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30 August 2006

Proj. No.: H0562C
File Loc.: Westminster

California Regional Water Quality Control Board
Central Coast Region
895 Aero Vista Drive, Suite 101
San Luis Obispo, CA 93401

Attention: Mr. Hector Hernandez

Dear Mr. Hernandez:

RE: REVIEW OF OLIN STATEMENT REGARDING NORTHEAST FLOW

On behalf of the City of Morgan Hill (the City), WorleyParsons Komex has reviewed the statement by Olin Corporation submitted to the Central Coast Regional Water Quality Control Board (RWQCB) along with the accompanying report by Mactec entitled, “Northeast Groundwater Flow Assessment, Regional Board Data Package, Olin/Standard Fusee, Morgan Hill, California” (jointly the Olin Statement) submitted in preparation for the September 7, 2006 RWQCB Board meeting. This review addresses items one through five of Olin’s Statement. A summary of refuting evidence is given below and further details are provided in attachments to this letter.

1) Olin’s Statement asserts that perchlorate was in groundwater near the Nordstrom Park well before pumping began. This is wholly consistent with Olin being the source of perchlorate to the north and east of the Olin Site. Attachment 1 to this letter illustrates how a conservatively-low estimation of the mass of perchlorate removed at the Nordstrom Well in the last several years (over 7,200 grams) far exceeds that theorized by Olin as having been introduced by well disinfection (on the order of 0.05 grams). In addition, Olin has theorized that the volume of water in the gravel pack of the Nordstrom Well hypothetically impacted by perchlorate due to disinfection at the Nordstrom Park well is 2,057 gallons. At the flow rate of 1,000 gallons per minute which the Nordstrom Well operates, this impacted volume would be removed during well pumping in approximately 2 minutes after pumping commenced, even in the time before the well was actually brought on line. Both of these simplified calculations help illustrate the technical infeasibility of Olin’s argument for perchlorate detections caused by well disinfection.

2) Olin’s Statement ignores evidence submitted by their own consultants on the northeast flow direction of the groundwater and perchlorate from the Olin Site. Numerous documents prepared by Mactec on behalf of Olin have clearly indicated a localized north, northeast or eastward groundwater gradient between the Olin Site and the Nordstrom Park well. The examples contained in Attachment 2, prepared by Mactec include the following:

a. Interpretation of the 1916 United States Geological Survey Data by Olin's consultant showing eastward and northward flow to the east of the Olin Site (Attachment 2.1);

b. Several occurrences of northward or northeasterly flow interpreted by Olin's consultants from historical information in the last decade (Attachment 2.2);

c. Gradient maps generated by Olin's consultant showing north and northeasterly flow in the deep aquifer zone, using data from the northeast piezometers for one year, dating back to summer of 2005 in Attachment 2.3 (for Q3, 2005, Q4, 2005, Q1, 2006 and Q2, 2006); and,

d. Ternary flow diagrams prepared by Olin's consultant for the gradient between three northeast piezometers, illustrating a consistent predominantly north component of flow for one year (Attachment 2.4).

3) Olin's Statement asserting that perchlorate has not migrated from the Olin Site to the Nordstrom Park and/or other City wells because no wells other than City wells have detected perchlorate greater than 6 micrograms per liter (ug/L) is not correct. The gradient in the Olin Site vicinity, although almost always northward in the deep aquifer, does have west and eastward variability, depending on annual hydrologic conditions and seasonal groundwater extraction, not just the operation of the Nordstrom Park or Dunne wells. As such, a simplified analogy for the plume migration from the Olin Site would be a zig/zag pattern of contaminant migration. As a result, the tail of a dispersed plume, most of which may already have been removed by City wells and other extraction wells, may be all that remains. Additionally, the detection of perchlorate at the Dunne 1, San Pedro and Condit City wells in the vicinity of the Nordstrom Park well at average concentrations greater than 1.4 ug/L indicates there is perchlorate in this area. Furthermore, although there may not be what is generally considered a traditional high concentration groundwater plume northeast of the Olin Site, a non-traditional plume would be expected after decades of migration and pulsed gradient shifts.

4) Olin has asserted that a hydraulic barrier exists between the Nordstrom Park well and the Olin Site. Although there clearly is recharge to the shallow water bearing zone in the Llagas Subbasin by the Madrone Ponds, there is no hydraulic head data to support this claim for deeper aquifers. This barrier in deeper aquifers is a theoretical divide and has yet to be proven. It has been suggested by the City for several years that data points to verify this assertion be installed, however this has not occurred.

5) Olin implies that the nitrate concentrations in groundwater north of the Olin Site are distinguishable from groundwater south of the Olin Site. This assertion does not have any significant bearing on perchlorate migration and is incorrect, based on Olin's interpretation of nitrate distribution in the intermediate aquifer shown in Attachment 5.1. However, suggestions by others have been made that lower concentrations of nitrate to the northeast of the Olin Site are inconsistent with Olin being the source of perchlorate to City wells. This theory is not valid in that:

a. the contribution of nitrate to groundwater from the Olin Site is low (possibly contributing ug/L concentrations) compared to basin-wide nitrate loading (resulting in milligram per liter concentrations), that would make any nitrate contribution from Olin indistinguishable (as supported by nitrate source data compiled by the Lawrence Livermore National Laboratory [LLNL] in Attachment 5.2);

b. the nitrate distribution north and south of the Olin Site is highly variable (as depicted by Mactec in Attachment 5.1); and,

c. there is not a strong nitrate-to-perchlorate concentration correlation south of the Olin Site, which would be expected if the theories about co-occurrence of perchlorate and nitrate were correct.

WorleyParsons Komex is pleased to provide these comments to the RWQCB and we are at your disposal to discuss any of the responses above. If you have any questions or need additional information please call Jon Rohrer at (714) 379-1157 extension 241 or Mark Trudell at extension 161.

Sincerely,
WorleyParsons Komex

Jon Rohrer, P.G., C.Hg.
Senior Hydrogeologist

Mark Ausburn, P.G., C.Hg.
Project Director

enc.

cc: Mr. Steven Hoch, Hatch and Parent
Mr. Jim Ashcraft, City of Morgan Hill

Enclosures:

Attachment 1: Estimates of perchlorate mass

Attachment 2: Mactec groundwater gradient figures

Attachment 5: Llagas subbasin nitrate distribution information

ATTACHMENT 1: ESTIMATES OF PERCHLORATE MASS

A) Estimated mass of perchlorate removed at Nordstrom Park Well = Volume Removed x Average Concentration

Volume pumped between 2003 to 2005 = 584,000,000 gallons (per City staff);
Average perchlorate concentration between 2003 to 2005 = 3.29 ug/L (per City's transmittal of J-flagged lab results)

<u>Calculation:</u>
(584,000,000 gallons) x (3.29 ug/L) x (3.78 liters/gallon) = 7,262,740,800 ug
[7,262 grams, or 7.262 kilograms]

B) From Mactec, March 29, 2006 Llagas Subbasin Characterization Report and Appendix S

Estimated mass of perchlorate which by Olin's theory was hypothetically introduced during disinfection of Nordstrom Park Well = volume of hypochlorite used x concentration of perchlorate in that sodium hypochlorite

Maximum total volume of hypochlorite used = 50 gallons of 5.25 % solution (Appendix S);
Estimated concentration of perchlorate in sodium hypochlorite = 280 ug/L (Mactec, Characterization Report)

<u>Calculation:</u>
(50 gallons of sodium hypochlorite) x (280 ug/L perchlorate in sodium hypochlorite) x (3.78 liters/gallon) = 52,920 ug [0.053 grams]

ATTACHMENT 2: MACTEC GROUNDWATER GRADIENT FIGURES

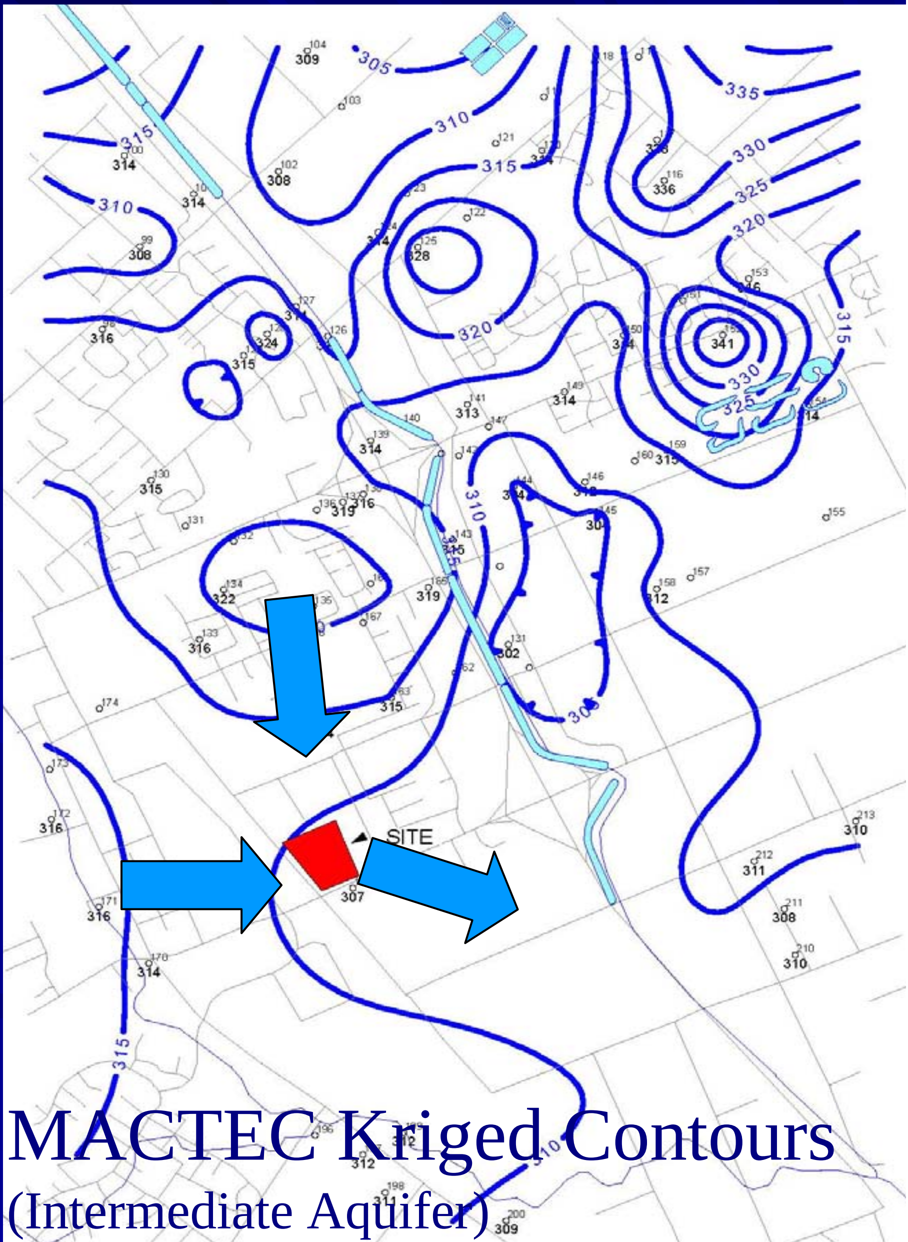
2.1: Excerpt from Mactec, December 20, 2005 RWQCB Meeting Presentation depicting contouring of USGS water level data from 1916.

2.2: Groundwater contour figures from Mactec, October 24, 2004 Groundwater Flow Assessment White Paper.

2.3: Quarterly deep aquifer groundwater contour figures from Mactec 3rd Quarter, 2005; 4th Quarter, 2005; 1st Quarter 2006 and 2nd Quarter 2006 Reports.

2.4: Deep aquifer ternary groundwater gradient direction figures from Mactec 4th Quarter, 2005; 1st Quarter 2006 and 2nd Quarter 2006 Reports (data are included from 3rd Quarter, 2005 in the 4th Quarter, 2005 Report).

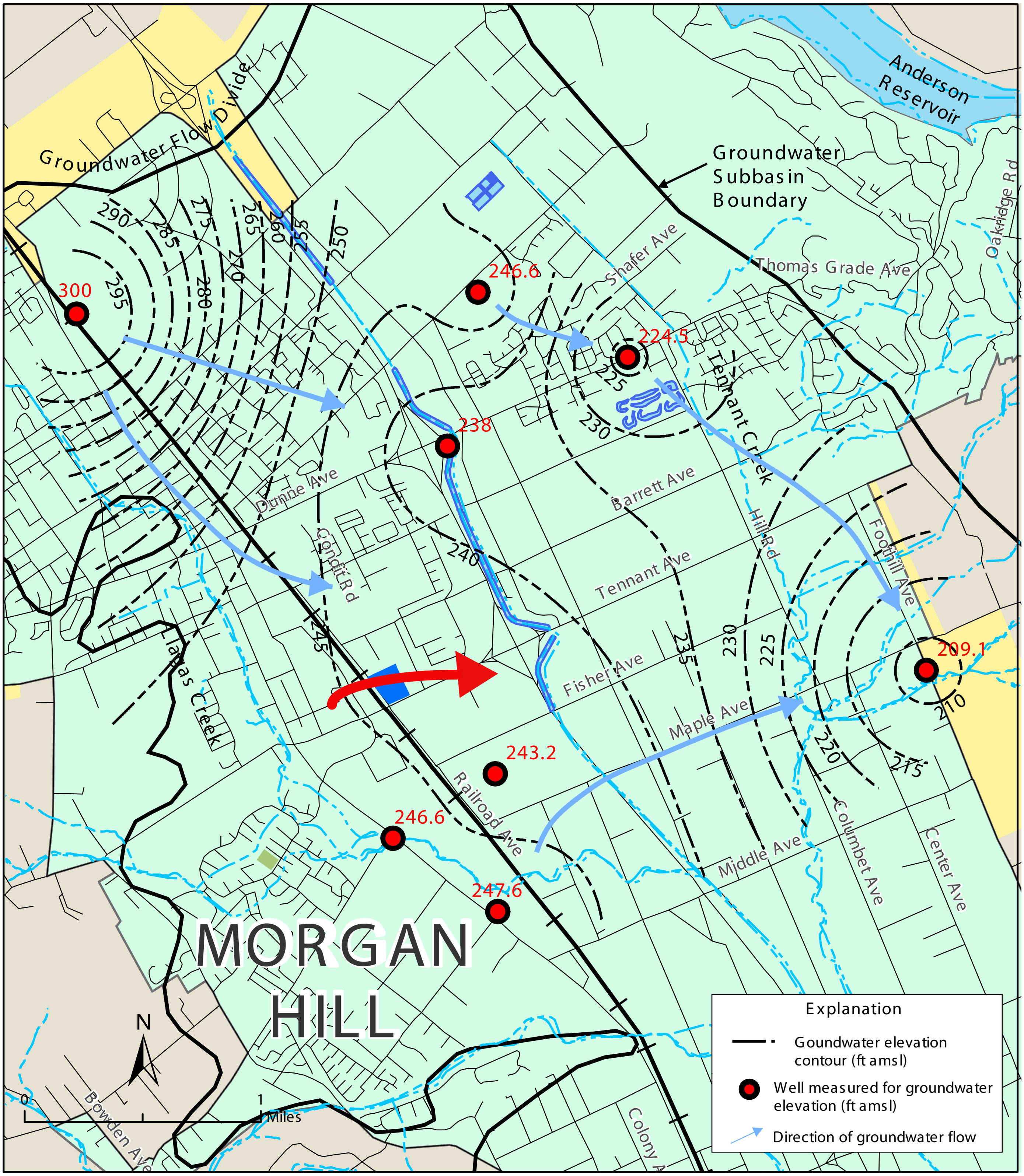
Attachment 2.1: Excerpt from Mactec, December 20, 2005 RWQCB Meeting Presentation depicting contouring of USGS water level data from 1916.



MACTEC Kriged Contours

(Intermediate Aquifer)

Attachment 2.2: Groundwater contour figures from Mactec, October 24, 2004 Groundwater Flow Assessment White Paper.



ATTACHMENT A

MACTEC

Groundwater Elevation Contour Map
Spring 1990
Groundwater Flow Assessment - White Paper
Olin/Standard Fusee Site
Morgan Hill, California

B15

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
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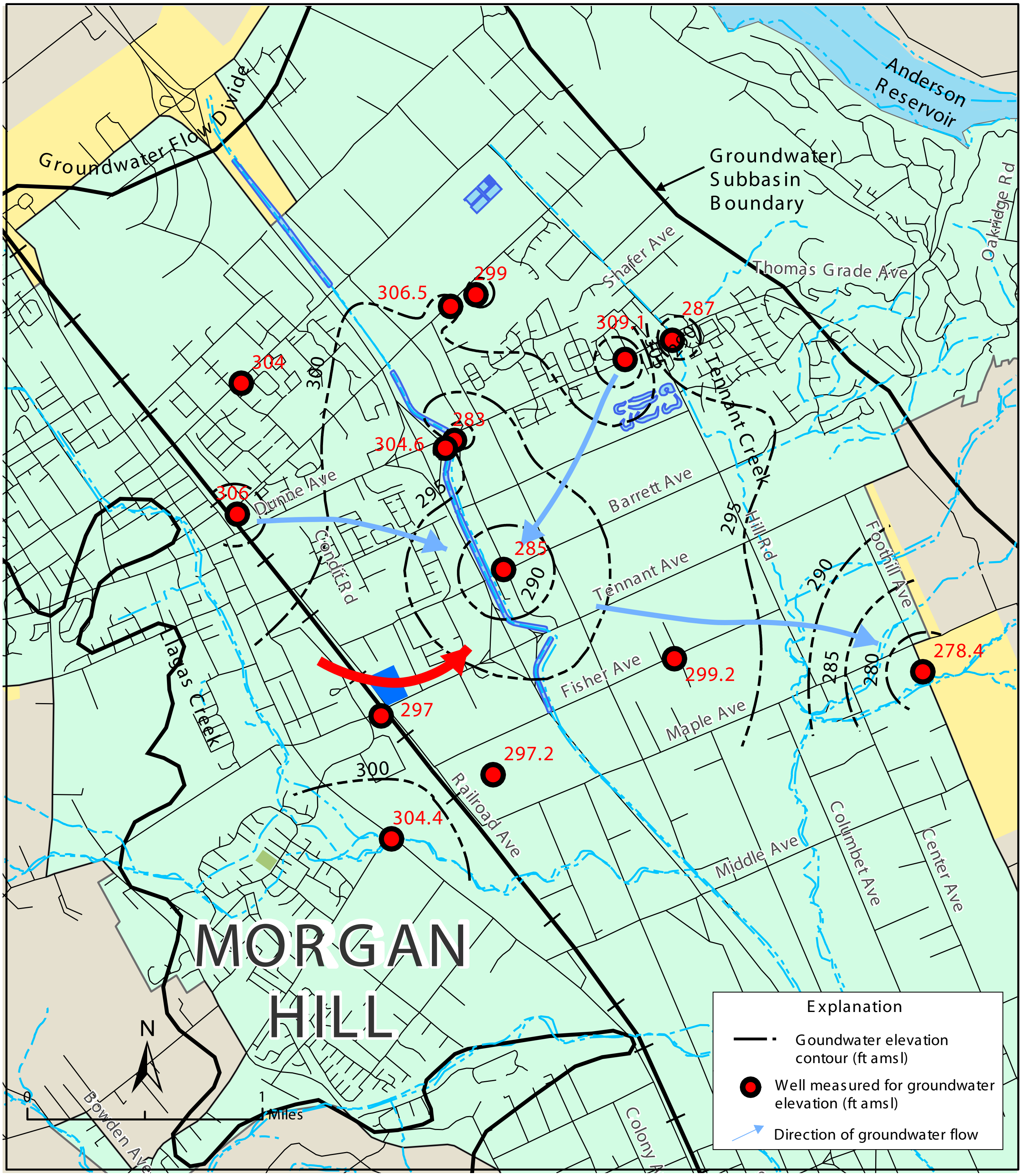

Figure B18-10/21/04

MACTEC

Groundwater Elevation Contour Map
Spring 1999

Groundwater Flow Assessment
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
B18

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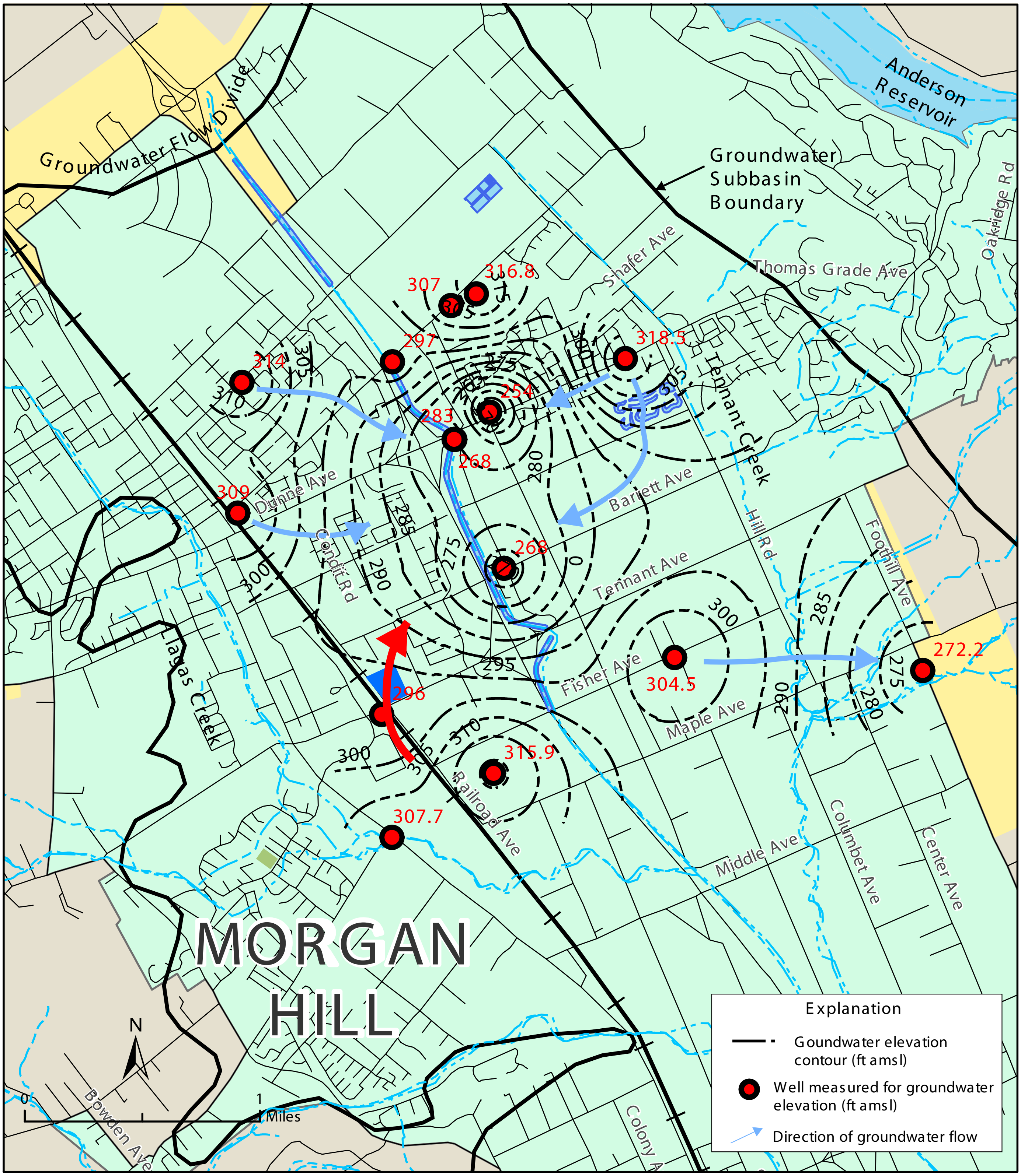

MACTEC

Groundwater Elevation Contour Map
Spring 2001

Groundwater Flow Assessment
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
B 20

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
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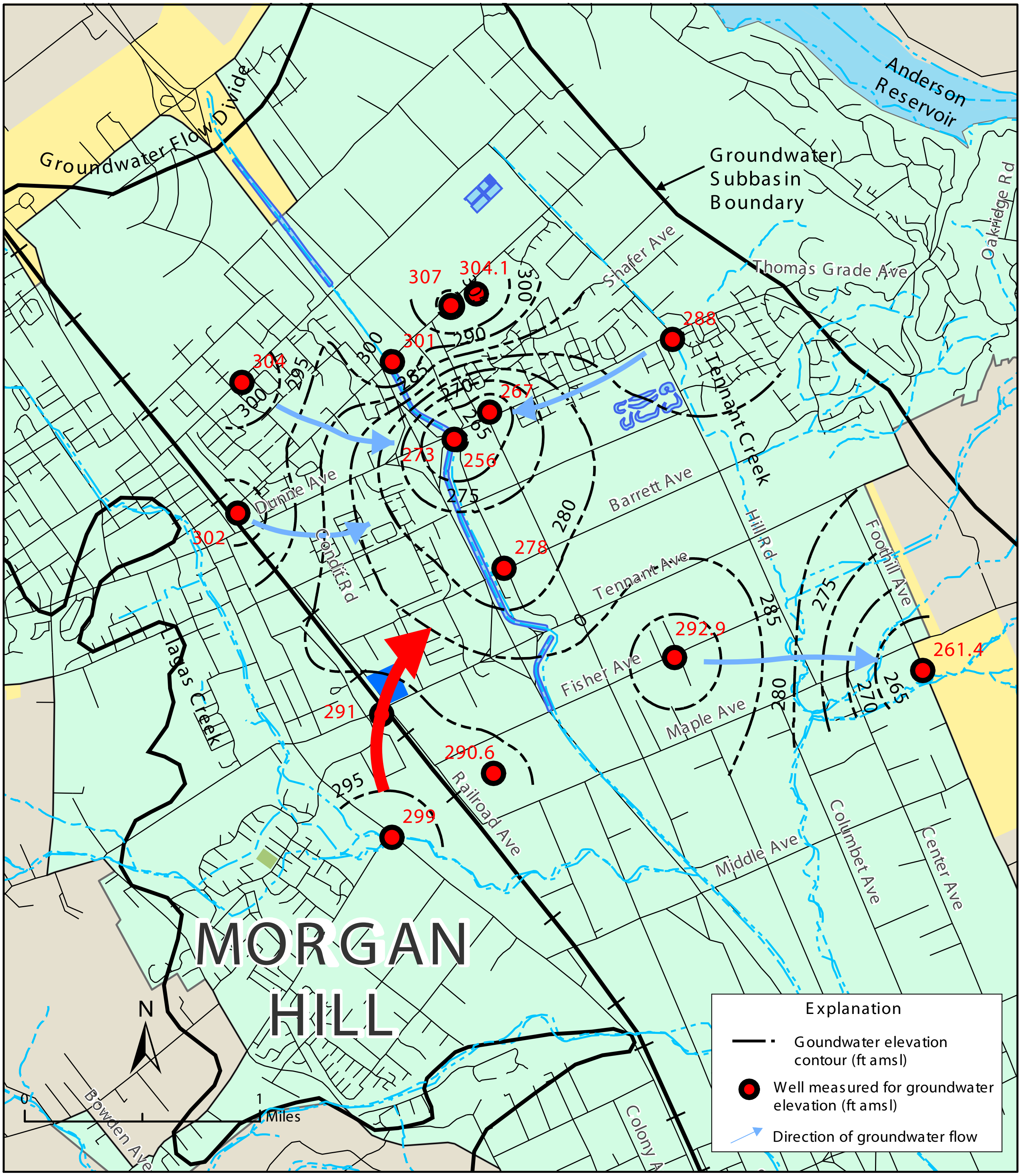

MACTEC

Groundwater Elevation Contour Map
Spring 2002

Groundwater Flow Assessment
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
B21

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
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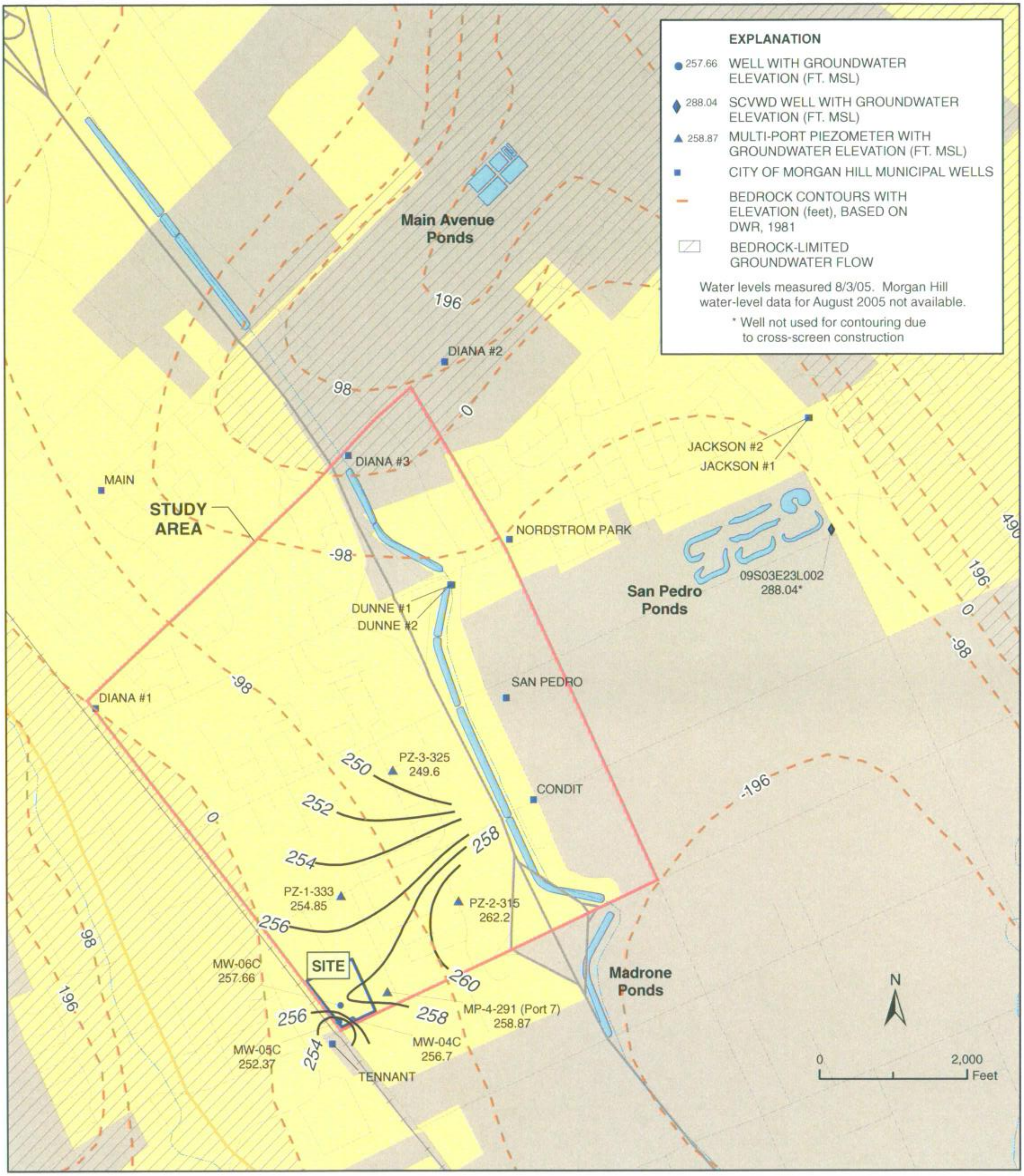
Attachment 2.3: Quarterly deep aquifer groundwater contour figures from Mactec 3rd Quarter, 2005; 4th Quarter, 2005; 1st Quarter 2006 and 2nd Quarter 2006 Reports.



Groundwater Elevations - Deep Zone (Middle)

MACTEC

Third Quarter 2005 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E5b

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
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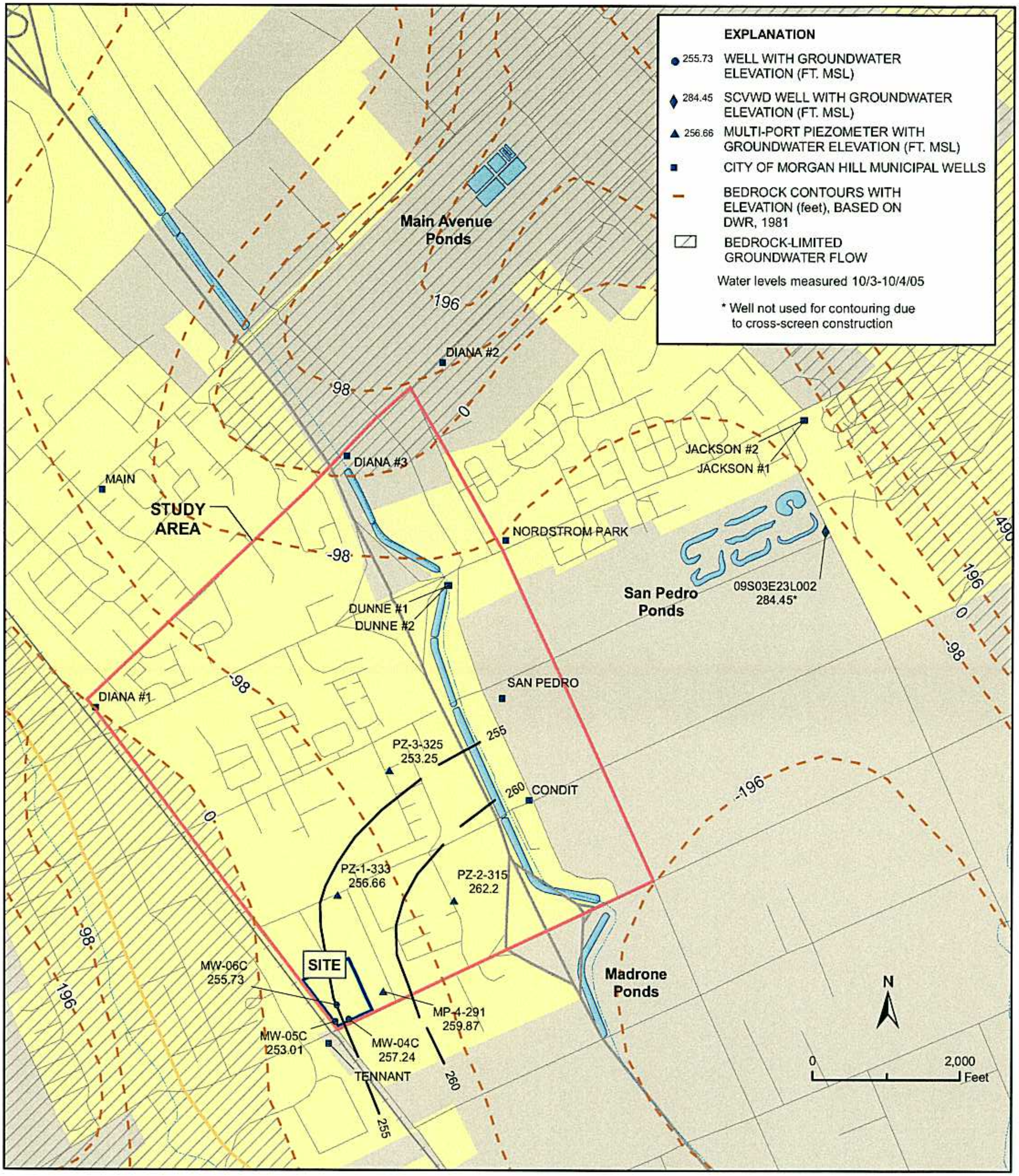

MACTEC

Groundwater Elevations - Deep Zone (Middle)

Fourth Quarter 2005 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E5b

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
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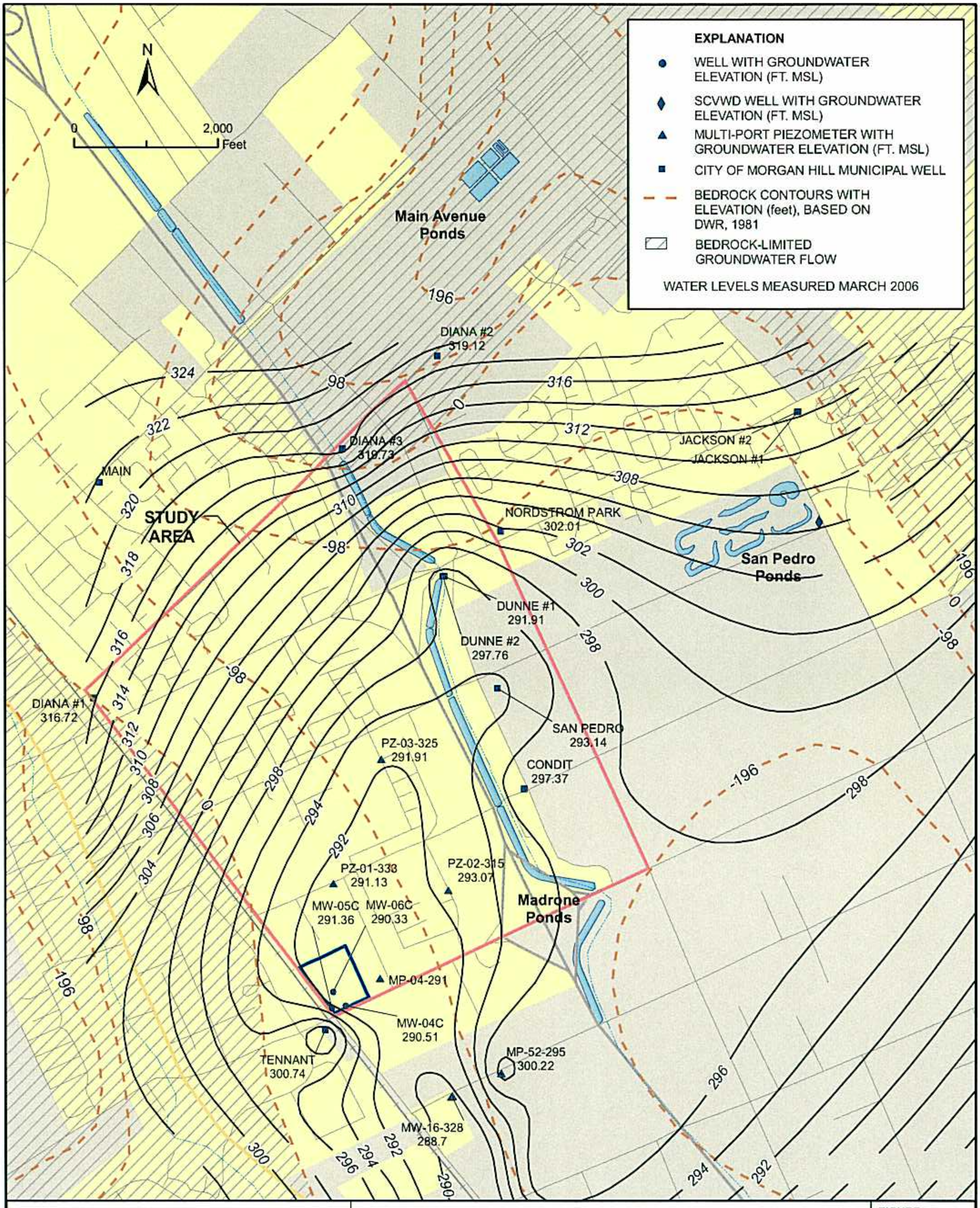

Groundwater Elevations - Deep Zone (Middle)

MACTEC

First Quarter 2006 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E5b

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
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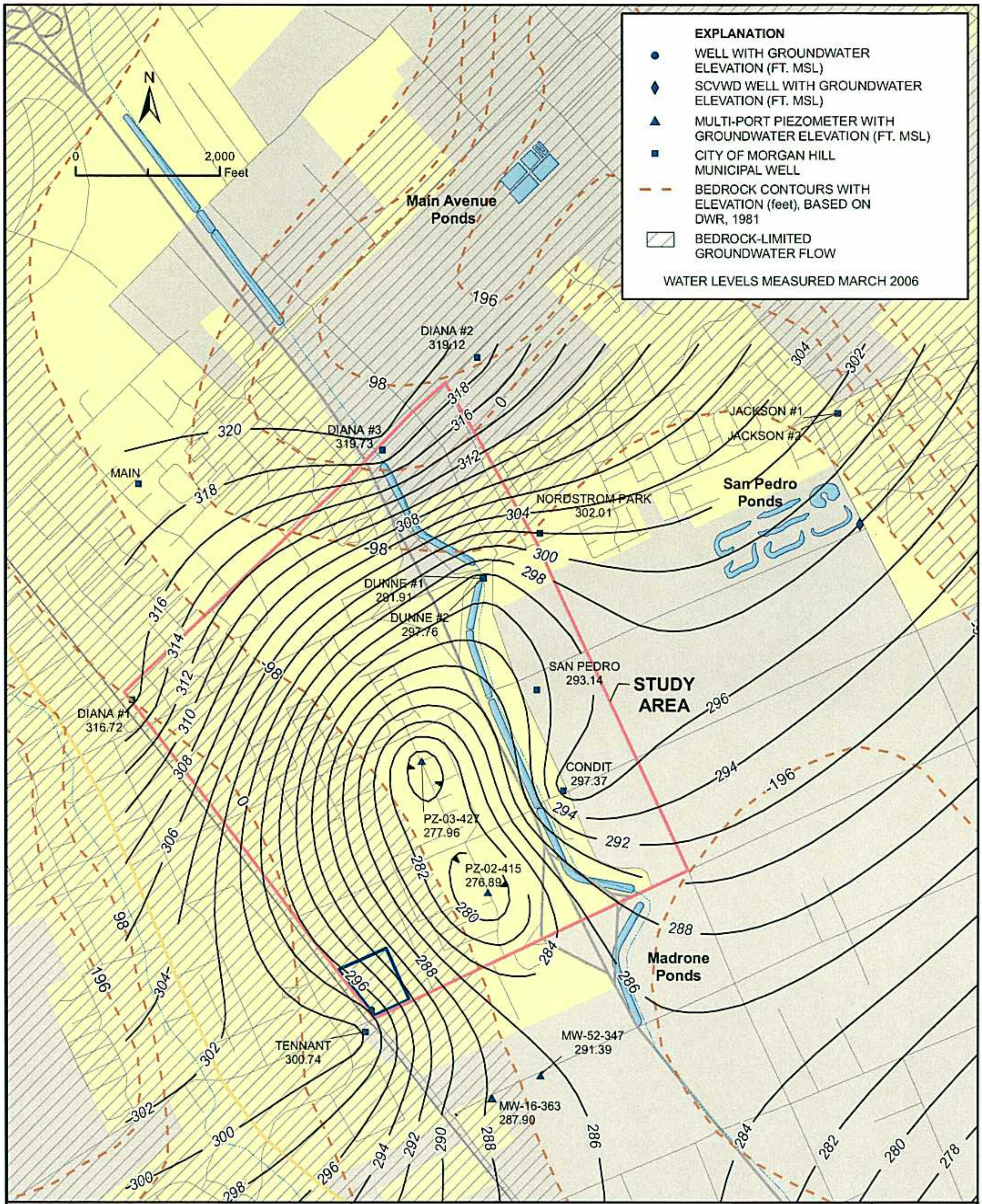
FigureE5b-MARCH.mxd - 4/19/06



Groundwater Elevations - Deep Zone (Lower) First Quarter 2006 Groundwater Monitoring Report Olin/Standard Fusee Site Morgan Hill, California	FIGURE E5c

MACTEC

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
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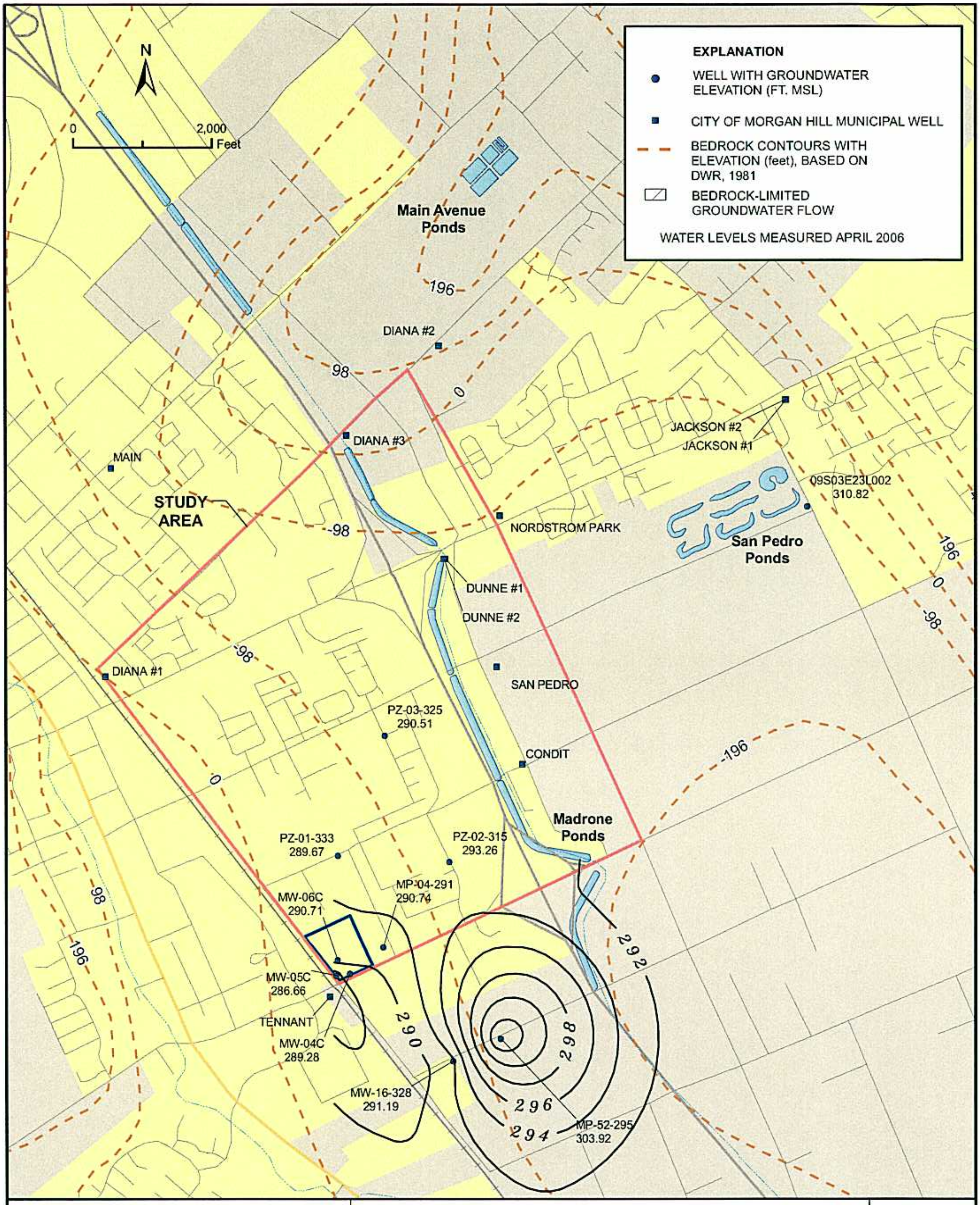
FigureE5c.mxd - 4/18/06



MACTEC

Groundwater Elevations - Deep Zone (Middle)
Second Quarter 2006 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E5b

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
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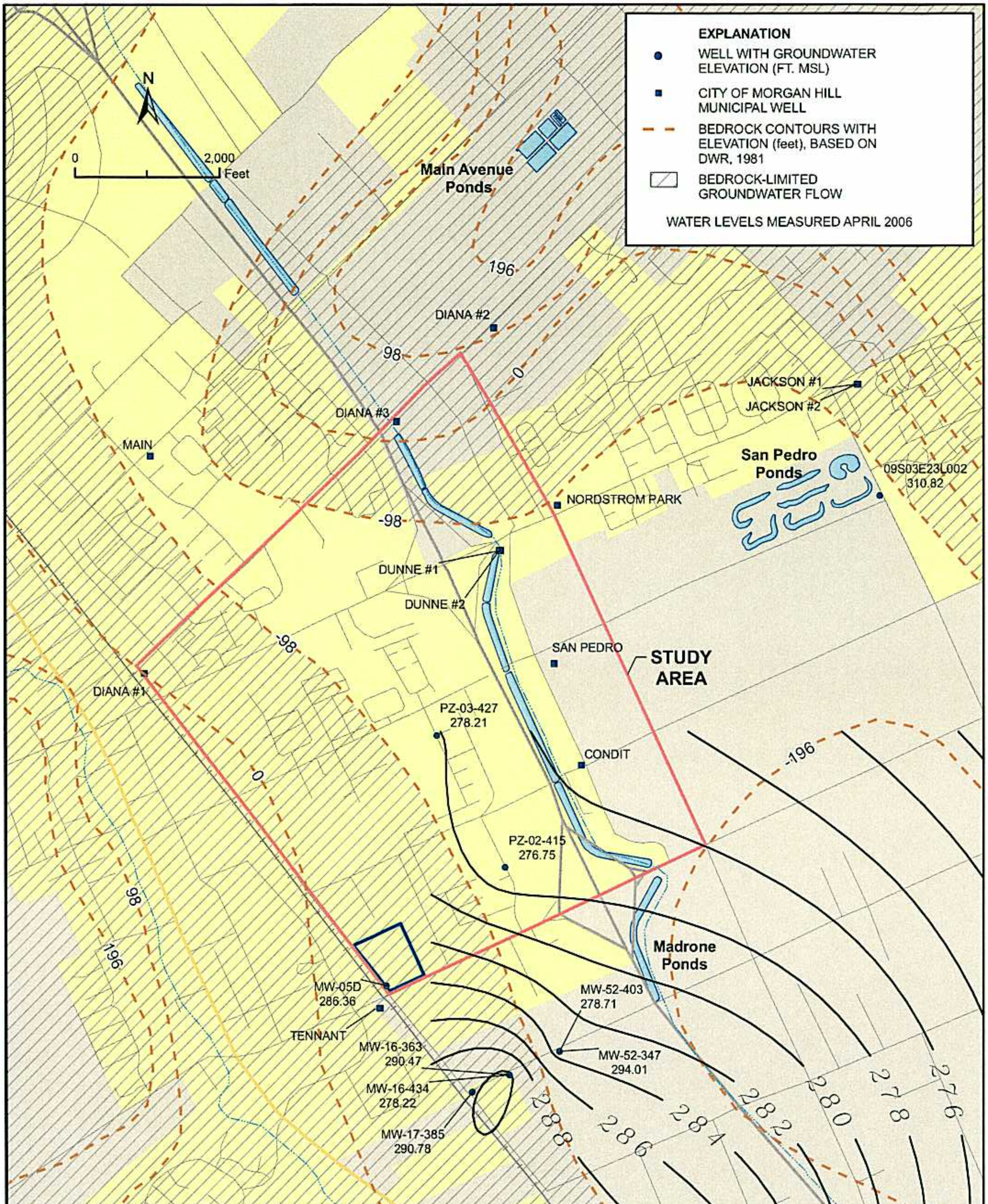
FigureE5b-wl-deepm.mxd - 7/26/06



MACTEC

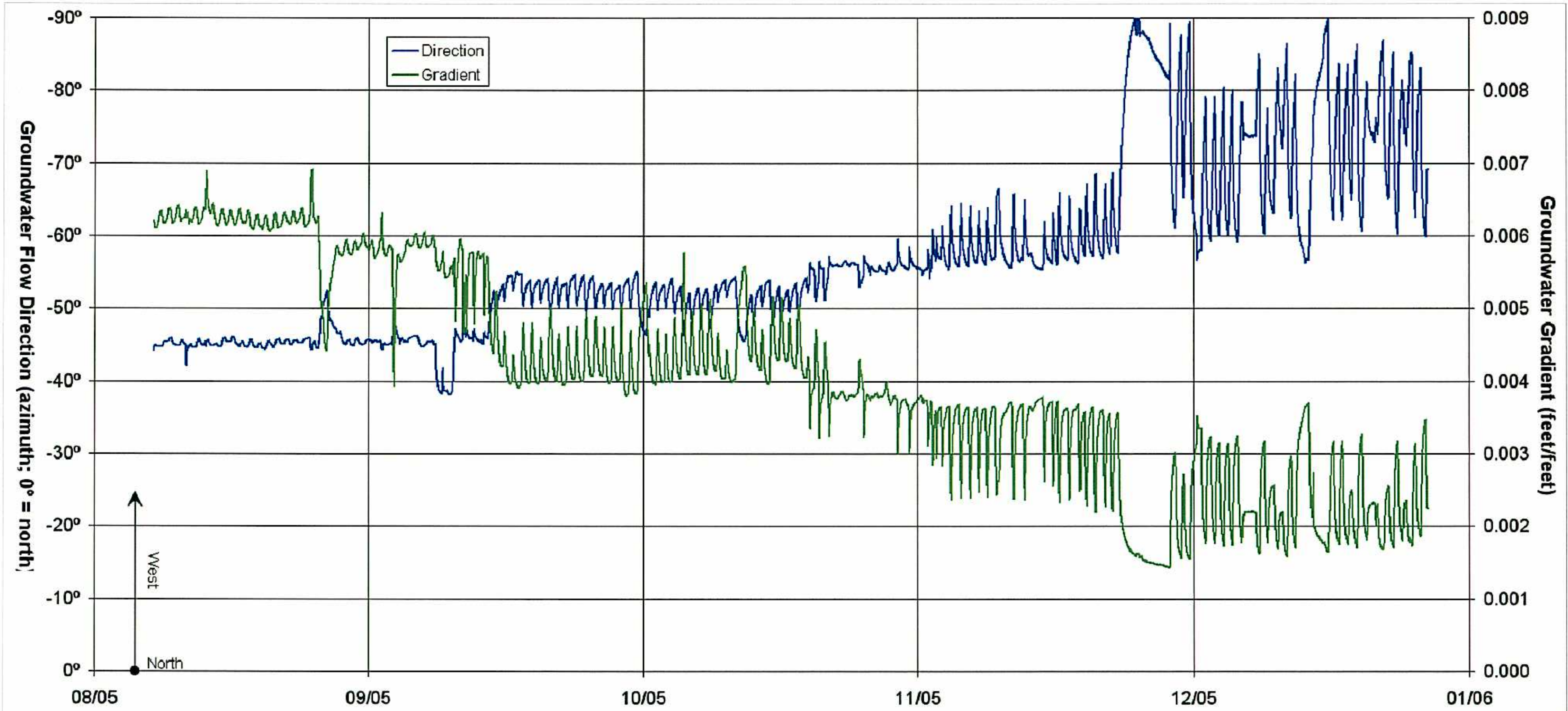
Groundwater Elevations - Deep Zone (Lower)
Second Quarter 2006 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E5c

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
TJH	6300060006 01.0		6/2006		7/06

FigureE5c.mxd - 6/5/06

Attachment 2.4: Deep aquifer ternary groundwater gradient direction figures from Mactec 4th Quarter, 2005; 1st Quarter 2006 and 2nd Quarter 2006 Reports (data are included from 3rd Quarter, 2005 in the 4th Quarter, 2005 Report).



6300060002006.DWG 40.0
20060111.1147

MACTEC

Transient Groundwater Flow Directions and Gradients, Middle-Deep Aquifer
Fourth Quarter 2005 Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE **E17**

DRAWN	JOB NUMBER	CHECKED	CHCK'D DATE	APPROVED	APPRV'D DATE
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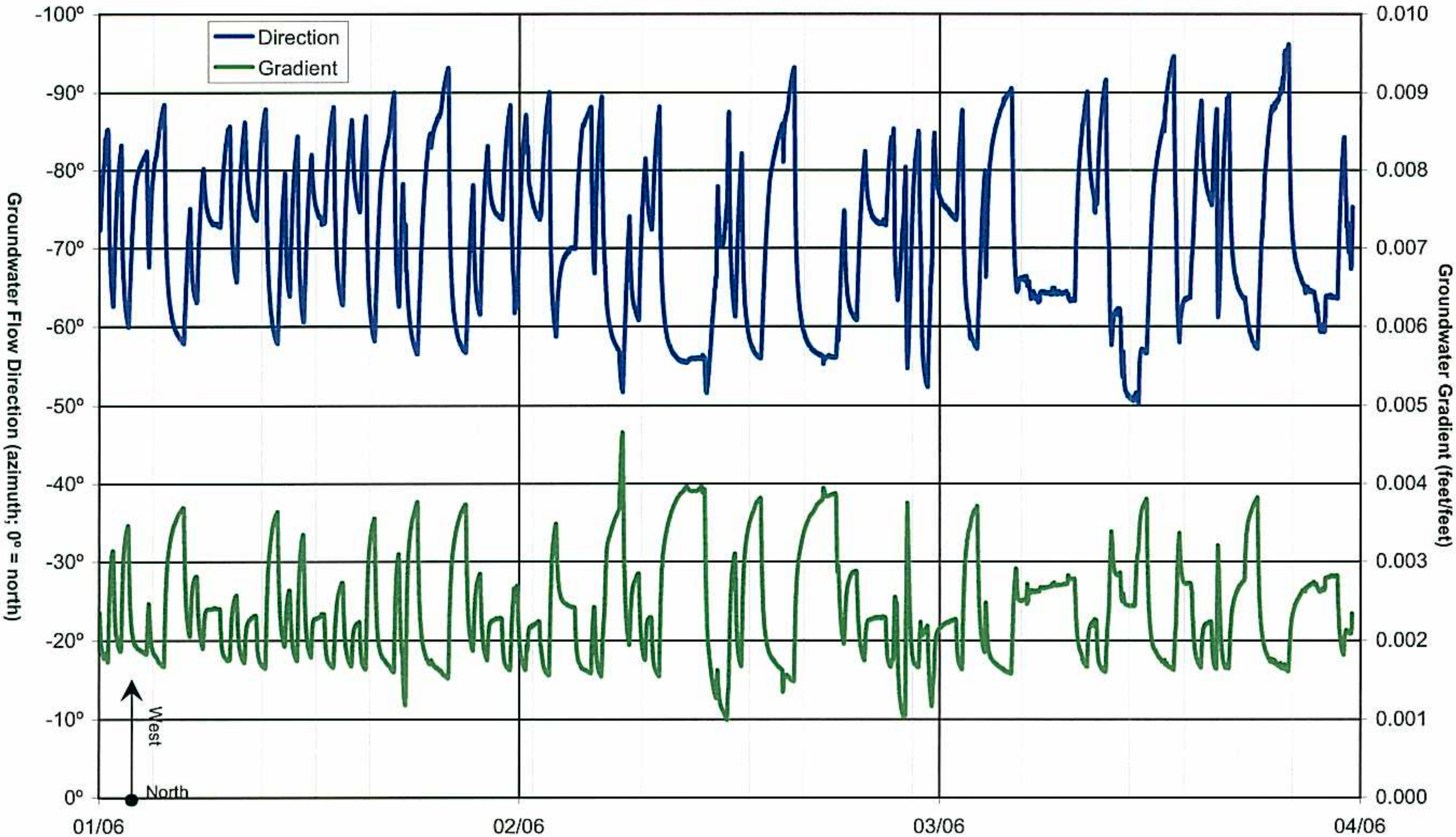

MACTEC

Groundwater Flow Directions and Gradients
Upper 180-Foot Aquifer
First Quarter 2006 Groundwater Monitoring Report
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE
E16

DRAWN BY	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
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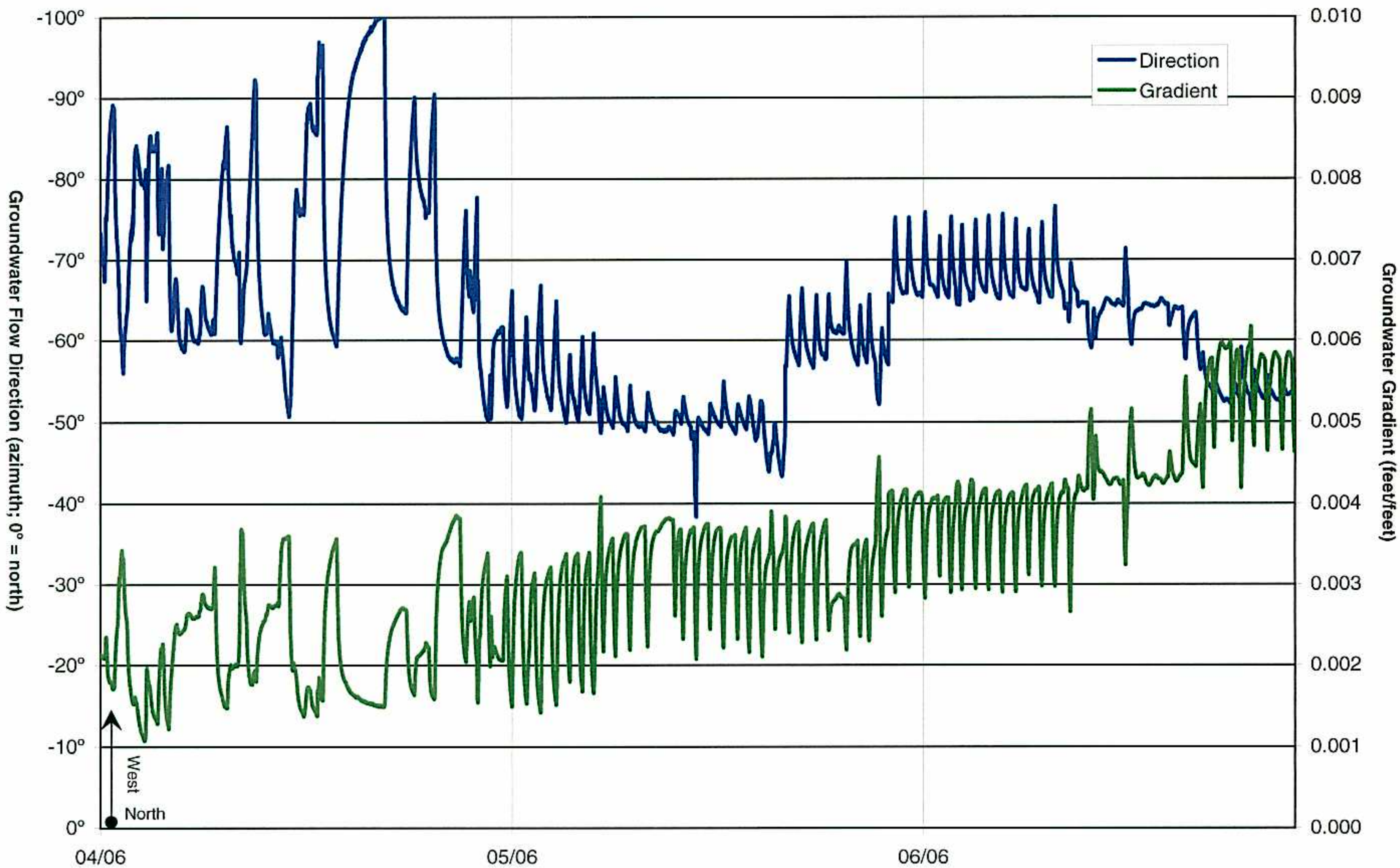


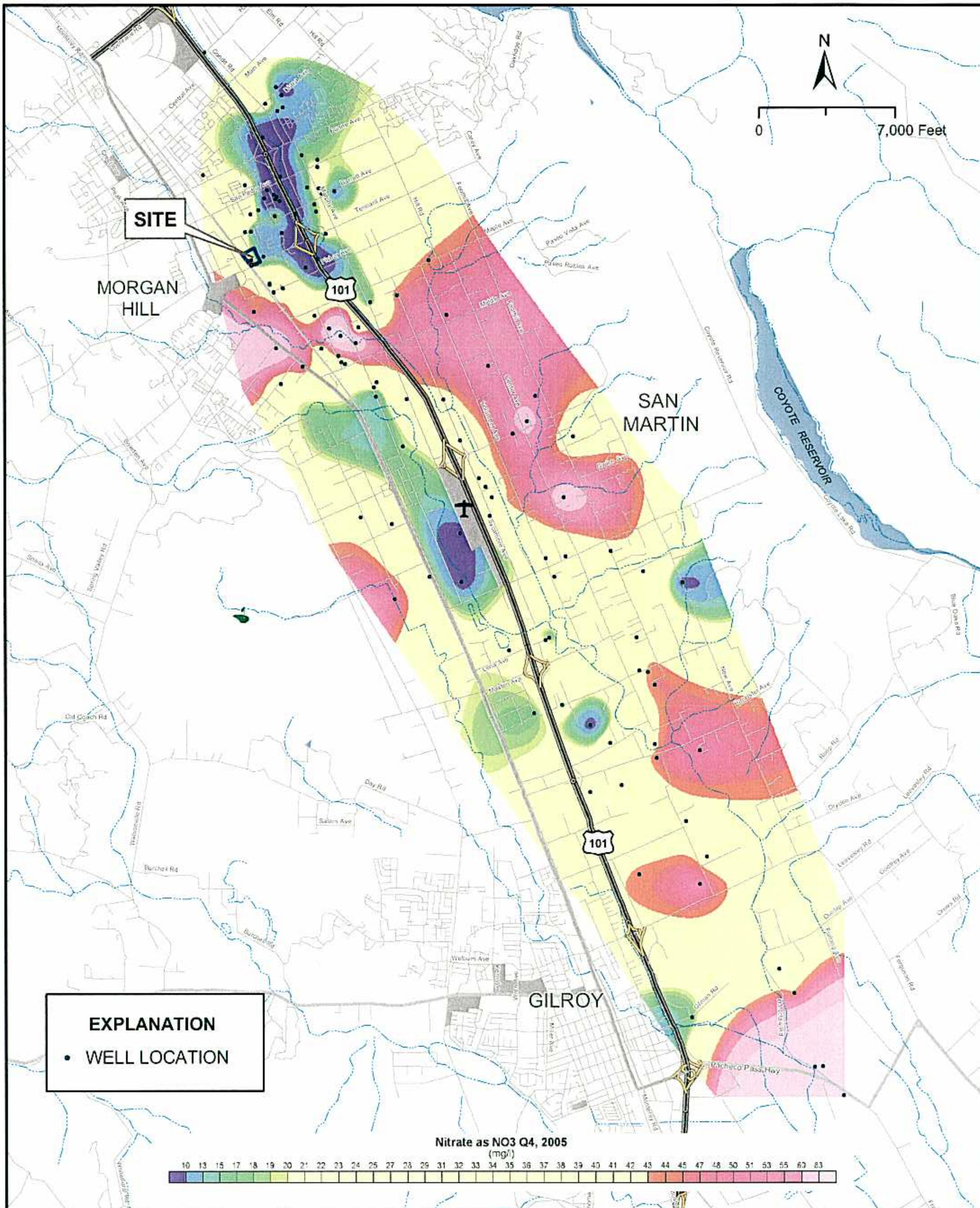
MACTEC		**Groundwater Flow Directions and Gradients - Middle-Deep Aquifer** **Second Quarter 2006 Groundwater Monitoring Report** **Olin/Standard Fusee Site** **Morgan Hill, California**	FIGURE **E13**
DRAWN BY LNC	JOB NUMBER 6300060006 01.0	CHECKED SKP CHECKED DATE 7/06	APPROVED AWN APPROVED DATE 7/06

ATTACHMENT 5: LLAGAS SUBBASIN NITRATE DISTRIBUTION INFORMATION

5.1: Figure from Mactec March 29, 2006 Llagas Subbasin Characterization Report Illustrating Nitrate Concentrations in the Intermediate Aquifer

5.2: Excerpt from LLNL, 2005 “California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California”

Attachment 5.1: Figure from Mactec March 29, 2006 Llagas Subbasin Characterization Report Illustrating Nitrate Concentrations in the Intermediate Aquifer



MACTEC

Nitrate Distribution in the Intermediate Aquifer
Fourth Quarter 2005
Llagas Subbasin Characterization
Olin/Standard Fusee Site
Morgan Hill, California

FIGURE **5.32**

DRAWN	JOB NUMBER	CHECKED	CHECKED DATE	APPROVED	APPROVED DATE
TJH	6300060006 04.0	MAF	3/2006	MDT	3/06

Figure 5-32.mxd - 3/20/06

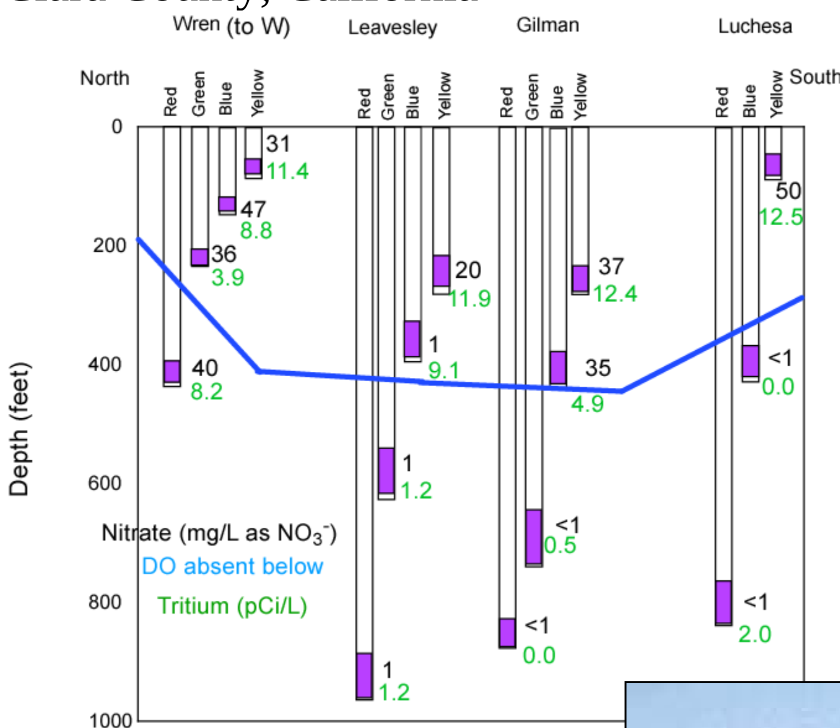
Attachment 5.2: Excerpt from LLNL, 2005 “California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California”

UCRL-TR-213705

LAWRENCE LIVERMORE NATIONAL LABORATORY

Prepared in cooperation with the
CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California



July, 2005
This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.

has taken place over the past 30 years. In rural residential areas, nearly every parcel has a septic tank for wastewater treatment, and a previous study (SCVWD, 1994) estimated potential nitrogen loading from septic tanks at 53 to 151 thousand pounds per year over the study area (Table 1). The other sources considered in the study were agricultural lands fertilized by commercial N-fertilizer (227,000 lb/yr), agricultural lands fertilized by cattle manure (8,000 to 30,000 lb/yr), rainwater (14,000 lb/yr), 4 existing dairies (4.6 to 6.9 thousand lb/yr), 20,000 to 50,000 cattle, including some small feed lots of up to 200 cattle (162,000 to 538,000 lb/yr assuming no waste management), 4 egg farms (one with 230,000 chickens; 90,000 to 151,000 lb/yr assuming no waste management), wastewater from three food packaging operations (3.5 to 5.2 thousand lb/yr), process wastewater from 2 wineries, wastewater from a cogeneration facility that converts agricultural waste into electrical energy, a sewage treatment facility (2.1 to 3.1 thousand lb/yr), and 602 acres of greenhouse operations (11,000 to 54,000 lb/yr). Several of the potential sources have decreased in number or extent in the study area over the past few decades. For example, before about 1970 several large feedlots with more than 2000 cattle existed in the area, and the number of dairies has likewise decreased from more than 20 to 4 since the 1960's. The study concludes that the two main sources are likely septic discharges and inorganic fertilizer from agricultural lands. Nursery crops, the highest cash crop produced in the area, and greenhouse operations are considered potentially large and growing contributors.

Table 1. Estimated potential nitrogen loadings to groundwater (SCVWD, 1996)

Source	Total Potential N Loading (thousands of pounds per yr)
Septic Tanks	53-151
Agricultural Lands Fertilized by Commercial N fertilizer	227
Agricultural Lands Fertilized by Manure	8.1-26.9
Rainwater	14
Dairies	4.6-6.9
Cattle Feed Lots	162-538*
Egg Farms	90-151
Food Packaging Operations	3.5-5.2
Cogeneration Facility	2.2-3.3
Sewage Treatment Facilities and disposal pits	2.1-3.8
Greenhouse Operations	11-54

* assuming no nitrate waste management

In 1997, SCVWD began implementation of a Nitrate Management Program based on a study of nitrate contamination in shallow groundwater that included an assessment of potential sources of nitrate (SCVWD, 1996). One of the main elements of the program consists of assisting growers in evaluating and adopting the use of in-field nitrate testing and N management planning to improve fertilizer use efficiency and profitability. Routine field monitoring and comparative trials utilizing in-field soil and petiole testing is carried out to confirm the utility of in-field soil nitrate testing for N-fertilizer