



**CONESTOGA-ROVERS
& ASSOCIATES**

December 8, 2008

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Reference No. 054041-04

part of the chromium groundwater treatment which are immediately upgradient of Desert View Dairy. The dairies to the west were present but the land around those dairies does not appear to be irrigated. There appeared to be a large stockpile of manure immediately south of Nelson Dairy, which was there for several years according to Mr. Ryken. The area along Thompson Road continues to be heavily irrigated as well.

NRCS FILE REVIEW

CRA reviewed the records from the local NRCS office. Unfortunately, past maps, farming records and past ownership were not kept. We were able to review some older historical maps that confirmed what the aerial photos have shown.

DISCLAIMER

This evaluation was conducted by CRA based on available information and may be updated or revised as additional information becomes available. This evaluation was intended to identify potential sources of nitrate to groundwater which warrant further evaluation. This letter should not be used to draw conclusions on whether potential sources are actually causing nitrate contamination in groundwater.

yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Ron Frehner

Steve Mockenhaupt

SM/ma/1

Encl.



SOURCE: USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM

LEGEND

- WELL WITH NITRATE-NO₃ DETECTION BEFORE 1991
- NITRATE-NO₃ CONCENTRATION (mg/L)
- DESERT VIEW DAIRY
- PLOT BOUNDARY
- COUNTY PARCELS

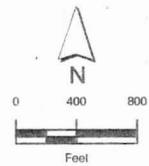
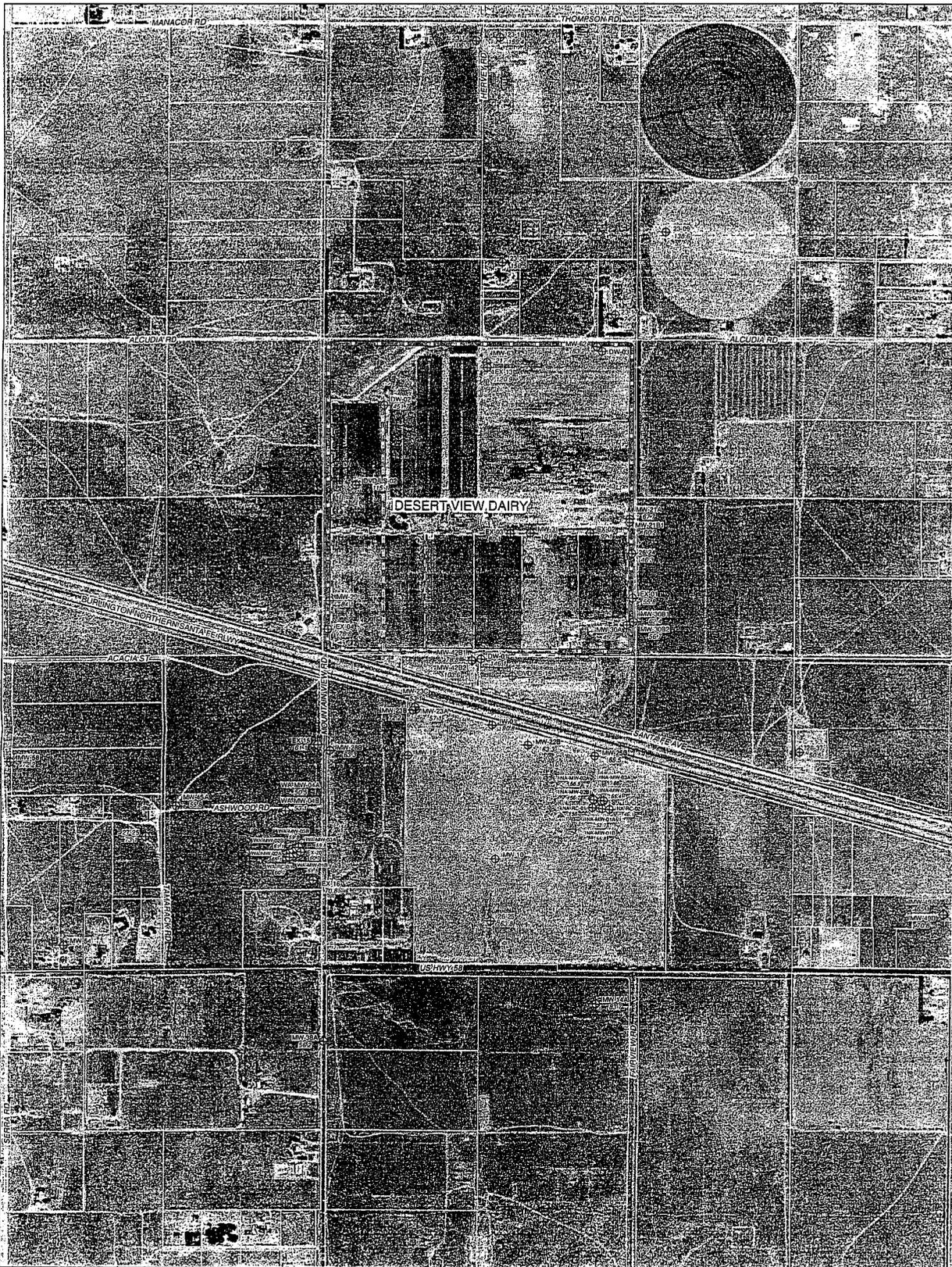


figure 1
 NITRATE-NO₃ DETECTIONS
 PRIOR TO 1991
 DESERT VIEW DAIRY
 Hinkley, California



SOURCE: USDA - NATIONAL AGRICULTURE IMAGERY PROGRAM

LEGEND

- WELL WITH DRINKING WATER STANDARD EXCEEDANCE (45 mg/L)
- MAXIMUM NITRATE-NO₃ CONCENTRATION (mg/L)
- DESERT VIEW DAIRY
- PLOT BOUNDARY
- COUNTY PARCELS

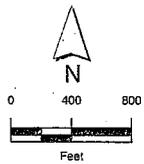


figure 2
 NITRATE-NO₃ DRINKING WATER
 STANDARD EXCEEDANCES
 DESERT VIEW DAIRY
 Hinkley, California

ATTACHMENT A
TECHNICAL MEMORANDUM
NITRATE MIGRATION ANALYSIS



**CONESTOGA-ROVERS
& ASSOCIATES**

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MEMORANDUM

TO: Steve Mockenhaupt; CRA REF. NO.: 54041-04
FROM: Brian Sandberg  DATE: December 8, 2008
C.C.: Ron Frehner; CRA
RE: Nitrate Migration Rate Analysis
Desert View Dairy
San Bernardino County, California

This technical memorandum estimates the downward nitrate migration rate resulting from a subsurface infiltration gallery associated with Desert View Dairy Land Treatment Unit (LTU) program. This calculated migration rate is then compared with an earlier prediction presented by CH2MHill.

BACKGROUND

Since August 2004, groundwater extraction has been occurring to capture and remove chromium-impacted groundwater. This extracted groundwater also contains nitrate (as NO₃) at concentrations ranging from 40.5 to 57.1 mg/L (or 9.15 to 12.9 mg/L as nitrate as N). The extracted water is conveyed to a subsurface infiltration system located on the Desert View Dairy property. Portions of the infiltration gallery system are located in areas that were formerly used for manure application. Figure 1 presents the former manure application areas. Attachment A includes a CH2MHill figure (Figure 2) from their July 2007 Annual Monitoring Report (AMR) that identifies the subsurface infiltration areas and lysimeter (i.e., vadose zone) monitoring locations.

As noted in the Regional Water Board Order R6V-2004-0034, CH2MHill predicted that the percolation of the irrigation water (i.e., re-injected groundwater) would reach groundwater after eight years. Figure 2 presents nitrate (as NO₃) lysimeter data starting eight months (April 2005) after reinjection.

GROUNDWATER REINJECTION CALCULATIONS

Based on the July 2007 AMR prepared by CH2MHill, approximately 400,000 gallons per day (53,480 ft³/d) is discharged into an approximate 80 acre (3,485,000 ft²) area. The ratio of the daily discharge rate (Q) to the infiltration area (A) defines the infiltration rate into the subsurface soils. The daily infiltration rate (I) can be calculated by the following formula:

$$I = \frac{Q}{A} = 53,480 \text{ ft}^3/\text{d} / 3,485,000 \text{ ft}^2 = 0.015 \text{ ft/d, or } 6 \text{ ft/yr.}$$

MODEL SETUP AND RESULTS

To estimate the travel time it would take for the re-injected water to reach the water table, CRA utilized the United States Environmental Protection Agency (USEPA) model VLEACH (version 2.2). VLEACH is a one-dimensional numerical model that can estimate the migration of a particular compound from the unsaturated zone to the water table. The model employs a number of major assumptions; but it provides a useful preliminary assessment on the potential impact to groundwater.

Although VLEACH was originally created to assess the migration of organic compounds (e.g., benzene), it can also be used to assess inorganic compounds, such as nitrates. Nitrates are highly soluble and mobile in groundwater. For this analysis, the chemical properties for sodium nitrate were used. Sodium nitrate has a solubility of 815,000 mg/L, and does not readily volatilize or partition onto soil. A Material Safety Data Sheet (MSDS) for sodium nitrate is presented in Attachment B.

By inputting the chemical and physical properties into VLEACH, the model can calculate the time it takes for nitrate (as NO_3) mass to reach the water table. The input parameters used for the VLEACH model are presented on Table 1.

To evaluate the time it takes for infiltrated water to reach the Upper Aquifer, it was assumed that the soil did not contain a nitrate prior to the start of reinjection. Using this conservative approach, the nitrate-affected water would reach the water table within one year. The VLEACH results are presented in Attachment C.

BSS/ma/2

Enc.

FIGURE 2
CH2MHILL LYSIMETER NITRATE RESULTS

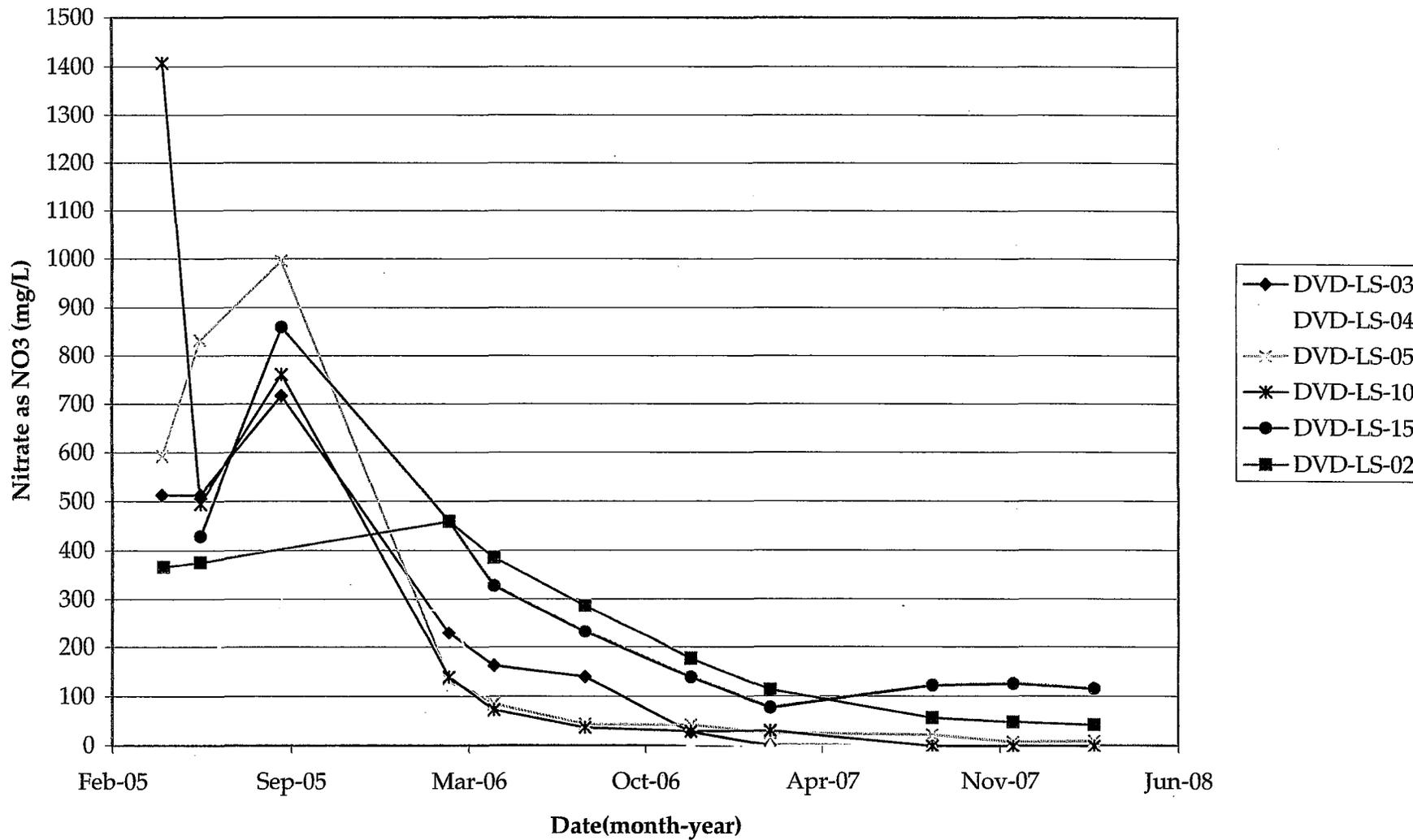


TABLE 1

VLEACH INPUT PARAMETERS
 DESERT VIEW DAIRY
 HINKLEY, CALIFORNIA

Compound:	Sodium Nitrate
Solubility:	815,000 mg/L
Henry's Law Constant :	0
Organic Carbon: Distribution Coefficient	0
Air Diffusion: Coefficient	0
Soil Type:	Loamy Sand
<u>Soil Parameters</u>	
Bulk Density	1.62 g/cm ³ (default value)
Effective porosity	0.41 (default value)
Volumetric Water Content:	0.057 (default value)
Fraction of Organic Carbon:	0.0061 (default value)
Saturated Hydraulic: Conductivity:	11.49-62.08 ft/d (default value)
Recharge rate:	6 ft/yr
Concentration of Recharge: Water	53.1 mg/L nitrate as NO ₃
Polygon Height:	80 ft (depth to water table)
Initial Nitrate: Soil Concentration	0 mg/L.

ATTACHMENT A

CH2MHILL FIGURE 2