ROY R. CELLAN
CORPORATE MANAGER
RECLAMATION

ENVIRONMENTAL, HEALTH, SAFETY
AND GOVERNMENT AFFAIRS

40-8903

July 14, 2000

Ms. Mary Heather Nobel
Ground Water Section
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Re: Grants Reclamation Project
Discharge Plan Renewal Application (DP-200)

Dear Ms. Nobel:

Homestake Mining Company of California (Homestake) has operated the Grants site under an approved Ground Water Discharge Plan (DP-200) for several years. That Discharge Plan is due to expire on November 15, 2000.

This letter is submitted to request the renewal of and modification to Homestake's Discharge Plan as required under Subpart III, Section 3106, Paragraph F, of the New Mexico Water Quality Control Commission Regulations (WQCC). Attached to this letter is the renewal application, along with the support attachments, and the $50.00 filing fee.

The original Discharge Plan was approved on May 10, 1984, renewed and approved on July 24, 1989, and most recently renewed and approved on November 15, 1995.

Homestake was asked as a part of the renewal process to submit the renewal based upon the WQCC regulations, as amended and dated November 15, 1996. The previous submittal was addressed under the WQCC 82-1, Parts 1, 2, 3 and 5 dated August 19, 1982.

The restoration methods Homestake proposes to use to ensure compliance with WQCC, Subpart III, Section 3106, Paragraph C, are outlined on pages one and two of the November 15, 1995 approved Discharge Plan Modification and Renewal. These methods were previously submitted to the New Mexico Environment Department (NMED) as part of the original discharge plan approved May 10, 1984. The restoration plan has been modified to fit site conditions at the time of each subsequent renewal.

HOMESTAKE MINING COMPANY
P.O. BOX 98 • GRANTS, NM 87020-0011

NMSSOIPublic

Additionally, methods to ensure compliance with the Nuclear Regulatory Commission (NRC) hazardous constituents are outlined in the Groundwater Corrective Action Plan (CAP) originally submitted and approved by the NRC and copied to the NMED in September 1989. The CAP is presently being updated to reflect the current activities approved by the NMED and NRC. In addition to having the CAP collection/injection activities reflect the most recent approved monitoring plan, the modified CAP will also reference the addition of the RO treatment plant and the on-going bio-research program. The updating of the CAP will not affect any of the information presented in this renewal application since the application is solely based upon already approved monitoring plans and operating programs.

As you proceed through this submittal you will note that we have used the NMED's "Ground Water Discharge Permit Application Form" for the renewal form. Although the application form does not actually reflect the activities at this site (for example, the form appears to be set up for a new user or an injection well user) we have filled the form out in a way that best represents this site and its activities.

We have also provided, for additional support to the application, a document titled "DP-200 Renewal WQCC Compliance Document" which outlines how the DP-200 Renewal Application with attachments and previously submitted documents comply with the requirement for Discharge Plan Renewal described in Section 3106 of the New Mexico Water Quality Control Commission Regulations (WQCC), dated November 15, 1996.

Homestake has supplied additional support information about the site and its on-going commitment to ground water restoration in the form of an annual report titled "Ground-Water Monitoring and Performance Review for Homestake's Grants Project" since the early 80's. The annual report provides to the agencies, on a yearly basis, a complete summary of the restoration work completed at the site. During the years from 1983 through 1997 information, the well data in the report was organized to show complete historical restoration progress. Since 1998 report, the well data in the annual report has been reorganized in the form of a 5 year progress summary.

Homestake's ground water remediation program has been very effective at reversing natural ground water flow gradients and containing the contamination within the injection containment zone around the tailings piles. The newly installed RO treatment plant produces a product water for reinjection that is 99% free of contaminates. Restoration tests using this extremely pure product water are very encouraging. In addition, we have been running bench scale and column test work using passive and active bio-remediation methods. The result of this test work is also encouraging.

As discussed with the NMED on several occasions over the past three years, Homestake would like the NMED to consider, during this permit renewal period, adjusting the site standards for TDS, sulfate (SO_4), selenium (Se) and nitrate (NO_3) to more accurately reflect the actual full range up-gradient back ground quality of the San Mateo alluvium. We have presented our case on this issue in more detail in the DP-200 Renewal WQCC Compliance document.

This package consists of the following:

- Cover Letter
- Renewal Application Form
- Filing Fee
- DP-200 Renewal WQCC Compliance Document
- Support Attachments
  - Attachment A - Ground Water Hydrology, July 2000
  - Attachment B - 2000 Grants Completion Schedule
  - Attachment C - Statistical Evaluation of Background
  - Attachment D - Homestake Environmental Report, 1999 Environmental Goals and Commitment
  - Attachment E - Standard Operating Procedure HP-15

Homestake is prepared to discuss any of the technical issues relative to this renewal at your earliest convenience once you have had a chance to digest its contents. Homestake also recommends that the NMED document their comments prior to any meeting so that Homestake and our consultant can be prepared to respond to all of the issues in one meeting.

If you have any comments or questions concerning this renewal application, please contact either Mr. Ron Waterland or myself at 505.287.4456.

Very truly yours,

Attachments

cc: Mr. Harold F. Barnes, cover ltr only
Mr. Ken Hooks, NRC, with attachments
Ms. Petra Sanchez, EPA, with attachments

CONTENTS

ROY R. CELLAN
CORPORATE MANAGER
RECLAMATION

ENVIRONMENTAL, HEALTH, SAFETY
AND GOVERNMENT AFFAIRS

July 14, 2000

Ms. Mary Heather Nobel
Ground Water Section
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Re: Grants Reclamation Project
Discharge Plan Renewal Application (DP-200)

Dear Ms. Nobel:

Homestake Mining Company of California (Homestake) has operated the Grants site under an approved Ground Water Discharge Plan (DP-200) for several years. That Discharge Plan is due to expire on November 15, 2000.

This letter is submitted to request the renewal of and modification to Homestake's Discharge Plan as required under Subpart III, Section 3106, Paragraph F, of the New Mexico Water Quality Control Commission Regulations (WQCC). Attached to this letter is the renewal application, along with the support attachments, and the $50.00 filing fee.

The original Discharge Plan was approved on May 10, 1984, renewed and approved on July 24, 1989, and most recently renewed and approved on November 15, 1995.

Homestake was asked as a part of the renewal process to submit the renewal based upon the WQCC regulations, as amended and dated November 15, 1996. The previous submittal was addressed under the WQCC 82-1, Parts 1, 2, 3 and 5 dated August 19, 1982.

The restoration methods Homestake proposes to use to ensure compliance with WQCC, Subpart III, Section 3106, Paragraph C, are outlined on pages one and two of the November 15, 1995 approved Discharge Plan Modification and Renewal. These methods were previously submitted to the New Mexico Environment Department (NMED) as part of the original discharge plan approved May 10, 1984. The restoration plan has been modified to fit site conditions at the time of each subsequent renewal.

Additionally, methods to ensure compliance with the Nuclear Regulatory Commission (NRC) hazardous constituents are outlined in the Groundwater Corrective Action Plan (CAP) originally submitted and approved by the NRC and copied to the NMED in September 1989. The CAP is presently being updated to reflect the current activities approved by the NMED and NRC. In addition to having the CAP collection/injection activities reflect the most recent approved monitoring plan, the modified CAP will also reference the addition of the RO treatment plant and the on-going bio-research program. The updating of the CAP will not affect any of the information presented in this renewal application since the application is solely based upon already approved monitoring plans and operating programs.

As you proceed through this submittal you will note that we have used the NMED's "Ground Water Discharge Permit Application Form" for the renewal form. Although the application form does not actually reflect the activities at this site (for example, the form appears to be set up for a new user or an injection well user) we have filled the form out in a way that best represents this site and its activities.

We have also provided, for additional support to the application, a document titled "DP-200 Renewal WQCC Compliance Document" which outlines how the DP-200 Renewal Application with attachments and previously submitted documents comply with the requirement for Discharge Plan Renewal described in Section 3106 of the New Mexico Water Quality Control Commission Regulations (WQCC), dated November 15, 1996.

Homestake has supplied additional support information about the site and its on-going commitment to ground water restoration in the form of an annual report titled "Ground-Water Monitoring and Performance Review for Homestake's Grants Project" since the early 80's. The annual report provides to the agencies, on a yearly basis, a complete summary of the restoration work completed at the site. During the years from 1983 through 1997 information, the well data in the report was organized to show complete historical restoration progress. Since 1998 report, the well data in the annual report has been reorganized in the form of a 5 year progress summary.

Homestake's ground water remediation program has been very effective at reversing natural ground water flow gradients and containing the contamination within the injection containment zone around the tailings piles. The newly installed RO treatment plant produces a product water for reinjection that is 99% free of contaminates. Restoration tests using this extremely pure product water are very encouraging. In addition, we have been running bench scale and column test work using passive and active bio-remediation methods. The result of this test work is also encouraging.

As discussed with the NMED on several occasions over the past three years, Homestake would like the NMED to consider, during this permit renewal period, adjusting the site standards for TDS, sulfate (SO_4), selenium (Se) and nitrate (NO_3) to more accurately reflect the actual full range up-gradient back ground quality of the San Mateo alluvium. We have presented our case on this issue in more detail in the DP-200 Renewal WQCC Compliance document.

This package consists of the following:

- Cover Letter
- Renewal Application Form
- Filing Fee
- DP-200 Renewal WQCC Compliance Document
- Support Attachments
  - Attachment A - Ground Water Hydrology, July 2000
  - Attachment B - 2000 Grants Completion Schedule
  - Attachment C - Statistical Evaluation of Background
  - Attachment D - Homestake Environmental Report, 1999 Environmental Goals and Commitment
  - Attachment E - Standard Operating Procedure HP-15

Homestake is prepared to discuss any of the technical issues relative to this renewal at your earliest convenience once you have had a chance to digest its contents. Homestake also recommends that the NMED document their comments prior to any meeting so that Homestake and our consultant can be prepared to respond to all of the issues in one meeting.

If you have any comments or questions concerning this renewal application, please contact either Mr. Ron Waterland or myself at 505.287.4456.

Very truly yours,

Attachments

cc: Mr. Harold F. Barnes, cover ltr only
Mr. Ken Hooks, NRC, with attachments
Ms. Petra Sanchez, EPA, with attachments

New Mexico Environment Department
Ground Water Discharge Permit Application Form

Name of facility: Homestake Mining Company - Grants Project

Name, title, and address of person(s) legally responsible for discharge:
Roy R. Cellan, Corporate Manager Reclamation
P.O. Box 98
Grants, NM 87020
Telephone no.: 505-287-4456
FAX no.: 505-287-9289

Owner of Facility
Owner's address:
Homestake Mining Company
P.O. Box 98
Grants, NM 87020
Telephone no.: 505-287-4456
FAX no.: 505-287-9289

Name, title and address of local representative or contact person at the facility (if different than the responsible person), and consultant if consultant used:

Facility Representative	Consultant
Ronald A. Waterland	
Roy R. Cellan	
Telephone no.: 505-287-4456	Telephone no.:
FAX no.: 505-287-9289	FAX no.:

1. Type of facility or operation (dairy, municipality, mining, etc.):
Mining Milling Reclamation

2. Proposed method(s) of treatment, storage, and/or disposal of effluent or leachate (Package plant-lagoon-leachfield, wetlands-infiltration gallery, air stripper-injection well, etc.):
Pump and treat with reverse osmosis and evaporation.

Discharge Characteristics

3. Quantity:

a. Design discharge rate in gallons per day (gpd): unknown
b. Gallons per day computed on an annual basis: unknown
c. Number of days per year facility will be discharging: 365

4. Method used to meter or calculate the discharge rate:
Discharge from tailings pile not metered.

5. Flow characteristics. Describe if flow is:

a. Daily (five or seven days per week) or seasonal (give months):
Daily

b. Continuous or intermittent: Continuous

Discharge Quality. List the concentrations of contaminants and toxic pollutants generally associated with the type of facility or operation. The contaminants of concern are those listed in Section 3-103 of the NM Water Quality Control Commission (WQCC) Regulations and total nitrogen (nitrate + total Kjeldahl nitrogen). The toxic pollutants are listed in WQCC Regulation 1101.TT

Contaminant	Concentration (mg/l)
refer to original discharge plan approved May 10, 1984	

Location Information

7. Location of discharge site (see Attachment A):
County: Cibola

Township: 12N Range: 10W Section: 26

Latitude/Longitude: 35°14' / 107°52'

Please provide a copy of a State of New Mexico road map with the property clearly outlined.

8. Location of any water supply wells, injection wells, seeps, springs, bodies of water or water courses within one mile of the outside perimeter of the discharge site. These items must be plotted on a copy of the pertinent USGS topographic map(s) or an aerial photograph. Include the name(s) of the USGS topographic map(s).

9. Give the location of any proposed or existing wells to be used for monitoring the ground water quality.

Well ID	Township	Range	Section
refer to approved Table 2 (8-99)			

The wells must be located on USGS topographic map(s) or aerial photograph from Item 8.

Ground Water Conditions

10. a. The depth (feet) to ground water below the discharge site:
See d. below

b. The flow direction of ground water below the site:
See d. below

c. The gradient of the ground water below the site:
See d. below

d. Reference or source of information for 10. a, b, c, above:
Refer to Ground-Water Hydrology at the Grants Reclamation Site (Attachment A)

11. a. The Total Dissolved Solids (TDS) concentration (mg/l) of the ground water:
See b. below

b. Reference or source of information: Refer to Ground-Water Hydrology at the Grants Reclamation Site (Attachment A)

Flooding Potential

12. Describe the flooding potential of the discharge site based on the latest Federal Emergency Management Agency flood plain information or site specific analysis: Not applicable. Discharge is located beneath reclaimed tailings pile which meets federal requirements for flood protection.

13. Describe the methods used to control flooding of the discharge site (berms, diversion channel, etc.): Tailings are protected by berms, diversion channel and scour trench.

Soil and Geologic Information

14. Attach a copy of the USDA Soil Conservation Service soil survey map and descriptive information for soil(s) associated with the discharge site.

15. Describe the lithology and thickness of each geologic unit below the discharge site. Please indicate which units are water bearing. This information may be obtained from driller's logs or geologic reports.

Thickness (feet)	Description
Refer to Ground-Water Hydrology at the Grants Reclamation Site (Attachment A)	

Operational Plan

16. An operational plan must be attached which describes how the system(s) for the collection, treatment, distribution and disposal of waste waters or other discharges will be operated and maintained.

Refer to existing DP-200 Discharge Plan

Contingency Plan

17. A contingency plan must be attached which describes actions to be taken in the event that spills or failures occur or ground water standards are threatened.

Refer to existing DP-200 Discharge Plan

Monitoring Plan

18. A monitoring plan must be attached which outlines the proposed sampling point locations (monitoring wells, outfalls, etc.), sampling protocols (bailers, pumps, etc.), sampling frequency (monthly, yearly, etc.), chemical parameters to be analyzed for (TDS, nitrate, etc.), static water levels, discharge rates (gpd), etc.

Refer to existing DP-200 Discharge Plan with approved Table 2 (8-99)

Closure Plan

19. A closure plan must be attached for system components that are likely to be discontinued during the term of the permit. The closure plan must address the reclamation and post-operational monitoring of ground water at the site, as appropriate. Also the plan shall provide for plugging and abandonment of all monitor wells, after ground water quality meets the WQCC Regulations.

Not applicable. Refer to Reclamation Schedule (Attachment B)

Signature(s)

20. a. I certify that I am the legal owner of the property in which all discharges will occur.

Agent for: Homestake Mining Company

Signature _____ Date 7/14/00

OR b. Enclose a signed copy of the lease agreement between you and the owner of the property on which the proposed discharge will occur. Lease agreement should be valid for the duration of the discharge plan or until the discharge plan is modified.

21. I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete and accurate.

Agent for: Homestake Mining Company

Signature of person legally responsible for the discharge _____ Title: Corporate Manager Reclamation Date: 7/14/00

Homestake Mining Company
1600 Riviera Avenue, Suite 200
Walnut Creek, CA 94596-3568

CHECK NO: 9180

DATE: 13-JUL-00 VENDOR NAME: NM Environmental Dep VENDOR NO: 2062

INVOICE NO	INVOICE DATE	DESCRIPTION	DISCOUNT	NET AMOUNT
12-JUL-00	12-JUL-00		0.00	50.00
			0.00	50.00

PLEASE DETACH AND RETAIN THIS STATEMENT AS YOUR RECORD OF PAYMENT

Thank you

THE BACK OF THIS DOCUMENT CONTAINS A HOMESTAKE MINING CO. FACSIMILE WATERMARK • CAN BE SEEN AT AN ANGLE • VOID IF NOT PRESENT

Homestake Mining Company
1600 Riviera Avenue, Suite 200
Walnut Creek, CA 94596-3568

DRAWN ON:
Wachovia Bank, N.A. Greenville, SC
In Cooperation with Wells Fargo Bank, NA
#4759-626252

67 - 1 /532

PAY Fifty Dollars And 00 Cents**********

CHECK DATE	CHECK NO	AMOUNT
13-JUL-00	9180	$ *********50.00

TO THE ORDER OF
NM Environmental Department
Ground Water Pollution
Prevention Section
P. O. Box 26110
Santa Fe, NM 87502

BY _____
AUTHORIZED SIGNATURE

⑈000009180⑈ ⑆053200019⑆ 5404 51036⑈

DP-200 Renewal WQCC Compliance

Homestake has been asked as a part of the renewal process for the DP-200 permit, to submit the renewal based upon the WQCC regulations, as amended and dated November 15, 1996.

The restoration methods Homestake proposes to use to ensure compliance with WQCC, Subpart III, Section 3106, Paragraph C, are outlined on pages one and two of the November 15, 1995 approved Discharge Plan Modification and Renewal. These methods were previously submitted to the New Mexico Environment Department (NMED) as part of the original discharge plan approved May 10, 1984 and subsequently modified and submitted with each renewal.

Information addressing the requirements of WQCC Subpart III, Section 3106 C. 1 through 8 was most recently submitted January 20, 1989 in "Hydro-Engineering 1988, Renewal Ground-Water Discharge Plan, DP-200". Additionally, some of this information is submitted to the NMED annually in the Ground-Water Monitoring and Performance Review Report. Additional updated hydrological information is included in the attached document "Ground Water Hydrology at the Grants Reclamation Site" (refer to Attachment A).

Pursuant to WQCC Subpart IV Section 4105 A. 4 and 6, Homestake is exempt from the restoration plan requirements of Sections 4104 and 4106 since Homestake is operating a ground water restoration program under the authority of the NRC and under the authority of an approved ground-water discharge plan respectively.

4105 EXEMPTIONS FROM ABATEMENT PLAN REQUIREMENT

4105- A. ***Except as provided in Subsection B of this Section, Sections 4104 and 4106 of this part do not apply to a person who is abating water pollution: [12-1-95]***

4. ***under the authority of the U.S. Nuclear Regulatory Commission or the U.S. Department of Energy pursuant to the Atomic Energy Act; [12-1-95]***

6. ***under the authority of a ground-water discharge plan approved by the secretary, provided that such abatement is consistent with the requirements and provisions of Section 4101, 4103, 4106.C, 4106.E, 4107 and 4112 of this Part; [12-1-95]***

As required by 4105 A. 6. the following discussion describes how the existing methods outlined in the 1989 NRC CAP document and outlined in the approved discharge plan are

consistent with the requirements and provisions of Sections 4101, 4103, 4106.C, 4106.E, 4107 and 4112 of Subpart IV of the WQCC Regulations.

4101 PURPOSE

4101 - A. The purpose of this Subpart are to:

1. Abate pollution of subsurface water so that all ground water of the State of New Mexico which has a background concentration of 10,000 mg/L or less TDS, is either remediated or protected for use as domestic and agricultural water supply, and to remediate or protect those segments of surface waters which are gaining because of subsurface-water inflow, for uses designated in the Water Quality Standards for Interstate and Intrastate streams in New Mexico (20 NMAC 6.1); and [12-1-95]

The methods Homestake is using to contain and remediate the existing concentrations of pollutants within the contaminant plume at the Grants Reclamation Site as outlined in the existing CAP and the existing DP-200 discharge plan are designed to ensure that the ground-water at the site boundary is protected for use as domestic and agricultural water supply. As part of the restoration program, Homestake has in place since 1977 an injection system that supplied uncontaminated water at a rate of about 400 to 600 gpm to build a hydraulic barrier between the contaminated zone on the Homestake property and the residential areas. This barrier has been very effective and remains in place today.

It must be noted that the domestic use of the ground water from the San Mateo Alluvium in the sub-divisions located south of the Homestake property is limited to lawn and garden irrigation and some agricultural use such as livestock watering and small farm irrigation. The natural quality of the alluvial water in these areas is high in sulfate and TDS which does not promote its use for drinking. It also should be noted that in 1985, Homestake provided to the property owners of the subdivisions free hook ups to the Milan municipal water system, plus free water use for a 10 year period.

Subsurface-water inflow to gaining segments of surface waters do not exist within the area of contamination and the ground water at the site boundary is presently protected.

2. Abate surface-water pollution so that all surface waters of the State of New Mexico are remediated or protected for designated or attainable uses as defined in the Water Quality Standards for Interstate and Intrastate streams in New Mexico (20 NMAC 6.1); and [12-1-95]

- Surface waters are not effected at this site. The mill tailings are capped with an interim cover of clean clay on top and a final design cover of clay and rock on the side-slopes. The cover is designed to withstand precipitation and flooding events so there is no potential for erosion or precipitation to introduce pollutants to surface waters.

4101 - B. ***If the background concentration of any water contaminant exceeds the standard or requirement of Sections 4103.A, 4103.B or 4103.C of this Part, pollution shall be abated by the responsible person to the background concentration. [12-1-95]***

As referenced on page 2 of the November 15, 1995 DP-200 Discharge Plan Modification and Renewal, submitted in 1995, the background quality of the San Mateo Alluvium was determined in 1984 by sampling monitor wells P, Q, and R which are located up-gradient from Homestake's reclamation site. Mean-background values for groundwater parameters regulated under the WQCC regulations were calculated. All parameters were under the WQCC standards except for TDS, sulfate (SO_4), selenium (Se), and nitrate (NO_3).

Homestake has more than a decade and a half of additional monitoring data on a more diverse selection of background wells. Since existing background standards were set on calculated mean values of relatively few data points, Homestake proposes that the standards for these four parameters be modified based on the statistical 95th percentile value for wells in the near up-gradient data set. Using the 95th percentile value will take into account the natural range of variation within the up-gradient aquifer to ensure that site monitoring standards are not being influenced by background concentrations. Homestake proposes the following background standards to be incorporated into the requested discharge plan modification and renewal for DP-200: TDS - 3060 mg/L, SO_4 - 1870 mg/L, Se - 0.27 mg/L, and NO_3. 23 mg/L. The attached "Statistical Evaluation of Alluvial" (refer to Attachment C) supports Homestakes' proposed changes to the back ground standards.

The methods outlined in the CAP and the existing approved discharge plan are designed to restore the ground water in the San Mateo Alluvium to these background concentrations for these parameters

4101 - C. ***The standards and requirements set forth in Section 4103 of this Part are not intended as maximum ranges and concentrations for use, and nothing herein contained shall be construed as limiting the use of waters containing higher ranges and concentrations.***

Since the background concentrations of the four parameters discussed above are greater then the WQCC standards set forth in Section 4103 then the WQCC standards should not be construed as limiting the use of waters abated to the background standards proposed above.

The only use of the up gradient water is, at best, used for non-drinking and agricultural uses. This up gradient water should never be considered a source of drinking water due to its poor quality.

4103. ABATEMENT STANDARDS AND REQUIREMENTS

4103 - A. The vadose zone shall be abated so that water contaminants in the vadose zone shall not be capable of contaminating ground water or surface water, in excess of the standards in Subsections B and C below, through leaching, percolation or as the water table elevation fluctuates. [12-1-95]

The methods outlined in the CAP and the existing discharge plan involve a dynamic process of moving the lines of injection in stages north toward the collection wells. The injection wells mound water into the lower portions of the vadose zone , thereby flushing the contaminants from the lower portion of the vadose zone. There is no contamination in the upper portion of the vadose zone except directly beneath the tailings area. This area will be flushed with clean water delivered through the toe drains when dewatering of the tailings is completed to ensure that contaminants have been removed from this portion of the vadose zone.

4103 - B. Ground-water pollution at any place of withdrawal for present or reasonably foreseeable future use, where the TDS concentration is 10,000 mg/L or less, shall be abated to conform to the following standards:

The site boundary is the potential place of withdrawal for present or reasonably foreseeable future use. Upon completion of the remediation the site will be turned over to the Department of Energy for long term maintenance and surveillance. The methods outlined in the CAP and the existing discharge plan are designed to ensure the WQCC standards or approved background standards are met at the site boundary.

1. toxic pollutant(s) as defined in Section 1101 of this Part shall not be present; and [12-1-95]

The potential for toxic pollutants as defined in Section 1101 does not exist at this site.

2. the standards of Section 3103 of this Part shall be met. [12-1-95]

With the exception of TDS, SO_4, Se, and NO_3, the standards of Section 3103 are presently being met at the site boundary (refer to the 1999 annual Ground-Water Monitoring Performance Review Appendix B Tables B.4-3 and B.4-4). If the proposed new back ground standards for TDS, SO_4, Se, and NO_3 are granted, then Homestake will already meet the those standards at the site boundary (refer to the 1999 annual Ground-Water Monitoring Performance Review Appendix B Tables B.4-3 and B.4-4).

There are some concentrations of selenium which have recently been identified in the alluvial aquifer to the south of the site boundary that are presently slightly greater than the proposed background standards (refer to the 1999 annual Ground-Water Monitoring Performance Review Figure 4.3-30B and Appendix B Table B.4-6). These concentrations are being abated

by pumping and mixing this water with water pumped from the same aquifer but containing much lower concentrations of selenium and using it in our irrigation program. The maximum level of selenium in combined water use by the irrigation program is below present site background standard (Se - 0.12 mg/L). The irrigation program was approved earlier by both NMED and NRC.

The maximum uranium concentration Homestake is using in its irrigation program is significantly less than the NMED standard. Homestake is using NRC's health based release standard of 0.44 mg/L as the maximum uranium concentration that will be used for irrigation to the south of the site boundary.

4103 - C. Surface-water pollution shall be abated to conform to the Water Quality Standards for Interstate and Intrastate Streams in New Mexico 920 NMAC 6.1). [12-1-95]

Surface waters are not effected at this site. The mill tailings are capped with an interim cover of clean clay on top and a final design cover of clay and rock on the side-slopes. The cover is designed to withstand precipitation and flooding events so there is no potential for erosion or precipitation to introduce pollutants to surface waters.

4103 - D. Subsurface-water and surface-water abatement shall not be considered complete until a minimum of eight (8) consecutive quarterly samples from all compliance sampling stations approved by the secretary meet the abatement standards of Subsection A ,B, and C above. Abatement of water contaminants measured in solid-matrix samples of vadose zone shall be considered complete after one-time sampling from compliance stations approved by the secretary. [12-1-95]

Additional voluntary quarterly monitoring will be performed in areas where the annual compliance monitoring indicates that restoration to WQCC and background standards has been achieved. This will be done to satisfy this requirement.

4103 - E. Technical Infeasibility. (page 43 NMWQCC Regulations)

At this time Homestake does not feel that compliance with the WQCC and realistic background standards is technically infeasible by using the methods outline in the CAP and existing discharge plan.

4103 - F. Alternate Abatement Standards. (page 44 NMWQCC Regulations)

At this time Homestake is not proposing Alternative Abatement Standards. We do, however, propose that the background standards for TDS, SO_4, Se, and NO_3 be re-evaluated and approved as discussed above and allowed pursuant to Subpart IV Section 4101.B. of the WQCC Regulations.

4106. ABATEMENT PLAN PROPOSAL

4106 - C. Stage 1 Abatement Plan.

The purpose of Stage 1 of the abatement plan shall be to design and conduct a site investigation that will adequately define site conditions, and provide the data necessary to select and design an effective abatement option. Stage 1 of the abatement plan may include, but not necessarily be limited to, the following information depending on media affected, and as needed to select and implement an expeditious abatement option: [12-1-95]

The existing approved discharge plan DP-200 is consistent with the requirements of this section. Elements of the Stage 1 Abatement Plan were completed prior to the approval of the original Discharge Plan DP-200 on May 10, 1984 (refer to Hydro-Engineering, 1983, Ground-Water Discharge Plan for Homestake Mill near Milan, New Mexico DP-200 submitted in 1983). Additional information was supplied on January 20, 1989 (refer to Hydro-Engineering, 1988, Renewal Ground-Water Discharge Plan, DP-200, for Homestake's Mill near Milan, New Mexico submitted in 1988). Updated site and monitoring information is included in the 1999 Ground-Water Monitoring and Performance Review. Additional updated hydrological information is included in the attached document "Hydrology at the Grants Reclamation Site" (refer to Attachment A).

1. Description of the site, including a site map, and of site history including the nature of the discharge that caused the water pollution, and a summary of previous investigations;

For a description of the site, site history and the nature of the discharge and a summary of previous investigations please refer to Section 2.0 "Historical Summary and Current Operation" in Hydro-Engineering, 1988, Renewal Ground-Water Discharge Plan, DP-200 submitted to the NMED in 1988, for Homestake's Mill near Milan, New Mexico. For the most recent location map and site map refer to Figure 1.2-2 and Figure 2.1-1 in the 1999 Ground-Water Monitoring and Performance Review.

2. Site investigation work plan to define:

a. site geology and hydrogeology, the vertical and horizontal extent and magnitude of vadose-zone and ground-water contamination, subsurface hydraulic parameters including hydraulic conductivity, transmissivity, storativity, and rate and direction of contaminant migration, inventory of water wells inside and within one (1) mile from the perimeter of the three-dimensional body where the standards set forth in Section 4103.B are exceeded, and location and number of wells actually or potentially affected by pollution; and

For a description of the site geology and hydrogeology, the vertical and horizontal extent and magnitude of ground-water contamination, subsurface hydraulic parameters including

hydraulic conductivity, transmissivity, storativity, and rate and direction of contaminant migration please refer to Sections 4.0 through 4.5.2 in Hydro-Engineering, 1988, Renewal Ground-Water Discharge Plan, DP-200, for Homestake's Mill near Milan, New Mexico submitted to the NMED in 1988. Additional updated hydrological information is included in the attached document "Hydrology at the Grants Reclamation Site" (refer to Attachment A). An inventory of water wells inside and within one mile of the site boundary is presented in Tables 4.1-1, 4.1-2, 4.1-3, 4.1-4, 5.1-1, 5.1-2, 5.1-3, 5.1-4, and 8.0-1 in the 1999 Ground-Water Monitoring and Performance Review submitted to the NMED earlier this year.

b. ***surface-water hydrology, seasonal streams flow characteristics, ground-water/surface-water relationships, the vertical and horizontal extent and magnitude of contamination and impacts to surface water and stream sediments. The magnitude of contamination and impacts on surface water may be, in part defined by conducting a biological assessment of fish, benthic macroinvertibrates and other wildlife populations. Seasonal variations should be accounted for when conducting these assessments. [12-1-95]***

Surface waters are not effected at this site. The mill tailings are capped with an interim cover of clean clay on top and a final design cover of clay and rock on the side-slopes. The cover is designed to withstand precipitation and flooding events so there is no potential for erosion or precipitation to introduce pollutants to surface waters.

3. ***Monitoring program, including sampling stations and frequencies, for the duration of the abatement plan that may be modified, after approval by the secretary, as additional sampling stations are created; [12-1-95]***

The monitoring program is described in the CAP and the existing approved NMED discharge plan. The recent modifications to the number of monitoring wells and frequency of samples were approved by NMED should be incorporated in this renewal (refer to Homestake letters to the NMED submitted July 7, 1999 and August 20, 1999 and the NMED approval letter to Homestake on October 13, 1999 included as Attachment F). Additionally, we have attached a copy of Homestake's internal standard operating procedure for monitoring ground-water on the site (HP-15 included as Attachment E).

4. ***Quality assurance plan, consistent with the sampling and analytical techniques listed in Section 3107.B of this Part and with Section 1103 of the Water Quality Standards for Interstate and Intrastate Streams in New Mexico 920 NMAC 6.1), for all work to be conducted pursuant to the abatement plan; [12-1-95]***

The attached a copy of Homestake's internal standard operating procedure for monitoring ground-water on the site (HP-15 included as Attachment E) meets the requirements listed in Section 3107.B.

5. Site health and safety plan for all work to be performed pursuant to the abatement plan; [12-1-95]

The site health and safety plan is included in the Corporate Health and Safety Policy guidelines and the Grants Project Hazard Briefing requirement (included as part of Attachment D) are consistent with this requirement.

6. A schedule for all Stage 1 abatement plan activities, including the submission of summary quarterly progress reports, and the submission, for approval by the secretary, of a detailed final site investigation report; and [12-1-95]

The Homestake Grants Reclamation Project is well beyond the Stage 1 abatement plan activities. Twelve quarterly monitoring reports from 1983 through half of 1986 were submitted to the New Mexico Environmental Improvement Division. Semi-annual monitoring and annual Performance Review reports have been submitted for the last 14 years. Numerous documents submitted to the NMED over the years including those referenced in this letter contain enough information to provide more than an adequate data base about the site.

7. Any additional information that may be required to design and perform an adequate site investigation. [12-1-95]

Homestake has provided over the years a wealth of additional information to NMED. Most of which is in the form of the semi-annual and annual reports have been submitted to the NMED. In addition we have provided the information attached to this renewal request.

4106 - E. The purpose of Stage 2 of the abatement plan shall be to select and design, if necessary, an abatement option that, when implemented, will result in attainment of the abatement standards and requirements set forth in Section 4103 of this Part, including post-closure maintenance activities. Stage 2 of the abatement plan should include, at a minimum, the following information: [12-1-95]

The methods Homestake is using to contain and remediate the existing concentrations of pollutants within the contaminant plume at the Grants Reclamation Site as outlined in the existing CAP and the existing DP-200 discharge plan are designed to ensure that the ground-water at the site boundary is in compliance with the background standards and the standards and requirements set forth in Section 4103. Upon completion of these methods the site will be turned over to the Department of Energy (DOE) for long term maintenance, monitoring and care. A bond will be secured with that agency to cover the long term costs of maintenance, monitoring and care.

1. Brief description of the current situation at the site; [12-1-95]

Please refer to the 1999 Ground-Water Monitoring and Performance Review submitted earlier this year.

2. Development and assessment of abatement options; [12-1-95]

The developed abatement options for this site are described in the existing approved discharge plan. They include collection of the contaminated water and injection of fresh water from the San Andres aquifer and re-injection of reverse osmosis product water. Homestake continues to assess the potential for other restoration options, such as the potential for biological treatment, and will keep the NMED informed of the results of these assessments.

4. Modification, if necessary, of the monitoring program approved pursuant to Stage 1 of the abatement plan, including the designation of pre and post abatement-completion sampling stations and sampling frequencies to be used to demonstrate compliance with the standards and requirements set forth in Section 4103 of this Part; [12-1-95]

Homestake recognizes that any monitoring plan needs to be dynamic and will require periodically updating due to successful restoration plus potential changes in technology. The current monitoring plan have been updated twice in the past four years and will continue to modified as plans and schedules dictate.

The post restoration-completion sampling will consist of monitoring the point of compliance wells (POC) (referenced in Table 2 of the monitoring plan) on a mutually agreed upon schedule between the approving agencies.

5. Site maintenance activities, if needed, proposed to be performed after termination of abatement activities; [12-1-95]

Post restoration site maintenance activities will be conducted by the DOE. A bond will be secured with that agency to cover the long term costs of maintenance, monitoring and care.

6. A schedule for the duration of abatement activities, including the submission of summary quarterly progress reports; [12-1-95]

The schedule for the duration of the restoration activities titled "Homestake Restoration Rates" has been included as Attachment B.

We are presently submitting two semi-annual Environmental Reports and one annual Ground-Water Monitoring Performance Review Report.

7. A public notification proposal designated to satisfy the requirements of Section 4108.B and 4108.C of this Part; and [12-1-95]

The existing discharge plan is consistent with this requirement because public hearings were held February 20, 21, and 22, 1984 prior to the original discharge plan being approved. Restoration methods have not significantly changed since that approval.

8. Any additional information that may be reasonably required to select, describe, justify and design an effective abatement option. [12-1-95]

Additional updated information has been submitted as attachments to this request.

4107. OTHER REQUIREMENTS (pages 49 and 50 of the NMWQCC Regulations)

Homestake has and will continue to abide by the provisions of this Subsection.

4112. COMPLETION AND TERMINATION (page 54 of the NMWQCC Regulations)

Homestake will submit for consideration and approval a restoration completion report at the end of this project. At that time the DOE will outline the long term monitoring and site maintenance activities proposed for this site.

Please consider the following proposed changes to the Conditions for Approval, Specific Requirements, and General Discharge Plan Requirements contained in the existing DP-200 discharge plan as written and approved November 15, 1995:

CONDITIONS FOR APPROVAL

- Retain Condition 1.
- Remove Conditions 2, 3, and 4 as they have been completed.

SPECIFIC REQUIREMENTS

- Modify Requirement 3 to read as follows: "Homestake Mining Company will monitor and report as required in condition 35 of their NRC materials license SUA-1471 (which includes the most recently approved table 2)."

GENERAL DISCHARGE PLAN REQUIREMENTS

- Modify the section under **Spills, Leaks and Other Unauthorized Discharges** to read as follows: This approval authorizes only those discharges specified in the discharge plan. Any unauthorized discharges violate WQCC Reg. 3-104, and must be reported to NMED and remediated as required by WQCC Reg. 1-203. This requirement applies to spills

and/or leaks discovered from Homestake's remediation system that contain large enough quantities of contaminants that may, with reasonable probability, injure or be detrimental to human health, animal or plant life, or property, or unreasonably interfere with the public welfare or use of property. It does not apply to small quantities (less than 300,000 gallons) of collected contaminated groundwater contained within the boundaries of the reclamation site. Nor does it apply to any quantity of water meeting or exceeding New Mexico groundwater standards.

GROUND-WATER HYDROLOGY
AT THE GRANTS RECLAMATION SITE

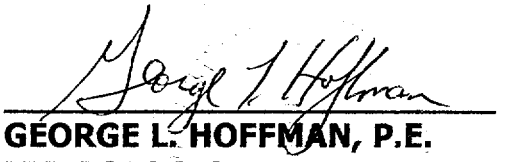
FOR:

HOMESTAKE MINING COMPANY
OF CALIFORNIA

BY:

HYDRO-ENGINEERING, L.L.C.
CASPER, WYOMING

JULY, 2000



GEORGE L. HOFFMAN, P.E.
HYDROLOGIST

TABLE OF CONTENTS

TABLE OF CONTENTS

FIGURES

TABLE OF CONTENTS

FIGURES
(continued)

TABLES

1.0 INTRODUCTION

This report presents an update to the ground-water hydrology at the Grants reclamation site. The ground-water hydrology at the Grants site was initially defined in 1976 (see Hoffman, 1976). The initial ground-water discharge plan for the Grants Project presents additional definition of the ground-water hydrology with initial definition of the bedrock aquifers (see Hydro-Engineering, 1983). The first renewal of DP-200 also presents definition of ground-water hydrology at the Grants site (see Hydro-Engineering, 1988c). The results of the ground-water restoration program have been defined in numerous ground-water monitoring reports for this site. The Corrective Action Program (CAP) (see Hydro-Engineering, 1989) for the Nuclear Regulatory Commission (NRC) presents the definition of the restoration program, along with the discharge plan.

This update presents additional data developed since these reports with details presented on the geologic setting, ground-water flow, aquifer properties and water quality for the alluvial and Upper Chinle aquifers. Less discussion of the deeper aquifers is presented due to the lack of importance of these ground-water systems to the discharge at this site.

2.0 GROUND WATER HYDROLOGY OF ALLUVIAL AQUIFER

This section presents the geologic setting and well completions for the alluvial aquifer. Water-level information and base of the alluvial aquifer are used to define the saturated thickness of the alluvial aquifer. Aquifer properties are presented and used with the water-level elevations to define the rates of ground-water movement and quantity of ground-water flow. Water-quality conditions in the alluvial aquifer concludes this section.

2.1 GEOLOGIC SETTING AND WELL COMPLETIONS

The geologic map for the Grants quadrangle in Dillinger (1990) presents the surface geology of this area. The surface geology and structure contours are also presented on USGS quadrangle topographic maps in Thaden, et. al. (1967). Geologic maps and other information were compiled and presented by Chapman, et. al. (1979) and Huffman and Condon (1993). The uranium ore bearing rocks that have been mined in this area outcrop in the San Mateo drainage system and contain significant natural concentrations of uranium and selenium. Therefore, the alluvial material would be expected to contain above normal concentrations of uranium and selenium that are typically present in uranium deposits. The Chinle formation forms the base of the alluvial aquifer at the Grants site.

The hydrologic conditions in this area have been defined by Gordon (1961), Baldwin and Rankin (1995), Baldwin and Anderholm (1992), Frenzel (1992), Stone, et. al. (1983), Brod and Stone (1981) and Dam, et. al. (1990). Hydro-Search (1981) contains hydrologic information developed on an adjacent uranium tailings site. Ground-water conditions for the Grants site have been defined in previous documents (see Hoffman, 1976; Hydro-Engineering, 1983; Hydro-Engineering, 1988; and Hydro-Engineering, 1996). The Grants project site exists on the San Mateo alluvial system. The San Mateo alluvial system follows the San Mateo alluvium and drainage system and extends from northeast of the site to the south and west. Bedrock material exists on the surface to the northeast and southeast sides of the alluvial material.

The basic well data for the alluvial wells at the Grants site is presented in Section 4 of the 1999 Annual Report. Figure 2-1 shows the location of the alluvial wells that have been used to define the ground-water conditions in the alluvial aquifer at the Grants site. This figure represents the current operation of injection and collection wells and is subject to change with this dynamic restoration program. The point of compliance (POC) wells are underlined in green. The limits of the alluvial aquifer are shown by delineating the area where the alluvium is not saturated by the green dotted pattern.

Figure 2-2 shows the saturated limit in the alluvium at the Grants Project site. The green dot pattern shows where the alluvium is not saturated.

2.2 WATER LEVELS

This section presents the water-level information for the alluvial aquifer. The direction of ground-water flow is defined by the water-level elevation maps, while gradients from this map are also used to determine rates of ground-water movement.

2.2.1 WATER-LEVEL DEPTHS AND ELEVATIONS

The depths of the water level are presented in the basic well data table in Section 4 of the 1999 Annual Report. Figure 2-3 presents the water-level elevations for the alluvial aquifer for 1999. A scale of 1" = 800' was used to present the water-level elevation data, along with the water-level contours, for the Grants site. This figure shows that the ground water is flowing into the tailings area from the north and converges to the collection wells. Red arrows are shown to indicate the direction of ground-water flow. The fresh-water injection downgradient of the site, used in conjunction with the collection wells, forces ground water to converge from all directions to the collection points. Water-level elevations vary from 6,540 ft above mean sea level (ft-msl) on the east side of the tailings to a low of 6,500 ft-msl on the western edge of Pleasant Valley. Typical gradients in the area of the collection wells are from 0.01 to 0.02 ft/ft.

2.2.2 WATER-LEVEL CHANGE

The water-level changes at the Grants site have been defined in detail in each of the past years annual reports. The 1999 Annual Report presents the water-level changes through 1999 for the alluvial wells (see Section 4.2). The 1997 Annual Report presents the historical water-level change plots through 1997, while the 1999 Annual Report presents only the last five years of data. Water-level changes at the Grants Project site have been due to variations in the operation of the collection and injection systems. The changes in water level have generally been gradual at a few feet per year.

2.3 BASE OF THE ALLUVIAL AQUIFER

The drilling of a large number of wells at the Grants site has defined the base of the alluvium in detail. Figure 2-4 presents the data points that were used to develop the contours. The base of the alluvial contours show that an alluvial channel runs through the western portion of the large tailings and turns to the southwest near the southwest corner of the large tailings. The base of the alluvium contains higher elevations in eastern Murray Acres, which extend back to the northeast toward the small tailings pile. This area tends to decrease the amount of alluvial water flowing in this area. The edge of the alluvial aquifer is defined where the base of the alluvium is equal to the water-level elevation. The green line and green dotted pattern shows where the alluvium is not saturated and is the limits of the alluvial aquifer.

2.4 SATURATED THICKNESS OF THE ALLUVIUM

The alluvial aquifer saturated thickness is defined by the difference between the water-level elevation and the base of the alluvium. The saturated thickness is presented in the basic well data table in Section 4 of the 1999 Annual Report. These saturated thicknesses are posted on Figure 2-5 but the difference between the water-level elevation and base of alluvium contours were used to develop the contours presented in Figure 2-5 for the alluvial aquifer. The individual data points are influenced by conditions of use of the wells and, therefore, the difference in contours presents a more representative thickness. This shows that the saturated thickness in the southwest corner of the small tailings is 60

feet in the alluvial aquifer and decreases to zero at the boundary of the alluvial aquifer. Saturated thicknesses have been increased significantly in the area of the fresh-water injection. Figure 2-2 shows that an additional area of zero saturation exists to the south of this figure, causing the ground water to either move to the west of the Grants site or around the southeast side of Broadview and Felice Acres.

2.5 AQUIFER PROPERTIES

The most important aquifer property for the alluvial aquifer is the hydraulic conductivity (permeability). Hydraulic conductivity is a representation of the unit transmitting ability of the alluvial sands. The specific yield is the primary storage property for the unconfined alluvial aquifer.

Figure 2-6 presents the hydraulic conductivities measured for the alluvial aquifer at this site. The data presents the hydraulic conductivities determined from pump tests for the alluvial aquifer. These values have been contoured and are presented in Figure 2-6. This figure shows that hydraulic conductivities near the large tailings are greatest on the southwest side and generally decrease to the east. A ridge of lower hydraulic conductivities exists from the western edge of the small tailings to the southwest into Murray Acres. Hydraulic conductivities substantially increase to levels greater than 200 ft/day in the northern portion of Pleasant Valley and extend to the west. Hydraulic conductivities also increase in the Broadview Acres area.

Specific yields for the site have varied from 0.038 to 0.28, based on pump tests. A specific yield of 0.2 is thought to best represent the alluvial aquifer at the Grants site and was selected from calibration of numerical modeling of the site. This value is considered conservative relative to the restoration of the site. The lower hydraulic conductivity area will probably have a slightly smaller specific yield, which should reduce the volume required for restoration. The two factors may offset each other, resulting in similar restoration times for varying aquifer properties.

2.5.1 RATES OF GROUND-WATER MOVEMENT

The ground-water velocity equation is presented on pages 70 and 71 of Freeze and Cherry (1979). The ground water upgradient of the large tailings pile is moving at an average rate of 0.5 ft/day based on a gradient of 0.0033 ft/ft, a permeability of 30 ft/day and an effective porosity of 0.2. To the southwest of the Murray Acres injection system the ground water is estimated to be moving at a rate of 0.7 ft/day. Similar velocities are expected west of the tailings until the western half of Section 27 and Section 28, where velocities reach up to 4 ft/day.

2.5.2 QUANTITY OF GROUND-WATER MOVEMENT

The quantity of water moving in the alluvial aquifer is governed by Darcy's Law where the rate is equal to the product of the transmissivity, gradient and width of the aquifer. The flow of the San Mateo alluvial system north of the tailings has been estimated to be between 58 and 62 gpm. Under the injection conditions that have occurred for over 20 years, the quantity of water moving west of the Homestake property through the western subdivisions is estimated to be 260 gpm based on an aquifer width of 6000 feet, an average gradient of 0.0062 ft/ft and a transmissivity of 10,000 gal/day/ft. An estimate of 69 gpm was obtained for the area to the southeast of Broadview Acres. This estimate is based on a width of 4000 feet, a gradient of 0.005 ft/ft and a transmissivity of 5000 gal/day/ft. This indicates that approximately 330 gpm is moving downstream of the Homestake property.

2.6 WATER QUALITY

This section presents the 1999 water-quality data for the alluvial aquifer. Major constituents of importance at this site are sulfate, chloride and TDS, with sulfate concentration being used as the most important indicator for contaminant restoration. Uranium, selenium and molybdenum are the hazardous constituents of most concern at this site. Nitrate and radium-226 plus radium-228 are also discussed. The water-quality data is tabulated in Appendix B of the annual reports for each year. The 1995 Annual Report presents all historical water-quality data up through that report year.

The standards for the Grants Project are presented in Table 2-1. This table presents both the NRC and New Mexico State standards, which are both based on average concentrations of limited data at the time these concentrations were set. This table also presents background concentrations for the range of concentrations measured in the background wells in 1999 and the 95% confident level of all of the background data. The 95% confident level is the concentration that is needed to be 95% confident that a concentration below this level is due to background. The 95% confident level is a good measurement of the full range of natural concentrations in the background data. This data was developed in two statistical reports of the background data (see ERG, Inc. 1999a and 1999b).

TABLE 2-1. GRANTS WATER-QUALITY STANDARDS AND BACKGROUND

CONSTITUENTS	HOMESTAKE STANDARDS		BACKGROUND CONCENTRATIONS	
	NRC	NEW MEXICO	95% CONFIDENT LEVEL	1999 RANGE
URANIUM	0.04	5.00	0.15	0.03 – 0.24
SELENIUM	0.10	0.12	0.27	0.03 – 0.63
MOLYBDENUM	0.03	1.0@	0.05	<0.03 – <0.03
VANADIUM	0.02	-----	<0.01	<0.01 – <0.01
RA-226+RA-228	5.00	30.0	<5	<1.2 – <2.6
THORIUM-230	0.30	-----	<0.3	<0.2 – <0.2
SULFATE	-----	976	1870	440 – 1540
CHLORIDE	-----	250	112	48 – 86
TDS	-----	1770	3060	1130 – 2870
NITRATE	-----	12.4	23	1.1 – 15.2

NOTE: **All concentrations are in mg/l except: Ra-226+Ra-228 and Th-230 are in pCi/l.**
@ = Irrigation Standard

The NRC and New Mexico site specific standard for the Grants site has been set based on average concentrations of a few samples and a selected few of the background wells. The natural variability areally is great in this aquifer and, therefore, an analysis that accounts for the full natural variability over the upgradient aquifer is important in establishing standards. The background selenium concentrations for 1999 significantly exceed both the New Mexico and NRC site standards for 1999 (see Table 2-1). Sulfate,

TDS and nitrate concentrations monitored in only 1999 also exceeded the New Mexico specific site standards for this alluvial aquifer. The specific site standards, therefore, need to be established based on an estimate of the full range of the natural background concentrations. The 95% confident level gives a reasonable estimate of the full range. Five percent of the background concentrations would be expected to still exceed this level.

The 95% confident level is, therefore, used in this report to define the full range of natural background concentrations. Therefore, concentrations downgradient of the tailings are not considered to be confidently defined to be from tailings seepage unless they exceed the 95% confident level for background.

2.6.1 SULFATE CONCENTRATIONS

Sulfate concentrations in the alluvial aquifer have been used as a main indicator parameter. Sulfate concentrations for 1999 are presented in Figure 2-7. The data points measured in late 1999 are shown on this figure that were used to develop the contours. The 95% level of background concentrations for TDS at this site is 1870 mg/l (see Table 2-1). Concentrations below this level cannot be confidently determined to be from the tailings seepage. Figure 2-7 shows that sulfate concentrations in excess of 10,000 mg/l exist near the large tailings and the 2000 contour extends around the large and small tailings. Sulfate concentrations need to be restored only in the large and small tailings areas.

Water-quality concentrations versus time are presented in the annual reports for sulfate, uranium, selenium and molybdenum. The 1999 Annual Report should be reviewed to define the changes in sulfate concentrations over the last five years. The 1997 Annual Report presents the historical sulfate concentrations through 1997. Data presented in the annual reports to date indicate that sulfate concentrations will easily be restored with the restoration of the hazardous constituents at this site.

2.6.2 TDS CONCENTRATIONS

Total dissolved solids (TDS) concentration contours for the alluvial aquifer for 1999 are presented in Figure 2-8. TDS concentrations exceed 20,000 mg/l in the large tailings area and exceed 5000 around the large and small tailings. A TDS of 3060 or larger is needed to be confident that the concentrations are not naturally occurring. TDS concentrations will be restored easily with the restoration of the hazardous constituents at this site. TDS versus time plots have generally not been developed for the alluvial wells because sulfate concentrations adequately define the changes with time for TDS.

2.6.3 CHLORIDE CONCENTRATIONS

Chloride concentrations are important in defining seepage due to the conservative nature of this constituent and low natural concentrations. Figure 2-9 presents the 1999 chloride concentrations for the alluvial aquifer. The State standard of 250 mg/l will govern this constituent at this site. This figure shows that the large and small tailings areas need additional restoration based on chloride concentrations. Chloride concentration plots have not been developed due to the fact that sulfate concentrations adequately define changes in this major constituent.

2.6.4 URANIUM CONCENTRATIONS

Uranium is an important parameter to this site due to the significant levels in the tailings seepage. The uranium data measured in late 1999 is presented in Figure 2-10. These data points have been contoured to present the variation of uranium over the area. Restoration of uranium will be to lower levels than the State standard. This lower level has not been determined. Uranium concentrations in the area of the large and small piles exceed 50 mg/l and are above 5 mg/l over the majority of the two pile areas. A small area to the southeast of the small tailings pile exceeds 5 mg/l also. Restoration of uranium will continue to be one of the main restoration goals and will play an important role in the future restoration schedule.

Time concentration plots are presented for uranium in each of the annual reports. The 1999 Annual Report presents the uranium concentration plots from 1995 through 1999. The 1997 Annual Report should be reviewed for historical concentration plots through 1997.

2.6.5 SELENIUM CONCENTRATIONS

Selenium concentrations are also a very important concentration at the Grants site due to significant levels of this constituent historically in the tailings. Figure 2-11 presents the selenium concentrations for the alluvial aquifer for 1999. The 95% confident level of all of the background data for selenium is 0.27 mg/l. Therefore, concentrations lower than 0.27 could be natural concentrations. Areas of concentrations greater than 0.27 mg/l are mainly around the large and small tailings pile and extend approximately 1500 feet to the west of the large tailings and to the southeast of the small tailings pile. Restoration of selenium is also a main restoration goal and will play an important role in the restoration schedule. However, restoration results indicate that selenium restores similar to the conservative parameters of chloride, TDS and sulfate and will be followed by uranium and molybdenum. Selenium is also naturally being decreased to below background levels with time in the tailings solution.

Time concentration plots for selenium are presented in the annual reports. These plots should be used for restoration versus time at selected wells.

2.6.6 MOLYBDENUM CONCENTRATIONS

Molybdenum at the Grants site is also a very important constituent. Molybdenum concentrations are also high in the tailings. Figure 2-12 presents the molybdenum concentrations for 1999 and shows that molybdenum concentrations exceed 10 mg/l over most of the large and small tailings areas. Molybdenum concentrations extend to approximately 800 feet west of the large tailings pile and to the southeast of the small tailings pile. The State standard for molybdenum is 1.0 mg/l for irrigation. Molybdenum concentrations beyond the Homestake property are very low due to

attenuation of this constituent. Time plots for molybdenum concentrations versus time are presented in the annual reports to show restoration of this constituent with time.

2.6.7 NITRATE CONCENTRATIONS

Some of the nitrate concentrations upgradient of the tailings site exceed the State drinking water standard of 12.4 mg/l of nitrate for this site. Figure 2-13 shows where nitrate concentrations exceed 22.9 mg/l, which is the 95% confident level of the background data. A small area is shown between the large and small tailings that exceeds 22.9 mg/l. These concentrations are likely due to tailings effects. A second area to the northwest of the large tailings pile also exceeds this level. These concentrations are likely due to variations in background levels due to their locations. Nitrate concentrations at this site will be restored with the restoration of the key parameters.

2.6.8 RADIUM-226 AND RADIUM-228 CONCENTRATIONS

Radium concentrations are monitored at the Grants site due to this parameter typically being a significant constituent at uranium tailings sites. Radium concentrations have been highly attenuated in the partially saturated alluvial material underneath the pile. The infiltration barrier that will be placed over the pile will, essentially, eliminate movement in the very long term in this area. This makes it an un-important parameter for this site. Figure 2-14 presents the radium-226 and radium-228 concentrations for the alluvial aquifer in 1999. The radium-226 concentrations are presented horizontally in black by the well symbol, while the radium-228 concentrations are presented at a 45° angle in a magenta color. This data shows that all of the radium-226 plus radium-228 concentrations that were measured in 1999 were below the 5 pCi/l except in one well, which contained less than 5.6 pCi/l. The four values for radium concentrations in 1999 for this well averaged less than 2.8 pCi/l, which shows that the 5.6 is an outlier. These parameters are not significant at this site and should be dropped except for monitoring of radium-226 at the POC wells to demonstrate that site conditions are not changing in the future.

2.6.9 OTHER CONSTITUENTS

The remainder of the hazardous constituents at this site have not been detected at significant concentrations. Chromium was a site standard and has been dropped by the NRC due to the very low levels of chromium in the aquifer. Additional monitoring of chromium continues to support the low levels (see the 1999 Annual Monitoring Report).

COUNTY ROAD 63

LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)

HMC OFFICE

HIGHWAY-605

PLEASANT-VALLEY ESTATES

LINED EVAP POND NO. 2

COLLECTION POND

LINED EVAP POND NO. 1

SMALL TAILINGS PILE

MURRAY-ACRES

BROADVIEW ACRES

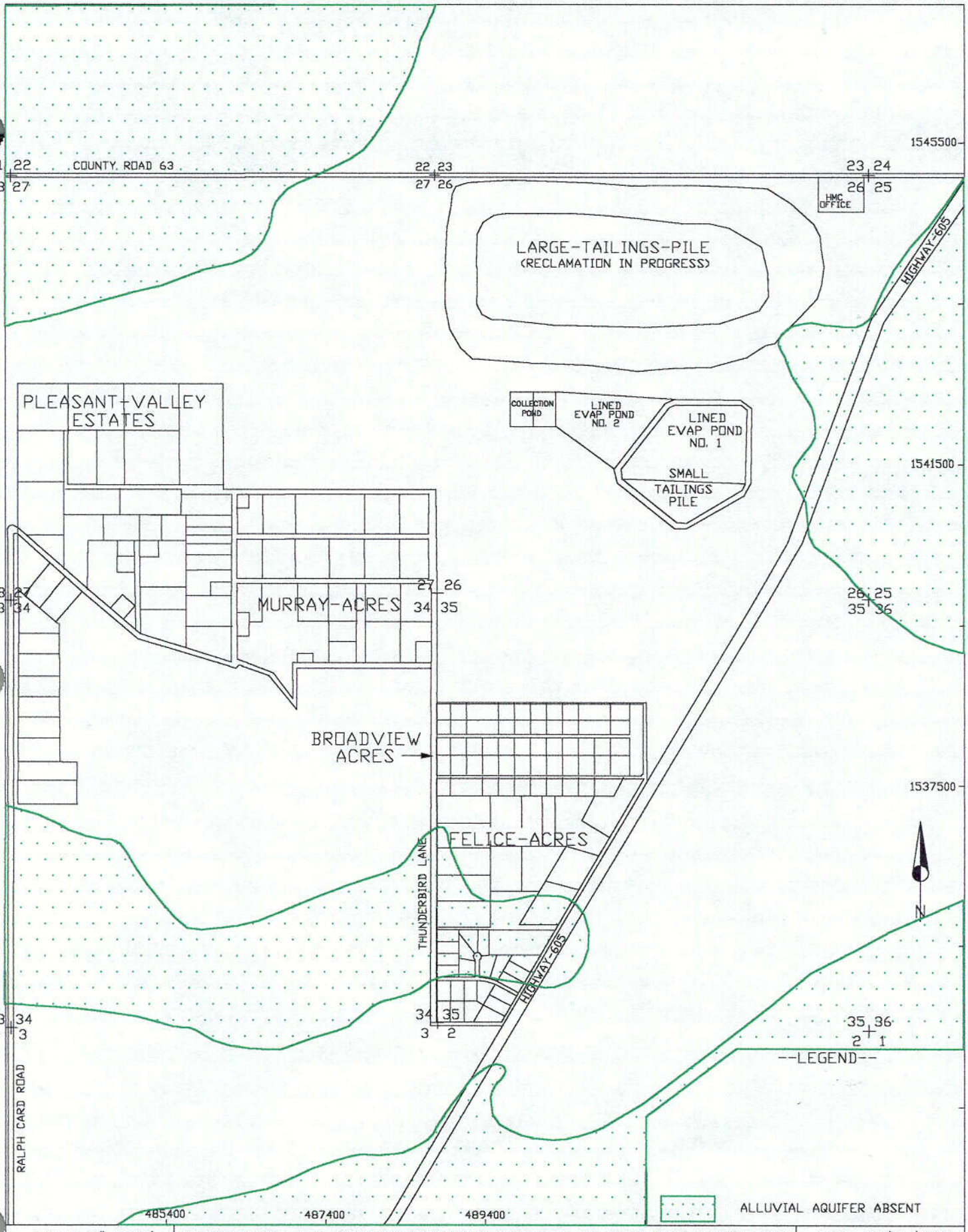
1541500

FIGURE 2-1. ALLUVIAL WELLS IN THE AREA OF THE GRANTS PROJECT

- L — COLLECTION FOR REINJECTION
- KE — ACTIVE COLLECTION WELL
- X1 — ACTIVE INJECTION WELL
- S4 — POINTS OF COMPLIANCE
- ALLUVIAL AQUIFER ABSENT

C1

SCALE: 1"=800'
DATE: 07/15/2000

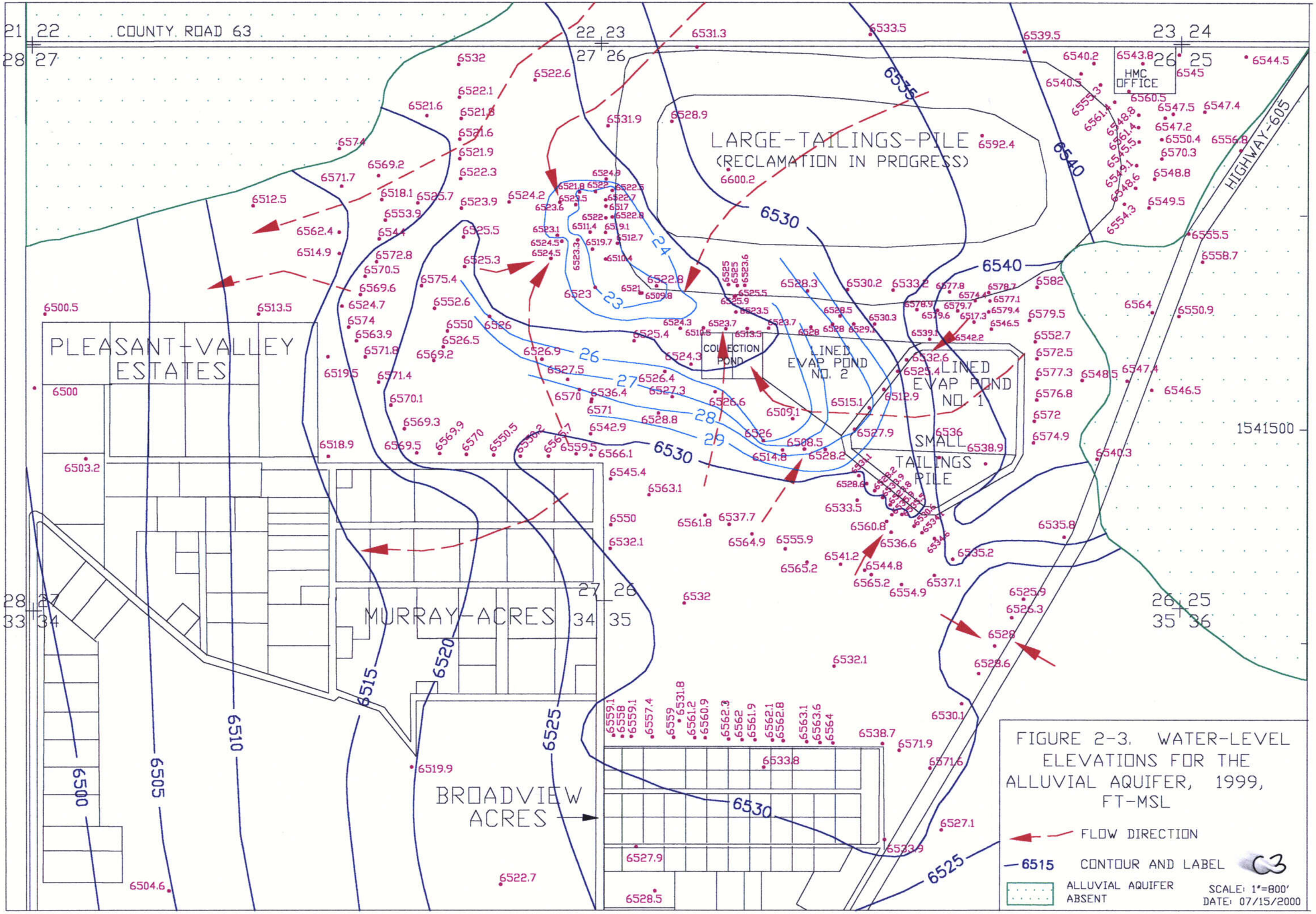


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 01/31/2000

FIGURE 2-2. SATURATED ZONE LIMITS

R13\DDS
HMC2000\2000EQAL

C2


COUNTY ROAD 63
LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)
HMC OFFICE
HIGHWAY-605
PLEASANT-VALLEY ESTATES
MURRAY-ACRES
BROADVIEW ACRES
LINED EVAP POND NO. 2
LINED EVAP POND NO. 1
COLLECTION POND
SMALL TAILINGS PILE
1541500
6555
6540
6530
6520
6515
6510
6505
6500
6525
23
24
26
27
28
29
FIGURE 2-3. WATER-LEVEL ELEVATIONS FOR THE ALLUVIAL AQUIFER, 1999, FT-MSL
FLOW DIRECTION
6515 CONTOUR AND LABEL
ALLUVIAL AQUIFER ABSENT
SCALE: 1"=800'
DATE: 07/15/2000

COUNTY ROAD 63

LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)

PLEASANT-VALLEY ESTATES

MURRAY-ACRES

BROADVIEW ACRES

COLLECTION POND

LINED EVAP POND NO. 2

LINED EVAP POND NO. 1

SMALL TAILINGS PILE

HMC OFFICE

HIGHWAY-605

1541500

FIGURE 2-4. ELEVATION OF BASE OF THE ALLUVIUM FT-MSL

6510 CONTOUR AND LABEL

6479 DEPTH OF ALLUVIUM FT-MSL

ALLUVIAL AQUIFER ABSENT

SCALE: 1"=800'

DATE: 07/15/2000

2-15

C4

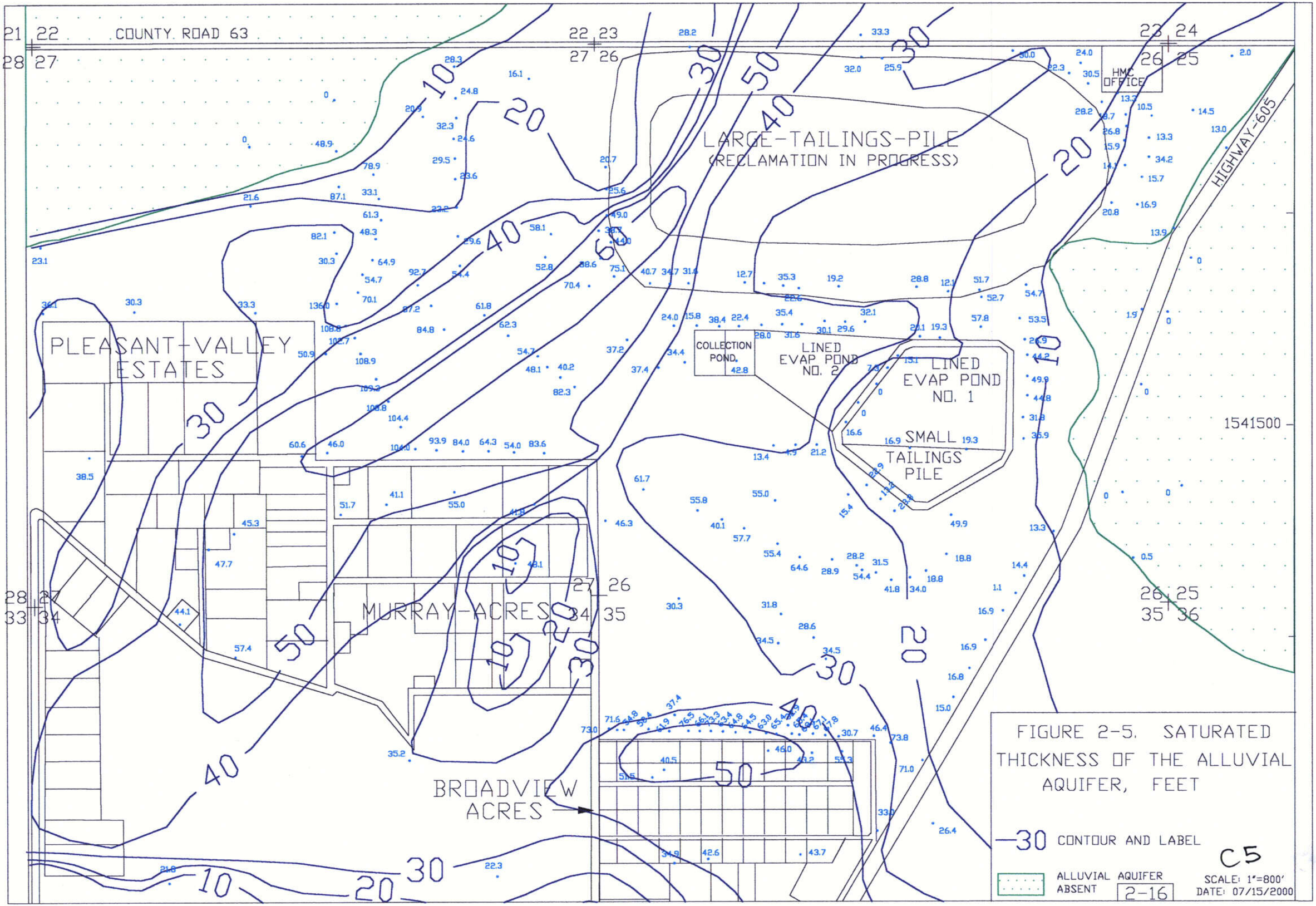


FIGURE 2-5. SATURATED THICKNESS OF THE ALLUVIAL AQUIFER, FEET

—30 CONTOUR AND LABEL

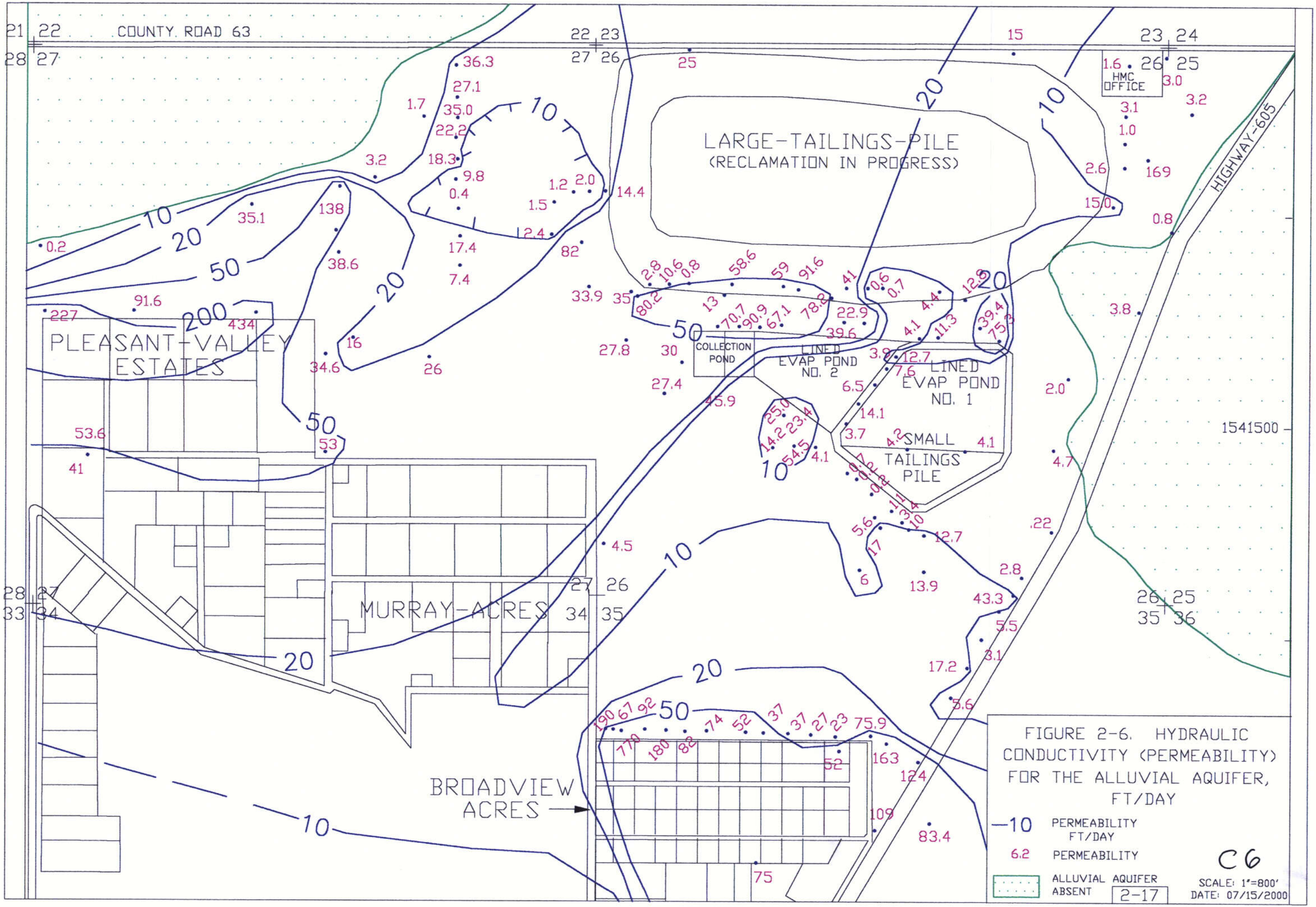
ALLUVIAL AQUIFER ABSENT

C5

2-16

SCALE: 1"=800'

DATE: 07/15/2000


COUNTY ROAD 63
LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)
HMC OFFICE
HIGHWAY-605
PLEASANT-VALLEY ESTATES
MURRAY-ACRES
BROADVIEW ACRES
COLLECTION POND
LINED EVAP POND NO. 2
LINED EVAP POND NO. 1
SMALL TAILINGS PILE
1541500
21 22 28 27
22 23 27 26
23 24 26 25
28 27 33 34
27 26 34 35
26 25 35 36
10
20
50
200
FIGURE 2-6. HYDRAULIC CONDUCTIVITY (PERMEABILITY) FOR THE ALLUVIAL AQUIFER, FT/DAY
—10 PERMEABILITY FT/DAY
6.2 PERMEABILITY
ALLUVIAL AQUIFER ABSENT
2-17
C6
SCALE: 1"=800'
DATE: 07/15/2000

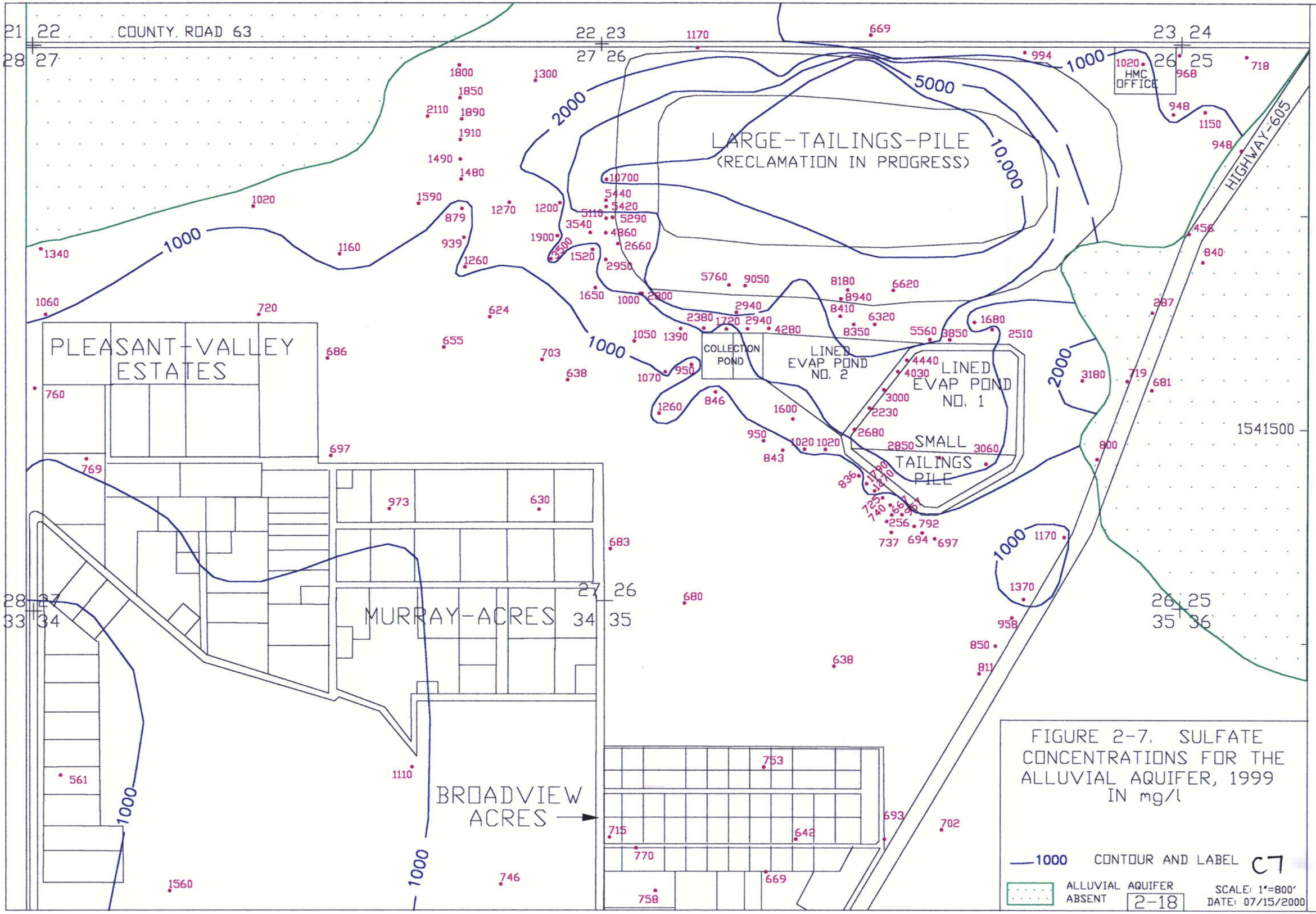


FIGURE 2-7. SULFATE CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

1000 CONTOUR AND LABEL C7

ALLUVIAL AQUIFER ABSENT

2-18

SCALE: 1"=800'

DATE: 07/15/2000

COUNTY ROAD 63

21 22 / 28 27

22 23 / 27 26

23 24 / 26 25

LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)

HMC OFFICE

HIGHWAY-605

PLEASANT-VALLEY ESTATES

MURRAY-ACRES

BROADVIEW ACRES

28 27 / 33 34

27 26 / 34 35

26 25 / 35 36

COLLECTION POND

LINED EVAP POND NO. 2

LINED EVAP POND NO. 1

SMALL TAILINGS PILE

2000

5000

10000

20000

1541500

FIGURE 2-8. TDS CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999, IN mg/l

2000 CONTOUR AND LABEL

ALLUVIAL AQUIFER ABSENT

2-19

C8

SCALE: 1"=800'

DATE: 07/15/2000

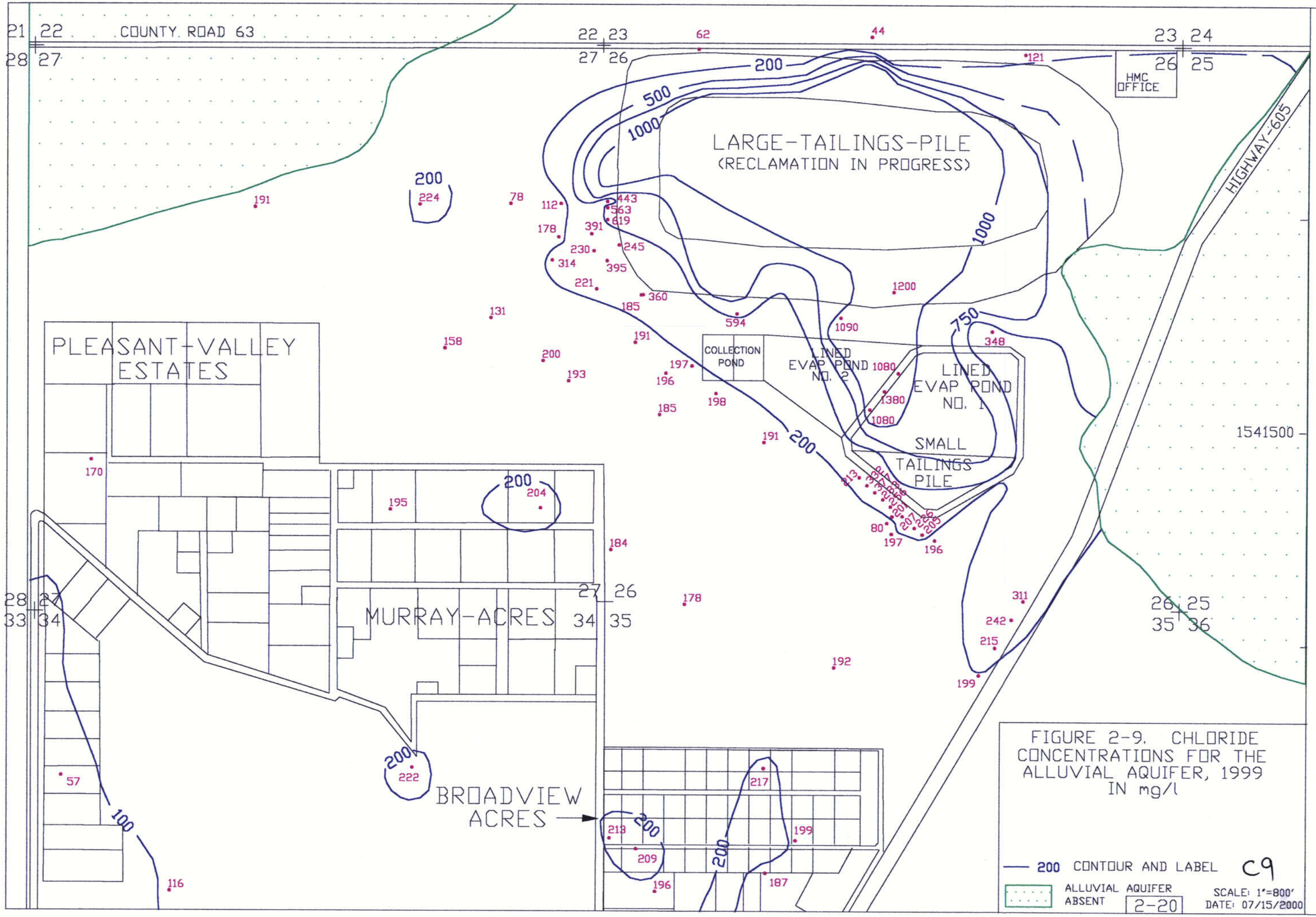


FIGURE 2-9. CHLORIDE CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

200 CONTOUR AND LABEL

ALLUVIAL AQUIFER ABSENT

C9

2-20

SCALE: 1"=800'

DATE: 07/15/2000

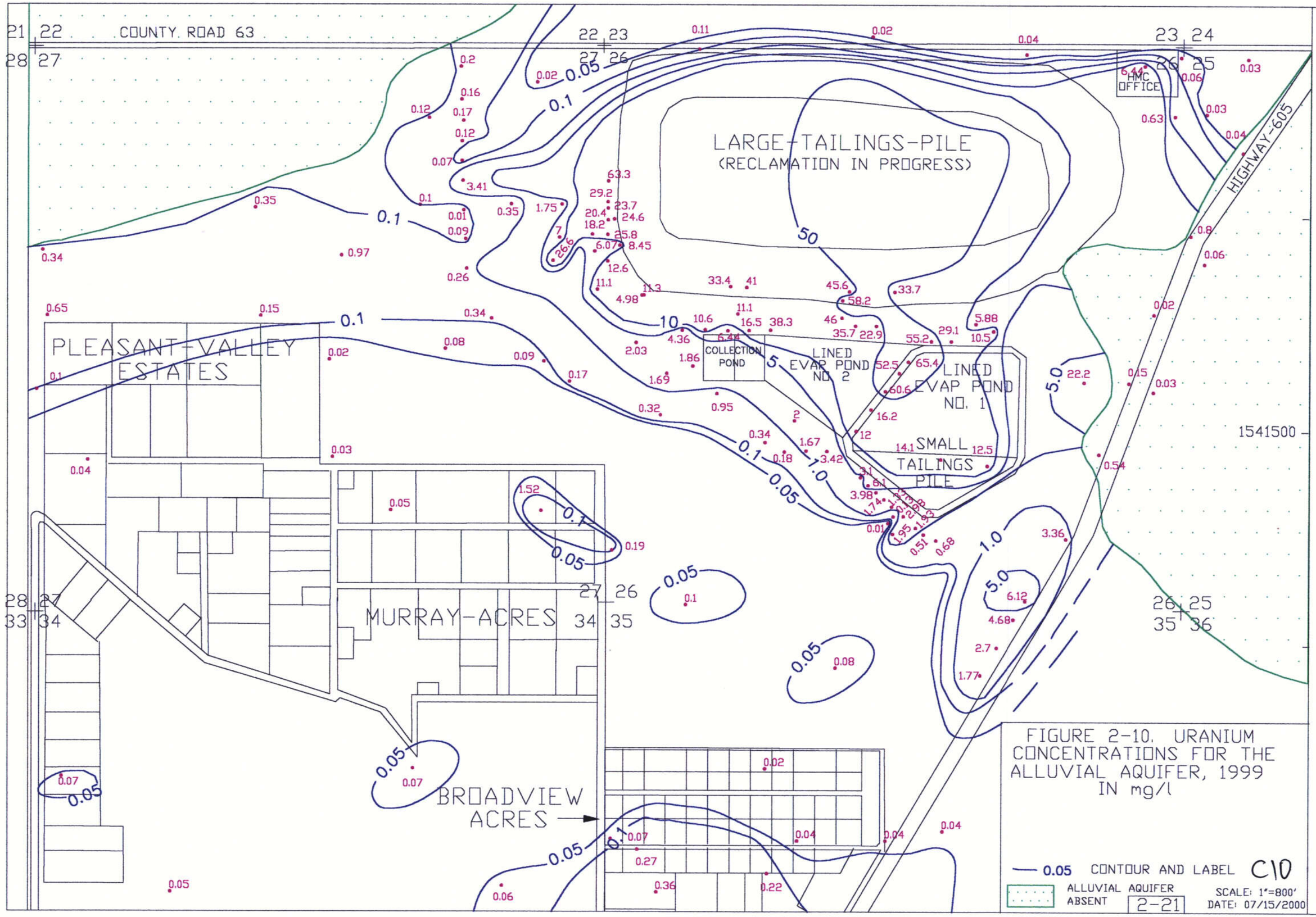


FIGURE 2-10. URANIUM CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

0.05 CONTOUR AND LABEL C10

ALLUVIAL AQUIFER ABSENT 2-21

SCALE: 1"=800'

DATE: 07/15/2000

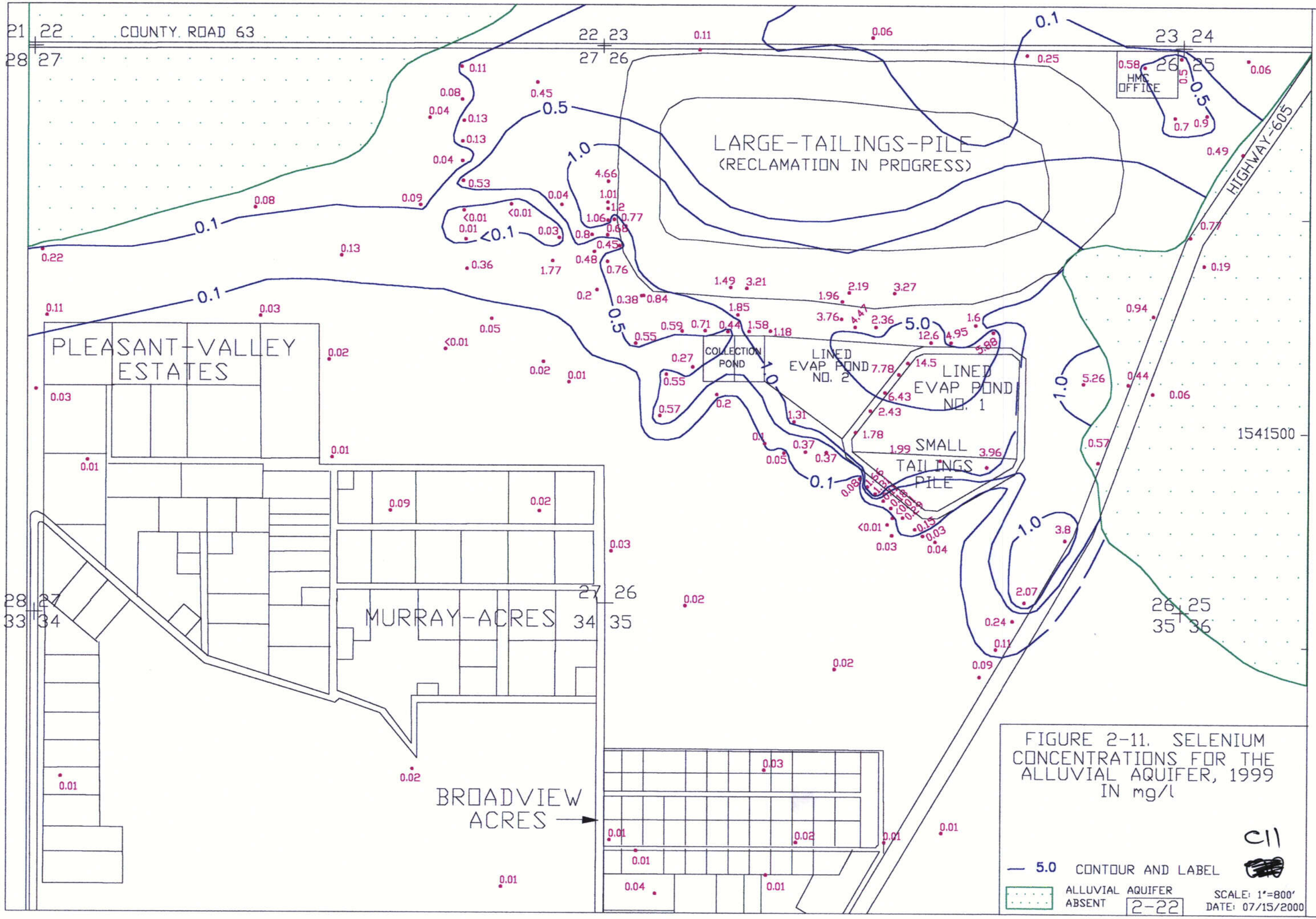


FIGURE 2-11. SELENIUM CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

C11

— 5.0 CONTOUR AND LABEL

ALLUVIAL AQUIFER ABSENT

2-22

SCALE: 1"=800'

DATE: 07/15/2000

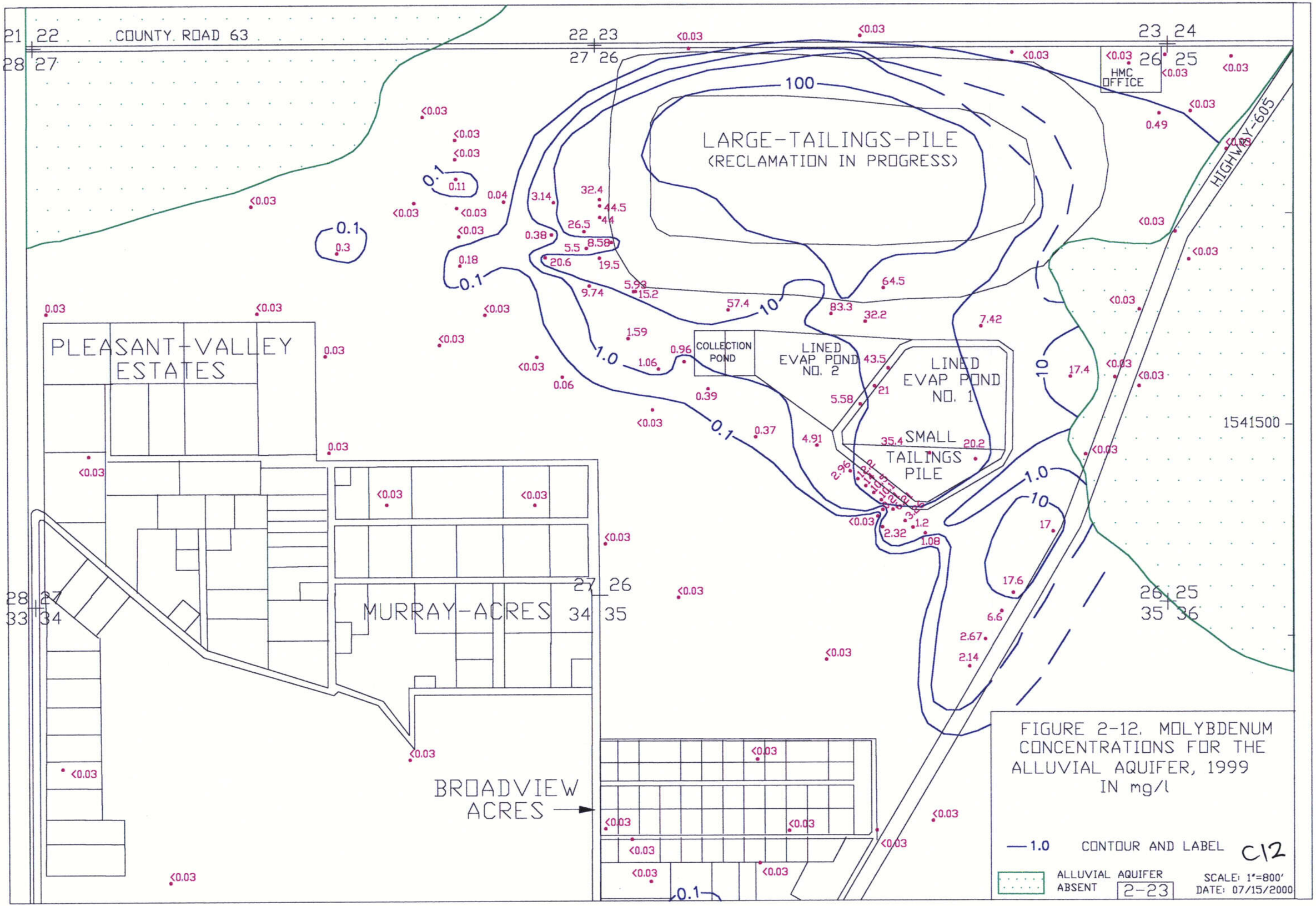


FIGURE 2-12. MOLYBDENUM CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

— 1.0 CONTOUR AND LABEL

ALLUVIAL AQUIFER ABSENT

SCALE: 1"=800'

DATE: 07/15/2000

2-23

C12

21 22 COUNTY ROAD 63 22 23 23 24
28 27 27 26 26 25

HMC OFFICE

LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)

HIGHWAY-605

PLEASANT-VALLEY ESTATES

COLLECTION POND

LINED EVAP POND NO. 2

LINED EVAP POND NO. 1

SMALL TAILINGS PILE

MURRAY-ACRES

BROADVIEW ACRES

28 27 27 26
33 34 34 35

26 25
35 36

1541500

17.3 38 15.3 56.5 43.2 16.5 4 4.1
10.4 15.6 0.2 <0.1 11.9 11 11.6 <0.1 7 4.6 8 7.1 5.2 2.5 5 5.3 6.7 43.5 44.3 16.3
13.4 7.1 1 <0.1 5.7 1.8 2.2 5.1 4.1 2.6 9.9 12.8 9.6 4 10 10.9
1.6 1.2 2.9 1.9 2.2 2 1.8 1.7 1.9 2.5 3 4
2.5 6.4 1.9 2 1.6 2.2 2 2.2 11.7

FIGURE 2-13. NITRATE CONCENTRATIONS FOR THE ALLUVIAL AQUIFER, 1999 IN mg/l

10 CONTOUR AND LABEL

ALLUVIAL AQUIFER ABSENT

C13

2-24

SCALE: 1"=800'
DATE: 07/15/2000

COUNTY ROAD 63

LARGE-TAILINGS-PILE
(RECLAMATION IN PROGRESS)

HMC OFFICE

HIGHWAY-605

PLEASANT-VALLEY ESTATES

MURRAY-ACRES

BROADVIEW ACRES

COLLECTION POND

LINED EVAP POND NO. 2

LINED EVAP POND NO. 1

SMALL TAILINGS PILE

1541500

FIGURE 2-14. RADIUM-226 AND RADIUM-288 CONCENTRAIONS FOR THE ALLUVIAL AQUIFER, 1999, IN pCi/l

RADIUM 226

RADIUM 228

ALLUVIAL AQUIFER ABSENT

2-25

C14

SCALE: 1"=800'

DATE: 07/15/2000

3.0 GROUND-WATER HYDROLOGY OF THE UPPER CHINLE AQUIFER

The Upper Chinle aquifer is important to this site because direct connection between this aquifer and the alluvium exists in the tailings area. The Upper Chinle aquifer is not as important as the alluvial aquifer, but the ground-water hydrology conditions for this aquifer are important with respect to potential discharge from the tailings.

3.1 GEOLOGIC SETTING AND WELL COMPLETION

The Upper Chinle aquifer is the uppermost significant sandstone in the Chinle Formation. Figure 3-1 shows a typical cross section of the bedrock aquifers in this area. This figure shows the alluvium in red with Chinle Shale existing below the alluvium until the Upper Chinle Sandstone is reached. Additional sandstones exist within the Chinle Shale, which is approximately 800 feet thick at the tailings site. The Upper Chinle Sandstone subcrops against the alluvial aquifer in some areas of the project site. Figure 3-2 shows the location of the typical cross section A – B (Figure 3-1).

The limits of the Upper Chinle aquifer are also shown on Figure 3-2. The green pattern shows where the Upper Chinle Sandstone exists between the two faults with Chinle shale above the Upper Chinle Sandstone. The Upper Chinle does not extend to the west to the West Fault but subcrops against the alluvial aquifer on its western and southern borders. The crosshatched blue pattern shows where the Upper Chinle exists east of the East Fault with the shale above the sandstone. The red pattern shows where the Upper Chinle aquifer subcrops against the alluvium and a crosshatched red pattern shows where the alluvium is saturated over the subcroped Upper Chinle Sandstone.

The basic well data for the Chinle wells is presented in Section 5 of the 1999 Annual Report. The annual reports present the Chinle wells that are on the Homestake property, in Broadview and Felice Acres, in Murray and Pleasant Valley Acres, and regional wells that are beyond these subdivisions and the Homestake site.

3.2 WATER LEVELS

The depth to water levels and elevations are presented in the basic well data in the 1999 Annual Report. The water-level elevations were used to show flow direction and calculate the gradient of ground-water movement for the Upper Chinle aquifer.

3.2.1 WATER-LEVEL DEPTH AND ELEVATION

The water-level depths vary over the area but, in general, are less than 100 feet to the water level in Upper Chinle wells. Water-level elevations are presented in Figure 3-3 for 1999. This figure shows that ground water in the Upper Chinle between the two faults is flowing into the large tailings area from the north. The fresh-water injection into Upper Chinle well CW5 forces flow back toward the collection wells south of the large tailings from the Broadview Acres area. Flow in the Upper Chinle in Broadview and Felice Acres is to the south and discharges to the alluvial aquifer in the subcrop area. Flow east of the East Fault is parallel to the fault to the northeast of injection well CW13, close to the fault due to the high permeability zone adjacent to the fault. South of injection well CW13 the flow is parallel to the fault back toward the subcrop area. The flow in the majority of the ground water east of the East Fault is to the east-southeast into the lower permeability material away from the fault.

3.2.2 WATER-LEVEL CHANGES

Water-level changes in the Upper Chinle aquifer are shown in the annual reports. The 1999 Annual Report presents the water-level changes from 1995 to 1999. Historical water-level changes up through 1997 are presented in the 1997 Annual Report. Water-level changes, in general, have been small in the Upper Chinle aquifer except for changes due to the fresh-water injection into wells CW5 and CW13 and the pumping that has occurred in wells CW4R and CE2. Water levels on the east side of the East Fault close to the East Fault have responded significantly to the fresh-water injection into well CW13.

3.3 STRUCTURE OF THE UPPER CHINLE AQUIFER

The top of the Upper Chinle aquifer is the most important geologic feature of the Upper Chinle Sandstone because the elevation of this unit and the base of the alluvial aquifer defines where these two aquifers are in direct connection. Two faults exist in the area of the Grants site and are significant in definition of the Upper Chinle structure. Numerous cross sections have been developed to correlate geophysical logs in Upper Chinle drill holes and wells. These cross sections were used in developing these structure maps. Figure 3-4 presents the elevation of the top of the Upper Chinle aquifer. This figure shows that the Upper Chinle Sandstone between the two faults generally dips to the east. The general dip is also to the east, east of the East Fault. The structure on the south side of the project area turns and dips to the northeast at a steeper gradient, which causes the sandstone to subcrop in the area of southern Felice Acres with the alluvial aquifer.

3.4 AQUIFER PROPERTIES

Aquifer properties in the Upper Chinle aquifer vary significantly over the area due to the effects of secondary permeability on the sandstone. The hydraulic conductivities adjacent to the east side of the East Fault are approximately 10 feet per day (see Figure 3-5) and decrease to below one foot per day to the east of this area. This affects the ground-water flow in the high permeability zone adjacent to the East Fault. High hydraulic conductivity values also exist in the area west of the East Fault on the south side of the Small Tailings. The Upper Chinle aquifer is a confined aquifer but will, in general, have a storage coefficient of 5E-05. The specific yield of this confined aquifer is expected to be significantly less than the alluvial aquifer and is estimated at 0.1.

3.5 WATER QUALITY

The same water-quality parameters that are important to the alluvial aquifer are, in general, important to the Upper Chinle aquifer but to a lesser degree due to the limited contact with the Upper Chinle aquifer. The water quality in the Upper Chinle aquifer exceeds background conditions in only a few locations. Sulfate concentrations have been

adequately restored in the Upper Chinle aquifer. Selenium concentrations were less than the NRC and State standards in all Upper Chinle wells in 1999 except for the subcrop area near the large tailings. Uranium concentrations exceed background in four wells that are slowly being restored due to leaching of this constituent during restoration.

3.5.1 SULFATE CONCENTRATIONS

Sulfate concentrations for 1999 in the Upper Chinle aquifer are presented in Figure 3-6. This figure shows that only sulfate concentrations very near the subcrop area in the large tailings area are slightly above 1000 mg/l. This sulfate concentration is well below the range of background sulfate concentrations and, therefore, sulfate concentrations have been adequately restored in the Upper Chinle aquifer. Sulfate concentrations versus time are presented in the annual reports and generally show fairly steady concentrations of this constituent.

3.5.2 TDS CONCENTRATIONS

TDS concentrations are shown on Figure 3-7 for the Upper Chinle aquifer. This figure shows that TDS concentrations exceed 2000 near the subcrop area with the large tailings and east of the East Fault. TDS concentrations above 2000 east of the East Fault are natural. As the Upper Chinle water flows to the east-southeast in the lower permeability zone, TDS concentrations have naturally increased. TDS concentrations near the subcrop area are also less than the 95% background concentration level. Therefore, no additional restoration for TDS concentrations is necessary in the Upper Chinle aquifer.

3.5.3 CHLORIDE CONCENTRATIONS

Chloride concentrations for the Upper Chinle aquifer are presented in Figure 3-8 for 1999. This figure shows that chloride concentrations are greatest east of the East Fault where the ground water moves into the low permeability zone. Chloride concentrations above 250 mg/l exist east of the East Fault. These higher chloride concentrations are natural, based on their chloride to sulfate ratios. No restoration of chloride concentrations in the Upper Chinle aquifer is needed.

3.5.4 URANIUM CONCENTRATIONS

Uranium concentrations in the Upper Chinle aquifer for 1999 are presented in Figure 3-9. Elevated uranium concentrations exist near the subcrop area in the area of the large tailings pile and extend down to the northeast corner of Murray Acres. The existing CAP should adequately restore the uranium concentrations in the elevated areas. Uranium concentration variations with time are presented in the annual reports.

3.5.5 SELENIUM CONCENTRATIONS

Selenium concentrations for the Upper Chinle aquifer for 1999 are presented on Figure 3-10. This figure shows low selenium concentrations in the Upper Chinle aquifer except in two wells just south of the large tailings pile near the subcrop area. These selenium concentrations only slightly exceed the 95% background level and only a small area of selenium restoration is needed. The CAP will easily restore the small area of elevated selenium concentrations in the Upper Chinle aquifer.

3.5.6 MOLYBDENUM CONCENTRATIONS

The molybdenum concentrations are elevated in a similar area as the selenium concentrations in the Upper Chinle aquifer. Figure 3-11 shows the molybdenum concentrations for the Upper Chinle aquifer for 1999. The CAP will easily restore the molybdenum concentrations in the Upper Chinle aquifer in this area.

3.5.7 NITRATE CONCENTRATIONS

Nitrate concentrations in the Upper Chinle aquifer are very low. Figure 3-12 presents the 1999 nitrate concentrations for the Upper Chinle aquifer and shows that all the values are significantly less than 10 mg/l. Therefore, no restoration of nitrate concentrations is necessary in the Upper Chinle aquifer.

3.5.8 RADIUM-226 AND RADIUM-228 CONCENTRATIONS

Radium-226 plus radium-228 concentrations in the Upper Chinle aquifer, as nitrate and other constituents that have been slightly affected in the alluvial aquifer, do not show any

impacts in the Upper Chinle aquifer. Figure 3-13 presents the radium-226 and radium-228 concentrations for the Upper Chinle aquifer for 1999 and shows that none of these radium concentrations are significant in the Upper Chinle aquifer.

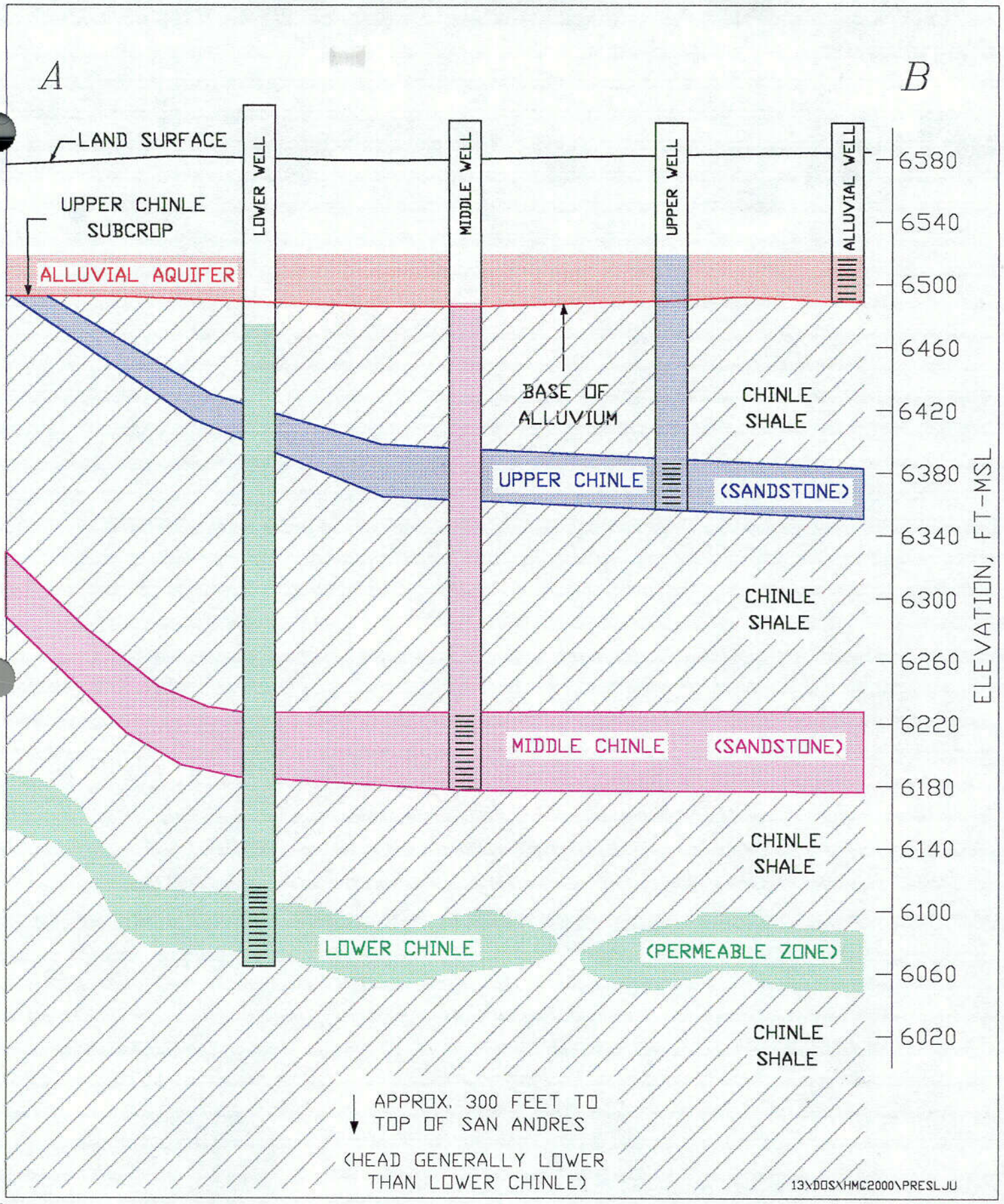
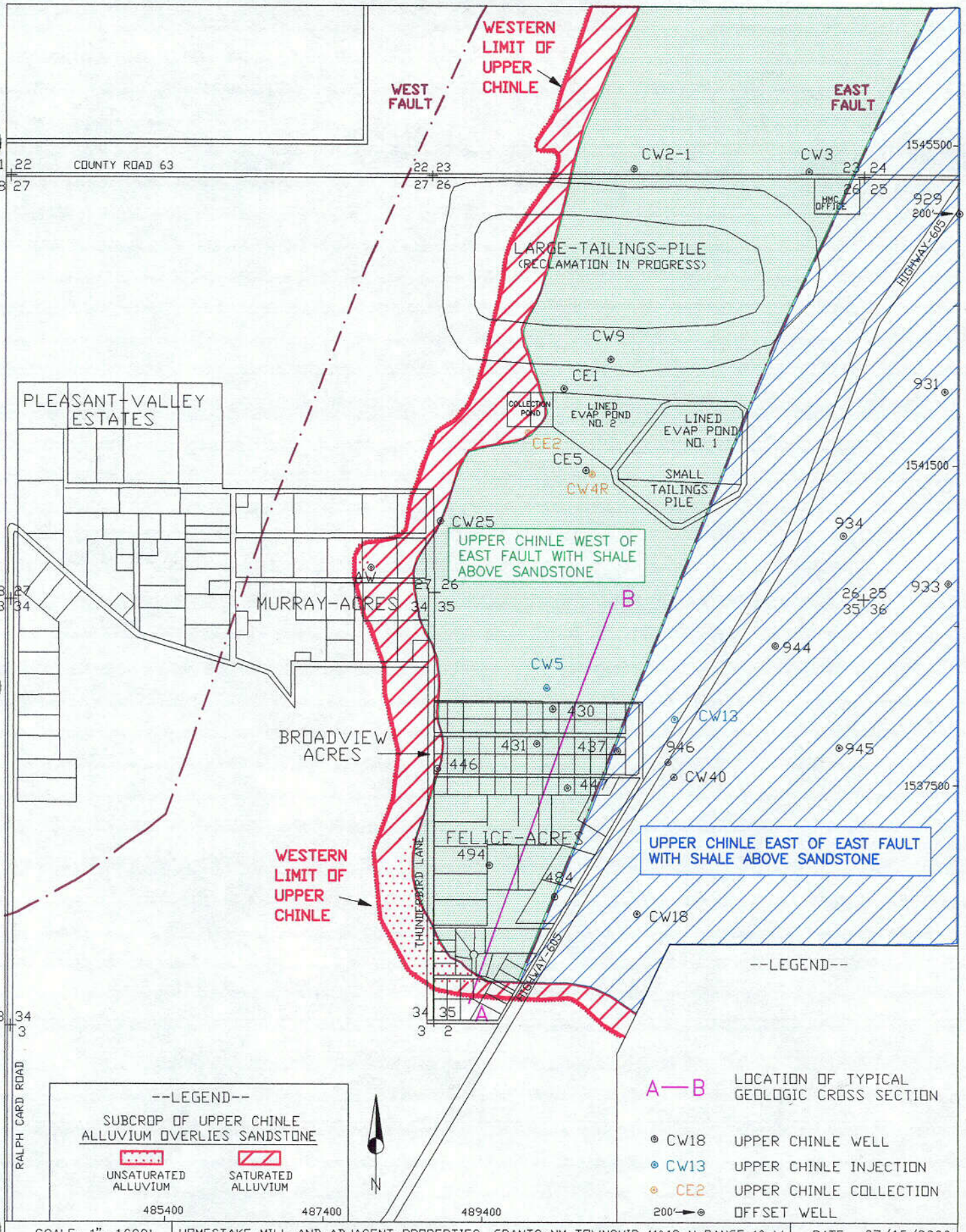


FIGURE 3-1. TYPICAL GEOLOGIC CROSS SECTION

C15

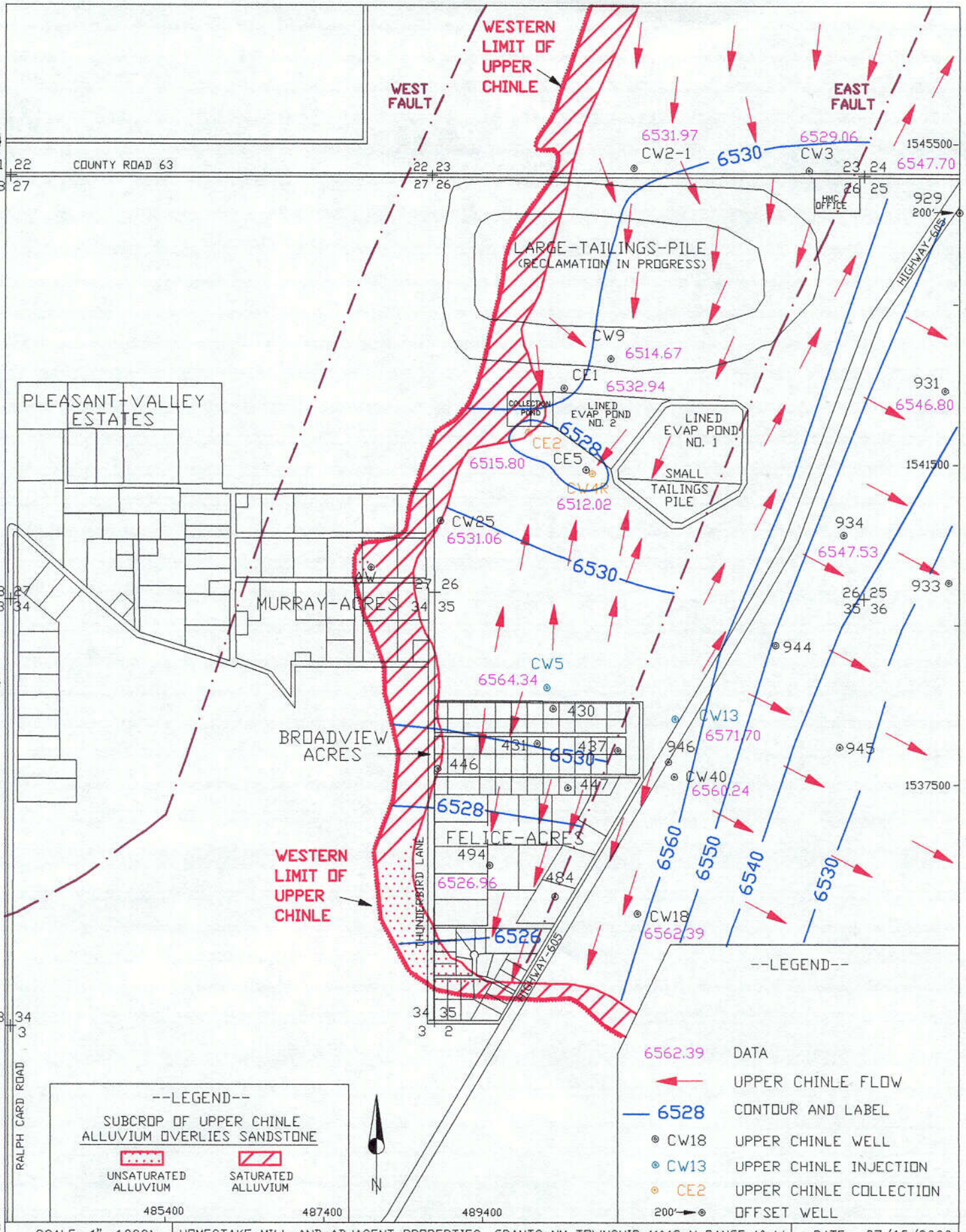


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-2. LIMITS OF UPPER CHINLE AQUIFER AND WELL LOCATIONS

9506/UP1600

C16

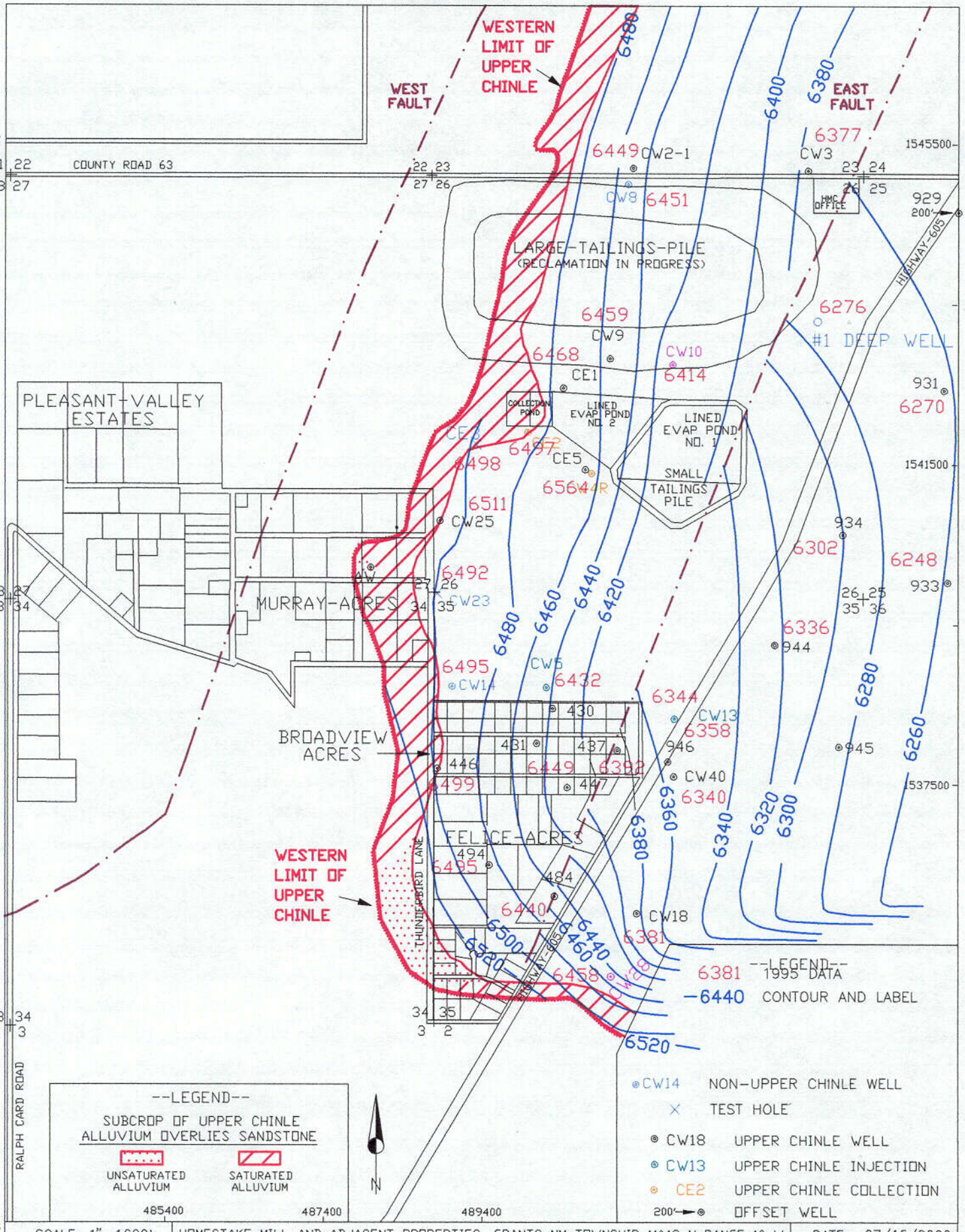


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-3. WATER-LEVEL ELEVATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, FT-MSL

9506/UP1600

C17

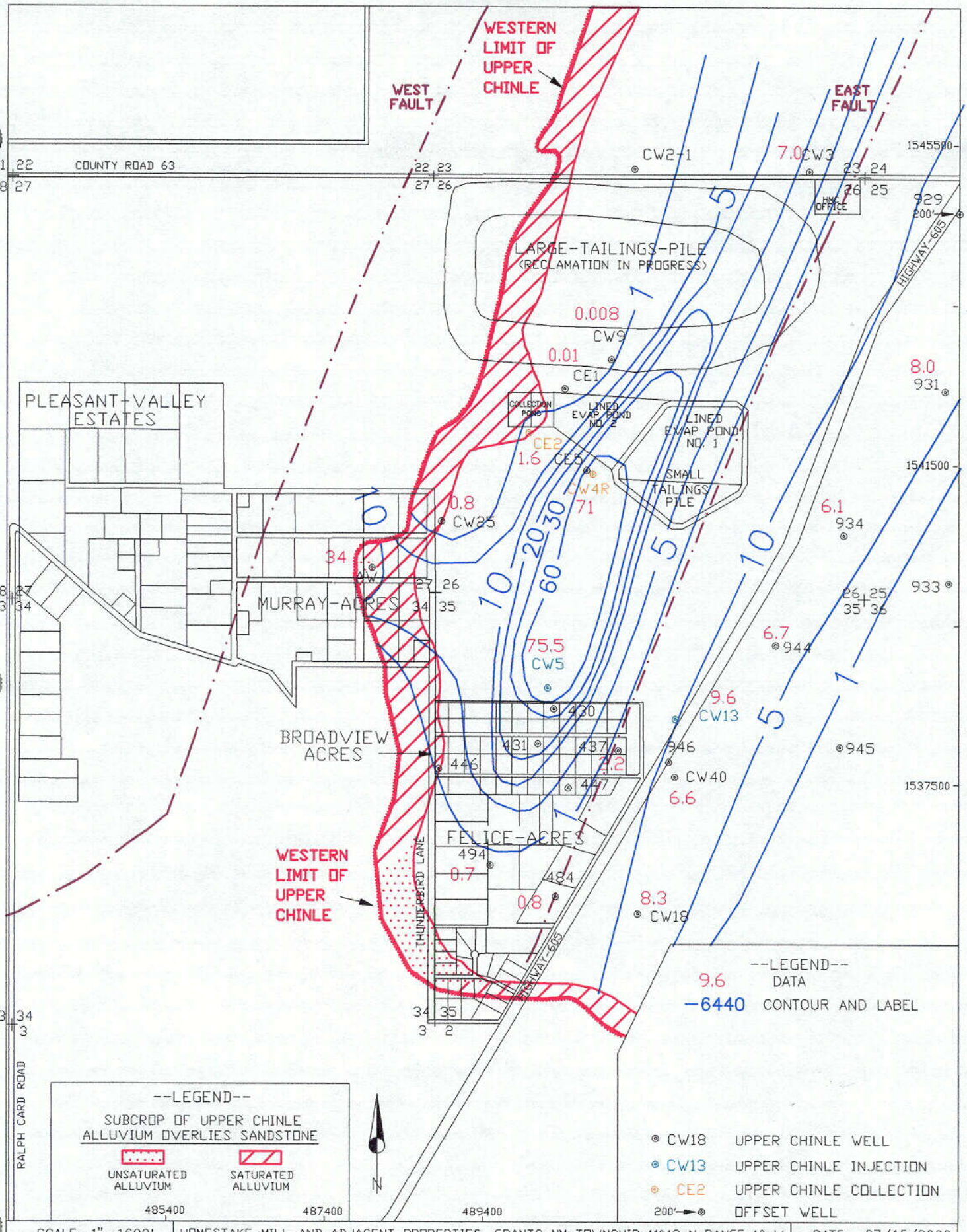


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-4. ELEVATION OF THE TOP OF THE UPPER CHINLE, IN FT-MSL

9506/UP1600

C18

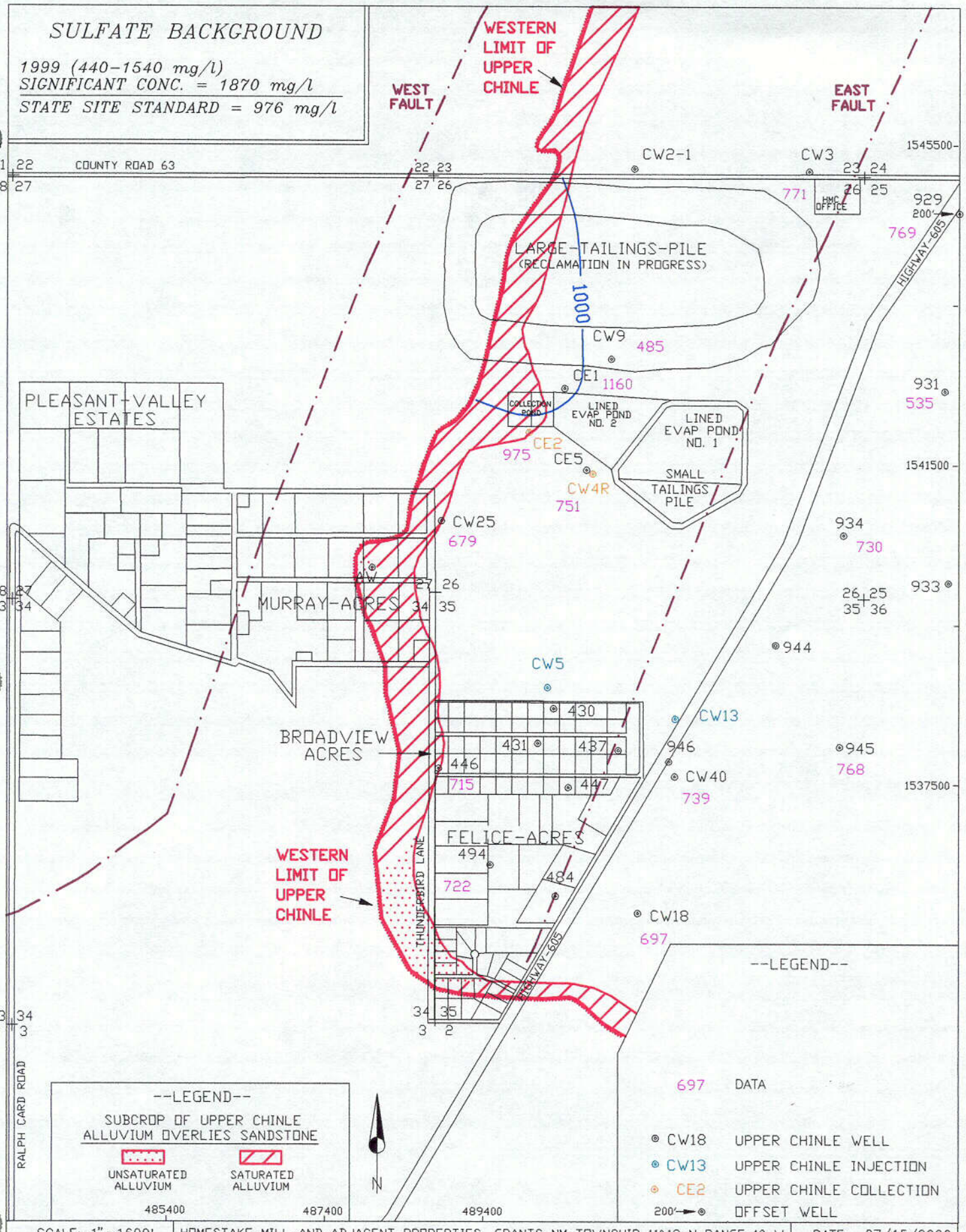


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-5. HYDRAULIC CONDUCTIVITY (PERMEABILITY) FOR THE UPPER CHINLE AQUIFER, FT/DAY

9506/UP1600

C19



SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-6. SULFATE CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C20

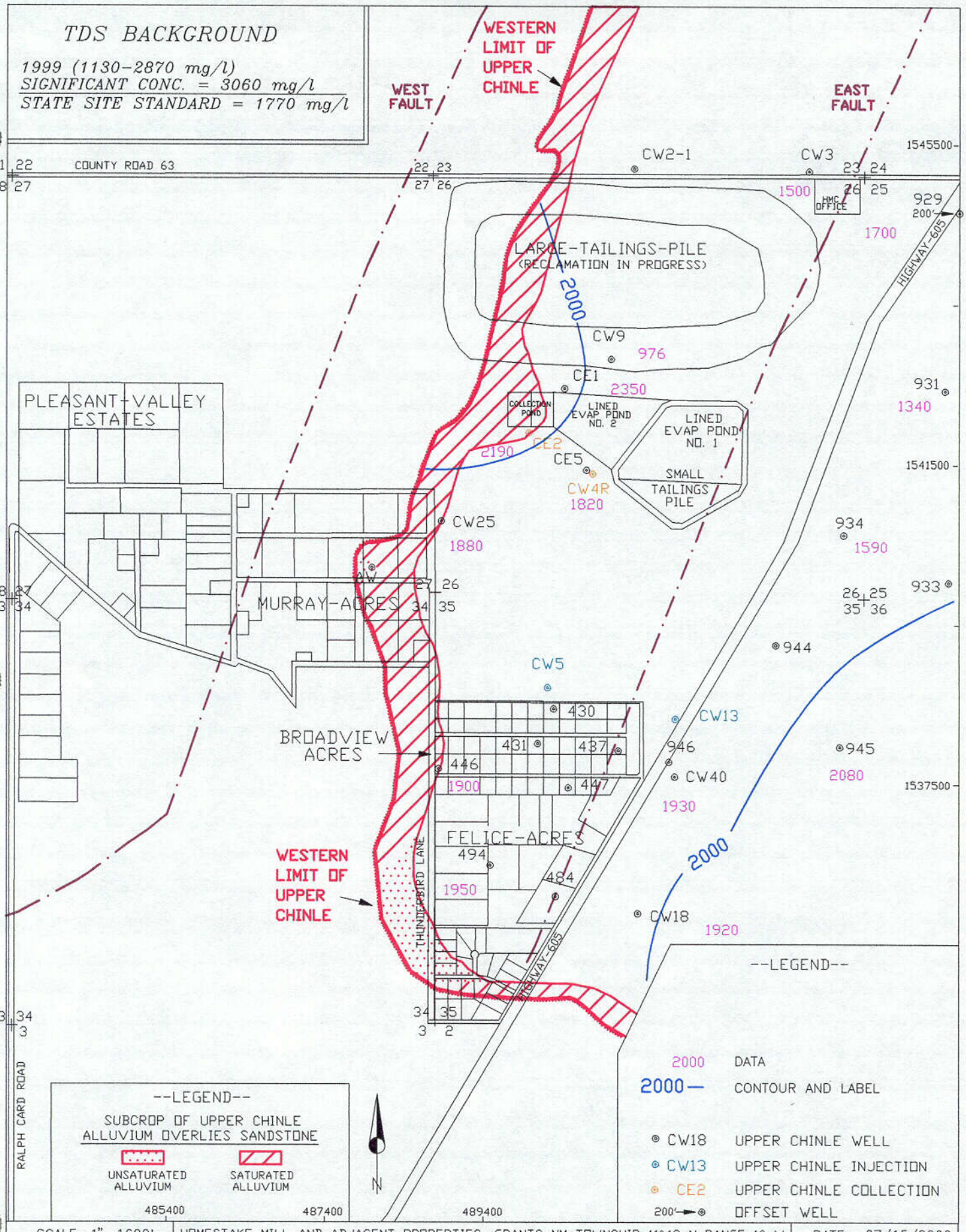
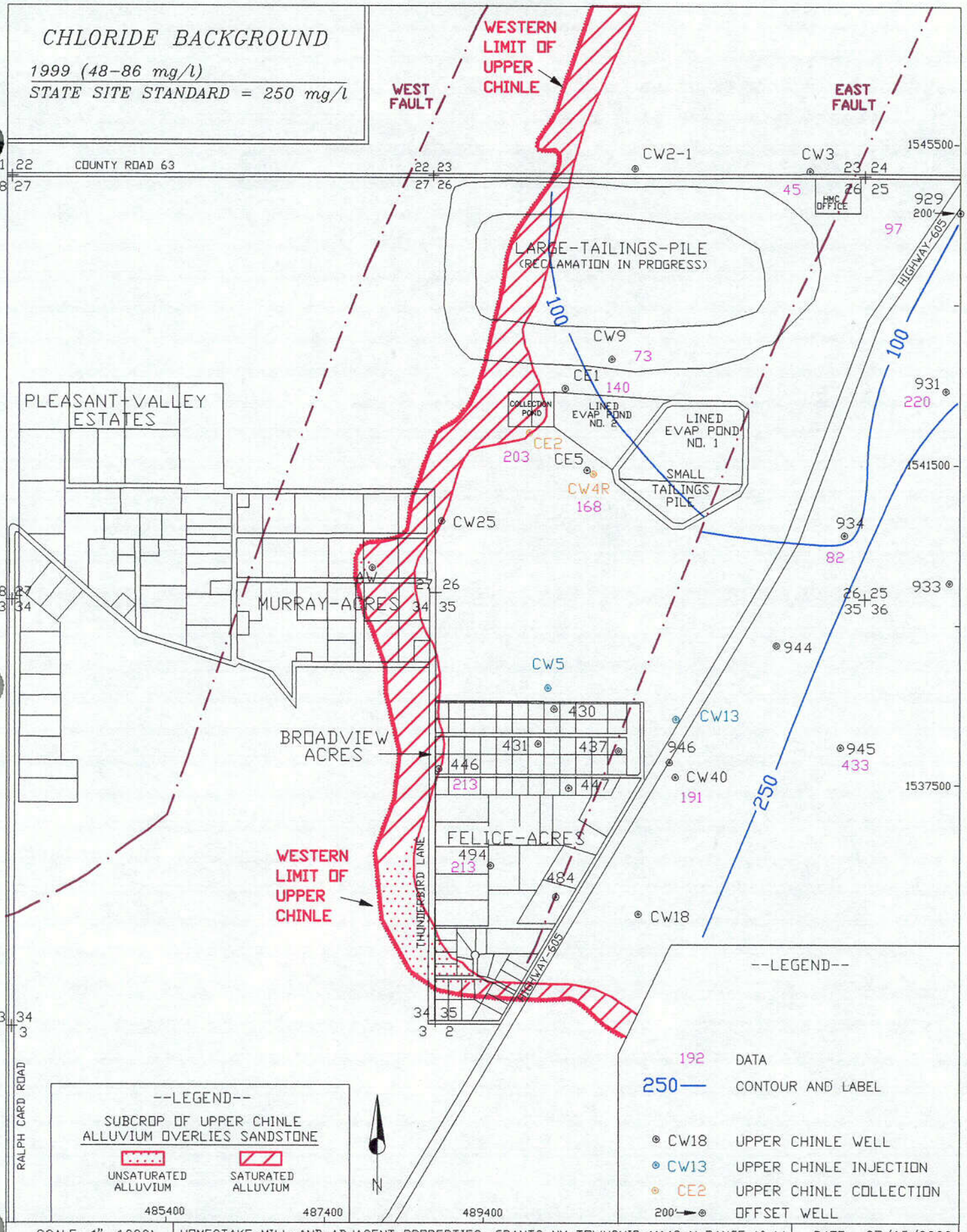


FIGURE 3-7. TDS CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C21

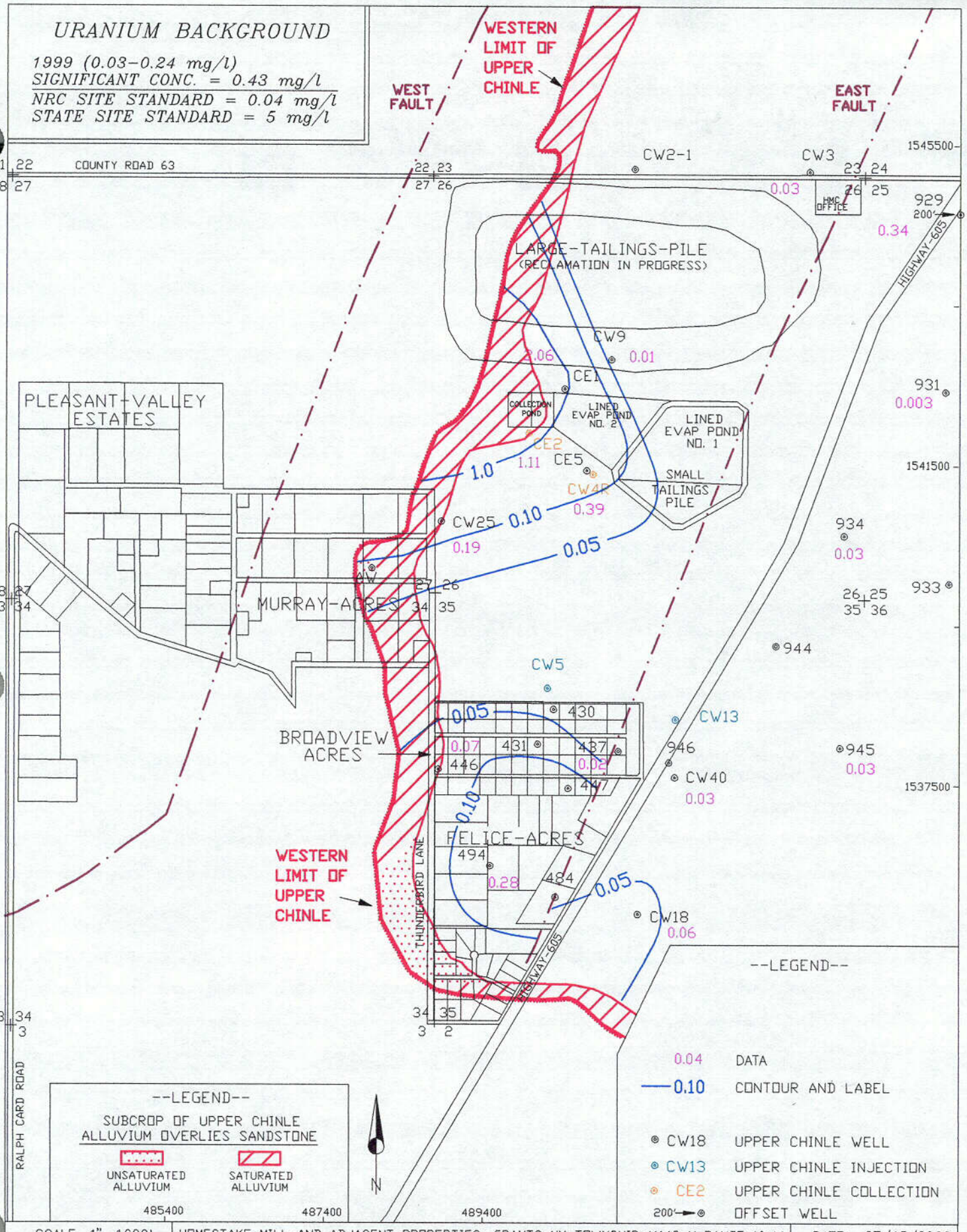


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-8. CHLORIDE CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C22

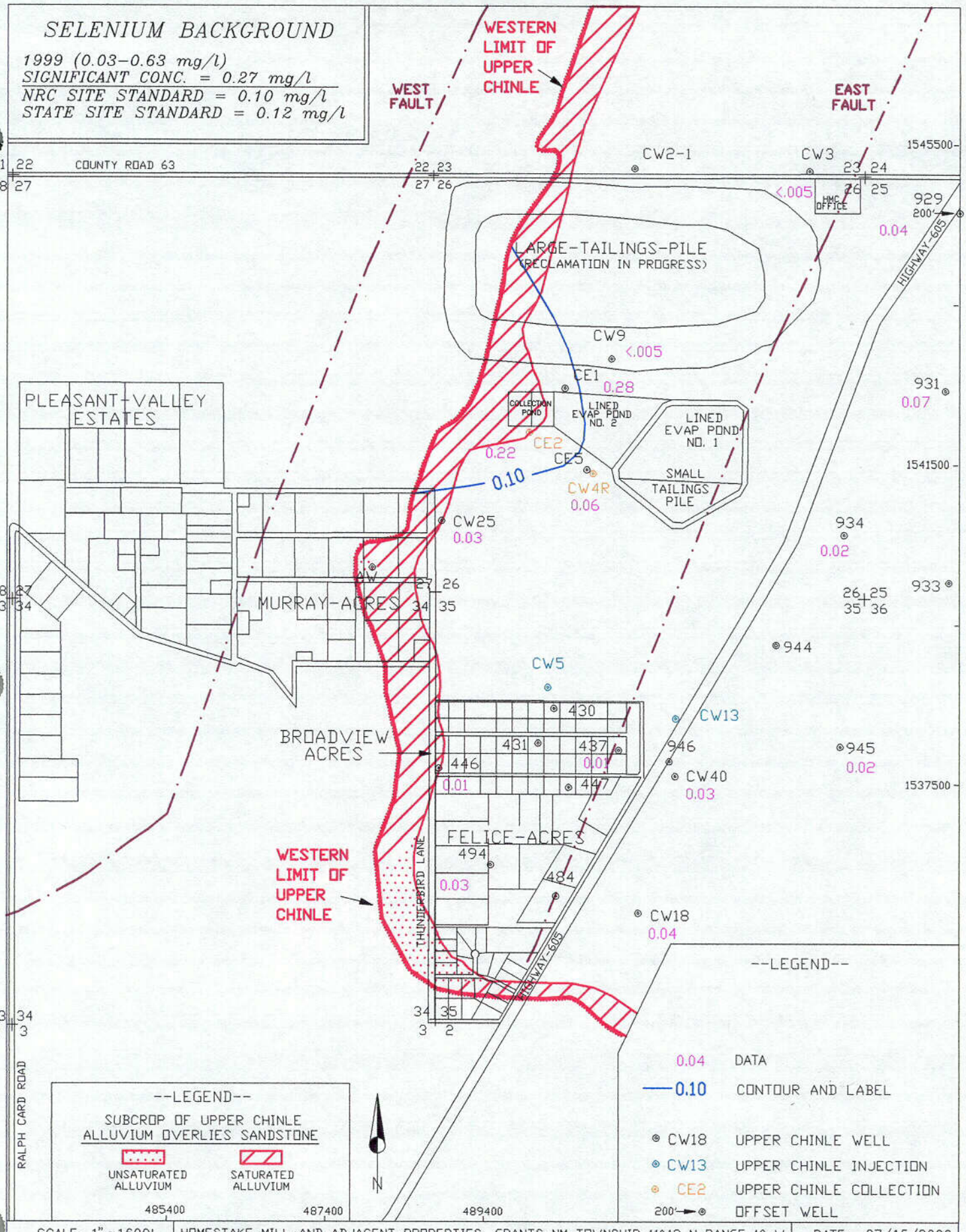


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-9. URANIUM CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C23

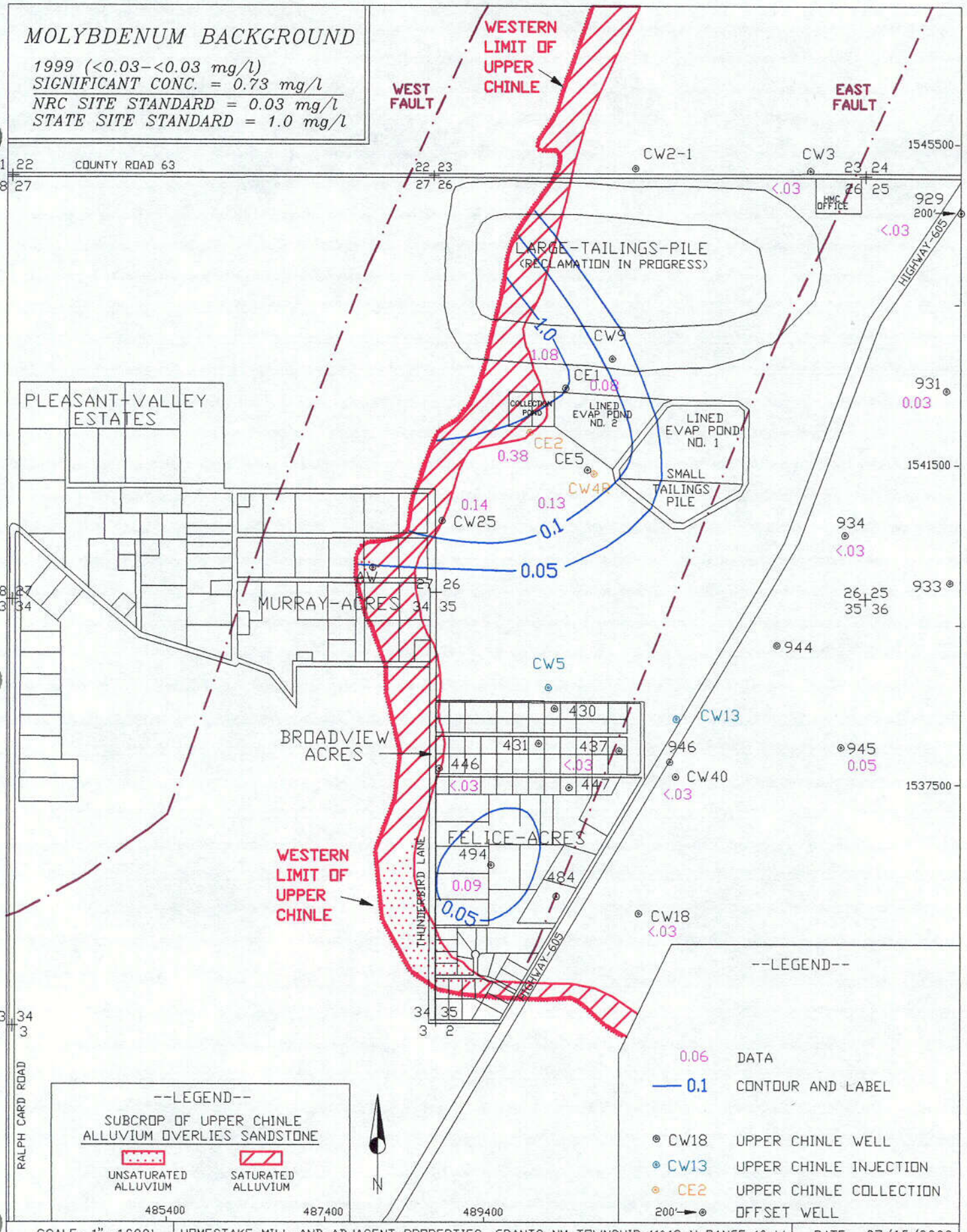


SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-10. SELENIUM CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C24



SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-11. MOLYBDENUM CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C25

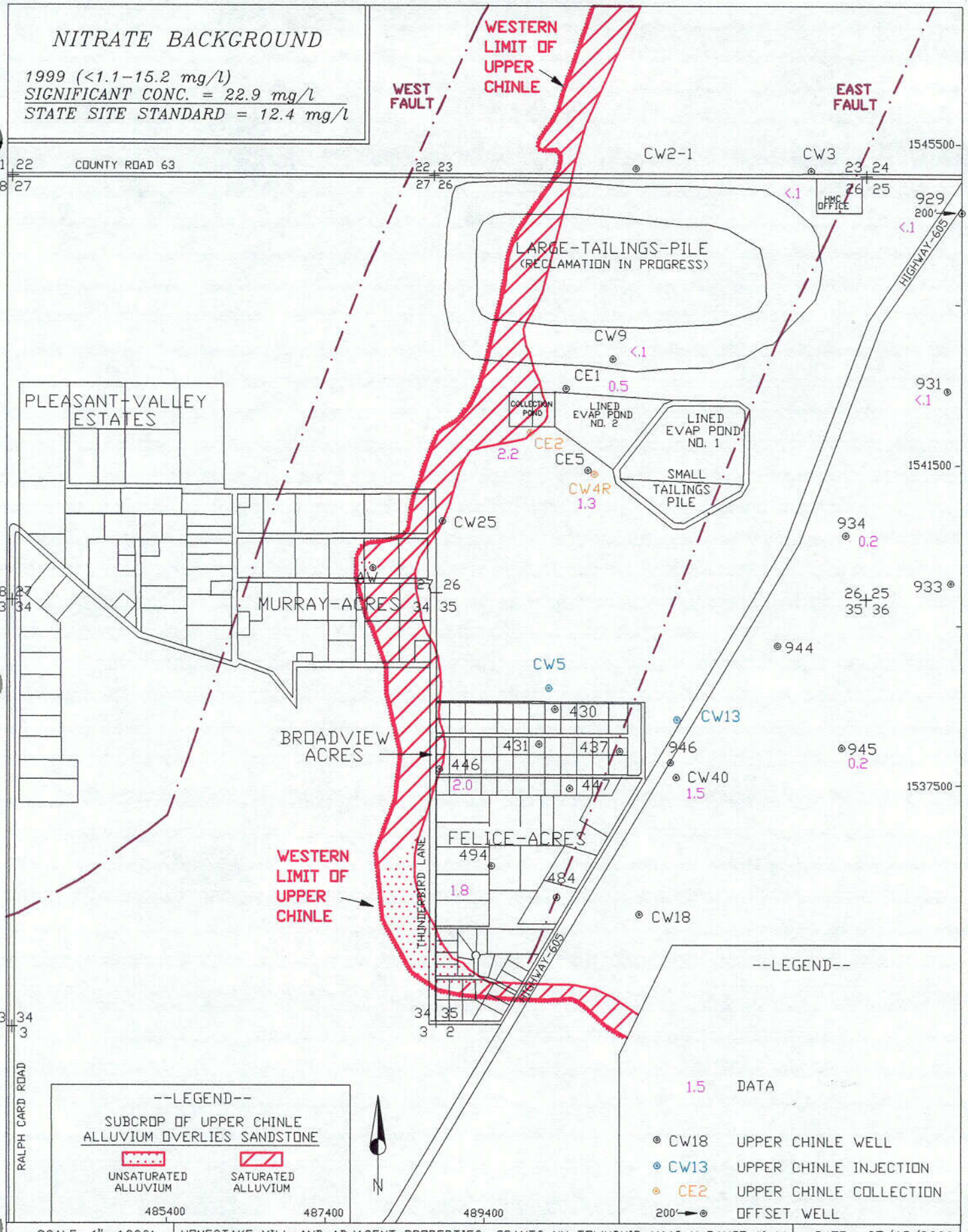
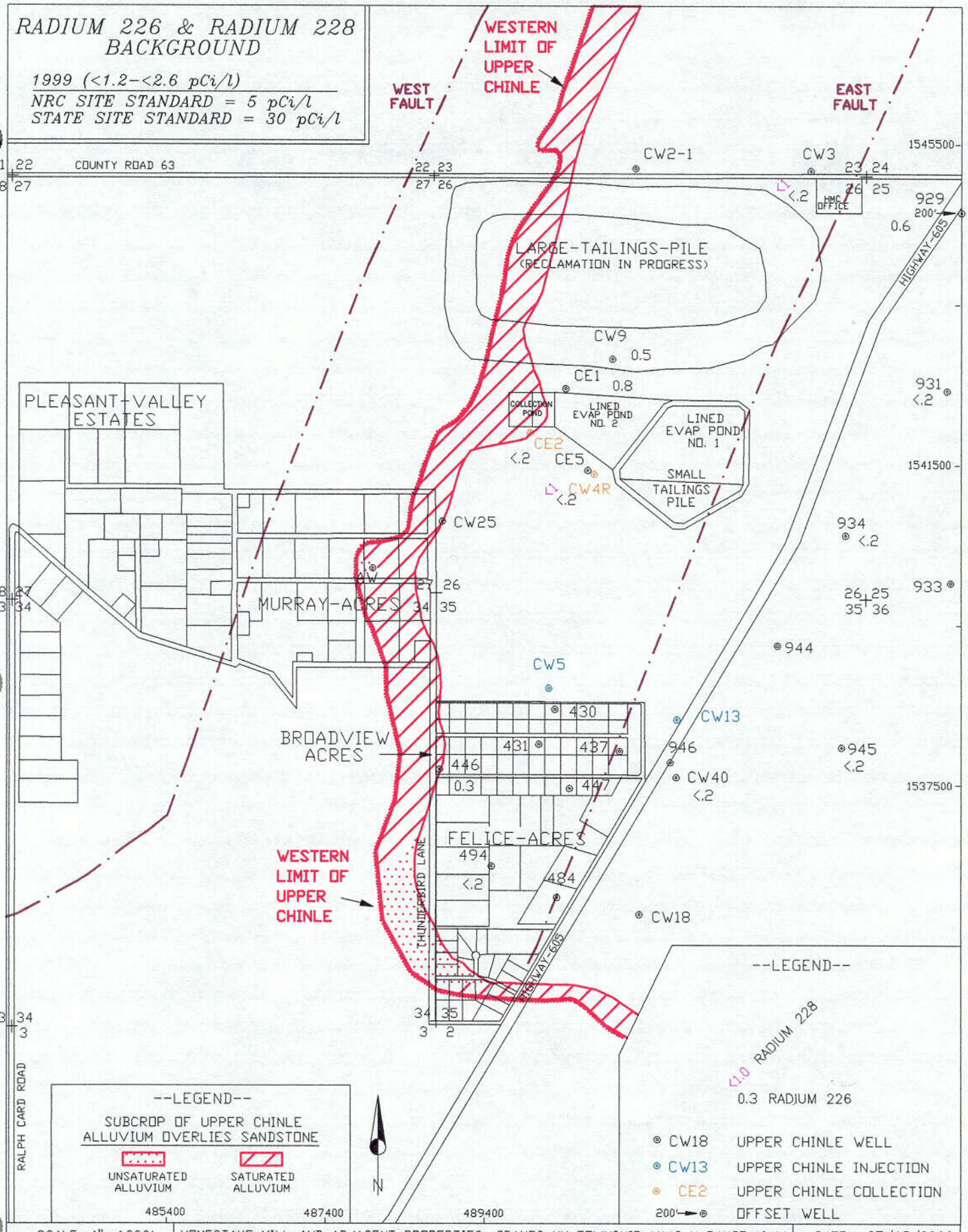


FIGURE 3-12. NITRATE CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, mg/l

9506/UP1600

C26



SCALE: 1"=1600' | HOMESTAKE-MILL-AND-ADJACENT-PROPERTIES GRANTS-NM-TOWNSHIP-11&12-N-RANGE-10-W | DATE: 07/15/2000

FIGURE 3-13. RADIUM-226 AND RADIUM-228 CONCENTRATIONS FOR THE UPPER CHINLE AQUIFER, FALL 1999, pCi/l

9506/UP1600

C27

4.0 GROUND-WATER HYDROLOGY OF THE DEEPER AQUIFERS

Additional Chinle sandstones exist in the Chinle Formation below the Upper Chinle aquifer. Figure 3-1 shows the location of the Middle Chinle Sandstone, which is greater than 100 feet below the bottom of the Upper Chinle Sandstone. This sandstone is generally thicker than the Upper Chinle Sandstone and is a significant aquifer in this area. A permeable zone in the Chinle shale exists below the Middle Chinle Sandstone and has been named the Lower Chinle aquifer. This Chinle zone is not as consistent because it depends on secondary permeability of the fine-grained shales in this area. The San Andres aquifer exists approximately 300 feet below the Lower Chinle aquifer.

The Middle Chinle Sandstone has been defined and is presented in Section 6 of the 1999 Annual Report. Figure 6.1-1 of the 1999 Annual Report shows the limits of the Middle Chinle aquifer and where the Middle Chinle aquifer subcrops against the alluvial aquifer. The Middle Chinle subcrops are away from the tailings and, therefore, do not have direct access as the Upper Chinle aquifer. The Middle Chinle aquifer, therefore, is not important relative to the discharge from the tailings at the Grants site.

The Lower Chinle aquifer, which exists below the Middle Chinle Sandstone, is a permeable zone within the Chinle Shale. This aquifer is more variable due to the dependence of secondary permeability on the Chinle Shale to create adequate transmitting ability. Section 7 of the 1999 Annual Report shows the approximate location of subcrops in the Lower Chinle aquifer to the alluvial formation. These subcrops are west and southwest of the Grants site and, therefore, the Lower Chinle aquifer is not important relative to discharge from the Grants site tailings.

The San Andres aquifer exists below the Lower Chinle aquifer and subcrops to the alluvial aquifer a few miles to the west of the Grants site. The fresh-water supply wells at the Grants site are completed in the San Andres aquifer. Therefore, this aquifer has been important to restoration of this site as a water supply. The distance to the subcrop area of the San Andres aquifer and a massive amount of Chinle Shale between the alluvial

aquifer and the top of the San Andres aquifer at the project site makes this aquifer unimportant relative to the discharge from the tailings.

5.0 REFERENCES

Environmental Restoration Group, 1999a, Statistical Evaluation of Alluvial Groundwater Quality Upgradient of the Homestake Site near Grants, NM, Molybdenum, Selenium and Uranium, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Environmental Restoration Group, 1999b, Statistical Evaluation of Alluvial Groundwater Quality Upgradient of the Homestake Site near Grants, NM, Nitrate, Sulfate and Total Dissolved Solids, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Freeze, R.A. and J.A. Cherry, 1979. Groundwater, Prentice-Hall, Inc.

Hoffman, G.L., 1976, Groundwater Hydrology of the Alluvium, Consulting Report to Homestake Mining Company.

Hoffman, G.L., 1977, Modeling, Design and Specifications of the Collection and Injection Systems, Consulting Report to Homestake Mining Company.

Hydro-Engineering, 1981, Ground-Water Discharge Plan for Homestake's Mill near Milan, New Mexico, DP-200, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1983, Ground-Water Discharge Plan for Homestake's Mill near Milan, New Mexico, DP-200, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1983a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1983b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1983c, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Fourth Quarter 1983, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1984a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, First Quarter 1984, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1984b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Second Quarter 1984, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1984c, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Third Quarter 1984, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1985a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Fourth Quarter 1984, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1985b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, First Quarter 1985, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1985c, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Second Quarter 1985, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1985d, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Third Quarter 1985, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1986a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Fourth Quarter 1985, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1986b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, First Quarter 1986, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1986c, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Second Quarter 1986, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1987a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Third and Fourth Quarters 1986, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1987b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, First and Second Quarters 1987, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1988a, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, Third and Fourth Quarters 1987, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1988b, Ground-Water Monitoring for Homestake's Mill Discharge Plan, DP-200, First and Second Quarters 1988, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1988c, Renewal Ground-Water Discharge Plan, DP-200 for Homestake's Mill Near Milan, New Mexico, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1989, Corrective Action Plan for Homestake's Tailings, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1990, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SUA-1471, 1989, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1991, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SUA-1471, 1990, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1992, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SUA-1471, 1991, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1993a, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SUA-1471, 1992, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1993b, Water Quality Changes in the Alluvial Aquifer Adjacent to the Homestake Tailings, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1994, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SCA-1471, 1993, Consulting Report for Homestake Mining Company, Grants, New Mexico.

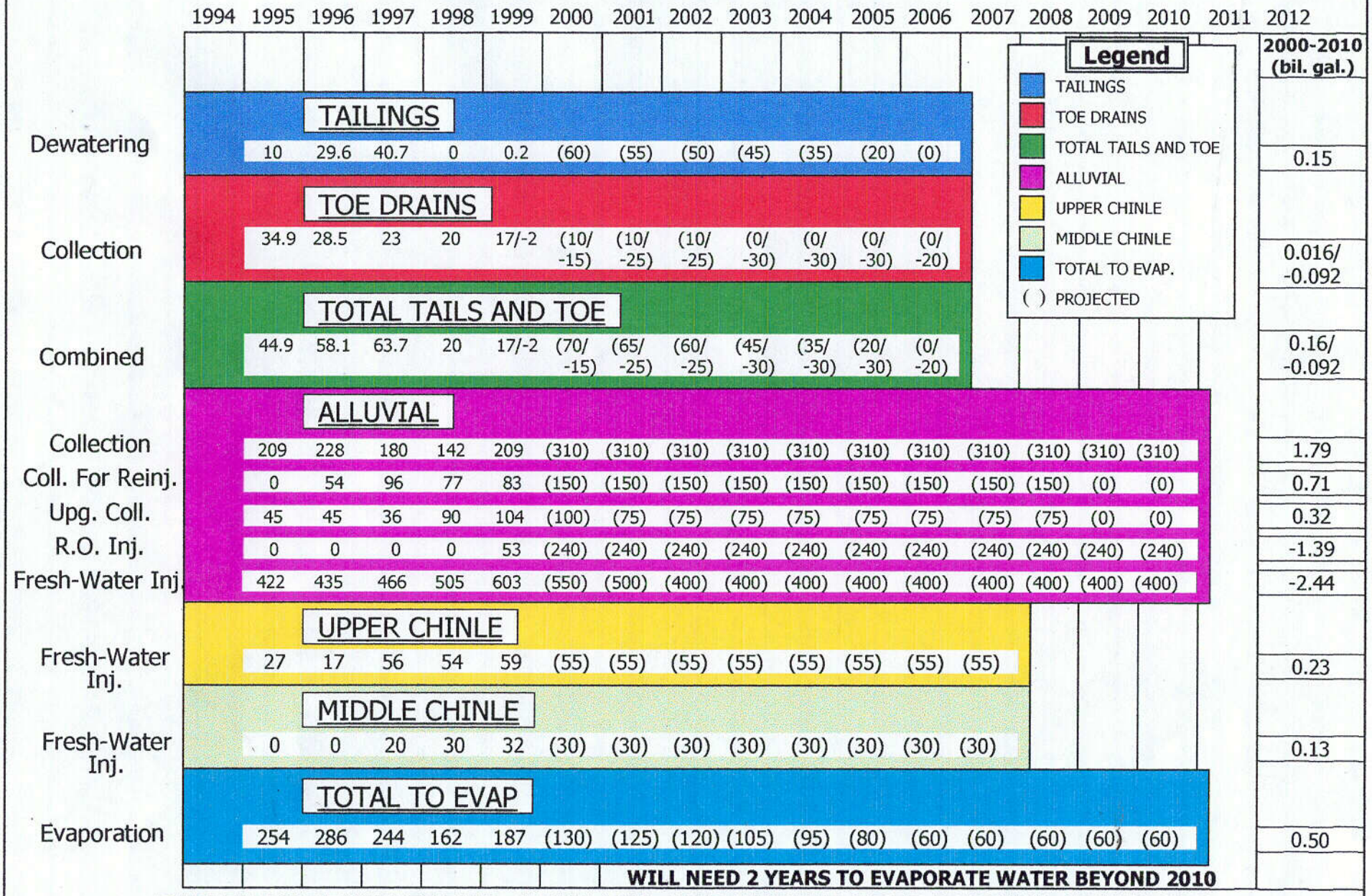
Hydro-Engineering, 1995, Ground-Water Monitoring for Homestake's Mill Discharge Plan DP-200 and NRC License SUA-1471, 1994, Consulting Report for Homestake Mining Company, Grants, New Mexico.

Hydro-Engineering, 1996. Ground-Water Monitoring for Homestake's Grants Project, NRC License SUA-1471, and Discharge Plan DP-200. Consulting Report for Homestake Mining Company of California.

Hydro-Engineering, L.L.C, 1997. Ground-Water Monitoring for Homestake's Grants Project, NRC License SUA-1471, and Discharge Plan DP-200, 1996. Consulting Report for Homestake Mining Company of California.

Hydro-Engineering, L.L.C., 1998, Ground-Water Monitoring and Performance Review for Homestake's Grants Project, NRC License SUA-1471, and Discharge Plan DP-200, 1997. Consulting Report for Homestake Mining Company of California.

HOMESTAKE RESTORATION RATES
Actual/(proj.) GPM



TAILINGS DEWATERING, ALLUVIAL AND CHINLE OPERATIONAL SCHEDULE.

C28