

Interpreting Groundwater Results – Information for Dairy Producers in California’s North Coast Region

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Representative wells located at all existing dairies, including domestic and agricultural supply wells, shall be sampled once per year for the first three years beginning in the year 2020, and then just once every three years thereafter. For example, existing dairies shall sample groundwater in the years 2020, 2021, 2022, then 2025, 2028, 2031, and so on. New dairies, expanding dairies, and previously inactive dairies will sample the first three consecutive years after enrollment in this Order and then once every three years thereafter.

Benchmark Values for Groundwater Sampling Parameters

One (1) sample from each representative well shall be tested for the following parameters:

Constituent	Units	Benchmark (municipal supply)
Nitrate	mg/l	Nitrate-Nitrogen (N) \leq 10 -or- Nitrate (NO ₃) \leq 45
Total Coliform Bacteria ¹	MPN/100 ml	1.1
Total Dissolved Solids ²	mg/l	<500

¹ Test domestic water supply wells only

² Adversely affects taste/odor

What do the results mean?

Groundwater Nitrate-Nitrogen Results >5 mg/l

Results should be reported as either nitrate (NO₃) or nitrate-nitrogen (NO₃-N) in units of mg/l or ppm (parts per million). The US Environmental Protection Agency (USEPA) has a maximum contaminant level (MCL) for this compound in drinking water. Elevated nitrate concentrations have been associated with compromise of the blood’s ability to carry oxygen resulting in blue baby syndrome in infants under 6 months of age. **Values above 45 ppm nitrate (NO₃) or 10 ppm NO₃-N exceed the MCL and are indicative of contamination of the water supply.** If nitrate results are higher than these levels, use an alternate water source to mix infant formula.

If at least two of the three groundwater sample results, for any one well sampled during the first three years, indicate a nitrate (measured as nitrogen) level of 5 mg/l or more (which is half of the benchmark value in Table 2), then that well shall be sampled every two years thereafter (e.g.: Year 2020, 2021, 2022, 2024, 2026, etc.). If the lab results only measure nitrate (measured as NO₃) then the trigger for this increase in groundwater sampling is > 22.5 mg/l nitrate (measured as NO₃) which is half of the benchmark. In addition, the Discharger shall submit a Work Plan to the Regional Water Board by November 30 during the fifth year of sampling (e.g. the year 2026) to report dairy practices implemented to prevent nitrate increases in the groundwater.

The Work Plan shall be prepared and signed by a professional engineer, registered geologist, or



qualified scientist, including staff employed with a Resource Conservation District (RCD), the Natural Resource Conservation Service (NRCS), or the University of California Cooperative Extension (UCCE). Individuals preparing the Work Plans must have adequate training and experience to address the components of the required Work Plan. The Work Plan must include an assessment of the extent of the impacted groundwater.

Total Coliform Results >1 MPN

Laboratory results for **total coliform** should be reported in units of most probable number (MPN). The lab sheet may show the results from each of 10 tubes (1 x 10) as positive (+) or negative (-) for the presence of coliform bacteria. The results observed in each of the 10 tubes at 96 hours are used to estimate MPN. Caution should be used when determining the sanitary significance of any single coliform result. The laboratory method precision for the estimation of MPN is greatly improved when several samples from a given sampling point are estimated separately and then the results combined to obtain an average.

An MPN greater than 1 means there may be fecal contamination of the water supply. The 95% confidence limits are one-third to three times the reported estimate. This means that if the reported value is less than 5.1, the actual estimate is within the range 0 to 9.7 MPN (see table on page 2). If this water supply is a drinking water supply, you may choose to resample. For MPN values of 5.1 or larger, the table below suggests it may be wise to chlorinate the well and resample after chlorination to be sure coliform bacteria are not present.

Total Dissolved Solids (TD)

TDS is the quantity of dissolved material in a given volume of water. The dissolved material may include minerals, salts, and organic matter such as: calcium, magnesium, potassium, sodium, bicarbonates, chlorides, nitrate, sulfates, metals, and other particles. The TDS of most drinking water averages 200 to 300 mg/l. Water with TDS greater than 500 mg/l adversely affects taste and odor and is not recommended for human consumption. EPA establishes that the secondary maximum contaminant level of TDS is 500 mg/l and that noticeable effects above this level include hardness, deposits, colored water, staining, and salty taste.

What should I do about positive results?

For positive results you should evaluate practices at or near the wellhead to identify if contamination is occurring in that immediate area. Manure applications near the wellhead or even in the vicinity could flow to the wellhead. Document any management modifications you make so you have it available when you prepare your Annual Report.

Samples should be collected as close to the wellhead as possible to reduce the possibility of obtaining false results from contamination in a storage tank or pipeline. Resample the water supply if there is a location closer to the wellhead than the site of the original sample.

Can I decontaminate my water supply?

If well results show elevated nitrate (above the drinking water standard) or the presence of coliform bacteria, you should take action. Your County Environmental Health Service may have additional brochures or handouts with information on well results and decontamination procedures, but here are some steps you should consider.

Elevated nitrate: Elevated nitrate concentrations may result from a poorly collected sample or from



actual nitrate contamination. Nitrate is mobile in the soil, so it is important to review applications of manure, fertilizers, and other soil amendments and to evaluate total nitrogen applied to fields and total nitrogen removed. In standard agricultural settings water is seldom treated to remove nitrate.

Presence of coliform bacteria: The presence of **coliform bacteria** may indicate contamination of the well by feces. Chlorination should take care of this if it is not a recurrent problem.

However, a thorough analysis of the source of feces and potential pathways into the water supply should be conducted to identify if modification of existing management practices could be beneficial to address direct contamination of wells through the well head may occur.

Documents from Humboldt County Environmental Health were used to prepare the following list regarding well contamination.

“Wells of insufficient depth or substandard construction are more susceptible to bacteriological contamination. This is particularly true of “dug wells” that are walled up with boards, brick, stone, or tile sections. These linings let unfiltered surface water and near- surface water seep in through cracks. Properly constructed wells (drilled wells) are usually free from bacteriological contamination because they seal off near-surface and surface waters from the well. However, if drilled wells are contaminated, one of the following reasons is likely the cause:

- Lack of or inadequate annular seal around well casing causing surfacewater intrusion.
- The casing is not terminated far enough above the ground.
- Well is too close to sources of contamination (sewage disposal system, corrals, etc.).
- Well head is subject to flooding, or slab does not drain away from casing, or is missing.
- Inadequate sanitary seal at well head.
- Cross connections in plumbing system.
- In old wells, the casing may have rusted through, leaving holes near the ground surface through which polluted surface water can enter.
- New wells often show contamination because the drill hole becomes contaminated through dirty tools, pipe and drilling water.
- New piping, pump or pressure system components may also contaminate a well if they are dirty and not disinfected prior to use, assembly or installation. Therefore, new wells, pumping equipment and water systems should be disinfected prior to use. The state code requires such disinfection.
- Storage tank in poor condition, or allows intrusion of water, dirt, insects, animals, etc.”

What will the North Coast Regional Water Board do if my Nitrogen or Coliform bacteria results are high as reported in my Annual Report?

Each Fall, the Regional Board will review the dairy groundwater data as reported in the dairy Annual Reports, which are due by November 30 of each year. If sampling results show elevated levels of nitrate or coliform bacteria, they may contact you regarding re-sampling or arranging an onsite inspection. If ongoing contamination is found to be a problem, measures will be taken to find the source of groundwater contamination (it may be offsite) and steps may be recommended to increase protection. Dairies that fertigate must have proper backflow prevention devices. Refer to workshop notes from April, 2021 for backflow prevention information. Technical assistance providers and consultants may be available to assist.



Use the table below to track your results over time.

Constituent	Benchmark	2020 result	2021 result	2022 result
Nitrate	≤ 10 mg/l Nitrate-N -or- ≤ 10 mg/l NO ₃			
Total Coliform Bacteria	< 1.1 MPN/100 ml			
Total Dissolved Solids	< 500 mg/l			

For additional information:

Residents of Humboldt County can visit <https://humboldt.gov/730/Land-Use-Program-Documents-and-Forms> (scroll down to Wells and Water, click on link for Procedure for Disinfecting Wells and Water Systems)

APHA AWWA WEF. 2005. 21st Edition Standard Methods for the Examination of water and wastewater. Method 9221. Ed. A.D. Eaton, L.S. Clesceri, E.W. Rice, A.E. Greenberg. American Public Health Association. Washington, DC.

Department of Water Resources Bulletin 74-90 - California Well Standards
<https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Standards/Combined-Well-Standards/Bulletin-74-90-Intro>

Information in this document was compiled by CDQAP to assist dairy producers in understanding and complying with the three North Coast Region General WDR or Waiver of WDR for dairies. Effort has been made to ensure accuracy, but these summaries are not official regulatory guidance and are not legal advice. Producers are advised that these summaries are not intended to be a substitute for reading the complete order and consulting their own legal counsel to ensure compliance with the waste discharge requirements. Should any information here conflict with the Orders and/or official information provided by the Regional Board, Board-provided information takes precedence. Staff at the Regional Board reviewed this document for completeness.