

MONITORING AND REPORTING WORKPLAN
AND
MONITORING WELL INSTALLATION AND SAMPLING PLAN

PHASE 2:
REPRESENTATIVE GROUNDWATER MONITORING NETWORK DESIGN &
MONITORING PROGRAM
EXISTING MILK COW DAIRIES – CENTRAL VALLEY, CALIFORNIA

ADDENDUM

Prepared for

Central Valley Dairy Representative Monitoring Program

August 8, 2012



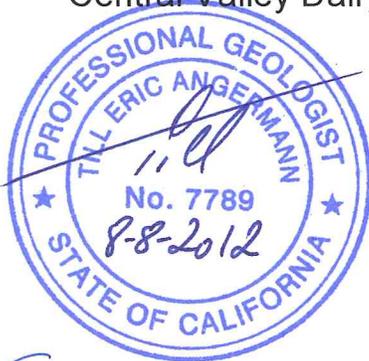
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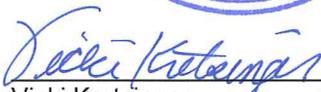
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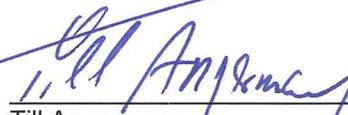
Central Valley Dairy Representative Monitoring Program



August 8, 2012




Vicki Kretsinger
Principal Hydrologist


Till Angermann
Senior Hydrogeologist



August 8, 2012
LSCE File No. 12-7-019

Mr. Clay Rodgers
Central Valley Regional Water Quality Control Board
1685 E Street
Fresno, CA 93706

**SUBJECT: SUBMITTAL OF MONITORING AND REPORTING WORKPLAN AND
MONITORING WELL INSTALLATION AND SAMPLING PLAN ADDENDUM
PHASE 2 REPRESENTATIVE MONITORING PROGRAM
EXISTING MILK COW DAIRIES, CENTRAL VALLEY, CALIFORNIA**

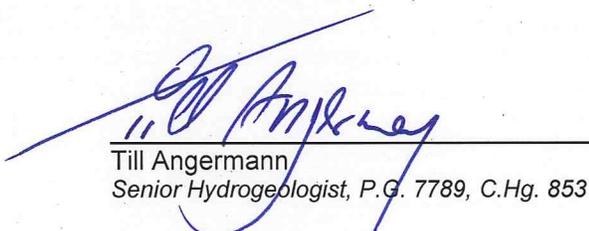
Dear Mr. Rodgers:

On behalf of the Central Valley Dairy Representative Monitoring Program (CVDRMP), Luhdorff and Scalmanini, Consulting Engineers (LSCE) has prepared the enclosed *Monitoring and Reporting Workplan and Monitoring Well Installation and Sampling Plan Addendum, Phase 2: Representative Groundwater Monitoring Network Design & Monitoring Program Existing Milk Cow Dairies – Central Valley, California* (Phase 2 RMP Workplan Addendum). Three copies of this report are enclosed, including one original and two additional copies. The Phase 2 RMP Workplan Addendum was prepared in response to the Central Valley Regional Water Quality Control Board's *Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies*, its revised Monitoring and Reporting Program, and its Conditional Approval of the Public Review Draft Phase 1 RMP Workplan.

Sincerely,

LUHDORFF AND SCALMANINI
CONSULTING ENGINEERS


Vicki Kretsinger
Principal Hydrologist


Till Angermann
Senior Hydrogeologist, P.G. 7789, C.Hg. 853

cc: J.P. Cativiela, Central Valley Dairy Representative Monitoring Program
ec (via emailed hyperlink): Clay Rodgers, J.P. Cativiela

Enclosure – 3 copies of the Phase 2 RMP Workplan Addendum

Table of Contents

Tables, Figures, and Attachments	2
1 Introduction	3
2 Refined Selection of Phase 2 Dairies	3
Liquid Manure Lagoons	5
Manure-fertigated Fields	5
3 Additional Reporting	6
4 Groundwater Monitoring Program.....	6
5 References.....	6

Tables, Figures, and Attachments

- Table 1 Dairy Farm Selection for Phase 2 of the Representative Groundwater Monitoring Program
- Table 2 Dairy Farm Herd Size and Animal Housing, Phase 2 Representative Groundwater Monitoring Program
- Table 3 Information on Engineered Lagoon Liners and Existing Monitoring Wells, Phase 2 Representative Groundwater Monitoring Program
- Figure 1 Location Map – Phase 1 and Proposed Phase 2 Dairies
- Attachment 1 Dairy Farm Site Maps with Monitoring Well Locations (dairy farms in the order shown in Table 1)

1 Introduction

This document was prepared in response to the Central Valley Regional Water Quality Control Board's (CVRWQCB) *Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies* (General Order) (CVRWQCB, 2007), its revised Monitoring and Reporting Program (MRP) (CVRWQCB, 2011a), and its Conditional Approval (CVRWQCB, 2011b) of the Public Review Draft Phase 1 Representative Monitoring Program (RMP) Workplan (LSCE, 2011; finalized without change January 2012).

This Phase 2 RMP Workplan Addendum supplements the public review draft of the *Monitoring and Reporting Workplan – Monitoring Well Installation and Sampling Plan, Phase 2: Representative Groundwater Monitoring Network Design & Monitoring Program, Existing Milk Cow Dairies – Central Valley, California* (LSCE, June 6, 2012) (i.e., the Phase 2 RMP Workplan). The formal 30-day public review period for the Phase 2 RMP Workplan extended from June 22 to July 23, 2012.

The Phase 2 RMP Workplan identified 46 dairies for potential inclusion in the representative monitoring effort. This Phase 2 RMP Workplan Addendum provides a refined selection of dairies and locations for the proposed installation of monitoring wells based on site visits that were conducted from July 2 to 31, 2012; inspections of pre-existing monitoring wells; and direct communication with dairy owners/operators and dairy consultants regarding dairy operations focusing on manure handling and lagoon operations, irrigation methods and crop choices.

2 Refined Selection of Phase 2 Dairies

The refined Phase 2 selection consists of 26 dairies, or a total of 44 dairies when combined with the Phase 1 dairies. Several of the 46 dairies included in the Phase 2 RMP Workplan were ultimately found to not be suitable for the program and were, therefore, not included in the refined selection (**Table 1**). Herd size and animal housing information are summarized in **Table 2**. The refined selection includes two dairies that were not included in the Phase 2 RMP Workplan. These dairies (i.e., the Giacomazzi Dairy and the Creekside Farms Silveira Dairy) were taken into consideration and added to the refined selection during ongoing site visits as it became apparent that a substantial number of dairies would not be suitable for the program.

The following are reasons for exclusion from the final selection:

1. The dairy had gone out of business
2. The dairy was deemed at definite risk of going out of business due to financial hardship
3. Owners/operators are at or exceed retirement age on small dairies without realistic prospects for continuation of the business beyond their retirement
4. Expiring leases on small dairies without realistic prospects for continuation of operation
5. Active downsizing of dairy operations and converting to other farming operations (mainly nut tree farming)
6. Concrete and imminent plans for converting to other farming operations

One or more of the above reasons apply to the following dairies:

- Amaral and Son Dairy
- Brooks-Erman Ranch
- Garcia and Sons Dairy

- ❑ K-Baar Dairy
- ❑ Greenwood #2/Simson Dairy¹
- ❑ Hillside Farms Silveira Dairy
- ❑ Leo Martin Dairy
- ❑ Martins Family Dairy¹
- ❑ Schager Dairy
- ❑ Tim Bekendam Dairy¹

Several of the dairies had substantively compromised existing monitoring well networks due to (i) dry wells, (ii) abandoned wells, (iii) wells that are damaged beyond repair, and/or (iv) wells that could not be located in the field or are located on property not associated with the dairy. One or more of these reasons apply to the following dairies:

- ❑ Silva Brothers Dairy
- ❑ Diamond H Dairy
- ❑ Highstreet Dairy
- ❑ Warmerdam Dairy
- ❑ Vanden Berge Dairy
- ❑ Homestead Dairy
- ❑ Triple H Dairy

In some cases, locations that appeared promising based on the inspection of aerial photography and RWQCB files were found to be less promising for RMP monitoring activities. Examples were:

- ❑ Unstable road conditions – many of the field roads are simple dirt paths, tentative in nature and subject to being plowed-over and modified during the seasons
- ❑ Low-lying roads between fields that are subject to occasional flooding by tail water
- ❑ Lack of construction information for existing monitoring wells
- ❑ Changing land uses associated with lagoon closure that may result in legacy groundwater quality conditions that are difficult to interpret and not related to current land uses

One or more of these reasons, in combination with other aforementioned reasons, contributed to the removal of the Kaehler, Tony Souza, LaSalle, and Galhandro Dairies from the final selection.

The Frank Borges dairy has converted large portions of its crop land to paulownia trees since adoption of the Dairy General Order and plans to expand the tree business such that manure water would not be applied to forage crops on this dairy anymore. Therefore, this dairy is not representative of typical dairy operations in the Central Valley. Lastly, arrangements for site visits were not able to be coordinated with the Vanderham Dairy and FM Ranch #2 for timely inclusion in this Addendum.

In summary, the refined Phase 2 RMP network consists of 26 dairies located in the counties of Tehama, Glenn, San Joaquin, Stanislaus, Madera, Fresno, Kings, Tulare, and Kern (this remained unchanged from the June 6, 2012 Phase 2 RMP Workplan) (**Figure 1**). Site maps for the selected dairies showing facility layout, fields, existing, and proposed to-be-installed monitoring wells are shown on individual maps in **Attachment 1** following the order shown in **Table 1**. The refined Phase 2 RMP adds 131 existing monitoring well sites (some of which are constructed as nested well sites),

¹ This dairy was not included in the Phase 2 RMP Workplan. It was taken into consideration during ongoing site visits as it became apparent that a substantial number of dairies would not be suitable for the program.

and 35 to-be-constructed nested monitoring well sites to the program. Overall, Phase 2 is comprised of 166 well sites with a total of 228 wells. For comparison, Phase 1 is comprised of 126 well sites (108 of which are constructed as nested wells) for a total of 234 wells. For Phases 1 and 2, there are now a total of 292 (i.e., 126+166) monitoring well sites (i.e., 462 wells).

Liquid Manure Lagoons

Although the overall number of monitoring wells is less than estimated in the June 6, 2012 Phase 2 RMP Workplan, the emphasis on groundwater monitoring near lagoons with engineered clay liners and plastic-lined lagoons that have construction documentation remains the same. Seven of the selected dairies have earthen lagoons with clay liners, partial clay liners, or existing soil conditions that were deemed sufficient to comply with California Code of Regulations Title 27, which requires that retention ponds receiving waste from confined animal facilities be lined with or underlain by soils that contain at least 10% clay and not more than 10% gravel. Three of the selected dairies have plastic lined lagoons.

Lagoon operation and manure handling have been found to be very similar across all the visited dairies (including Phase 1 dairies). There are two fundamentally different approaches. The simplest approach is to not employ purposeful solids separation: liquid manure is routed to a lagoon or lagoon(s) and solids are then removed either via agitation and pumping, occasional use of specialized slurry pumps, or removal via excavators (typically operating from the berms). Sometimes, farmers dry out a lagoon for solids removal via front loaders that can negotiate the lagoon floor. A more complex approach involves the use of mechanical separators and/or settling basins. In either case, solids need to be removed from a lagoon or settling basin sooner or later. Therefore, it is not immediately apparent that these different approaches would affect groundwater quality in categorically different ways.

While the great majority of Central Valley dairies are flush dairies, the refined selection of dairies also includes dry lot (scrape) dairies. Dry lot dairies still generate liquid manure in the milk barn that is typically routed to a lagoon. However, fields may receive proportionally greater amounts of manure solids than liquid manure in comparison to flush dairies. Overall, liquid and solid manure are applied to forage fields in different proportions (even among flush dairies). Solids from mechanical separators are often dried (and sometimes composted) and used for bedding before they eventually end up on the forage fields. Many of the visited dairies also export large proportions of their manure solids.

Manure-fertigated Fields

Based on LSCE's review of CVRWQCB files, the recent site visits, and direct communication with dairymen and their consultants, by far the most predominant crop grown on dairies in the Central Valley is corn, closely followed by oats and wheat. The most typical double cropping pattern is corn/wheat and corn/oats. Rye, sorghum, and triticale are sometimes substituted for wheat or oats. Alfalfa is a popular perennial forage crop. The refined dairy selection also includes one pasture dairy (Creekside Farms Silveira Dairy), where cows spend most of their life on pasture and walk significant distances from the pasture to and from the milk barn.

The most typical irrigation method is flood irrigation with border and checks. This includes not only winter crops and alfalfa but also some summer corn. As an alternative, furrow irrigated summer corn is also common. These characteristics have been found to be very similar to the Phase 1 dairies. Overhead sprinkle irrigation was found to be rare despite its substantial water savings due to improved irrigation uniformity and efficiency. However, the superior irrigation uniformity and efficiency of these systems have the potential to reduce leaching of nitrate and other salts below the root zone. Brentwood Farms and Richmar Farms Dairy employ center pivot sprinkle irrigation, and these dairies were included in the network. In contrast to the Phase 1 RMP dairies, which generally enjoy ample surface

water supply, most of the dairies included in the Phase 2 RMP network rely to some degree on groundwater supply from onsite agricultural wells. The dependence on groundwater by the selected Phase 2 dairies varies from 0 to 100% and fluctuates from year to year based on statewide water supply conditions.

Annual average precipitation ranges from more than 23 inches in Orland to less than 7 inches in Bakersfield. Soils present on the network dairies (Phases 1 and 2) range from dune sand to clay, with a range of loams represented.

3 Additional Reporting

CVDRMP will prepare a report that comprehensively examines the combined Phases 1 and 2 dairy farm and monitoring well network and will provide detailed rationale and explanations regarding the overall representativeness of the program. This report will also include additional input from the CVDRMP's technical advisory committees (including the Multidisciplinary Advisory Committee and the Groundwater Technical Advisory Committee), evaluate field-scale soils information on Phase 1 and 2 monitored dairies, and describe, to the extent possible, existing irrigation uniformities and efficiencies realized on Phase 1 and 2 monitored dairies. This latter effort will necessitate substantial communication with dairy farmers and their consultants.

It is envisioned that the above-described supplemental report will become a critical component in the overall Representative Monitoring Program as it aims to conclusively describe the overall scope of the RMP, aimed at demonstrating the range of pertinent site conditions and management practices evaluated to ensure that management practices are protective of groundwater quality. This includes the identification of potential additional data needs and additional monitoring well installations as they may be needed to further refine the CVDRMP network.

4 Groundwater Monitoring Program

The June 6, 2012 Phase 2 RMP Workplan differentiated between two tiers of groundwater monitoring activities depending on the depth to groundwater. Based on input received from the Groundwater Technical Advisory Committee, including insight from RWQCB staff regarding existing water quality records of existing monitoring wells, this Addendum proposes to implement monitoring activities in the Phase 2 RMP network that are identical to the monitoring activities described in Section 9 of the Phase 1 RMP Workplan (see Attachment 2 of the June 6, 2012 Phase 2 RMP Workplan), with two exceptions. The expanded sampling (i.e., the full suite of analyses) will be performed once in the first year, and annually thereafter; and monitoring frequencies will be evaluated and potentially adjusted after the first year of monitoring data collection.

5 References

- Central Valley Regional Water Quality Control Board. **2007**. *Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies*. May 3, 2007.
- Central Valley Regional Water Quality Control Board. **2009**. *Evaluation of Alternative Groundwater Monitoring Options at Dairies Operating under Waste Discharge Requirements General Order No. R5-2007-0035 for Existing Milk Cow Dairies (Draft)*. June 4, 2009.
- Central Valley Regional Water Quality Control Board. **2011a**. *Revised Monitoring and Reporting Program Order No. R5-2007-0035 General Order for Existing Milk Cow Dairies*. February 23, 2011.

Central Valley Regional Water Quality Control Board. **2011b.** *Conditional Approval of Monitoring and Reporting Workplan and Monitoring Well Installation and Sampling Plan – Phase 1, Existing Milk Cow Dairies.* September 9, 2011.

Luhdorff and Scalmanini, Consulting Engineers. **2011.** *Monitoring and Reporting Workplan and Monitoring Well Installation and Sampling Plan Phase 1: Initiation of Representative Groundwater Monitoring Network Design & Monitoring Program, Existing Milk Cow Dairies – Stanislaus and Merced Counties, California.* Public Review Draft. Prepared for Central Valley Dairy Representative Monitoring Program. June 16, 2011. Finalized without changes January 11, 2012.

Luhdorff and Scalmanini, Consulting Engineers. **2012.** *Monitoring Well Installation Completion Report Phase 1 Representative Monitoring Program, Existing Milk Cow Dairies – Stanislaus and Merced Counties, California.* Prepared for Central Valley Dairy Representative Monitoring Program. February 10, 2012.

Luhdorff and Scalmanini, Consulting Engineers. **2012.** *Monitoring and Reporting Workplan – Monitoring Well Installation and Sampling Plan, Phase 2: Representative Groundwater Monitoring Network Design & Monitoring Program, Existing Milk Cow Dairies – Central Valley, California.* June 6, 2012.