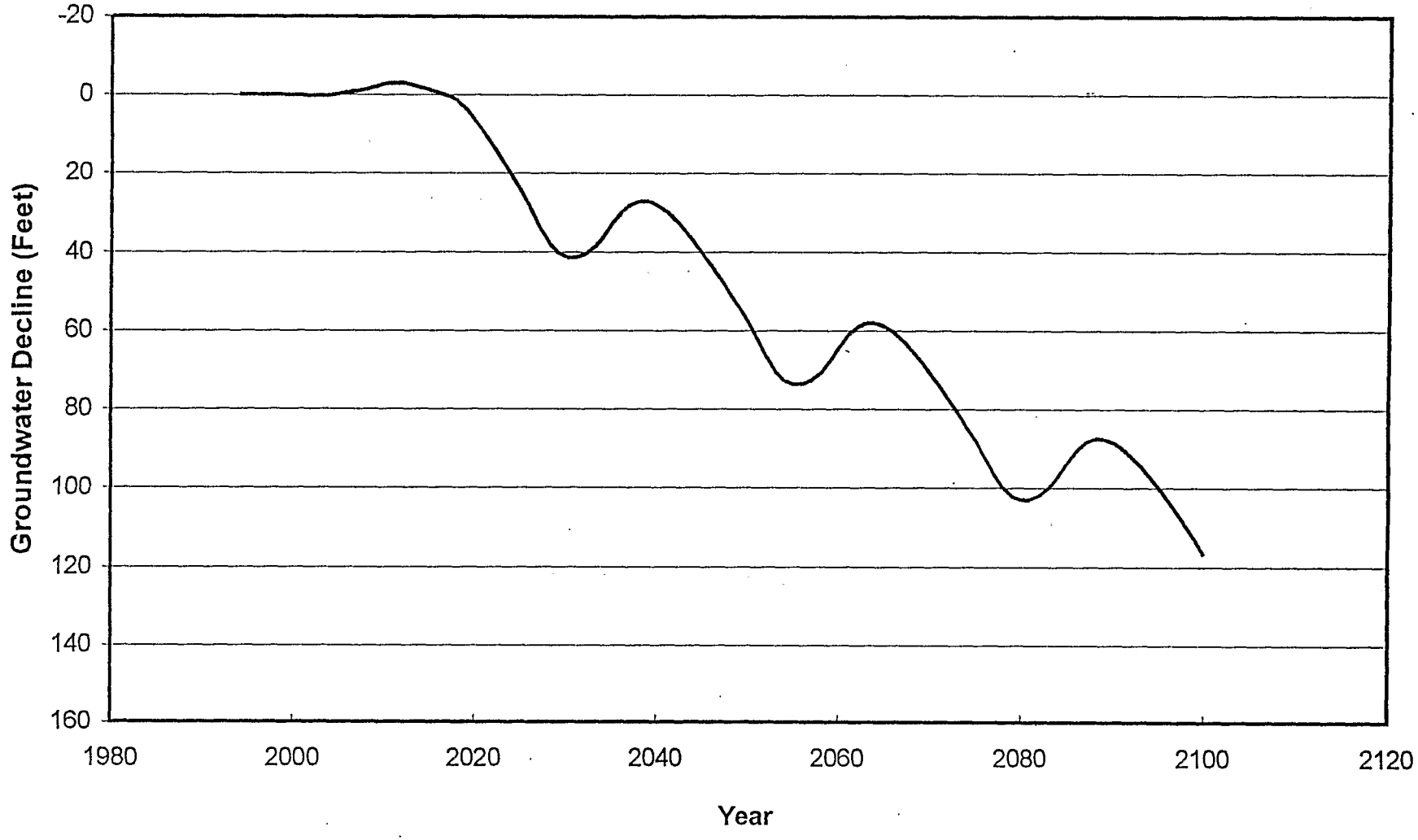


Refer to comment R3-67

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER NEAR BRISTOL LAKE	Figure 9
BY: TD	DRAWN: DWD		
	REV:		



Refer to comment R3-62

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER NEAR CADIZ LAKE	Figure 10
BY: TD	DRAWN: DWD		
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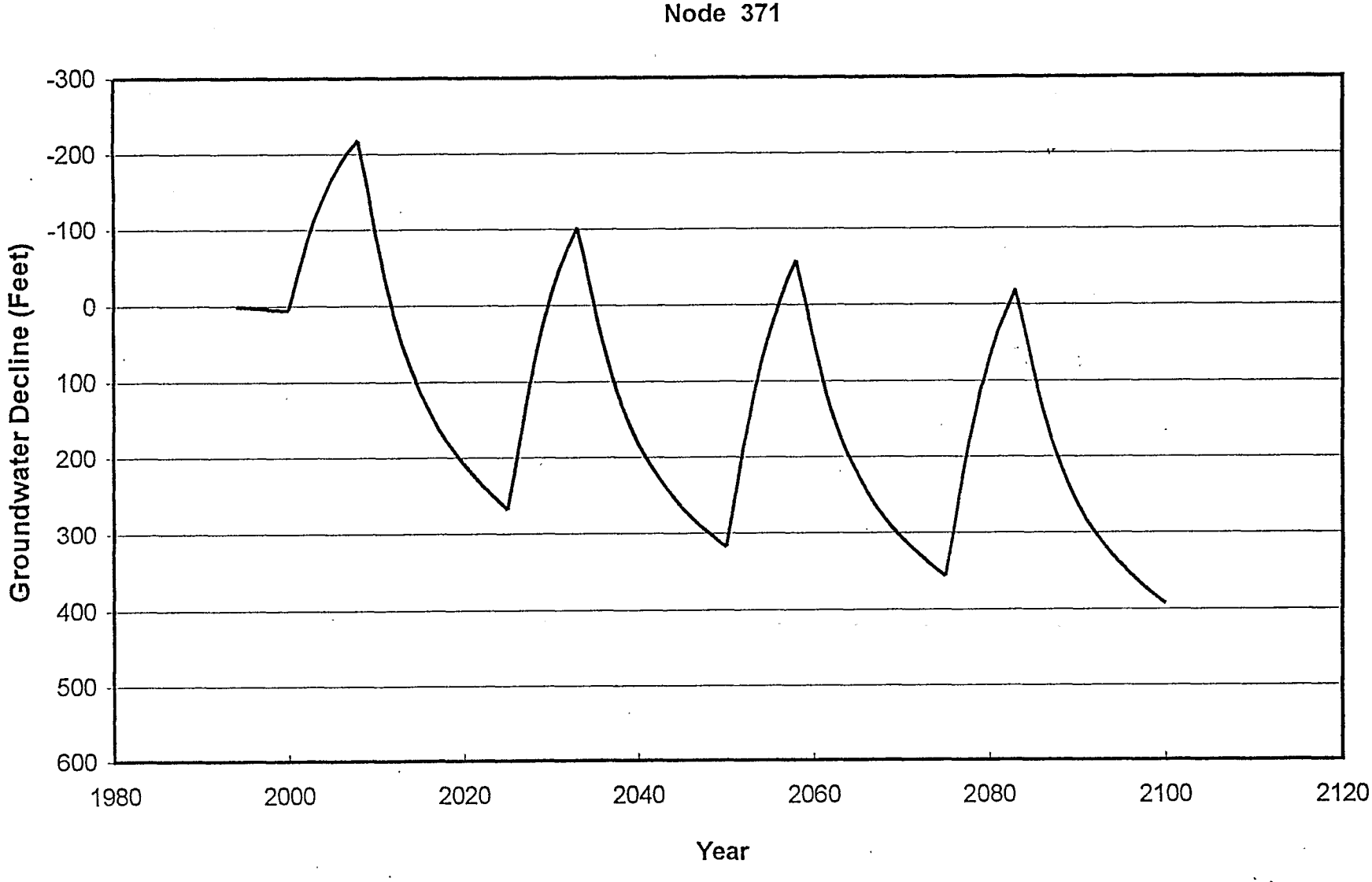

Refer to Comment R3-6.2

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER NEAR FENNER GAP	Figure 11
BY: TD	DRAWN: DWD		
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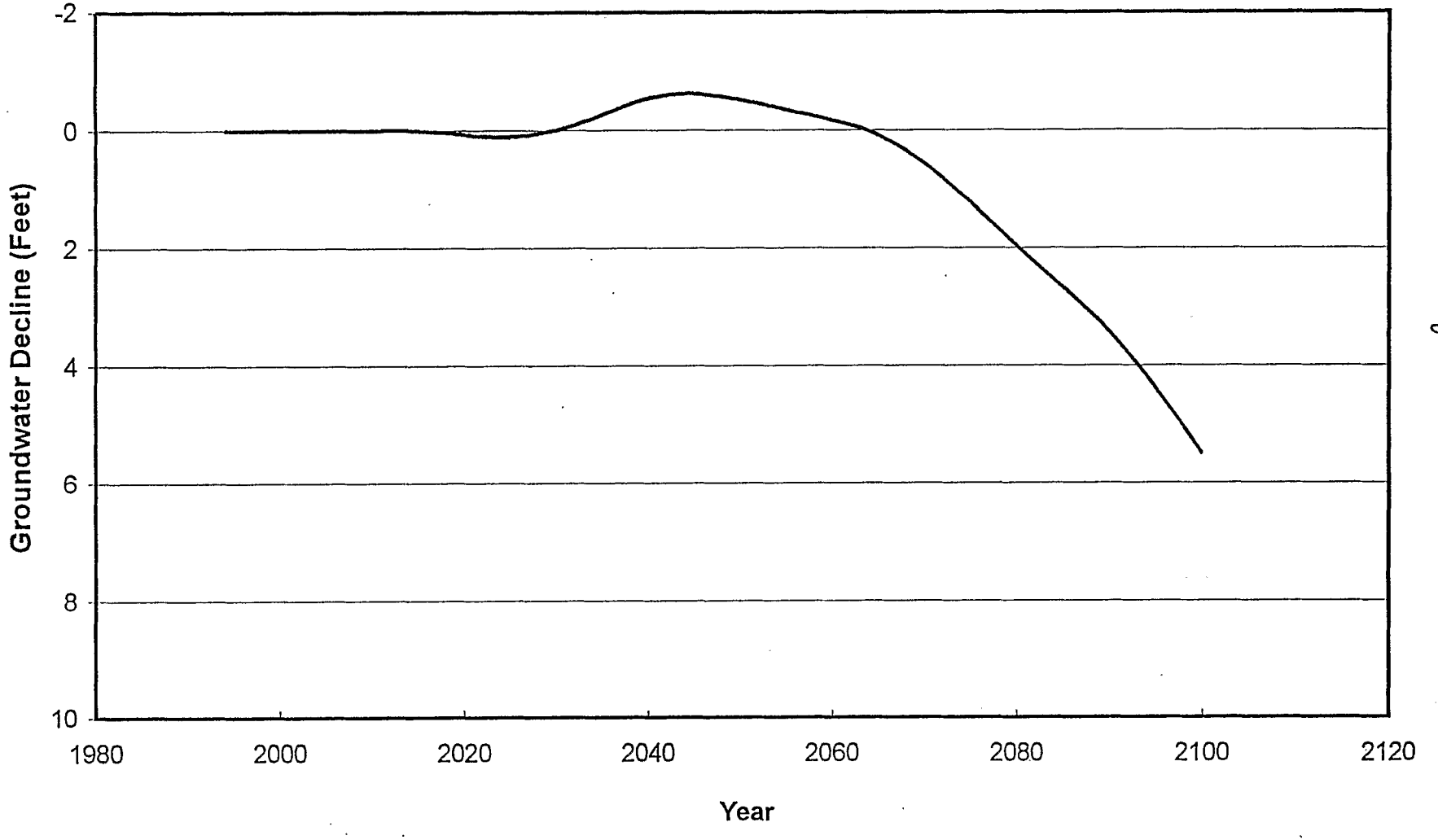

Refer to comment R3-6.2

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER NEAR MIDDLE OF FENNER VALLEY	Figure 12
BY: TD	DRAWN: DWD		
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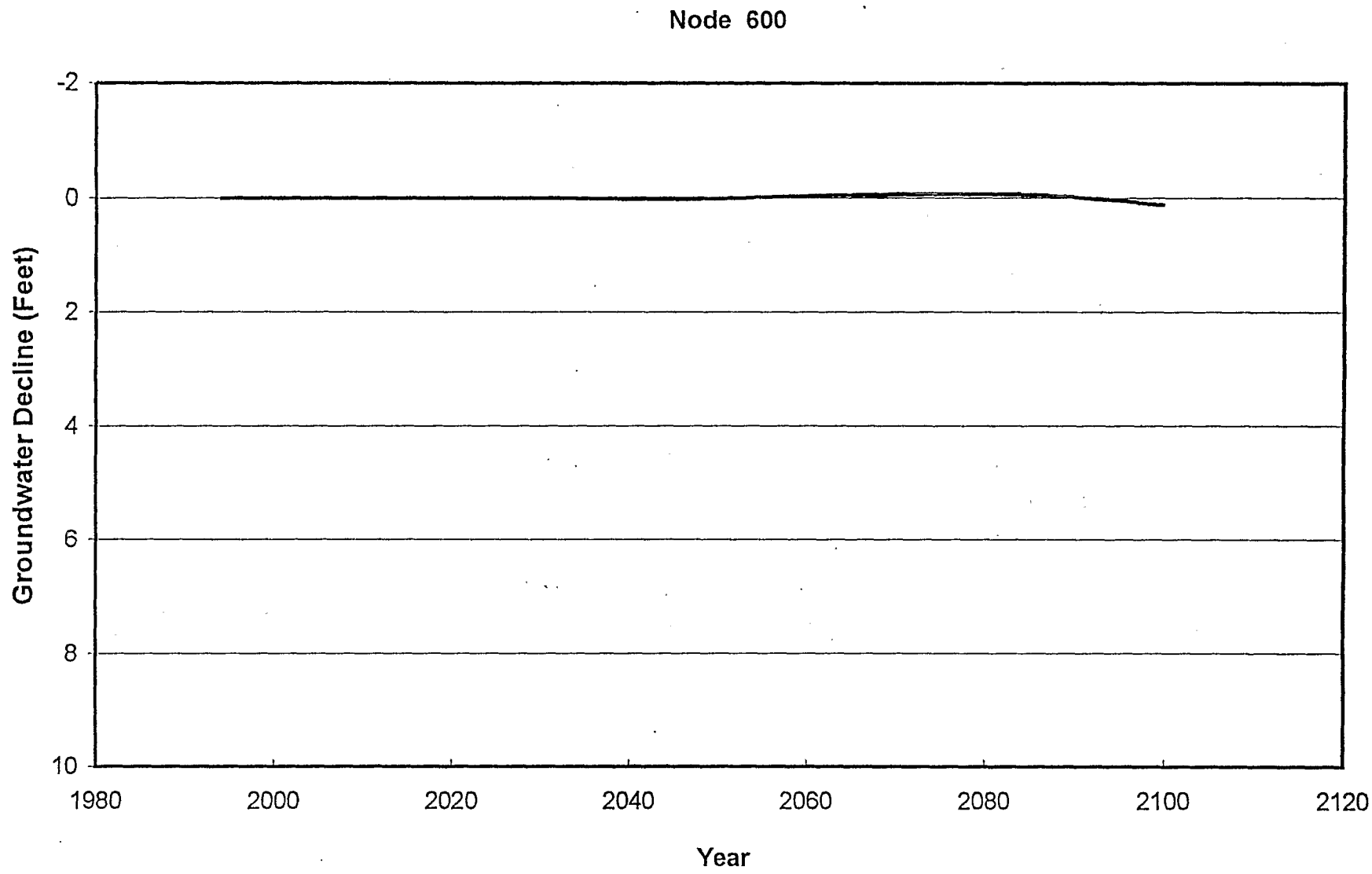

Refer to comment R3-6.2

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER NEAR UPPER END OF FENNER VALLEY	Figure 13
BY: TD	DRAWN: DWD		
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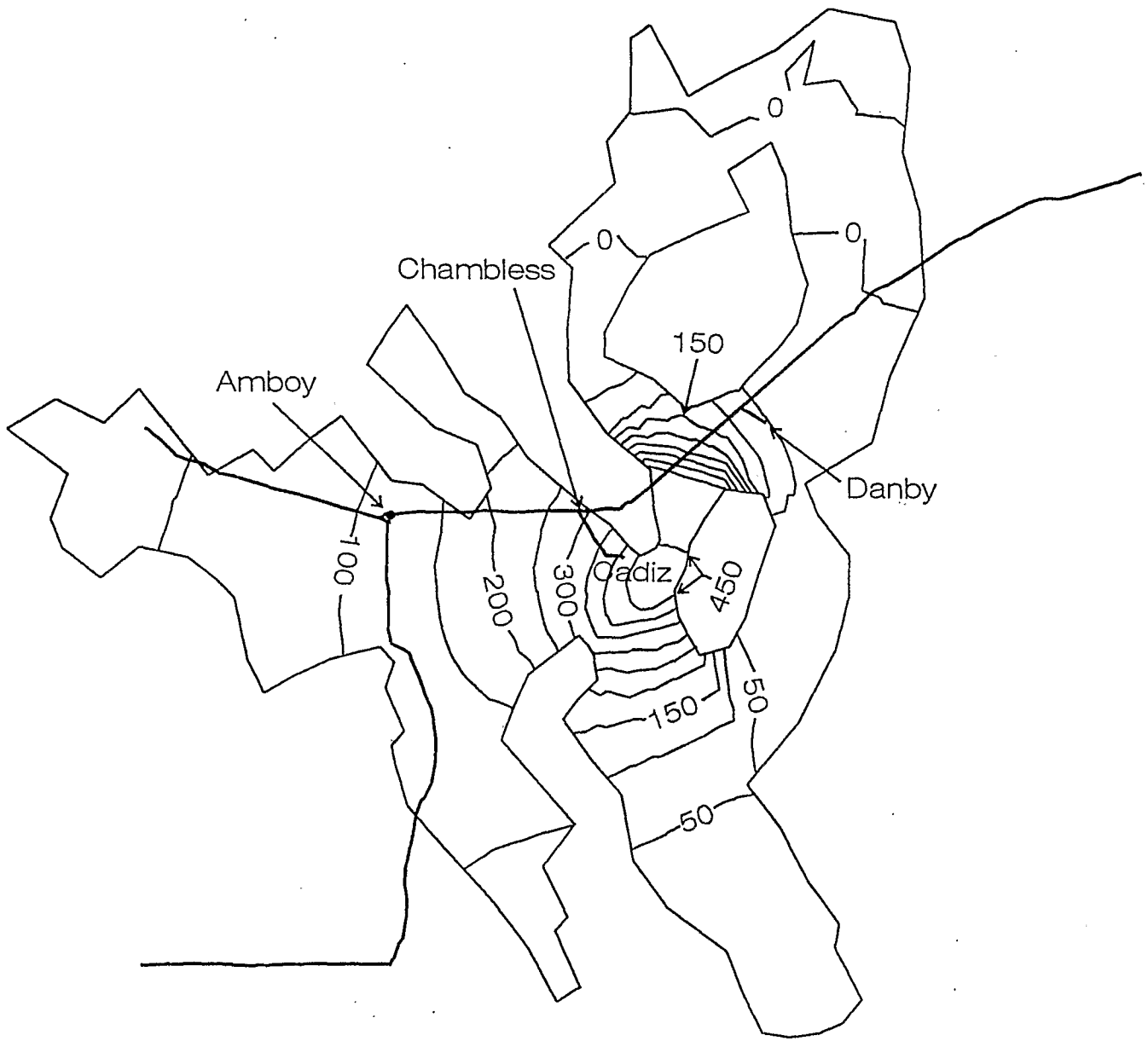
C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR



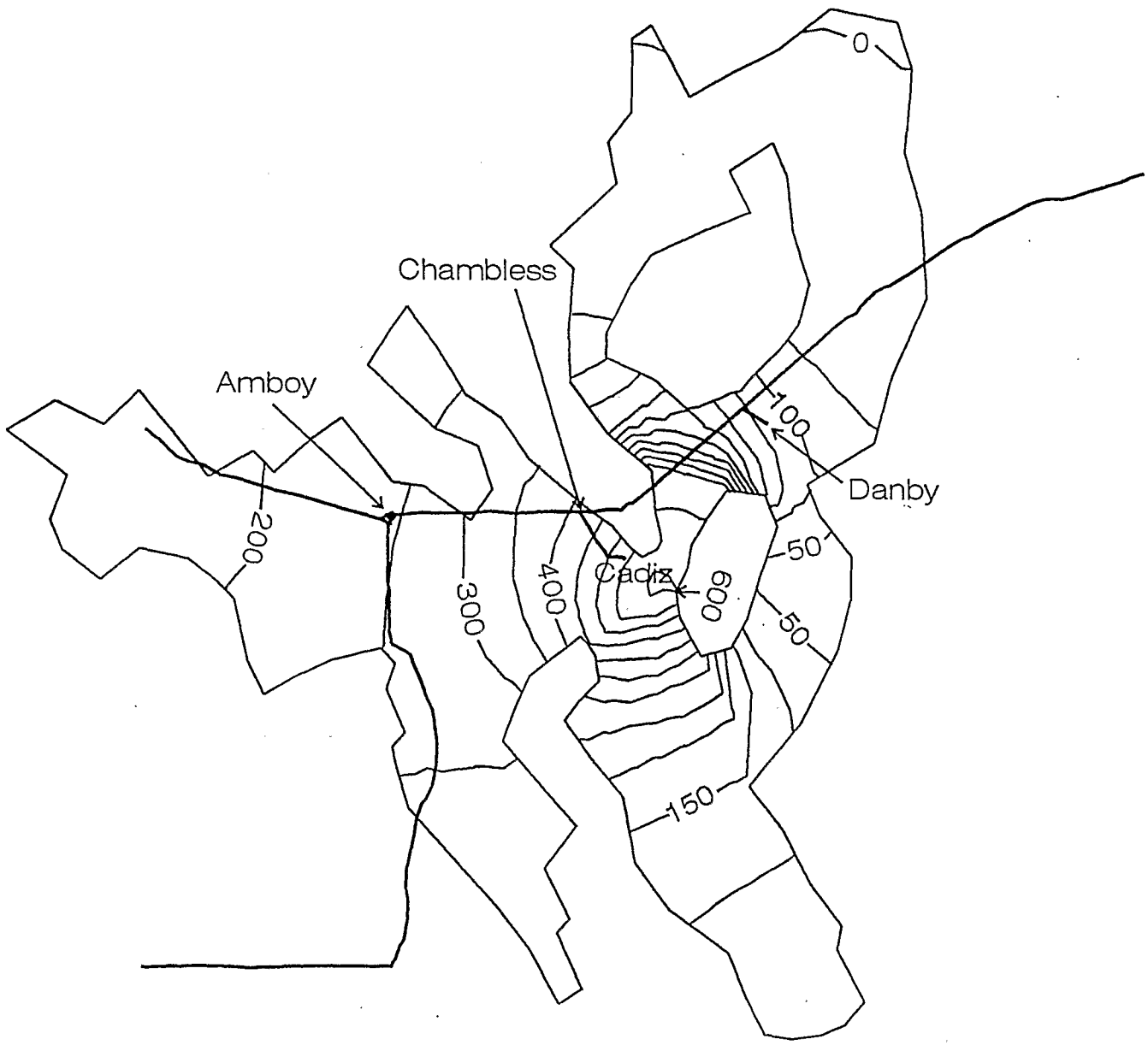
EXPLANATION

— 100 — WATER LEVEL CHANGE. Contour of change in groundwater level. Number indicates water-level decline in feet. All contours are in 50 foot intervals.

Refer to comment 23-65

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER LEVELS RESULTING FROM THE CUMULATIVE IMPACT OF COMBINED PROJECT AND FARMING OPERATIONS AFTER 50 YEARS	**Figure 14**
BY: TD	DRAWN: DWD		
	REV:		

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 -15.CDR



EXPLANATION

— 100— WATER LEVEL CHANGE. Contour of change in groundwater level. Number indicates water-level decline in feet. All contours are in 50 foot intervals.

Refer to comment R3-65

JOB NO.: 7600	DATE: 02/28/00	CHANGE IN GROUNDWATER LEVELS RESULTING FROM THE CUMULATIVE IMPACT OF COMBINED PROJECT AND FARMING OPERATIONS AFTER 100 YEARS	**Figure 15**
BY: TD	DRAWN: DWD		
	REV:		

C:\WORK\7600 CADIZ\FIGURES\FIGURE 2 - 15.CDR

Refer to comment R3-59

TABLE 1
RECHARGE PERCENTAGES
FOR THE MAXEY-EAKIN METHOD

Precipitation Zone	Maxey-Eakin Coefficient (%)
>20 in.	25
15 - 20 in.	15
12 - 15 in.	7
8 - 12 in.	3
<8 in.	0

Refer to Comment R3-59

TABLE 2
APPLICATION OF MAXEY-EAKIN METHOD
TO CADIZ-FENNER VALLEY WATERSHED

Precipitation Rate (inches)	Area (acres)	Precipitation Value (acre-feet)	Recharge Factor (percent)	Recharge Value (acre-feet)
8 - 9	29,300	20,800	3	600
9 - 10	47,500	37,600	3	1,100
10 - 11	70,500	61,700	3	1,900
11 - 12	62,700	60,100	3	1,800
Total	210,000	180,200		5,400

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Timothy J. Durbin

Ground-Water and Surface-Water Hydrologist

Education	Master of Science in Civil Engineering, 1971 Stanford University, Stanford, California
	Bachelor of Science in Civil Engineering, 1967 Stanford University, Stanford, California
Registration	Registered Civil Engineer, California Professional Engineer (Civil), Nevada Professional Engineer (Civil), Oregon Professional Engineer (Civil), Texas
Professional Societies	American Society of Civil Engineers American Geophysical Union National Water Well Association International Association of Hydrologists
Awards & Honors	U.S. Department of the Interior Honor Award U.S. Coast Guard Achievement Award

Professional Experience

February 1999 to Present

Timothy J. Durbin, Inc., Carmichael, California. President. Directs projects relating to ground-water and surface-water hydrology. Areas of expertise includ design of multidisciplinary investigations, design of large-scale programs for the collection and interpretation of hydrologic data, and application of mathematical modeling to the analysis of problems in ground-water and surface-water hydrology. Examples of such projects include:

- Analyzed the impacts of water-resource development and reservoir operations on water supply, streamflows, regional economics, and wildlife resources within the North Platte River Basin, Nebraska and Wyoming. Designed and directed a multi-disciplinary investigation

involving agricultural engineers, ground-water hydrologists, surface-water hydrologists, agricultural economists, and environmental scientists in six different consulting firms. Work is being done in support of litigation before the U.S. Supreme Court between the states of Nebraska and Wyoming.

- Analyzed the occurrence of MTBE in the Santa Monica ground-water basin, California. MTBE contamination from multiple sites has resulted in abandonment of public-supply wells. An analysis of the sources and fate of MTBE within the Santa Monica ground-water basin is being conducted. Work is being done within the context of State and Federal regulatory proceedings.

- Analyzed the relationship of landscape irrigation to the occurrence of a large-scale landslide in a residential area of Anaheim, California. The work involved developing a hydrologic description of the landslide area and then developing a ground-water model. The work was done in support of litigation.

- Assigned as Special Master in a technical dispute between City of San Bernardino, California and the Regional Water Quality Control Board. The issue is the cause of a wastewater discharge to the Santa Ana River. The work is being done within the context of a State regulatory proceeding.

May 1998 to January 1999

Bookman-Edmonston Engineering, Inc., Sacramento, California. Vice President. Directed projects related to ground-water and surface-water hydrology. Directed a staff of about 30 engineers, hydrologists, biologists, and geologists. Examples of such projects include:

- Analyzed the causes of flooding near Phoenix, Arizona. Residential and commercial areas were flooded during a summer storm. The analysis involved assessing the effect of irrigation ditches and other facilities on the depth of flooding. The work was done in support of litigation.

- Analyzed the impact of floodflows on the failure of a stream pipeline crossing within Thousand Oaks, California. A large sewer line failed owing to channel erosion during an extreme flood event. The recurrence interval of the erosion event was analyzed. The work was done within the context of a State regulatory proceeding.

- Analyzed the causes of soil saturation within an almond orchard near Turlock, California. The work involved evaluating the effects of

drainage pumping, precipitation, and irrigation on the depth below the land surface to the groundwater table. The work was done in support of litigation.

- Analyzed the effects of a large parking lot on downstream flooding and channel erosion. The work was done in support of litigation.

March 1989 to May 1998

Hydrologic Consultants, Inc., Sacramento, California. President. Directed projects related to ground-water and surface-water hydrology. Directed a staff of about 10 hydrologists, geologists, and engineers. Examples of such projects include:

- Analyzed the impacts of urban development on the water quality of Lake Tahoe, California. Work involved the analysis of sediment and nutrient transport in streams tributary to the lake and nutrient cycling within the lake. Work was done for litigation.

- Analyzed streamflow temperature within the Owens River, Owens Valley, California. Work was done to evaluate the hydrologic feasibility of reestablishing a fishery within the Owens River.

- Analyzed the source and management of surface-water and ground-water salinity within the Lompoc ground-water basin. Work involved developing groundwater and surface-water models of the Santa Ynez River basin, including salinity models. Work was done in support of litigation.

- Analyzed the causes and management of drainage water discharges from the Firebaugh and Central California Water District to natural watercourses and the San Joaquin River. Work was done in support of litigation.

- Developed a model for the optimal use of ground water and surface water within the Turlock and Modesto Irrigation Districts for the benefit of water supply and environmental resources. Work was done in support of the FERC re-licensing of New Don Pedro Reservoir.

- Analyzed the optimal facilities and facility operation for ground water and surface water within the Salinas Valley, California. Work involved development of ground-water, reservoir-operations, and optimization models. Work was done in support of litigation.

- Analyzed the source of soil and ground-water contamination by petroleum hydrocarbons at Santa Barbara, California. Work was done in support of litigation.

- Analyzed the source of soil and ground-water contamination by petroleum hydrocarbons at Oxnard, California. Work was done in support of litigation.

- Analyzed the occurrence of high ground-water levels in the San Bernardino Valley, California using surface-water and ground-water models. High ground-water levels resulted from excess artificial recharge and other factors. Work was done in support of litigation.

- Analyzed the effects of ground-water pumping and other factors in the depletion of streamflow in the Arkansas River at the Colorado-Kansas state line using surface-water, ground-water, and institutional models. Work was done in support of litigation in the U.S. Supreme Court between the states of Kansas and Colorado.

- Analyzed the effects of geothermal development on thermal-spring discharges in the Mammoth Lakes area, California using ground-water and heat-transport models. Work was done in support of litigation.

October 1985 to March 1989

S.S. Papadopulos & Associates, Inc., Davis, California. Vice President, and Manager of Davis office. Directed and conducted investigations of numerous aspects of ground-water hydrology. Examples of such projects include:

- Analyzed the migration of ground-water contaminants at the Love Canal hazardous waste site in Niagara Falls, New York using a ground-water model. The Love Canal site is a Superfund Site. Work was done in support of litigation.

- Analyzed the migration of ground-water contaminants at the Lone Pine landfill near Freehold, New Jersey. The Lone Pine landfill is a Superfund site. Work was done as part of a remedial investigation.

- Developed a computer program for the simulation of soil-water movement within and near a land-disposal facility. Work was done for the U.S. Environmental Protection Agency in support of the preparation regulations relating to the design of cover, liner, and leak-detection systems for land-disposal facilities.

- Developed a ground-water management plan for the San Bernardino Valley ground-water basin, California using a ground-water model and the techniques of operations research.

- Analyzed the impacts of urban development on flooding and sediment transport for streams in Orange County, California. Work was done to support the permitting of a large residential and commercial development project.

July 1984 to October 1985

Williamson and Schmid, Hydrotec Division, Davis, California. Manager of Davis office. Directed and conducted investigations for evaluation of ground-water resources, management of regional ground-water systems, and evaluation of hazardous waste sites. Studies involved identification of essential hydrologic issues, collection of hydrologic data, and application of quantitative methods to evaluate alternatives and to select an optimal solution. Examples of such projects include:

- Developed a three-dimensional ground-water model of a physical barrier at a hazardous waste landfill in order to evaluate performance of the existing barrier and proposed modifications. Work was done for regulatory compliance.

- Analyzed a hazardous waste site using isotope geochemistry and ground-water models as investigative tools. Work was done for regulatory compliance.

- Analyzed the utilization of fresh water body overlying saline water using surface geophysical techniques and a density-dependent ground-water flow model.

August 1982 to July 1984

U.S. Geological Survey, Water Resources Division, California District. District Chief (GS-15). Managed California District (350 persons in 14 offices) with annual budget of $25 million (in 1995 dollars) for hydrologic investigations. Responsible for developing plans for hydrologic investigations and ensuring plans were implemented. Provided organizational and technical input to development of large scale, multi-agency investigations. Examples of such projects include:

- Investigation of water quality related to agricultural drainage from the west side of San Joaquin Valley, California.

- Investigation of hydrodynamics of San Francisco Bay and Sacramento-San Joaquin, California Delta hydrologic systems.

- Investigation of the effects of exporting water from Owens Valley ground-water basin, California, including both hydrologic and biological impacts.

- Assessment of the ground-water resources of the Central Valley, California. Work was part of the Central Valley Regional Aquifer System Analysis (RASA).

- Development of numerical finite element codes (now used within the U.S. Geological Survey) for simulation of two- and three-dimensional ground-water flow and solute transport.

July 1977 to August 1982

U.S. Geological Survey, Water Resources Division, Nevada District. District Chief (GS-14) from 1/80 to 8/82 and Assistant District Chief (GS-13) from 7/77 to 1/80. Managed Nevada District (80 persons in three offices) with annual budget of $10 million (in 1995 dollars) for hydrologic investigations. Projects included:

- Design and organization of Truckee-Carson River Quality Assessment and Great Basin Regional Aquifer System Analysis (RASA).

- Development of ground-water and solute transport models for Washoe Valley, Galena Creek, Eagle Valley, and Carson Valley ground-water basins in Nevada.

- Design and organization of regional geothermal investigations of areas throughout Nevada including Dixie Valley, Ruby Valley, Black Rock Desert, and Carson Desert.

July 1972 to July 1977

U.S. Geological Survey, Water Resources Division, California District. Hydrologist (GS-13; 12/75 to 7/77), Hydrologist (GS-12; 10/74 to 12/74), Hydrologist (GS-11; 9/73 to 10/74), and Hydrologist (GS-9; 7/72 to 9/73). Served as Project Chief for numerous ground-water projects involving hydrogeologic and geophysical investigations and ground-water modeling. Conducted research in development of finite-element models for simulation of ground-water flow and mass transport. Applied results of research to solution of management problems and provided assistance to hydrologists within USGS and other public agencies in use of these models.

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Timothy J. Durbin

Publications

1. *Durbin, T.J.,* 1974, Digital simulation of the effects of urbanization on runoff in the upper Santa Ana Valley, California: U.S. Geological Survey Water-Resources Investigations 41-73, 44 p.

2. *Durbin, T.J.,* and Hardt, W.F., 1974, Hydrologic analysis of the Mojave River, California, using a mathematical model: U.S. Geological Survey Water-Resources Investigation 17-74, 50 p.

3. *Durbin, T.J.,* 1975, Selected effects of suburban development on runoff ir south-coastal California: in Proceedings of Second National Symposium on Urban Hydrology and Sediment Control, Lexington Kentucky, p. 209-217.

4. *Durbin, T.J.,* 1975, Ground-water hydrology of Garner Valley, San Jacint Mountains, California - a mathematical analysis of recharge and discharge: U.S. Geological Survey Open-File Report 75-305, 40 p

5. *Durbin, T.J.,* 1978a, Application of Gauss algorithm and Monte Carlo simulation to the identification of aquifer parameters: in Proceedings of 26th Annual American Society of Civil Engineers Hydraulic Division Specialty Conference, College Park, Maryland, p. 101-111.

6. *Durbin, T.J.,* 1978b, Calibration of a mathematical model of the Antelope Valley ground-water basin, California: U.S. Geological Survey Water-Supply Paper 2046, 51 p.

7. *Durbin, T.J.,* and Morgan, C.O., 1978, Well-response model of the confined area, Bunker Hill ground-water basin, San Bernardino County, California: U.S. Geological Survey Water-Resources Investigation 77-129, 39 p.

8. Arteaga, F.E., and *Durbin, T.J.,* 1978, Development of a relation for steady-state pumping rate from Eagle Valley ground-water basin, Nevada: U.S. Geological Survey Open-File Report 79-261, 44 p.

9. *Durbin, T.J.,* Kapple, G.W., and Freckleton, J.R., 1978, Two-dimensional and three-dimensional digital flow models of the Salinas Valley ground-water basin, California: U.S. Geological Survey Water-Resources Investigation 78-113, 134 p.

10. Van Denburgh, A.S., Seitz, H.R., *Durbin, T.J.,* and Harrell, J.R., 1982, Proposed monitoring network for ground-water quality, Las Vegas Valley, Nevada: U.S. Geological Survey Open-File Report 80-1286, 25 p.

11. *Durbin, T.J.,* 1983, Application of Gauss algorithm and Monte Carlo simulation to the identification of aquifer parameters: U.S. Geological Survey Open-File Report 81-688, 26 p.

12. Katzer, T., *Durbin, T.J.,* and Maurer, D.K., 1984, Water-resources appraisal of the Galena Creek basin, Washoe County, Nevada: U.S. Geological Survey Open-File Report 84-433, 59 p.

13. Kapple, G.W., Mitten, H.T., *Durbin, T.J.,* and Johnson, M.J., 1984, Analysis of Carmel Valley alluvial ground-water basin, California, using digital flow model techniques: U.S. Geological Survey Water-Resources Investigation 83-4280, 45 p.

14. Hromadka, T.V., and *Durbin, T.J.,* 1984, Adjusting the nodal point distribution in domain ground-water flow numerical models: in Proceedings of Fifth International Conference on Finite Elements in Water Resources, p. 265-284.

15. *Durbin, T.J.,* and Berenbrock, C., 1985, Three-dimensional simulation of free-surface aquifers by the finite-element method: U.S. Geological Survey Water-Supply Paper 2270, p. 51-67.

16. Martin, P., and *Durbin, T.J.,* 1990, Identification of net-flux rates for ground-water models: U.S. Geological Survey Water-Supply Paper, 2340, pp. 119-130.

17. Hromadka, T.V., and *Durbin, T.J.,* 1986, Two-dimensional dam-break analysis for Orange County Reservoir: Water Resources Bulletin, v. 22, n. 2, p. 249-256.

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20. Azrag, E.A., *Durbin, T.J.*, and Nour El-Din, N.N., 1986, Two-dimensional simulation of solute transport by finite-element method: Microsoftware for Engineers, v. 2, n. 3, p. 171-180.

21. Atkinson, L.C., *Durbin, T.J.*, and Azrag, E.A., 1992, Estimating the effects of non-Darcian flow on inflow to a pit and slope stability: Society for Mining, Metallurgy, and Exploration 1992 Annual Meeting, Paper 92-156, 4 p.

22. *Durbin, T.J.,* and Atkinson, L.C., 1993, Optimizing the design of mine dewatering systems: Society for Mining, Metallurgy, and Exploration 1993 Annual Meeting, Paper 93-103, 5 p.

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1. Hromadka, T.V., *Durbin, T.J.*, and DeVries, J.J., 1984, Computer methods in water resources: Lighthouse Publications, Mission Viejo (California), 344 p.

2. Hromadka, T.V., McCuen, R.H., Devries, J.J., and *Durbin, T.J.*, 1993, Computer methods in environmental and water resources engineering: Lighthouse Publications, Mission Viejo (California), 590 p.

INTEROFFICE MEMO

DATE: March 7, 2000

PHONE: 387-2805
MAIL CODE: 0835

FROM: **PATRICK J. MEAD**, P.E., Assistant Director - Planning
Transportation/Flood Control Department

TO: **JOHN GOSS**, Assistant County Administrator
Economic Development and Public Services Group

SUBJECT: **EIR TRAFFIC COMPONENT-MWD/CADIZ WATER PROJECT**

This office has reviewed the traffic data provided for the subject project and has determined that the following mitigation for traffic impacts is required: R3-67

♦ **OPENING DAY IMPROVEMENTS REQUIRED** R3-68

1. *Addition of a left turn pocket for westbound National Trails Highway (NTH) at Amboy Road. (Est. $70,000)* R3-69
2. *Addition of a left turn pocket for eastbound NTH at Kelbaker Road. (Est. $70,000)* R3-70
3. *Installation of safety flashers for both directions at curve on Amboy Road, west of Ironage Road. (Est. $40,000)*

Total: $180,000 R3-71

The project should fund 100% of these improvements.

FUTURE ROAD IMPACTS

Fair Share Contributions: R3-72

			Cost	Percentage of trips over life of Improvement
N.T.H.				
Road Improvement	*Amboy Rd to Kelbaker Rd*		*$ 41,000*	*(16.7%)*
	Kelbaker Rd to Cadiz Rd		*$118,000*	*(50.4%)* R3-73
			$159,000	
♦ Bridge Improvements (local share)	*Amboy Rd to Kelbaker Rd*		*$ 57,000*	***(3.1%)* R3-74
	Kelbaker Rd to Cadiz Rd		***$244,000*	***(14%)* R3-75
			***$301,000*	
AMBOY ROAD				R3-76
Road Improvements	*NTH to Ironage Rd*		*$186,000*	*(23.6%)*
	Ironage Rd to 29 Palms Cir		*$ 97,000*	*(23.6%)* R3-77
			$283,000	

TOTAL SHARE OF FUTURE COSTS *****$743,000*** R3-78

The impacts of the project are in two categories. First, the immediate safety concerns of the large increases in daily construction traffic requiring turn pockets and flashers. Second, the heavy additional fairshare impacts on the road and bridge infrastructure along N.T.H. and Amboy Road caused by the increase in auto and truck traffic for the duration of the project. R3-79

♦ ***Priority Items***
*** Revised 2/15/2000*

PJM:AMC

cc: Randy Scott
KAM/RF
JYB

INTEROFFICE MEMO

DATE February 22, 2000 PHONE 307-2669

FROM **Robert L. McKernan**, Senior Curator
Section of Biological Sciences, San Bernardino County Museum

TO **JOHN GOSS**, Assistant County Administrator
Economic Development and Public Services Group

SUBJECT CADIZ GROUNDWATER STORAGE AND DRY-YEAR SUPPLY PROGRAM – DRAFT EIR/EIS

23-80 The Section of Biological Sciences at the San Bernardino County Museum has reviewed the above-mentioned document as it pertains to Biological resources. The following comments and suggestions are the result of that review.

23-81 The biological resource technical report # 1164.
It appears that the field reconnaissance was the standard biological consultant's methods. Although, it appears that there was a wide breath of survey days, for a project of this size, I think more focused sensitive species surveys should have been conducted (e.g., desert tortoise). The general mammal surveys conducted for American badger, Yuma mountain loins and Nelson's bighorn sheep should have been more intensive. This comment is based on the fact that movement zones for these mammals could be impeded by the various alternatives through direct and indirect impacts. Within the project area Mojave wash scrub is a significant resource and for this reason a more detailed discussions regarding avoidance of this habitat should have been conducted. Because of the amount of "Special Interest Habitat" within the project area and the importance of this habitat statewide and worldwide, a more detailed discussion of impacts and avoidance should have been completed. Overall impacts to Special-Status Species should have included further analysis and discussions. This should include impacts and recommendations to more fully assess project affects. Although the USFWS will provide a Biological Opinion for the project, more detailed analysis from the consultant's prior to the BO would benefit San Bernardino County in its review of specific project impacts.

23-82 23-83 23-84 23-85

23-86 Within the project document no thorough analysis was indicated regarding the potential effects of "de-watering" of springs and seasonal water sources by groundwater extraction in this area of the Mojave Desert. The fact that springs and seasonal surface water is critical for wildlife species in arid environments; there is a potential for significant effects to water sources in the region. With the connectivity of Bristol, Fenner, and the Cadiz watersheds there will effects through extraction. Therefore, a complete sensitivity analysis should be performed regarding depletion of water sources for wildlife over a 200 square mile area covering the effected watershed.

23-87 Although spreading basins at Cadiz will provide loafing and resting areas for migratory birds which are transients to the area, spreading basins are usually relatively shallow. These shallow environments can create avian cholera and avian botulism that will significantly impact migratory bird species as well as other wildlife species.

23-88 Growth Inducements Impacts. The Cadiz project with its infrastructure needs and planned growth will have environmental impacts within San Bernardino County. Regional growth projections have to be address and evaluated on a regional perspective. Specifically, what effect will this project have on San Bernardino County's ongoing regional planning efforts, such as the San Bernardino Valley MSHCP and the Western Mojave regional plan? San Bernardino County has provided significant resources to the planning efforts of both regional plans and indirect effects from the Cadiz Project regionally could have significant implications to these plans and their future implementation.

23-89 Cumulative impacts and related projects within the Cadiz Valley have not been fully or adequately analyzed. The short and long term environment effects I believe will be significant.
Cumulative impacts regionally based on increased infrastructure and growth has to be analyzed more thoroughly. As mentioned earlier, cumulative growth would have a potential negative effect on San Bernardino County's regional planning efforts.

cc. Kevin Thomas, CCR
Randy Scott, Land Use Services

INTEROFFICE MEMO

DATE February 22, 2000 PHONE 307-2669

FROM **KATHLEEN SPRINGER**, Senior Curator
Section of Geological Sciences, San Bernardino County Museum

TO **JOHN GOSS**, Assistant County Administrator
Economic Development and Public Services Group

SUBJECT **CADIZ GROUNDWATER STORAGE AND DRY-YEAR SUPPLY PROGRAM – DRAFT EIR/EIS**

R3-90 The Section of Geological Sciences at the San Bernardino County Museum has reviewed the above-mentioned document as it pertains to paleontologic resources. The following comments, suggestions and queries are the result of that review.

- R3-91 There is no paleontologic technical report included in the EIR/EIS. The description of the fossil resources does not correlate with the table of fossil localities. One can not discern where the resources were recovered and what was recovered (i.e. taxa and elements) based on the information provided in Section 5-16, beginning on page 5-278.
- R3-92 There is no itemized, accession inventory of fossil resources recovered from the paleontologic survey of the project area. This is a requirement of the County of San Bernardino and the BLM.
- R3-93 There are 23 sites with fossil specimens recovered from the project area. To date, no fossil specimens have been curated into the collections of the SBCM. The Museum provided the project paleontologist with two accession numbers to assist them in the curation of the specimens prior to storage at the SBCM nearly one year ago. Two numbers are assigned because BLM (i.e. Federal) property is given a separate number because they are considered on "permanent loan" to the Museum, with the legal owner as the Federal government. The Museum has not received the fossils, the field data, or the back-up documentation for these fossil specimens. Before the specimens are deposited with the Museum, we require a copy of the Antiquities Act Permit obtained by the project paleontologist for the collection of paleontologic resources on BLM land and that he/she obtained the proper Field Work Authorization Permit before proceeding with the survey work.
- R3-94 In Tables ES-4 and 12-1, it should be noted that permits are required for paleontologic field studies on BLM land.
- R3-95 The text has no mention in Section 5-16, starting on page 5-278, of the mitigation conditions of the County of San Bernardino or the requirements of the BLM regarding fossil resources. The Society of Vertebrate Paleontology is an international organization of vertebrate paleontologists that upholds ethical conduct in paleontology and lobbies for the protection of fossil resources, but is not considered the Lead Agency.

- Interestingly, in the discussion regarding the thresholds of significance of fossil resources, a block of text starting on page 5-280 and ending on page 5-281 has been lifted ***verbatim*** from the guidelines written and established by the San Bernardino County Museum. The source of these guidelines should be referenced. R3-96
- Mitigation measure P-6. This is **not** a mitigation measure. It is a financial constraint on the implementation of mitigation measures P-1 through P-5. I have never seen such a condition applied to paleontological resource impacts. For cultural resources, I have seen "not to exceed ½ of 1% of total project costs", (which is in the CEQA statute Section 21083.2), but ¼ of 1% for paleontologic mitigation is an arbitrary limitation imposed by MWD. I believe that full mitigation be applied that is consistent with San Bernardino County policies on paleontological resource impacts as described below. R3-97
- With the implementation of a Paleontological Resource Mitigation Plan consistent with that described below, I believe that potential impacts could be mitigated to a less than significant level for the project. I believe that this level of mitigation is entirely appropriate and warranted for a project of this magnitude and cost. R3-98

- **The following are the standard mitigation conditions that the San Bernardino County Museum has designed and would recommend for this project. Please compare to the mitigation conditions in the text:** R3-99

The following are mitigation guidelines to be employed during excavation conducted on PROJECT X. These measures are commensurate with those utilized throughout southern California for numerous projects on public and private land. The mitigation measures will effectively mitigate adverse impacts to paleontologic resources to less than significant levels. These measures are summarized below as Paleontology Actions (PA) 1 through 5. The specifics of the mitigation efforts, including monitoring of excavation, curation, preparation of the final report and storage of specimens,

Prior to construction

PA-1 An orientation workshop shall be prepared and presented by a professional vertebrate paleontologist to explain paleontologic mitigation guidelines and procedures to the contractor and construction workers. This workshop can be presented in conjunction with any pre-grade meetings conducted prior to excavation. The workshop will review the Paleontologic Resources Mitigation Plan (PRMP), and will endeavor to explain the nature, appearance and importance of fossil vertebrates, invertebrates and plants. The responsibilities of construction personnel in a paleontologic mitigation context will also be detailed. Construction workers shall not collect any fossils found during construction before their significance can be assessed by a qualified paleontologist. An outline for the paleontology workshop should be provided. A document entitled A Checklist for Paleontologic Resources and Guidelines for Construction Personnel should be prepared for this task. R3-100

All construction inspectors and environmental monitors shall be briefed on the locations of high sensitivity areas for paleontologic resources as part of a training program including information on all aspects of the project. This training program will cover items addressed in the paleontology workshop, but

more training and detail will be included. It will be stated during the paleontology briefing that it is unlawful for construction inspectors or environmental monitors to collect fossils from the project alignment or any other construction area during construction, as these fossils belong to the public and will be placed in a recognized curation facility such as a museum or university, where they will be treated, stored, maintained and made available for scientific study.

R3-100

During construction

PA-2 If paleontologic resources are found at any time during construction, work shall be redirected to another area nearby so that the scientific significance of the find may be assessed. Construction monitors shall notify the onsite construction monitoring coordinator. As part of the monitoring procedure, a qualified professional vertebrate paleontologist with regional experience shall then assess the significance of the find and recommend additional mitigation measures, as necessary. The paleontologist shall be retained to perform inspection of the excavation and to salvage exposed fossils. A standard sample [2,724 kg (= 6,000 lbs. or 2.4 cubic meters) of fossiliferous sediment may be collected for recovery and identification of microvertebrates (rodents, birds, rabbits). Monitors shall also determine whether the fossil is part of an archaeological deposit; if so, it shall then be considered a cultural resource discovery and treated according to the procedures specified in the Cultural Resource Monitoring Plan prepared prior to construction.

R3-101

This measure will be implemented by requiring paleontologic monitoring in rock units that have been designated as having high potential to contain paleontologic resources. The paleontologic monitoring plan calls for the placement of one paleontologic monitor at each construction location in all areas of high paleontologic sensitivity. This monitor will be a qualified vertebrate paleontologist with regional experience. The paleontologic monitor is empowered to determine significance in the field and recover the data immediately.

If fossils are discovered by environmental monitors and/or construction personnel in areas of low paleontologic sensitivity, work shall be redirected to another area nearby so that the scientific significance of the find may be assessed.

Large fossils exposed by excavation will be expeditiously jacketed with plaster bandages or strips of burlap saturated with plaster, then removed and returned to the paleontology laboratory for preparation, identification and permanent storage. Standard samples [2,724 kg (= 6,000 lbs. or 2.4 cubic meters) of sediment, as modified from Wolff (1975)] of fossiliferous sediments will be salvaged from designated microfossil sampling localities. This sedimentary matrix will be stockpiled on-site, and subsequently processed; recovered specimens will be identified and curated.

PA-3 The preservation of significant fossils (if found during construction) by removal will occur as described in PA-3, unless it is not feasible. Due to the potential for rapid deterioration of exposed surface fossils, preservation by avoidance is not an acceptable mitigation measure. In cases where the fossil(s) cannot be removed immediately, the location of the fossil(s) shall be stabilized to prevent further deterioration prior to data recovery under the direction of a qualified vertebrate paleontologist. Stabilization in these cases can (as necessary and safely feasible) include the following: removal of overburden; exposure of the resource(s); application of an appropriate hardening agent (e.g., Glyptal for large vertebrate fossils); and (in those cases where the resource cannot be recovered at all) reburial of the resource. Data recovery in these cases will include documentation of pertinent data (lithology, stratigraphy, taphonomy, etc.) as well as photodocumentation where possible.

R3-102

This measure will be further implemented by the mobilization of additional professional paleontologic field monitors within hours of the discovery if unusually large finds are encountered. This procedure will optimize data recovery and avoid construction delays.

After construction

PA-4 For all macro- and microfossils (vertebrate, invertebrate and/or plant) recovered during construction, a data recovery program shall be undertaken that includes preparation of recovered specimens to a point of identification and permanent preservation (including screen washing of fossiliferous sediment samples to recover small to microscopic vertebrate fossils); preparation of large vertebrate fossils recovered in plaster jackets; long-term stabilization of all recovered significant fossils; and analysis. The paleontologic monitoring and salvage team shall include an expert in vertebrate paleontology. A final report, including an itemized and accessioned inventory of recovered specimens, shall be prepared by a professional vertebrate paleontologist and distributed to the appropriate lead agencies. This report shall include any important megainvertebrate fossil localities and/or fossil plant localities.

R3-103

PA-5 All fossil remains recovered during construction and associated development activity shall be curated and stored at the expense of the project proponent at a qualified research facility (e.g., SBCM). A Memorandum of Agreement (MOA) for curation shall be reviewed and approved among the developers, the appropriate Lead Agency or other landowner (if land is owned by others), and the curation facility providing rights to these materials for guaranteed future research access.

R3-104

If I can provide any clarification or other information please contact me at (909) 307-2669 ext. 242.