THE BOARD OF SUPERVISORS OF THE COUNTY OF STANISLAUS
BOARD ACTION SUMMARY

DEPT: Environmental Resources BOARD AGENDA #: *B-2

AGENDA DATE: May 3, 2016

SUBJECT:
Approval of the Stanislaus County Local Agency Management Program and Authorization to Submit to the Central Valley Regional Water Quality Control Board for Approval

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BOARD ACTION AS FOLLOWS: **No.** 2016-216

On motion of Supervisor O'Brien , **Seconded by Supervisor** Withrow
and approved by the following vote,
Ayes: Supervisors: O'Brien, Chiesa, Withrow, DeMartini, and Chairman Monteith
Noes: Supervisors: None
Excused or Absent: Supervisors: None
Abstaining: Supervisor: None

1) X **Approved as recommended**
2) _____ **Denied**
3) _____ **Approved as amended**
4) _____ **Other:**

MOTION:

ATTEST: ELIZABETH A. KING, Clerk of the Board of Supervisors

File No.

THE BOARD OF SUPERVISORS OF THE COUNTY OF STANISLAUS
AGENDA ITEM

DEPT: Environmental Resources
Urgent ○ Routine ◉

BOARD AGENDA #: *B-2

AGENDA DATE: May 3, 2016

CEO CONCURRENCE: pht

4/5 Vote Required: Yes ○ No ◉

SUBJECT:
Approval of the Stanislaus County Local Agency Management Program and Authorization to Submit to the Central Valley Regional Water Quality Control Board for Approval

STAFF RECOMMENDATIONS:

1. Approve the Stanislaus County Local Agency Management Program.

2. Authorize the Director of Environmental Resources, or designee, to submit the Local Agency Management Program to the Central Valley Regional Water Quality Control Board for approval.

DISCUSSION:

The State Water Resources Control Board (SWRCB) protects water quality by setting statewide policy, coordinates and supports the nine Regional Water Quality Control Boards' (Regional Board) efforts, and reviews petitions that contest Regional Board actions. Stanislaus County falls within the jurisdiction of the Central Valley Regional Water Quality Control Board (CVRWQCB).

On September 27, 2000, Governor Gray Davis signed into law Assembly Bill (AB) 885 that required the SWRCB to adopt regulations for the permitting and operation of Onsite Wastewater Treatment Systems (OWTS) by January 1, 2004. The Bill was originally written to address coastal onsite treatment systems, but was later amended to address all OWTS throughout California.

On June 19, 2012, and after multiple delays, the SWRCB adopted regulations entitled "Water Quality Control Policy for the Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems" (Policy). On November 13, 2012, the Office of Administrative Law approved the Policy, which established an effective date of May 13, 2013. By May 13, 2014, local jurisdictions intending to prepare a Local Agency Management Plan (LAMP) were required to submit a Letter of Commitment (LOC) to their respective Regional Board. On May 6, 2014, the Board of Supervisors approved Stanislaus County's LOC, and it was submitted to the Central Valley Regional Board for review. The LOC outlined the County's current standards for OWTS, taking into consideration unique local conditions that differ from those standards contained within the Tier 1 specifications of the Policy. The LOC also outlined the County's desire to continue the use of its current standards and to address conditions that are unique to its geographical area. Selecting this approach, which is referred to as the Tier 2

option, requires that the County prepare a LAMP and submit it to the Regional Board by May 13, 2016, for approval.

On August 12, 2014, this Department met with representatives from the Regional Board to discuss whether any components of Stanislaus' current standards would be problematic for approval. A list of important items was compiled and subsequently addressed in the LAMP.

On December 10, 2015, the Department conducted a public information workshop to meet with local stakeholders, specifically local septic contractors and septic engineers, regarding proposed provisions contained within the LAMP. Local stakeholders did not have any significant concerns with the provisions of the LAMP, but did point out that the State's Tier 1 standards are significantly more stringent than Stanislaus County's current standards that have been traditionally approved and successful. If the Regional Board disagrees with any of the elements of the County's OWTS program and LAMP, future revisions to the standards contained within our local program may become necessary. Accordingly, any subsequent revisions may require future Board action and possible ordinance changes so that our ordinances will align with modifications with the LAMP.

Approval of the LAMP is exempt from the California Environmental Quality Act.

POLICY ISSUE:

The Department of Environmental Resources locally regulates the installation and repair of Onsite Wastewater Treatment Systems (OWTS). The State Water Resources Control Board (SWRCB) has implemented new regulation that may directly impact the standards used to design OWTS. Implementation of a LAMP enables the County to comply with Statewide mandates while also maintaining most of the traditional standards of its existing program.

FISCAL IMPACT:

There is no immediate fiscal impact associated with this item. The Department of Environmental Resources (DER) Fiscal Year 2016-2017 Budget includes sufficient funding to cover the start-up costs associated with implementing the Local Agency Management Plan (LAMP).

BOARD OF SUPERVISORS' PRIORITY:

The recommended actions are consistent with the Board's priorities of A Safe Community, A Healthy Community, A Well Planned Infrastructure System, and the Efficient Delivery of Public Services, and also support the Department's mission to promote a safe and healthy environment and improve the quality of life in the community through a balance of science, education, partnerships, and environmental regulation.

STAFFING IMPACT:

Existing staff will continue to oversee the work related to this program change.

Approval of the Stanislaus County Local Agency Management Program and Authorization to Submit to the Central Valley Regional Water Quality Control Board for Approval

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CONTACT PERSON:

Jami Aggers, Director of Environmental Resources Telephone: 209-525-6770

ATTACHMENT(S):

A. Stanislaus County's Local Agency Management Program (LAMP)

Stanislaus County

Striving to be the Best

Stanislaus County

Department of Environmental Resources

Local Agency Management Program

For Onsite Wastewater Treatment Systems

Stanislaus County Board of Supervisors

District 1
William O'Brien
Vice Chairman

District 2
Vito Chiesa

District 3
Terry Withrow

District 4
Dick Monteith
Chairman

District 5
Jim De Martini

Stan Risen - Chief Executive Officer

Jami Aggers – Director of the Department of Environmental Resources

Final Draft: May 2016

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for printing as a double-sided document

EXECUTIVE SUMMARY

A local agency may submit to the Regional Water Quality Control Board (RWQCB) a Local Agency Management Program (LAMP) to manage Onsite Wastewater Treatment Systems (OWTS) to achieve the same policy purpose as RWQCB Tier 1 guidance, which is to protect water quality and public health. Stanislaus County proposes to adopt the LAMP described in this document to (1) confirm priority adherence to the spirit of Tier 1 standards, and (2) obtain approval for managing county-specific conditions under Tier 2 of the OWTS Policy. The Tier 2 guidance document is included as Appendix 1 of this document. As a draft, the proposed guidance was discussed with design engineers and installers of septic tank units and the Board of Supervisors received briefings on the LAMP as a whole. Once adopted by the Board of Supervisors, the LAMP will be submitted to the Regional Water Quality Control Board for approval. Once this process is completed, the final draft will be revised and re-submitted to the Board of Supervisors, if necessary, for reconsideration of approval and adoption.

The County is the sole agency that manages OWTS in its entire jurisdiction, so when approved by the RWQCB and the County Board of Supervisors, the Tier 2 Management of Onsite Wastewater Treatment Systems Guidance will be the sole regulation governing the design, installation, and repair of OWTS in Stanislaus County. Cases not covered by the Tier 2 guidance will be evaluated on a case-by-case basis, taking in consideration designs approved by a qualified professional, the spirit of the Tier 1 guidance, the standard-of-practice of the California Plumbing Code, the nature of local soils, and the local depth to the water table. Potentially problematic conditions related to soil and/or groundwater will be investigated by a qualified professional.

Stanislaus County can be divided into four geomorphic regions, from northeast to southwest: The Foothills, the Eastern Alluvial Fans, the Western Alluvial Fans, and the Coast Ranges. Both the Eastern and Western Alluvial fans can be divided into an upper and lower portion, a division that is important for the operation of Onsite Wastewater Disposal Systems. The San Joaquin River separates the lower reaches of the Eastern and Western Alluvial Fans.

Depth to groundwater generally increases with distance away from the San Joaquin River, although this pattern can be locally modified by well extraction (local lowering of the regional water table) or return from irrigation (local rising of the regional water table). In very general terms, the area between Highway 99 and Highway 33 is characterized by shallow groundwater and anoxic conditions that favor the reduction of NO_3 to N_2 through bacterial denitrification.

Nitrate impacts to groundwater have been investigated using a County-wide network of 538 wells. The overall picture of nitrate contamination in the aquifer suggests a modest impact, and as such does not warrant active remediation efforts. At this time the County will adopt “natural attenuation with monitoring” as its remediation strategy, and will perform an annual review of the monitoring well network as a mitigation effort, attentive to sudden increases in the number of contaminated wells, or in the intensity of contamination in known impacted wells. Public health is protected by the existing requirement that public water supply wells with nitrate content above the Maximum Contaminant Level (MCL) must have well-head treatment units, and that the outflow from such units must have concentrations below MCL before it is used as domestic water supply.

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1. INTRODUCTION

This document presents the proposed Local Agency Management Program (LAMP) pertaining to the oversight of onsite wastewater treatment systems (OWTS) within Stanislaus County, California. This LAMP has been prepared in accordance with the requirements of the State Water Resources Control Board's (SWRCB) Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems, dated May 13, 2013, also referred to as the "OWTS Policy".

The SWRCB OWTS Policy provides a multi-tiered strategy for management of OWTS in California. This LAMP has been prepared by Stanislaus County to (1) confirm priority adherence to the spirit of Tier 1 standards, and (2) obtain approval for managing necessary county-specific conditions under Tier 2 of the OWTS Policy. As such, it is intended to allow the County to continue providing local oversight of OWTS by implementing practices that: (a) are suited to the conditions in Stanislaus County; (b) meet or exceed the environmental protections of the "default" siting and design requirements for OWTS identified in Tier 1 of the SWRCB Policy; and (c) ensure the best opportunity for coordinated and comprehensive management of OWTS, public health, and water quality in Stanislaus County.

The proposed guidance, included here as Appendix 1, was discussed with design engineers and installers of septic tank units through two separate workshops; with the Board of Supervisors through briefings on the LAMP as a whole; and with the Regional Water Quality Control Board through ongoing consultation. Once this process is completed, the final draft will be revised and re-submitted to the Board of Supervisors, if necessary, for reconsideration of approval and adoption.

This LAMP is intended to apply to all OWTS within Stanislaus County having wastewater design flows of up to 10,000 gpd. The County is the only agency that regulates OWTS within the Stanislaus County area, and when approved will apply to all unincorporated areas, and, to the extent permitted by law, to State, Federal, and Tribal lands within Stanislaus County. Any OWTS with a design flow exceeding 10,000 gpd would be regulated by Waste Discharge Requirements issued by the RWQCB.

2. GEOGRAPHY AND GEOMORPHOLOGY

Stanislaus County is located in the Central Valley of California (Figure 1), and shares boundaries with Santa Clara (to the southwest), San Joaquin (northwest), Calaveras (north), Tuolumne (northeast), Merced (south), Mariposa (southeast), and Alameda (northwest) counties. The county encompasses an area of 1,515 square miles (969,600 acres), of which 1,495 square miles (956,800 acres) is land and 20 square miles (12,800 acres) (1.3%) is water. The county seat and largest city is Modesto.

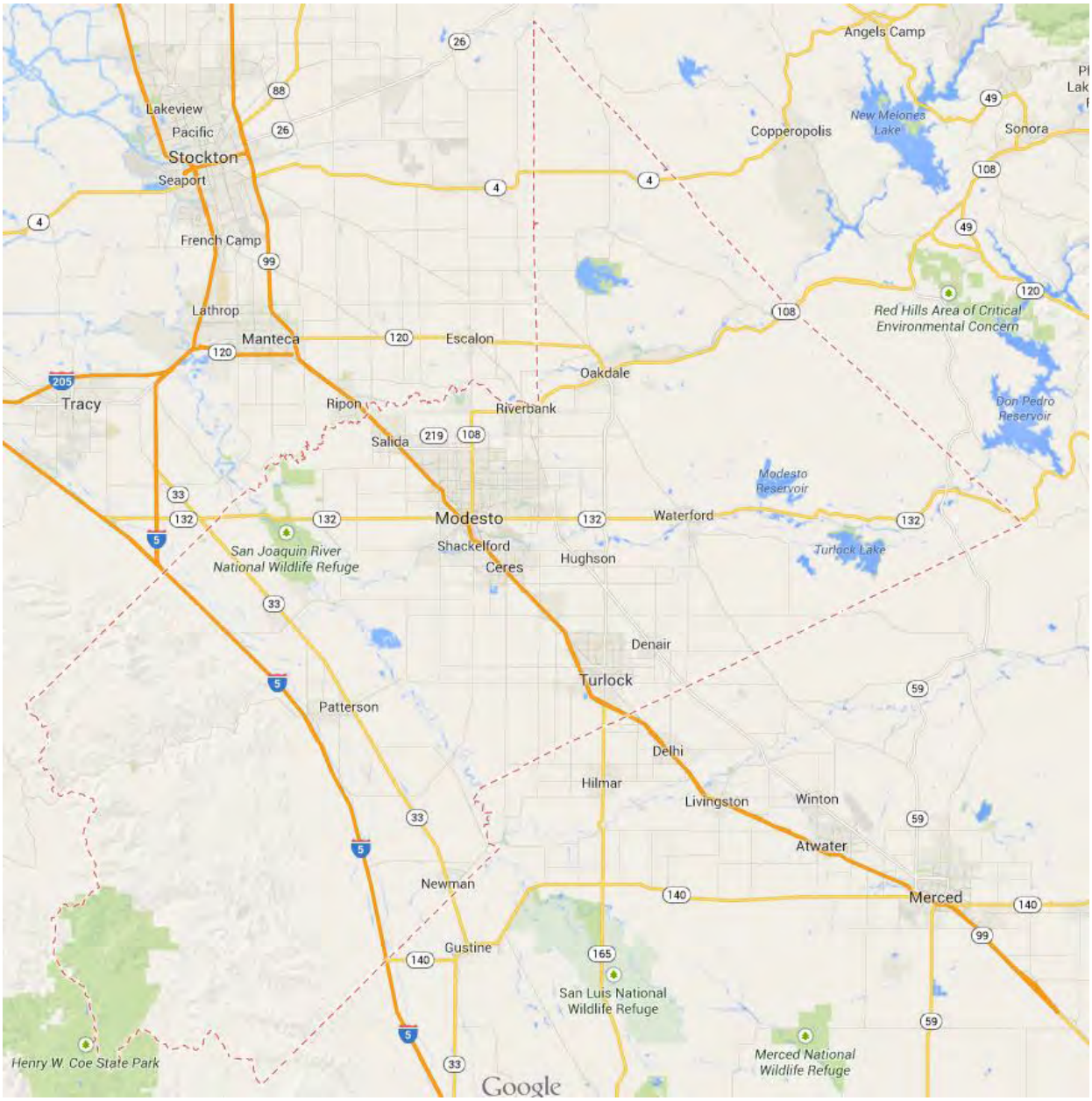

Figure 1. General geography of Stanislaus County

Stanislaus County can be divided into four geomorphic regions (Figure 2), from northeast to southwest: The Foothills, the Eastern Alluvial Fans, the Western Alluvial Fans, and the Coast Ranges. Both the Eastern and Western Alluvial fans can be divided into an upper and lower portion, a division that is important for the operation of Onsite Wastewater Disposal Systems. The San Joaquin River separates the lower reaches of the Eastern and Western Alluvial Fans, as shown in Figure 2.

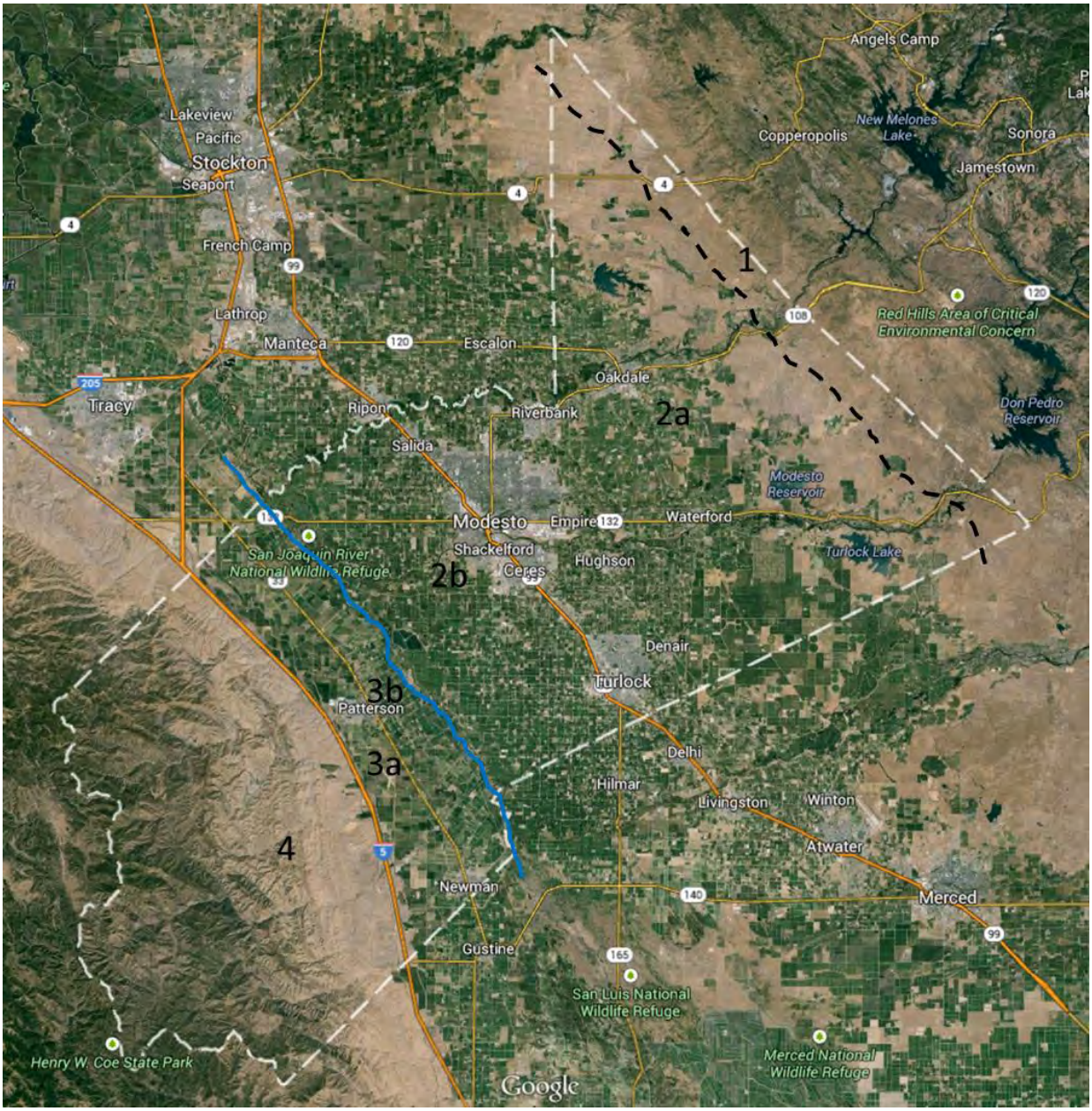

Figure 2. Geomorphic regions of Stanislaus County: 1. Foothills, 2a. upper portion of the Eastern Alluvial Fans, 2b. lower portion of the Eastern Alluvial Fans, 3a. upper portion of the Western Alluvial Fans, 3a. lower portion of the Western Alluvial Fans, 4. Coast Ranges.

The Foothills geomorphic region (labeled 1 in Figure 2) is a narrow belt on the east of the county, where metamorphic rocks are exposed or covered by a thin soil profile. Natural slope angles are typically larger than 10 degrees (17.5%). Groundwater is confined to fractures in the bedrock, and is typically found at depths greater than 100 ft. A qualified professional will review all proposed new and replacement OWTS in this region to assess the likelihood of thin soil profiles and potential fracture-controlled flow paths to nearby wells.

The upper portion of the Eastern Alluvial Fans (labeled 2a in Figure 2) is separated from the Foothills region by an imaginary line connecting La Grange with Knights Ferry (black dashed line in Figure 2), and from the lower portion of the Eastern Alluvial Fans by a line that generally follows Highway 99 (continuous orange line in Figure 2). Soils are generally thick within this region, and are underlain by variously indurated sedimentary rocks. Paleosoil horizons (locally referred to as "hardpan") are common at depths ranging from 5 to 25 ft. Depth to groundwater varies between 20 and 200 ft bgs, and groundwater occupies the pores between sediment particles. Most of the larger cities of the county are located within this region, but the main land uses are agriculture and cattle pastures.

The lower portion of the Eastern Alluvial Fans (labeled 2b in Figure 2) extends between Highway 99 to the east (continuous orange line in Figure 2), to the San Joaquin River to the east (continuous blue line in Figure 2). Soils are generally thick within this region, and are underlain by variously indurated sedimentary rocks. Depth to groundwater varies between 2 and 20 ft bgs, and groundwater occupies the pores between sediment particles. The main land uses are agriculture and dairies. A qualified professional will review all proposed new and replacement OWTS in this region to assess the likelihood of shallow depths to groundwater.

The lower portion of the Western Alluvial Fans (labeled 3b in Figure 2) extends between the San Joaquin River to the east (continuous blue line in Figure 2), to Highway 33 to the east (continuous yellow line in Figure 2). Soils are generally thick within this region, and are underlain by variously indurated sedimentary rocks. Depth to groundwater varies between 2 and 20 ft bgs, and groundwater occupies the pores between sediment particles. The main land use is agriculture. A qualified professional will review all proposed new and replacement OWTS in this region to assess the likelihood of shallow depths to groundwater.

The upper portion of the Western Alluvial Fans (labeled 3a in Figure 2) extends between Highway 33 in the east and Freeway 5 in the west. Soils are generally thick within this region. Depth to groundwater varies between 20 and 200 ft bgs, and groundwater occupies the pores between sediment particles. The main land use is agriculture.

The Coast Ranges geomorphic region (labeled 4 in Figure 2) extends between Freeway 5 in the east and the county boundary in the west. Sedimentary and metamorphic rocks are exposed or covered by a thin soil profile. Natural slope angles are typically larger than 20 degrees (36%) and highly unstable. Groundwater is found in either the pores of the sedimentary rocks, or in fractures in the metamorphic rocks. It is typically found at depths greater than 100 ft, but occasionally reaches the surface in natural springs. A qualified professional will review all proposed new and replacement OWTS in this region to assess the likelihood of thin soil profiles and potential fracture-controlled flow paths to nearby wells.

Within the Eastern and Western Alluvial Fan regions, the density of development is influenced by the corridors formed by Highways 99, 33, and to a lesser extent Freeway 5. Paralleling these major highways are the most intense areas of development within the county. (Figure 1)

3. WATER

Precipitation

Average annual precipitation throughout Stanislaus County varies from west to east, as shown in the following map.

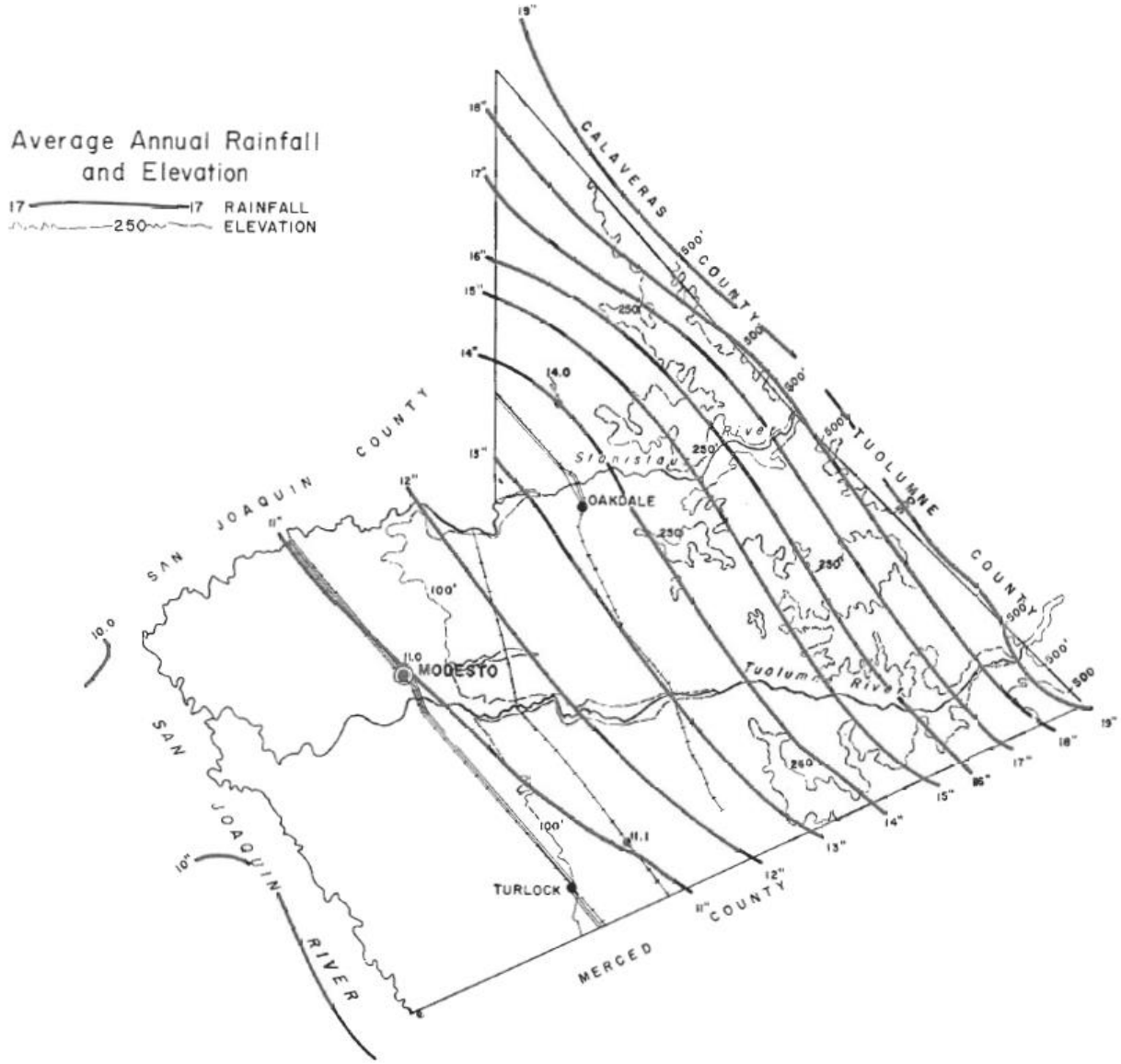

Figure 3. Average annual precipitation in Eastern and northern Stanislaus County (Arkley, 1964).

Around 10% of this annual precipitation (1 to 2 inches per year) eventually infiltrates to recharge groundwater. The rate of recharge is much larger, however, due to infiltration of excess irrigation water. About 1,000,000 acre-ft are delivered each year to the farms of Modesto and Turlock Irrigation Districts. Assuming that 30% of this water infiltrates over an area of 100,000 acres for MID, and 200,000 for TID, then the 300,000 acre-ft that infiltrate would be equivalent to an additional recharge of 1 ft or 12 inches per year between the San Joaquin River and the 13” isoyeth in Figure 3.

Depth to Groundwater

Depth to groundwater generally increases with distance away from the San Joaquin River, although this pattern can be locally modified by well extraction (local lowering of the regional water table) or return from irrigation (local rising of the regional water table). The following maps show the depth to groundwater (in feet bgs) throughout the most populated areas of the county: (a) the Modesto groundwater basin, and (b) the Turlock groundwater basin.

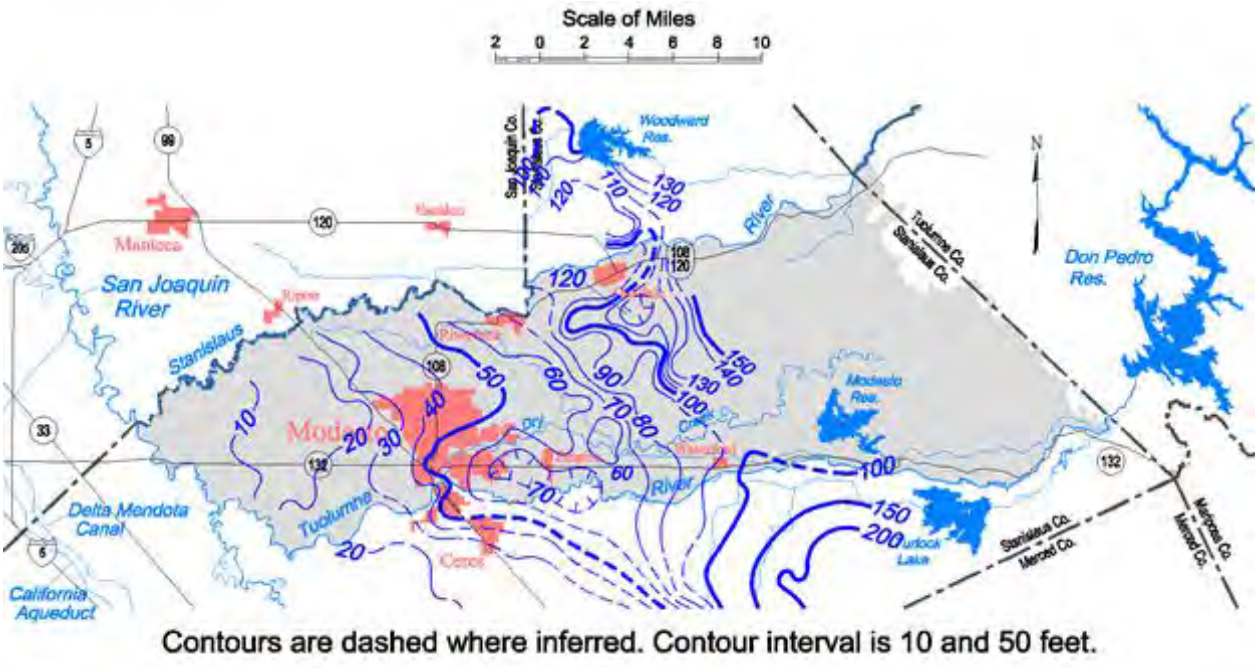

Figure 4. Lines of equal depth to water in wells, unconfined aquifer, in Spring 2010, for the Modesto groundwater basin (DWR, 2014).

Note the general increase in depth from 10 ft bgs near the San Joaquin River to about 50 ft bgs across Modesto and 100 ft bgs from Waterford to Oakdale. In very general terms, Highway 99 can be considered a threshold between shallow groundwater to the west and deep groundwater to the east. A qualified professional will review all proposed new and replacement OWTS in the area west of Highway 99 to assess the likelihood of shallow depths to groundwater.

Additionally, a qualified professional will review applications for new and replacement OWTS in close proximity to domestic wells (200 ft) or to public water supply wells (600 ft).

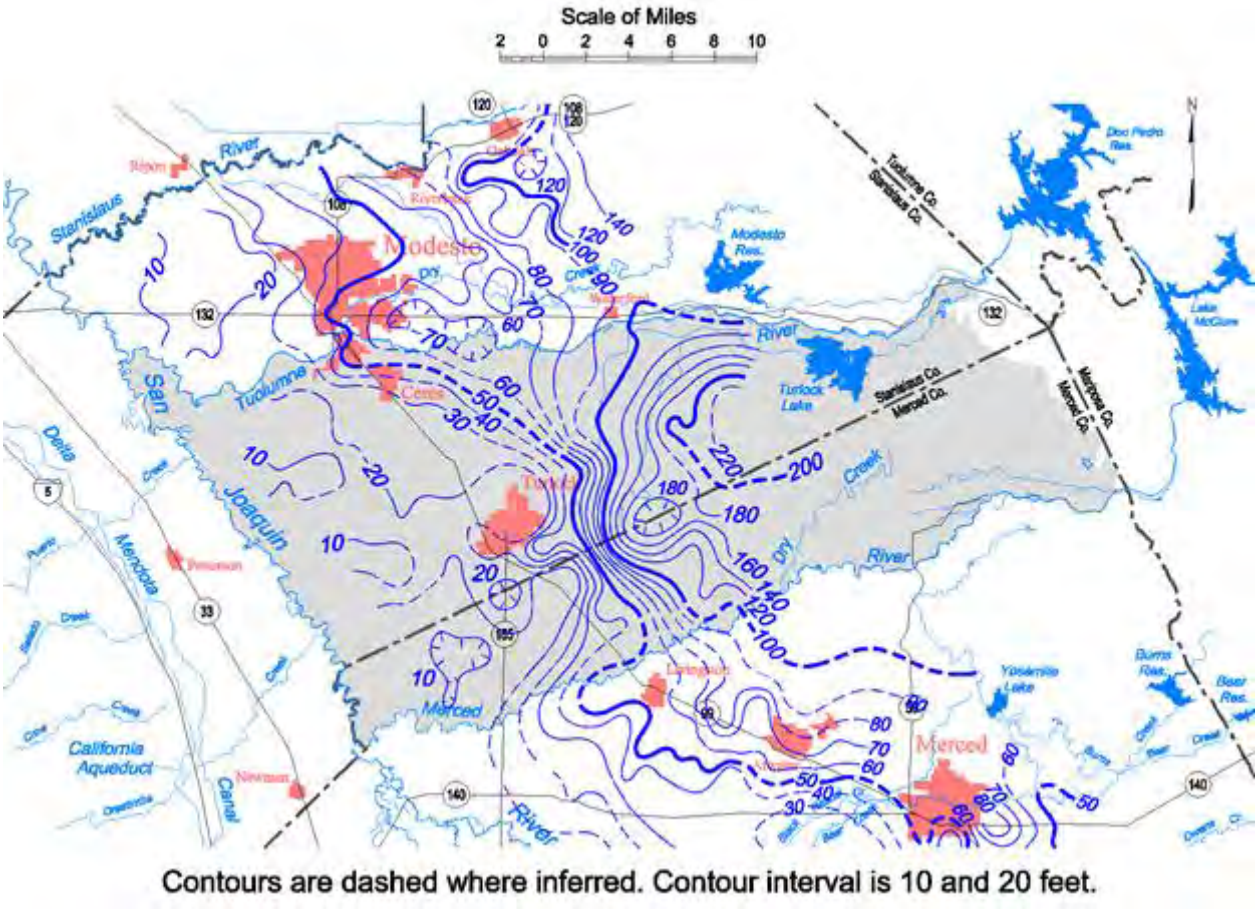

Figure 5. Lines of equal depth to water in wells, unconfined aquifer, in Spring 2010, for the Turlock groundwater basin (DWR, 2014).

Note the general increase in depth from 10 ftbgs near the San Joaquin River to about 20 ftbgs across Turlock. Depth to groundwater increases greatly east of Turlock due to the presence of a pumping extraction cone immediately east of Denair. In very general terms, Highway 99 can be considered a threshold between shallow groundwater to the west and deep groundwater to the east. A qualified professional will review all proposed new and replacement OWTS in the area west of Highway 99 to assess the likelihood of shallow depths to groundwater.

General Groundwater Chemistry

The relative redox status of groundwater samples can be assessed indirectly from the abundance of redox-sensitive solutes. Iron, manganese, and nitrate commonly are used for this purpose. Iron and manganese have oxidized forms that are highly insoluble under neutral to alkaline conditions. Elevated concentrations of these metals in water commonly are used as indicators of reduced conditions. Comparisons of iron and manganese concentrations indicate that the concentrations of both metals generally are higher in water in the Sierra Nevada sediments (east of the San Joaquin River) than in water in Coast Ranges sediments (west of the San Joaquin River) (Dubrovsky et al. (1991). This indicates that the Sierra Nevada sediments are more reduced than the Coast Ranges sediments.

Nitrate concentrations are higher in ground water in Coast Ranges sediments, indicating more oxidized conditions. The presence of nitrate indicates oxidized conditions because reduced conditions cause nitrate to be removed from solution by denitrification (however, other factors, such as insufficient nutrients for bacterial action, may prevent denitrification). Naturally high concentrations of nitrate in soils in the western San Joaquin Valley are partly due to the arid conditions and the lack of leaching of mudflow deposits (Sullivan, 1978). Conversely, the absence of nitrate in groundwater in Sierra Nevada sediments likely was affected by flushing during annual flooding concurrent with the deposition of flood-basin deposits as well as by reducing conditions.

These observations indicate that groundwater in Sierra Nevada sediments is more reducing than groundwater in Coast Ranges sediments. As a result of this difference, the pattern of areal distribution of redox status in the ground water is controlled by the areal distribution of these two lithologies.

Nitrate Levels in Groundwater

Groundwater in Stanislaus County is generally of good quality, although extensive farming and dairy operations have led to hot spots where nitrate levels are above drinking water standards. The map in Figure 6 indicates, with three different colored symbols, wells that in 2013 had low nitrate levels (less than 22.5 mg/l) in green, intermediate levels (more than 22.5 mg/l but less than 45 mg/l) in yellow, and high levels (more than 45 mg/l) in red.

Of the total database of 538 monitored wells (343 wells monitored by the GAMA project, and 195 wells monitored by Stanislaus County), 310 (58%) had nitrate contents below 22.5 mg/l (green symbols in Figure 6), 194 (36%) had nitrate contents between 22.5 and 45 mg/l (yellow symbols), and only 34 (6%) had nitrate contents higher than 45 mg/l (red symbols). Of the latter, 16 wells are associated to the two County landfills (Appendix 7) and define the two clusters seen on Figure 6 (north of Hughson for the Geer Rd. Landfill, and south of Patterson for the Fink Rd. Landfill).

Landon et al. (2011) used the GAMA database (Landon and Belitz, 2008) to examine the relations between hydrogeologic factors, reduction-oxidation (redox) conditions, and temporal and spatial distributions of nitrate (NO_3). They concluded that groundwater is predominantly oxic and modern, but some zones have anoxic conditions. Anoxic conditions are found near the valley trough (i.e., in geomorphic region 2b), in areas with shallow depth to water. Anoxic conditions favor the reduction of NO_3 to N_2 primarily due to denitrification (Korom, 1992). In denitrification, bacteria use the oxygen in the nitrate ion to oxidize organic carbon to CO_2, thus releasing biologically inert molecular nitrogen. Increasing NO_3 concentrations over time were slightly less prevalent in anoxic than oxic groundwater. Spatial and temporal trends of NO_3 are primarily controlled by water and NO_3 fluxes of modern land use.

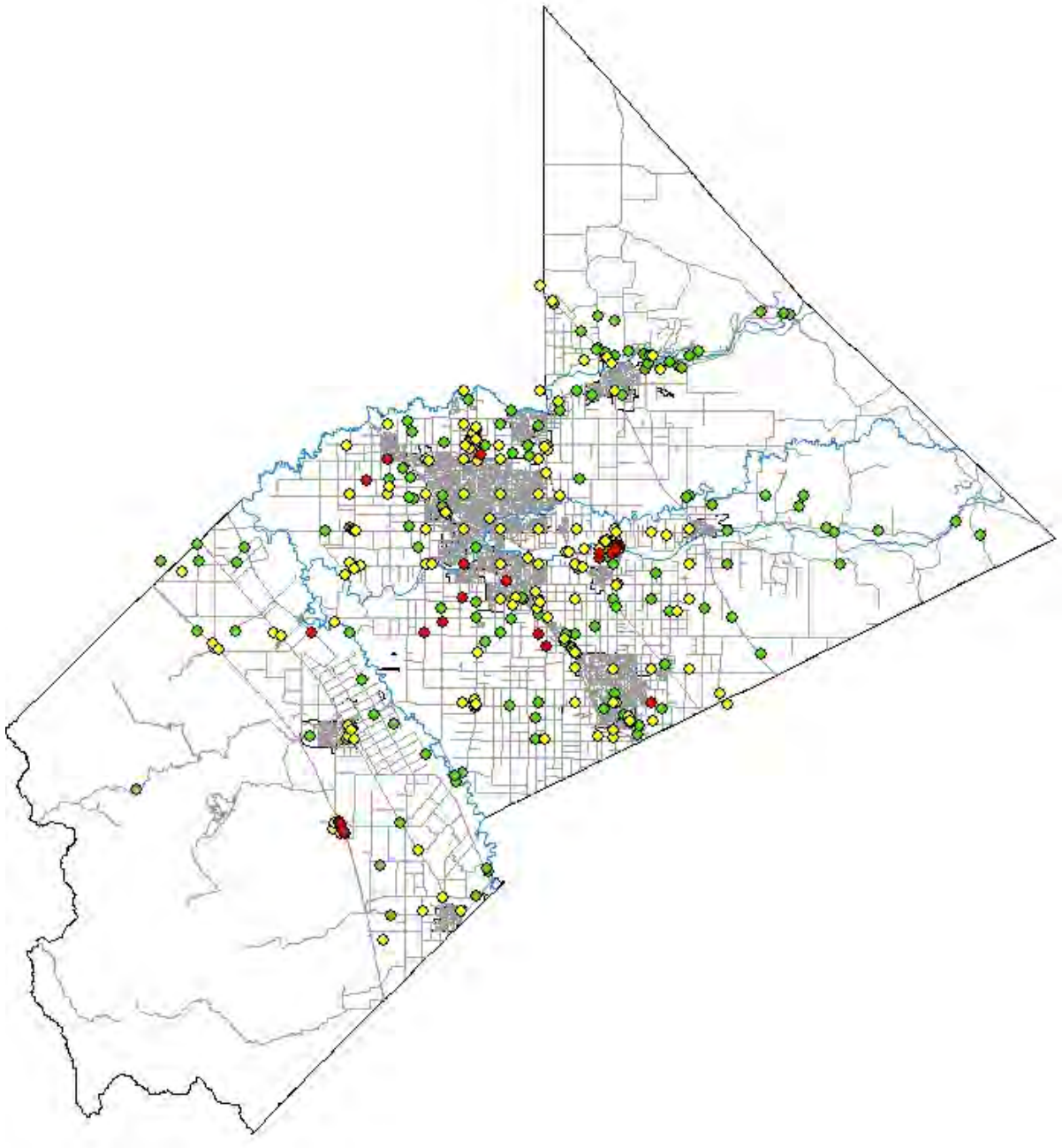

Figure 6. Relative concentration of nitrate in wells sampled during 2013 (SCDER, 2014). In green are shown wells with less than 22.5 mg/l nitrate, in yellow wells with nitrate contents between 22.5 and 45 mg/l, and in red wells with more than 45 mg/l nitrate.

At this time the overall picture of nitrate contamination in the aquifer suggests a modest impact, and as such does not warrant active remediation efforts. At this time the County will adopt “natural

attenuation with monitoring" as its remediation strategy, and will perform an annual review of the GAMA and in-house databases as a mitigation effort, attentive to sudden increases in the number of contaminated wells, or in the intensity of contamination in known impacted wells. Public health is protected by the existing requirement that public supply wells with nitrate content above the MCL must have well-head treatment units, and that the outflow from such units must have concentrations below the MCL before it is used as domestic water supply.

To further investigate the potential link between OWTS and nitrate contamination in wells, using satellite images we examined the location of each of the 82 wells monitored by the County that had nitrate contents above 22.5 mg/l. Among these 82 well locations, we distinguished those in which the surrounding land use was for agriculture, dairy farming, lawn expanses (golf courses or memorial parks), fringe urban, and urban. We also distinguished between "low OWTS use" (e.g., single homes or churches), and "high OWTS use" (e.g., mobile home parks). Animal waste associated to dairy farming, and fertilizers used in agriculture and lawn expanse land uses, were considered to be the most likely source of nitrate contamination, so those sites were not investigated further. Finally, we flagged those wells that were located in fringe urban or urban settings and had a "high OWTS use" designation, as being the most likely cases for OWTS impact on groundwater. 31 of the wells fall in this "suspect" category (15% of the grand total of 195 monitored wells).

A qualified professional will review all proposed new and replacement OWTS in areas with known intermediate and high nitrate contents, to assess the potential for additional impacts to groundwater.

The Western Alluvial Fans geomorphic region, which extends between Highway 33 in the east and Freeway 5 in the west, seems to have a consistent problem of high nitrate levels, again likely triggered by agricultural activities.

4. GENERAL STATEMENT ABOUT THE GEOLOGY AND SOILS OF STANISLAUS COUNTY

Geology

The following map shows the main outcropping geologic units of Stanislaus County (Page, 1986).

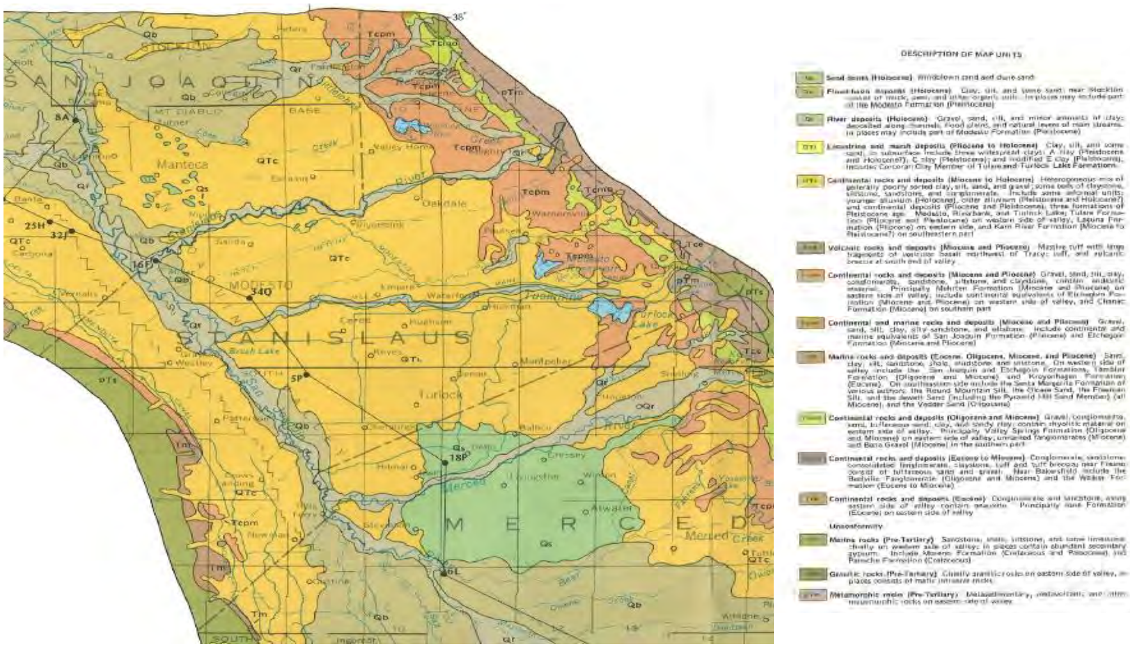

Figure 7. Regional geology of Stanislaus County (Page, 1986).

The alluvium strip along the rivers (Qr) has been described by Page (1986) as river channel deposits of gravel, sand, and silt with minor amounts of clay. They are among the most permeable deposits in the valley, and can be up to 100 ft thick.

Qb has been described by Page (1986) as flood-basin deposits of clay, silt and some sand. Vertical differences in hydraulic conductivity impedes vertical movement of water and restrict yields to wells. They can be up to 100 ft thick.

QTc has been described by Page (1986) as Plio-Pleistocene alluvial fan deposits formed by poorly sorted clayey and silty sands of the Modesto, Riverbank and Turlock Lake formations (east of the San Joaquin River). They can be hundreds of feet thick. See also Davis and Hall (1959). In the hydrogeologic literature (e.g., Phillips et al., 1991), this unit is referred to as "Sierra Nevada sediments". West of the San Joaquin River, the alluvial fan deposits derive from erosion of the Coast Ranges, so in the hydrogeologic literature they are referred as "Coast Range sediments".

Qs has been described by Page (1986) as windblown sand and dune sand. Maximum reported thickness of 140 ft.

Soils

With the exception of the Coast Ranges geomorphic area, which has a very low population density, the soils of the rest of Stanislaus County have been mapped by the Natural Resources Conservation Service (formerly the Soil Conservation Service) cooperatively with the University of California (Agricultural Experiment Station). Soil mapping was recorded on aerial photographs and topographic maps at a scale of 1:24,000, and are in general adequate to assess the suitability of the soils for leach fields. The reports include a specific assessment of percolation rate and potential for flooding for every soil class.

Soil survey work in Stanislaus County includes "Soil survey of the Eastern Stanislaus Area, California" (Arkley, 1964), "Soils of Westside Stanislaus Area, California" (McLaughlin and Huntington, 1968), and "Soil Survey of Stanislaus County, California, Northern Part" (USDA-NRCS, 2007).

More detail in soil associations in Stanislaus County is presented in Appendix 3 of this document. In brief, in northern Stanislaus County wind-blown sand (Delhi soils) and soils with duripans (San Joaquin-Exeter-Madera soils) present special challenges for the design of leach fields. Delhi soils have very high infiltration rates and may thus not be suitable for traditional leach fields (but they may be suitable for mounded leach fields). In contrast, duripans (i.e., hardpans), found in many areas of the county, may require special design to facilitate infiltration.

In eastern Stanislaus County, before development, the flood plains of the major rivers, the San Joaquin, Tuolumne, and Stanislaus, were subject to overflow during periods of high rainfall or rapid snow melt in their watersheds. The fresh alluvium added by each flood retarded or prevented the formation of distinct horizons. The flood plains are nearly level except where they are cut by channels and oxbow depressions. Clayey flood plain soils may require special attention when designing a leach field because of potentially slow percolation; soils with duripans may hinder infiltration; gravelly channel deposits require special attention because of very high percolation rates; and in the Sierra foothills soils require special attention because they tend to be shallow and rocky.

The soils in western Stanislaus County, between the San Joaquin River and Highway 5, include very deep, nearly level, moderately coarse to fine textured, moderately well to poorly drained soils on the flood plain of the San Joaquin River. These soils require special attention when designing a leach field because of potentially slow percolation. In contrast, the soils of the Older Alluvial Fans are well drained, gravelly soils that require special attention because of very high percolation rates.

Finally, the soils in westernmost Stanislaus County, west of Highway 5, have not been formally mapped, so each proposed OWTS site requires individual attention. Generally, the soils in this portion of the county are very thin to inexistent on the typically steep slopes, but can be very thick in the valley floors. Because most of the rock exposed are marine shales and siltstones, or heavily weathered metabasalts, the soils in valley floors tend to be clayey and have slow percolation rates.

5. CURRENT REGULATION OF ONSITE WASTEWATER TREATMENT SYSTEMS

The Stanislaus County Department of Environmental Resources (DER) is responsible for regulating OWTS throughout the unincorporated areas of the county. The DER also administers OWTS regulations in peripheral portions of various cities in the county, where the municipal sewer service does not extend. OWTS are used almost exclusively for properties located outside of municipal sewer service boundaries, which includes large areas in the agricultural portions of the county, as well as in the eastern and western Foothills and Coast Ranges regions.

The County has historically operated its onsite wastewater systems program under the authority granted to it by the Central Valley California Regional Water Quality Control Board.

OWTS ordinances and practices adopted by Stanislaus County

Stanislaus County has adopted the following ordinances and practices:

a. Section 16.10.010, Chapter 16 of the County ordinance adopts the California Plumbing Code as follows:

> The 2013 California Plumbing Code, as published by the International Association of Plumbing and Mechanical Officials, 2012 Edition, Chapter 1 Division II Administration Sections 103.1.1 and Appendices A, D, H and I are adopted by reference and incorporated in this chapter as if fully set forth herein, and shall be referred to as the Plumbing Code for the county. A copy of said code shall be kept and maintained by the building official for use and examination by the public. (Ord. CS 1137 §6, 2013; Ord. CS 1086 §6, 2010; Ord. CS 1017 §13, 2007; Ord. CS 625 §4, 1996).

b. Section 16.10.020, Chapter 16 of the County ordinance formally adopts Appendix H, H 1.11—Private sewage disposal of the 2013 California Plumbing Code, as follows:

> Appendix H 1.11 allows alternative systems. For purposes of this code, “primary and secondary on-site wastewater treatment systems” and “individual aerobic systems” are considered alternative systems and are subject to the following conditions:
>
> Operation and Maintenance. In those areas within the county where individual primary and secondary on-site wastewater treatment systems are required, it shall be unlawful for any person who owns or operates such a system to permit the system to be improperly operated or maintained in a manner inconsistent with the design and operation specifications of that system. (Ord. CS 1137 §7, 2013; Ord. CS 1017 §14, 2007; Ord. CS 893 §1, 2004; Ord. CS 625 §4, 1996).

c. Section 16.10.030, Chapter 16 of the County ordinance formally adopts Appendix H, California Plumbing Code, as follows:

> A. Appendix H, Section H 6.0 Disposal Fields, Table H 6.9 General Disposal Field Requirements of the California Plumbing Code is amended by adding the following: Septic tank leaching lines shall be spaced a minimum of twelve feet, center-to-center.

B. Appendix H, Table H 1.7 Location of Sewage Disposal System of the California Plumbing Code is amended by deleting Note 3 and adding Notes 3a and 9 to read as follows:

> Note 3a. No portion of a septic tank/ aerobic tank or leach line shall be located closer than fifty feet to a private well supplying water, or closer than one hundred feet to a well supplying water for public use.
>
> Note 9. Septic tanks and leaching areas can be permitted within the one hundred-year flood plain only if the sewage system and expansion area can be installed a minimum of two hundred feet from the main river channel.

(Ord. CS 1137 §8, 2013; Ord. CS 1017 §15, 2007; Ord. CS 625 §4, 1996).

d. Section 16.10.040, Chapter 16 of the County ordinance mandates a "Primary and secondary on-site wastewater treatment" notification, as follows:

A. To provide all property owners with constructive notice of Stanislaus County's Measure X guidelines concerning primary and secondary on-site wastewater treatment requirements, the ordinance codified in this chapter shall be recorded with the clerk-recorder of the county.

B. For all discretionary approvals of parcel maps or subdivision maps requiring primary and secondary on-site wastewater treatment, the county department of planning and community development shall include as a condition of approval that the final recorded map shall contain the following statement:

"As per Stanislaus County Code Sections 16.10.020 and 16.10.040, all persons purchasing lots within the boundaries of this approved map should be prepared to accept the responsibilities and costs associated with the operation and maintenance of the required primary and secondary on-site wastewater treatment system. All persons are required to provide adequate maintenance and operate the onsite wastewater treatment system as prescribed by the manufacturer, so as to prevent groundwater degradation."

C. The county department of public works development services division [now Planning and Community Development] shall provide all applicants for building permits for new residential construction or commercial project construction with a "primary and secondary on-site wastewater treatment notice" in substantially the form provided in subsection F of this section.

D. Commencing in the year 2004, and every year thereafter, the department of environmental resources [a duty currently performed by the clerk-recorder of the county with the annual notification of property taxes] shall annually mail a copy of the "primary and secondary on-site wastewater treatment notice," in substantially the form provided in subsection F of this section, to all owners of real property in Stanislaus County required to have primary and secondary on-site wastewater treatment.

E. The clerk-recorder of the county shall include a "primary and secondary on-site wastewater treatment notice," in substantially the form provided in subsection F of this section, with any land sale contract, grant deed, quitclaim deed or any other instrument of conveyance returned to the grantee by the clerk-recorder after recording.

F. The "primary and secondary on-site wastewater treatment notice" shall contain, and be substantially in the form of, the following:

> "In June of 1990 Measure X, a voter initiative, was passed. Measure X went into effect July 13, 1990. The Stanislaus County Board of Supervisors has adopted guidelines for implementation of Measure X."
>
> "Except for those properties excluded pursuant to the Measure X guidelines, all owners of property on lots subdivided after July 13, 1990, all owners of new residential sized parcels created from agricultural designated parcels after July 13, 1990, and all new commercial or industrial projects requiring building permits are required to dispose of all liquid waste through an approved primary and secondary on-site wastewater treatment system. The resident and/or property owner shall be responsible for the operation and maintenance of the primary and secondary on-site wastewater treatment system. The resident and/or property owner shall operate and maintain the primary and secondary wastewater treatment system as prescribed by the manufacturer specifications and system design. Groundwater degradation caused by improper operation and maintenance of the primary and secondary on-site wastewater treatment system shall be unlawful."

G. The County Department of Environmental Resources shall be responsible for the printing of the "primary and secondary onsite wastewater treatment notice" set forth in subsection F of this section and shall supply the department of public works development services division [now department of planning and community development] and the clerk-recorder with notices as needed. (Ord. CS 893 §2, 2004).

Note added for this LAMP document: The language and guidelines for Measure X can be found in Appendix 8 of this LAMP.

e. Section 20.56.170, Chapter 20 of the County ordinance formally adopts the following RWQCB guidelines:

> Individual sewage disposal systems, when permitted, shall be constructed in compliance with the provisions of that certain document entitled "Guidelines for Waste Disposal from Land Developments" and amendments and revisions thereto, as adopted by the Central Valley Regional Water Quality Control Board of the state for the protection of the public health by regulating the discharges from individual sewage disposal systems. (Ord. CS 179 §1, 1986; Ord. NS 1061 §2, 1981; prior code §9-43(b)(10)).

Note added for this LAMP document: Because the ordinance adopted "amendments and revisions thereto, as adopted by the Central Valley Regional Water Quality Control Board" the guiding document is now the June 19, 2012, OWTS Policy – Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems.

f. In-house policies developed to best meet the conditions and state-of-practice in Stanislaus County. These in-house policies are the basis for our Tier 2 program, and have historically included:

Policy #	Summary
1	Policy is obsolete and no longer used.
2	Prior to approving excavation of a swimming pool, DER must receive from the owner property plans indicating the location of existing wells, septic tank and sewage disposal field. The owner should designate a usable-undeveloped area where the sewage disposal field can be expanded in the event of failure. This area must be large enough to expand the existing sewage disposal fields by 100%. If the pool installation will disturb the disposal fields, the owner should designate the area where it will be replaced, in addition to the expansion area.
3	DER has established the following procedure for abandoning septic tanks: (1) The tank's septage shall be pumped and hauled to an approved disposal site. (2) A minimum of two holes shall be made in the bottom of the tank to allow for drainage of infiltration water, or two sides shall be caved/broken into the bottom of the tank. (3) The top cover of the tank shall be removed or broken into the tank. (4) The tank shall be completely filled with earth, sand, gravel, concrete, or other approved fill material. In practice, the owner has the option of completely removing the tank.
4	Contractor descriptions of size and depth of a septic tank excavation should be compared against reported volume of soil removed and weight slips.
5	Neither DER, nor the Building Division (BD), will issue septic system installation permits for undeveloped parcels. A site-specific construction project proposal must accompany all septic tank installation requests. Emergency cases will be evaluated on a case by case basis by DER and BD.
6	In order to evaluate an undersized parcel prior to issuing a building permit, the owner must submit existing and planned well locations, and locations of septic tanks and leachfields.
7	The Building Chief of the County formally adopted Appendix H of the 2013 California Plumbing Code, and any subsequent versions thereof, which includes reducing the distance from septic tanks to private water supply wells from 100 ft down to 50 ft, and using the number of bedrooms to determine the minimum volume of the septic tank and the minimum area of the leach field filter.
8	When a construction permit is applied for construction of additional bedrooms, DER should work with the Building Inspector to make sure the construction permit is not finalized prior to inspection of the required additions to the septic tank and leach field. Provisions for non-compliance include a "Notice of Non-Compliance" recorded with the property deed.
9	To minimize groundwater degradation due to the installation of storm drainage "dry wells", the following minimum horizontal setback distances shall apply to all new storm drainage dry wells with a depth of 15 ft less: Public water well – 150 ft; domestic water well – 100 ft; septic tank – 50 ft; dispersal field – 50 ft; and seepage pit – 50 ft.

Policy #	Summary
10	New construction projects shall have permits for a storm water disposal system that: (1) is designed not to pollute receiving surface or groundwater, and (2) which could be integrated into an area-wide groundwater recharge program whenever feasible. Preferred mechanisms for on-site disposal of stormwater are the use of evapo/percolation basins and or the use of French drains. The practice of using dry wells is discouraged due to the potential impacts on groundwater.
11	Some geographic areas within Stanislaus County have particular soil, geologic, or topographic problems, which often require specially designed wastewater disposal systems. These areas are mainly in the Foothills and Coast Ranges geomorphic provinces. Based on experience DER has redlined these areas in maps available for inspection by project owners and their engineers.
12	When the owner of a home with an existing onsite wastewater system decides to have major work or a complete replacement of the system, the new system shall meet the current standards, regardless of when the house was constructed.
13	Installation of drilled seepage pits requires prior approval by DER. Use of drilled pits is normally limited to those areas of Stanislaus County where soil percolation rates in the top 20 feet exceed 60 minutes per inch and the water table is deeper than 50 feet. In addition, drilled pits are sometimes used for repairs in areas of poor soil and limited area for expansion. Each request for use/installation of drilled pits will be evaluated individually by DER. Since 2002, SCDER has strongly discouraged the installation of drilled seepage pits.
14	Table for calculating volume in cubic yards for different sizes and depths of excavation.
15	Guidelines for site evaluation for on-site wastewater disposal systems. Includes instructions about site research, and field inspection, among other evaluation activities.
16	Guidelines for inspection of on-site wastewater disposal systems. Includes inspection of the septic tank and of the leach field.
17	In accordance with the California Plumbing Code (Appendix K): 1a. The maximum credited width of leach line is 3 ft. 1b. Leach lines must have minimum of 5 ft separation between the bottom of the leach line and the water table. 2a. Leach lines will not be credited for any gravel deeper than 3 ft under the perforated drain line. 2b. Maximum drain line credit will be 7 square feet per running foot. 3a. Seepage pits, by definition, must have a depth greater than 8 ft from ground surface to bottom of the trench and will also be limited to a maximum credited width of 3 ft. 3b. Seepage pits must have a minimum of 10 ft separation between the bottom of the pit and the water table; this essentially eliminates the use of pits in areas where the water table is within 19 ft of ground surface.
18	Example of on-site wastewater disposal system calculations for a commercial project.
19	Example on how to create a 2400-gallon septic tank by installing two 1200-gallon septic tanks.
20	Guidelines for septic system design for single-family residences, and for multi-family or commercial buildings. Includes guidelines for installation, and tables with setback distances. Important policy.
21	Interim policy for the installation and use of individual aerobic wastewater treatment units. The policy requires that the system design and construction materials and performance meet the current National Sanitation Foundation (NSF) Standard Number 40, and that the applicant provide warranties, service policies, an owner's manual, and service schedule as set forth therein.
22	This policy provides further guidance on determining when primary and secondary sewage treatment is needed, and when can a traditional septic tank and leach field be used.

Policy #	Summary
23	Conditions for approval of on-site wastewater package sewage treatment facility for a proposed project.
23a	Requirement for a preliminary hydrogeologic study, and a groundwater monitoring program, for subsurface disposal of treated effluent from package treatment plants.
24	Template for failure evaluation report of a subsurface on-site wastewater disposal system.
25	A summary description of the factors that contribute to failures of wastewater disposal systems.
26	A step-by-step description of the registration and annual inspection procedures for septic pumper trucks.
27	Position paper explaining why using graywater for irrigation of lawns is not allowed in the County, unless a drought emergency is declared by the Board of Supervisors. This policy has been superseded by practice.
28	Alternatives for dispersal fields of onsite sewage disposal systems in new subdivisions.
29	Guidance on the use of distribution boxes versus "T"s and elbows in dispersal fields.
30-30A	Notification to property owners of restrictions and alternatives for on-site sewage disposal systems in flood plains or areas where there is a high groundwater table.
31	General guidelines for on-site sewage systems in the "red line areas" of Oakdale, Valley Home, Knights Ferry and the eastern foothills.
32	Guidelines for septic tank destruction and concurrent sewer hook-up.
33	Sets minimum land area required for construction of a septic system as a function of depth to the water table. It also sets minimum distance requirements between wells, streams, or lakes, and septic tanks, leach lines, and seepage pits.
34 - 34A	For commercial properties that use on-site sewage disposal, this policy prohibits waste water, spills, and other liquids from entering floor drains and discharging into septic tanks or aerobic treatment plants and/or subsurface disposal fields.
34B	Guidelines to assist commercial property owners, and their design engineers, when determining the appropriate size of a holding vault to accommodate accidental spills or leaks.
35	Formal adoption by SCDER of the Percolation Test protocol and wastewater application rates described in the EPA design manual, On-site Wastewater Treatment and Disposal Systems, 1980.
36	Suggested standard operating protocol for SCDER Environmental Health responders to sewage emergencies such as (a) sewage discharge into waterways, (b) sewage backup within a food facility, (c) sewage surfacing in residential dwellings and/or yards, and (d) sewage surface discharge onto public areas.
36A	Policy and procedures to be followed by SCDER in response to a complaint of surfacing sewage.
37	Guidelines for selection of on-site sewage disposal systems (traditional septic tank versus aerobic treatment systems) in agriculture-zoned parcels, and a determination on whether a permit is or is not required for different types of structures.
38	Guidelines for determining whether a Septic Repair Permit (and a follow-up inspection) is required or not.
39	On-site sewage disposal requirements for temporary mobile home use, even when special use permits are issued by the County Planning Department.
40	Policy on hold.

Policy #	Summary
41	In situations when the groundwater is high, a leach bed/evaporation bed can be installed. Guidance is given for the size of such alternative.
42	Policy and procedure for emergency abatement of an unsafe condition (including sewage emergencies).
43	Policy and procedure for summary abatement of an unsafe condition (not restricted to, but including sewage emergencies). A summary abatement takes place when the property owner is unable or unwilling to perform the abatement, and the County does it and later bills the owner.

The Stanislaus County liquid waste program has now adopted, and enforces, Part 5, Title 24 of the California Code of Regulations (effective January 1, 2014) and Environmental Health policies/guidance documents for OWTS.

Percolation rate testing method, as approved by Stanislaus County:
A percolation test consists of digging an 8-inch hole in the soil to the design depth, presoaking the hole by maintaining a high water level in the hole, then running the test by filling the hole to a specific level and timing the drop of the water level as the water percolates into the surrounding soil. Results are reported as minutes per inch of drop per the bottom area of the hole, from which one can calculate percolation rate in gallons per square feet per day.

For leach line testing, a minimum of three (and up to five) test holes are drilled, each eight inches in diameter, in a pattern of one hole at opposite corners of the proposed leach field (and the 100% future expansion area) and one test hole in the center. These holes should be drilled to the design depth below the surface.

Testing for horizontal pits typically requires five to eight test holes drilled in a straight line, or along a common contour, to the design depth. Testing is identical to leach line testing.

6. TIER 0 ASSESSMENT

There is no comprehensive record of all septic tanks existing in Stanislaus County. However, since 1984 Stanislaus County has required a permit for the construction of new OWTS, and for the repair or destruction of OTWS built before 1984. An estimated 5,000 registered OWTS have been built, repaired, or decommission since 1984. Many of these registered OWTS fall in the Tier 0 category. By the letter of the OWTS policy:

6.1 Existing OWTS are automatically covered by Tier 0 and the therein included waiver of waste discharge requirements if they meet the following requirements:

6.1.1 Have a projected flow of 10,000 gallons-per-day or less. Using the values on Table H 2.1 of the California Plumbing Code, three-bedroom residences could be expected to generate sewage at a rate of 450 gallons per day (or 150 gpd per bedroom), and clusters of 10 such residences sharing the same OWTS would be expected to generate 4,500 gallons per day. These numbers are substantially less than the 10,000 gpd waiver-threshold. Most of the existing and registered OWTS in Stanislaus County, are thus automatically covered by this waiver criterion of Tier 0.

6.1.2 Receive only domestic wastewater from residential or commercial buildings, or high-strength wastewater from commercial food service buildings that does not exceed 900 mg/L BOD and has a properly sized and functioning oil/grease interceptor (a.k.a. grease trap). Most of the existing and registered OWTS are exempt under this waiver criterion. The county has vibrant food and food processing industries, but these are clustered in the industrial portions of Modesto, Turlock, and Ceres, and all these cities have operating sewers.

6.1.3 Continue to comply with any previously imposed permitting conditions. The County has two subdivisions (Del Rio 1 and Del Rio 2) that operate packaged treatment plants. Even though these plants are currently under oversight by the state, the County receives courtesy notifications and, upon review, has consistently concluded that owners continue to comply with the permit conditions.

6.1.4 Do not require supplemental treatment under Tier 3. Stanislaus County does not have listed impaired surface or groundwater, so we do not have Tier 3 systems (303(d) waters).

6.1.5 Do not require corrective action under Tier 4. Stanislaus County responds quickly to notifications of surfacing sewage, and promptly directs owners to take corrective action. The county inspectors may direct destruction of the septic tank, mandate repairs, or mandate relocation of the leach lines prior to re-authorizing the faulty OWTS. While under corrective action, these systems have a Tier 2 requirement to be monitored.

6.1.6 Do not consist of a cesspool as a means of wastewater disposal. We have no existing cesspools left in the county, and we will not allow cesspools in the future. Dairy lagoons for dairies are monitored by the RWQCB.

In summary, most of the new and existing OWTS in Stanislaus County are covered by Tier 0, and do not require further action regarding monitoring or inspection. A few remaining OWTS, and any future replacement or new OWTS, automatically fall into Tier 1/Tier 2 scrutiny.

7. TIER 1 ASSESSMENT

As stated in the previous section, Section 20.56.170 of the County ordinance formally adopts the following RWQCB guidelines:

> Individual sewage disposal systems, when permitted, shall be constructed in compliance with the provisions of that certain document entitled "Guidelines for Waste Disposal from Land Developments" and amendments and revisions thereto, as adopted by the Central Valley Regional Water Quality Control Board of the state for the protection of the public health by regulating the discharges from individual sewage disposal systems. (Ord. CS 179 §1, 1986; Ord. NS 1061 §2, 1981; prior code §9-43(b)(10)).

Because the ordinance adopted "amendments and revisions thereto, as adopted by the Central Valley Regional Water Quality Control Board" the guiding document is now the June 19, 2012, OWTS Policy – Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems.

Local agencies may submit Tier 2 management programs that depart from Tier 1 guidance. Local Agency Management Programs (LAMP) approved under Tier 2 provide an alternate method from Tier 1 programs to achieve the same policy purpose, which is to protect water quality and public health. Stanislaus County proposes to adopt a Tier 2 set of guidelines that, when finally approved by the RWQCB and the County Board of Supervisors, will be the sole regulation governing the design, installation, and repair of OWTS in Stanislaus County.

8. TIER 2 GUIDANCE ASSESSMENT

Recognizing that OWTS standards set by the State Water Resources Control Board for the protection of groundwater quality work best when adapted to the unique conditions of each county, and even subareas within each county, Stanislaus County proposes to adopt a Tier 2 set of guidelines that, when finally approved by the RWQCB and the County Board of Supervisors, will be the sole regulation governing the design, installation, and repair of OWTS in Stanislaus County.

Cases not covered by the Tier 2 guidance (Appendix 1) will be evaluated on a case-by-case basis, taking in consideration designs approved by a qualified professional, the spirit of the Tier 1 guidance, the nature of local soils, and the local depth to the water table. Potentially problematic conditions related to soil and/or groundwater will be investigated by a qualified professional.

The following table summarizes the Tier 1 standards (columns 1 and 2), the current state of practice in Stanislaus County (column 3), and the proposed Tier 2 program (column 4). Again, the goal is to follow closely Tier 1 standards, except in cases where local conditions and experience support a different approach. The draft guidance for adoption of the Tier 2 Management of Onsite Wastewater Treatment Systems is included as Appendix 1.

Site Evaluation and Siting Standards			
Section 7.0	**Tier 1 guidance**	**Current practice in Stanislaus County**	**Content of the new Tier 2 standards**
7.1 –Qualified professional in charge of soil and site evaluations	When soil evaluation is required, the evaluation shall be conducted by a qualified professional.	Stanislaus County only requires site-specific soil evaluation for areas where (1) the County soil maps, or County experience, indicate soils with extremely low or extremely high percolation rates; or (2) when the project owner proposes a specially engineered design. The soil evaluation is conducted by the County inspectors, who have been specially trained by a qualified professional.	Current practice will be retained, since it meets the spirit of the Tier 1 guidance, and has proved expeditious and convenient in the installation of OWTS in the County.

Section 7.0	Tier 1 guidance	Current practice in Stanislaus County	Content of the new Tier 2 standards
7.2 – Depth of soil profile	Soil depth must be determined through the use of soil profile(s) in the dispersal area and the designated dispersal system replacement area, as viewed in excavations exposing the soil profiles in representative areas, unless the local agency has determined through historical or regional information that a specific site soil profile evaluation is unwarranted.	Required only in areas known to have thin soil profiles, such as in geomorphic regions 1 and 4. Not required in geomorphic regions 2 and 3.	Tier 1 language, which is consistent with current practice
7.3 - Site evaluation	Sites are evaluated by percolation rate (see 7.4) and the depth to groundwater (no less than 5 ft, as determined by inspection of soils, or historical monitoring data).	Depth to groundwater can also be evaluated by geomorphic region and measurements in nearby wells.	Tier 1 language, but with the option of not requiring percolation tests based on current knowledge of the area.
7.4 - Percolation test results	Percolation test results in the effluent disposal area shall not be faster than one minute per inch (1 MPI) or slower than one hundred twenty minutes per inch (120 MPI).	Acceptable limits of percolation for drainfield suitability range between 1 and 120 minutes per inch (US EPA, 1980). Percolation tests are not required for the five soils identified in Table H.2.1(2) of the California Plumbing Code.	Allowable application rates are set by a 3-step procedure (Appendix 1, page 46). Standard design only approved for percolation rates between 1 and 120 MPI.
7.5 - Minimum horizontal setbacks from any OWTS treatment component and dispersal systems	Section 7.5 in Appendix 2. Minimum horizontal setbacks.	Some setback distances different than Tier 1	Current practice will be slightly modified, as summarized in pages 44 and 45 (Appendix 1), to incorporate additional setbacks included in Tier 1.

Section 7.0	Tier 1 guidance	Current practice in Stanislaus County	Content of the new Tier 2 standards
7.5.7 - Effluent dispersal system setback requirements	Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, then the dispersal system shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.	This issue has not been addressed by the County, although existing OWTS are present at both Woodward and Modesto Reservoirs. Further discussion is presented in Appendix 4.	Tier 1 language, as applied to new OWTS systems.
7.5.8 - Effluent dispersal system setback requirements	Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, then the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.	No known case	Tier 1 language
7.6 – Permit requirements within 1200 feet of intake point	Provide copy of the OWTS permit application to the owner of the surface water treatment plant (or CDPH – Drinking Water Program) with a topographical map	Not previously required.	Tier 1 language
7.7 - Natural ground slope	<25%for effluent disposal	<30%for effluent disposal	Tier 1 language
7.8 - Average density for any subdivision of property made by Tentative Approval pursuant to the Subdivision Act Map	Allowable average densities per subdivision under Tier 1 is dependent on the average annual rainfall (in/yr) (Table 1in the next page)	Allowable average densities per subdivision are a function of depth to the water table (Table 2in the next page)	Current practice will be retained, as being more conservative*

*Justification: The County has an overall annual rainfall of 0 to 15 inches, so based on the criterion of Table 1, all dwellings should have a minimum land area of 2.5 acres. For the Tier 2 program we intend to use the standards in Table 2 as (1) being more stringent where the water table is low, and thus more susceptible to contamination; (2) just as stringent as those in Table 1 when the water table is between 5 and 12 ft bgs, (3) more realistic (and lenient) when the subdivision is connected to a public water supply or to sanitary sewer service.

Table 1: Allowable Average Densities per Subdivision under Tier 1.

Average annual rainfall (in/yr)	Allowable density (acres for each dwelling unit)
0 - 15	2.5
>15 - 20	2
>20 - 25	1.5
>25 - 35	1
>35 - 40	0.75
>40	0.5

Table 2: Allowable average densities per subdivision under current practice and proposed Tier 2.

Depth to the water table (ft bgs)	Allowable Density (acres for each dwelling unit)
5 ft or less, and water supply by onsite well	3 acres
Over 5 ft but less than 12 ft, and water supply by onsite well	2 acres
12 ft and over, water supply by onsite well, and subdivision outside of a sanitary sewer service area	1 acre plus 9,000 sq. ft for each bedroom in excess of four
12 ft and over, all main buildings connected to a public supply system, subdivision within an adopted sanitary sewer service area, but "dry sewers" not required. No OWTS are allowed.	20,000 sq. ft, plus 4,500 sq. ft for each bedroom in excess of three
12 ft and over, all main buildings connected to a public supply system, "dry sewers" required. No OWTS are allowed.	Single family dwellings – 9,000 sq. ft; two-family dwellings – 13,500 sq. ft; multiple family dwellings – 13,500 sq. ft plus 4,500 sq. ft for each dwelling unit in excess of three, plus 1,000 sq. ft for each bedroom in excess of an average of two per unit

OWTS Design and Construction Standards			
Section 8.0	**Tier 1**	**Current**	**Tier 2 (LAMP)**
8.1.1 - OWTS Design and Construction Standards	All new OWTS and modifications to existing OWTS shall be designed by a qualified professional. A qualified professional employed by a local agency may design, review and approve a design for an OWTS.	In practice, simple dispersal fields do not require engineering design and can be planned by experienced installers. Engineered OWTS are required for non-standard designs, and on areas known to the County to have unfavorable soil and groundwater conditions (redlined in maps available for inspection by project owners and their engineers). SCDER staff has EH and PG certifications.	Current practice will be retained, as it has proved expeditious and convenient in the installation of OWTS in the County.
8.1.2 - OWTS location, design, and construction	OWTS shall be located, designed, and constructed in a manner to ensure that effluent does not surface at any time, and that percolation of effluent will not adversely affect beneficial uses of waters of the State	Same as in Tier 1	Tier 1 language, which is consistent with current practice
8.1.3 - Design of new and replacement OWTS shall be made based on:	• Expected influent water quality • Flow no larger than 3,500 GPD • Expected peak flow for sizing the hydraulic components • Projected average daily flow for sizing the dispersal field. • Characteristics of the site • Required level of treatment.	Same as Tier 1, but allowing up to 10,000 GPD of flow	Tier 1 language, but new projects that plan to exceed 10,000 GPD flow must have WDRs and MPs approved by the RWQCB.
8.1.4 - Soil cover thickness over dispersal systems	At least 12 inches, but pressure distribution systems must have at least 6 inches.	At least 18 inches or as per engineer's design	Tier 1 language will be adopted.

Section 8.0	Tier 1	Current	Tier 2 (LAMP)
8.1.5 - Minimum depth to the water table, measured from the bottom of the dispersal system	Dependent on the percolation rate, as listed in Table 2 (page 56 of this LAMP), but with 5 ft as a minimum.	Based on the most common type of soil in the County (sandy loam), we require 5 ft minimum depth to groundwater from the bottom of the leachfield; or 10 ft minimum depth to groundwater for seepage pits. Unfavorable soil conditions (e.g., sandy soils or tight clay soils) trigger additional requirements, which are in general consistent with the Tier 1 approach.	Current practice will be retained, but will clarify the additional requirements in case of unfavorable soil conditions.
8.1.6 - Dispersal system shall be a leachfield, designed…	Using not more than 4 square-feet of infiltrative area per linear foot of trench, and with trench width no wider than 3 feet. Maximum application rates shall be determined from stabilized percolation rate as provided in Table 3 from the OWTS Policy (Appendix 1, page 61), or from soil texture and structure determination as provided in Table 4 from the OWTS Policy (Appendix 1, page 62).	The current practice is to have all trenches be no more than 3-ft wide. For a "single depth" (1 ft of gravel under the perforated pipe) leachfield we use a 3 ft^2 per linear foot absorption area. For a "double depth (2 ft of gravel under the perforated pipe) leachfield we use 5 ft^2 per linear foot. Finally, for a "triple depth" (3 ft of gravel under the perforated pipe) leachfield we use 7 ft^2 per linear foot. Narrower widths are evaluated on a case by case basis.	Current practice will be retained, and the appropriate infiltration area will be determined by the 3-step procedure detailed in Section 8.1.6 of the Guidance.
8.1.6 - Seepage pits and other dispersal systems	Authorized for repair only when siting limitations require a variance.	Current practice allows horizontal seepage pits only where the depth to the water table is greater than 10 ft from the bottom of the pit, where the soils have low percolation rates, and there are lot size limitations. Special conditions are evaluated on a case-by-case basis.	Current practice will be retained, as it has proved expeditious and convenient in the installation of OWTS in the County.
8.1.6 - Leachfield trench width	No wider than 3 feet	Current practice is a maximum of 3 feet, but evapotranspiration beds are allowed to be wider, if properly designed. Special conditions are evaluated on a case-by-case basis.	Current practice will be retained, as expeditious and convenient.

Section 8.0	Tier 1	Current	Tier 2 (LAMP)
8.1.7 - Dispersal systems depth	Dispersal systems shall not exceed a maximum depth of 10 feet as measured from the ground surface to the bottom of the trench.	No maximum depth specified, although the practice is no more than 10 feet for dispersal fields, and no more than 15 ft for horizontal seepage pits; the latter are only allowed when depth to the water table is in excess of 10 ft from the projected bottom of the pit.	Current practice will be retained, as it has proved expeditious and convenient in the installation of OWTS in the County.
8.1.8 - Dispersal systems replacement area	All new dispersal systems shall have a 100% replacement area that is equivalent and separate, and available for future use.	All new dispersal systems must have a 100% replacement area available for future use.	Tier 1 language, which is consistent with current practice
8.1.9 - Dispersal systems and replacement areas	Not to be covered by impermeable surface such as paving, building foundation, slab, or plastic sheeting.	An asphalt cover has been allowed, as long as the square footage of the installed leachfield was doubled. Permeable covers such as gravel or paving stones interspersed with grass are allowed and preferred.	Tier 1 language, amended to allow only permeable covers such as gravel and paving stones interspersed with grass.
8.1.10 –Allowable content of coarse particles in native soil	The native soil surrounding the dispersal system shall not have more than 50% by volume of rock fragments sized as cobbles or larger (i.e., larger than 64 mm in diameter).	No formal restriction, but systems are not allowed in soils classified as gravels.	Tier 1 language, which is consistent with current practice
8.1.11– Management of IAPMO (International Association of Plumbing and Mechanical Officials) certified dispersal systems.	Decreased leaching area for IAPMO-certified dispersal systems is not allowed.	Allows decreased leaching area for IAPMO-certified dispersal systems, using a multiplier of no less than 0.70	Current practice will be retained
OWTS Construction and Installation			
8.2.1 - All new or replacement septic tank, grease interceptors, and aerobic units must…	…comply with the standards contained in Sections K5(b), K5(c), K5(d), K5(e), K5(k), K5(m)(1), and K5(m)(3)(ii) of Appendix K, of Part 5, Title 24 of the 2007 California Code of Regulations.	Same as Tier 1	Tier 1 language, adapted to the 2013 edition of the California Plumbing Code

Section 8.0	Tier 1	Current	Tier 2 (LAMP)
8.2.2.1 - All new septic tanks access openings must have	.. watertight risers, the tops of which shall be set at most 6 inches below finished grade	Rises are not required for conventional systems. Rises are required for aerobic systems, which by design are set at a shallow depth.	Current practice will be retained, as it has proved expeditious and convenient in the installation of OWTS in the County.
8.2.2.2 - All new septic tanks access openings at grade or above …	… shall be locked or secured to prevent unauthorized access.	Locking not required, but modern aerobic systems come with locks.	Current practice will be retained because 95% of tanks have heavy concrete lids and are below grade under 24 inches of soil. Aerobic systems are required to be locked.
8.2.3 - All new and replacement OWTS septic tanks are …	… limited to those approved by IAPMO, or certified by a registered civil engineer as meeting industrial standards, and installation shall be according to manufacturer's instructions.	Same as Tier 1	Tier 1 language, which is consistent with current practice
8.2.4 - New and replacement OWTS tanks shall be designed to …	… prevent solids in excess of three-sixteenths (3/16) of an inch in diameter from passing to the dispersal system.	Filtering not required	Current practice will be retained because of the operational problems associated with maintaining a filter. A clogged filter could lead to system failure.
8.2.5 - Installation of new and replacement of OWTS shall be by …	… a General Engineering Contractor class A, a General Building contractor B, a Sanitation System Contractor C-42, or a Plumbing Contractor C-36.	Same as Tier 1	Tier 1 language, which is consistent with current practice

Section 8.0	Tier 1	Current	Tier 2 (LAMP)
8.2.5 - Installation of new and replacement of OWTS by property owner	A property owner may install his/her own OWTS, if the as-built diagram and the installation are inspected and approved by the RWQCB or the local agency.	A property owner may install his/her own OWTS if permitted, inspected, and approved by DER	Current practice which is consistent with Tier 1

The following additional statements have been included in the County's Tier 2 guidance:

1. The County expects a very limited number of cases to be transferred from RWQCB oversight to Local Agency oversight, namely packaged treatment plants with a daily flow between 5,000 and 10,000 gallons per day. These plants are currently subject to quarterly monitoring requirements, which the County will continue as part of its oversight.
2. In cases of OWTS repairs or new installations within 1,200 ft of the intake of a known public water system, the Department of Environmental Resources (DER) will notify in writing the manager of said public water system. This notification will be within 15 days following the permit request. In the case of a OWTS failure, public well and water intake owners within 1,200 ft, and the California Department of Public Health, will be notified as soon as practicable, but no later than 72 hours upon discovery of a failing OWTS.
3. Permit applications that include alternate siting, design, construction, and operation of OWTS not covered in the provisions of the Tier 2 Guidance will be evaluated on a case-by-case basis, adhering to good civil engineering design, the California Uniform Plumbing Code, the spirit of the Regional Water Quality Control Board's OWTS Policy, and best practices suited to the local conditions of Stanislaus County.

9. TIER 3 EXPERIENCE

The State Water Resources Board has not listed any impaired surface or groundwater bodies in Stanislaus County (303(d) waters), so we have no systems that require Tier 3 action.

10. TIER 4 EXPERIENCE

The Dept. of Environmental Resources of Stanislaus County has considerable experience inspecting failing septic tanks, and guiding the owners through the process of repair. From 2000 to 2013, SCDER issued 3,910 permits for repairs, replacements, or destruction of septic systems. 86 of these permits were canceled; of these 67 were canceled within a month of issue, and 19 were canceled within a month to two years of issue. Review of the database, which is available as an Excel file on request, has made SCDER aware that additional information needs to be collected regarding each case, including a formal statement for the reason a permit was requested, and a final statement on the part of the inspector (e.g., satisfactory completion of the repair, satisfactory completion of the replacement leach line, or in-situ closure of the septic tank).

In the “typical case” SCDER will be alerted to a septic tank malfunction because of a complaint of “sewage smell” or actual seepage of sewage. The most common causes are overload of the system because too many people live in a single home, failure to pump the septic tank out every 5 to 10 years, or progressive loss of infiltration capacity due to clogging of the leachate field. The most common solutions to these problems are replacement and relocation of the leachate field.

During 2000 to 2013, 441 permits were issued for repairs to existing septic systems. 6 of these permits were cancelled, leaving a total of 435 permits for septic tank repairs. 397 of these repairs were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The 38 cases where a permit was issued but the job was not inspected have been flagged as Tier 4 cases for future inspection.

During 2000 to 2013, 896 permits were issued for replacement of the leach field of existing septic systems. 14 of these permits were cancelled, leaving a total of 882 permits for leach field replacement. 792 of these repairs were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The 90 cases where a permit was issued but the job was not inspected have been flagged as Tier 4 cases for future inspection.

During 2000 to 2013, 323 permits were issued for destruction of an existing septic system. 7 of these permits were cancelled, leaving a total of 316 permits for OWTS destruction. 278 of these repairs were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The 38 cases where a permit was issued but the job was not inspected have been flagged as Tier 4 cases for future inspection.

The data for 2000 to 2013 gives a general idea of the type of OWTS used in the county. 66% of the permits (2,593 permits) were issued for systems where the disposal was through a leach lines field, whereas 34% of the permits (1,317 permits) were issued for systems where the disposal was through one or more horizontal seepage pits. The leach lines ranged in length from 20 to 140 ft (spread between the 5 and 95 percentiles), with an average length of 55 ft. In contrast, the horizontal seepage trenches ranged in length from 10 to 45 ft (spread between the 5 and 95 percentiles), with an average length of 20 ft.

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APPENDIX 1. PROPOSED TIER 2 GUIDANCE

Guidance to the Construction and Operation of Onsite Waste Treatment Systems

This Guidance to the Construction and Operation of Onsite Waste Treatment Systems is mandated by Section 20.56.170 (B) of the Stanislaus County Code. It is the guiding document for the siting, construction, operation, and maintenance of Onsite Waste Treatment Systems (OWTS) in Stanislaus County.

The provisions of the Guidance will be monitored and enforced by the Stanislaus County Department of Environmental Resources (SCDER). SCDER believes that:

1. The protection of the health, welfare, and safety of the residents of the county require that onsite wastewater disposal systems (OWTS), such as septic tanks and packaged treatment plants, be sited, designed, constructed, and operated in accordance to best engineering and management practices.

2. Best OWTS practices can be achieved by adherence to good civil engineering design, the California Uniform Plumbing Code, the spirit of the Regional Water Quality Control Board's OWTS Policy, and best practices suited to the local conditions of Stanislaus County and the information contained herein.

3. SCDER is committed to promptly address failures and complaints related to OWTS, with the purpose of protecting water quality and human health.

1. Definitions.

IAPMO means International Association of Plumbing and Mechanical Officials.

OWTS means Onsite Wastewater Treatment Systems, which include but are not limited to septic tanks, horizontal seepage pits, vertical seepage pits, aerobic septic tanks, and packaged treatment plants.

RWQCB means Regional Water Quality Control Board.

SCDER means Stanislaus County Department of Environmental Resources.

SCPCD means Stanislaus County Department of Planning and Community Development.

DDW means State Water Resources Control Board, Division of Drinking Water.

2.Permit Requirements.

2.1 The Stanislaus County Department of Planning and Community Development Services shall inform all applicants for building permits for new residential construction or commercial project construction that a permit is required for construction of an Onsite Wastewater Treatment System. Such permit will be issued by the Stanislaus County Department of Planning and Community Development (SCPCD), but will

be reviewed by SCDER, and will conform to the provisions of this Guidance. No permit will be issued for construction of cesspools, which are hereby prohibited in the County.

2.2 Where conventional systems are permissible, homeowners may design a OWTS for their own property without the need of a professional, but are still required to obtain a County permit from SCDPCD.

2.3 A County permit is required for the repair or replacement of an existing OWTS. Applications for such permits should be submitted to the Stanislaus County Department of Environmental Resources (SCDER).

2.4 An extra fee will be levied on project owners if geology/hydrogeology review is needed because of regional shallow groundwater, thin soil profiles, unstable slopes, or close proximity to domestic or public supply wells.

2.5 Permits issued by SCDPCD and/or SCDER shall be entered in the County's database. Older hard-copy records should be entered as well in the database, as time permits. Electronic records should be maintained in perpetuity, and should be made available to the Regional Water Quality Control Board within a 10-day period from the time of request.

3. Obligations of the Stanislaus County Department of Environmental Resources (SCDER).

3.1 SCDER will prepare an annual report of the OWTS oversight program. The report should (1) detail numbers and locations of complaints, related investigations, and means of resolution; (2) include numbers and locations of permits for new and replacement OWTS, and their Tiers according to the system used by the Regional Water Quality Control Board;(3) include the number of applications and registrations for septic haulers issued as part of the local registration pursuant to California Health and Safety Code §117400 et seq.; (4) include a summary of the septage disposal reports submitted by septic haulers; (5) include a copy of the Annual Assessment of Nitrate Contamination in Stanislaus County. The report should be submitted by the Director of SCDER to the Regional Water Quality Control Board, on or before June 1 of every year, following the RWQCB approval of this Guidance.

3.2 Starting in 2023, and every 5 years thereafter, SCDER will prepare a Water Quality Assessment Report to document and discuss the impact of OWTS in the regional water quality of the County. The report should (1) identify those areas of the County with a known high density of septic tanks; (2) report trends in the nitrate and pathogen contents of wells included in the State Small Water Systems and GAMA programs; (3) other information deemed pertinent to assess the quality of groundwater in the County; (4) recommended mitigation action, if any. The report should be submitted by the Director of SCDER to the Regional Water Quality Control Board on or before June 1.

3.3 On an annual basis, a qualified professional will assess the nature and extent of nitrate contamination in groundwater, by carefully analyzing water chemistry data collected by the county and by the state, and trends derived from these data. The Annual Assessment of Nitrate Contamination in Stanislaus County shall be submitted to the Director of SCDER on or before May 1 of every year.

3.4 SCDER will notify the California Department of Public Health (i.e., State Board Division of Drinking Water) within 72 hours upon discovery of a failing OWTS located within 150 feet of a public supply water well, or within 1,200 feet of a surface water intake. A failing OWTS is defined as follows:

- Any OWTS that has pooling effluent, discharges wastewater to the surface, or has wastewater backed up into plumbing fixtures because its dispersal system is no longer adequately percolating the wastewater, is deemed to be failing, and no longer meeting its primary purpose to protect public health. Such failing OWTS requires major repair, and as such the dispersal system must be replaced, repaired, or modified so as to return to proper function.
- Any OWTS septic tank failure, such as a baffle failure or tank structural integrity failure, such that either wastewater is exfiltrating or groundwater is infiltrating, is deemed to be failing, and no longer meeting its primary purpose to protect public health. Such failing OWTS requires major repair, and as such shall require the septic tank to be brought into compliance with the requirements of this Guidance.
- Any OWTS that has a failure of one of its components, other than those covered by the two bullets above, such as a distribution box or broken piping connection. Such failing OWTS requires minor repair to return the OWTS to a proper functioning condition.

3.5 SCDER will notify the California Department of Public Health (i.e., State Board Division of Drinking Water) within 72 hours upon discovery of an OWTS that has affected, or might affect, groundwater or surface water to a degree that makes it unfit for drinking or other uses, or is causing a human health or other public nuisance condition, even if not failing.

4. This chapter reserved for future use.

5. This chapter reserved for future use.

6. This chapter reserved for future use.

7. Minimum Site Evaluation and Siting Standards.

7.1 Site-specific soil evaluation may be required for areas where the County soil maps, or County experience, indicate that thin soils or soils with extremely low or extremely high percolation rates might be present. When the project owner proposes a specially engineered dispersal system design, a soil evaluation may be required. The soil evaluation will be conducted by the County inspectors, who will be specially trained by a Professional Geologist (PG), a Professional Engineer (PE geotechnical), or a Certified Soil Scientist (CSS).

Site-specific hydrologic and geotechnical evaluation will be required for the foothills of the Sierra Nevada and the Coast Ranges areas of Stanislaus County, where (1) fractured-bedrock can be expected under a thin soil profile, (2) slope creep or slope failure could damage the OWTS. The evaluation must be performed by a Professional Geologist (PG) or a Professional Engineer (PE geotechnical).

Local hydrogeologic evaluation is required for new or replacement OWTS within a 200 ft radius of a domestic supply well, or within a 600 ft radius of a public supply well. The evaluation must be performed by a qualified professional.

7.2 When required, a site evaluation shall determine that adequate soil depth is present in the dispersal area. Soil depth is to be measured vertically to the point where bedrock, hardpan, impermeable soils, or saturated soils are encountered, or an adequate depth has been determined. Soil depth shall be

determined through the use of soil profile(s) in the dispersal area and the designated dispersal system replacement area, as viewed in excavations exposing the soil profiles in representative areas.

7.3 Site investigation of groundwater level will be required where nearby wells, or County experience, indicates that groundwater might be encountered at less than 10 ft below ground surface. When required, a site evaluation shall determine whether the anticipated highest level of groundwater within the dispersal field and its required minimum dispersal zone is not less than prescribed in Table 1a by using one or a combination of the following methods:

7.3.1 Direct observation of the highest extent of soil mottling observed in the examination of soil profiles, recognizing that soil mottling is not always an indicator of the uppermost extent of high groundwater; or

7.3.2 Direct observation of groundwater levels during the anticipated period of high groundwater. Methods for groundwater depth determination and monitoring shall be decided by the Department of Environmental Resources; or

7.3.3 Depth to groundwater can also be evaluated by geomorphic region and measurements in nearby wells.

7.3.4 Where a conflict in the above methods of examination exists, the direct observation method indicating the highest level shall govern.

Table 1a. Depth to the Water Table and Allowable Average Densities per Subdivision

Depth to the water table (ft bgs)	**Allowable Density (acres for each dwelling unit)**
5 ft or less, and water supply by onsite well	3 acres, coupled with a mounded OWTS design
Over 5 ft but less than 12 ft, and water supply by onsite well	2 acres
12 ft and over, water supply by onsite well, and subdivision outside of a sanitary sewer service area	1 acre plus 9,000 sq. ft for each bedroom in excess of four
12 ft and over, all main buildings connected to a public supply system, subdivision within an adopted sanitary sewer service area, but “dry sewers” not required. No OWTS are allowed.	20,000 sq. ft, plus 4,500 sq. ft for each bedroom in excess of three
12 ft and over, all main buildings connected to a public supply system, “dry sewers” required. No OWTS are allowed.	Single family dwellings – 9,000 sq. ft; two-family dwellings – 13,500 sq. ft; multiple family dwellings – 13,500 sq. ft plus 4,500 sq. ft for each dwelling unit in excess of three, plus 1,000 sq. ft for each bedroom in excess of an average of two per unit

Table 1b. General Disposal Field Requirements

	Minimum	Maximum
Number of drain lines per field	1	-
Length of each line	-	100 feet
Bottom width of trench (preferred 36 inches)	No wider than 36 inches	-
Spacing of lines, center-to-center	12 feet	
Depth of earth cover of lines (preferred 18 inches)	12 inches	-
Grade of drain lines	Level	3 inches per 100 feet
Filter material under drain lines	12 inches	10 feet
Filter material over drain lines	2 inches	-

7.4 Percolation tests will be required for areas where the County soil maps, or County experience, indicate soils with extremely low or extremely high percolation rates. Percolation test results in the effluent disposal area that are faster than 1 minute per inch (1 MPI), or slower than one hundred twenty minutes per inch (120 MPI) indicate the soils are not suitable for standard septic tank design. Rates smaller than 1 MPI trigger concerns about contamination of groundwater by nitrates and bacteria. Rates larger than 120 MPI trigger human health concerns due to ponding sewage.

A percolation test will consist of digging a 6 inch hole in the soil to the design depth, presoaking the hole by maintaining a high water level in the hole, then running the test by filling the hole to a specific level and timing the drop of the water level as the water percolates into the surrounding soil. The test shall be continued until a stabilized rate is achieved. Results will be reported as minutes per inch of drop in water level.

For leach line testing, a minimum of three uniformly spaced test holes will be drilled, each six inches in diameter, in a pattern of one hole at opposite corners of the proposed leach field (and the 100% future expansion area) and one test hole in the center. These holes should be drilled to the design depth below the surface. Testing for horizontal pits will require five to eight test holes drilled in a straight line, or along a common contour, to the design depth. Testing will be identical to leach line testing.

7.5 Minimum horizontal setbacks from any OWTS treatment component and dispersal systems shall be as shown in Table 2, or as otherwise approved by the enforcement agency to ensure equivocal protection of water quality and public health.

In addition to the setbacks shown in Table 2, any new OWTS shall be subject to:

- Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, new dispersal systems shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.
- Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.

Table 2. Minimum horizontal setbacks

Minimum Distance To	Septic Tank	Leach Line	Horizontal Seepage Pit
Building or Structure	5'	8'	8'
Property Line	5'	5'	8'
Private Well	100'	100'	150'
Public Well	150'	150'/200'/600'†	150'/200'/600'†
Streams / River^ / Spring	100'	100'	200'
Lake / Reservoir / Vernal pools	200'	200'	200'
Seepage Pit	10'	12'(CENTER)	12'(CENTER)
Leach Line	10'	12'(CENTER)	12'(CENTER)
Domestic Water Line	5'	5'	5'
Public Water Lines	10'	10'	10'
Distribution Box	5'	5'	5'
Dry Well (Storm Drain)	8'	50'	50'
French Drain	8'	12'	12'
Drainage Course/Unlined Irrigation Ditch	25'	50'	50'
Storm Drainage Ponds	25'	50'	50'
Cut, Bank, or Fill	10'	4h*	4h*

^ Septic tanks and leaching areas can be permitted within the one hundred-year flood plain only if the sewage system and expansion area can be installed a minimum of two hundred feet from the main river channel.

* h = vertical height of cut/bank, measured from top of the bank with 100' maximum unless greater distance is deemed necessary by the Department.

† A 150 feet setback from a public water well where the depth of the effluent dispersal system does not exceed 10 feet; 200 feet from a public water well where the depth of the effluent dispersal system is between 10 and 20 feet; and 600 ft from a public water well when the dispersal system is greater than 20 feet in depth. In the latter case, if the distance is less than 600 feet, then the setback must be greater than the distance for two-year travel time of microbiological contaminants, as determined by qualified professional, but in no case shall the setback be less than 200'.

7.6 Prior to issuing a permit to repair or replace an OWTS, SCDER shall determine if the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and located such that it may impact water quality at the intake point such as being upstream of the intake point for a flowing water body. If the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and is located such that it may impact water quality at the intake point, then:

7.6.1 SCDER shall provide a copy of the permit application to the owner of the water system of their proposal to install an OWTS within 1,200 feet of an intake point for a surface water treatment. If the owner of the water system cannot be identified, then SCDER will notify the State Water Resources Control Board, Division of Drinking Water (DDW). Notification will be done at least 5 working days prior to permit issue.

7.6.2 The permit application shall include a topographical plot plan for the parcel showing the OWTS components, the property boundaries, proposed structures, physical address, and name of property owner.

7.6.3 The permit application shall provide the estimated wastewater flows, intended use of proposed structure generating the wastewater, soil data, and estimated depth to seasonally saturated soils.

7.6.4 The public water system owner shall have 15 days from receipt of the permit application to provide recommendations and comments to the Department of Environmental Resources.

7.7 The natural ground slope in all areas used for effluent disposal shall not be greater than 25 percent. Steeper slopes would be considered only when the permit is accompanied by a slope stability report approved by a registered professional (PE Geotechnical or PG Engineering Geology)

7.8 The average density for any subdivision of property shall not exceed the allowable density values in Table 1a for a single-family dwelling unit, or its equivalent, for those units that rely on OWTS.

7.9 Prior to issuing a permit to repair or replace an OWTS, SCDER shall determine if the OWTS is within the setback distances stated in Section 7.5 from a public supply well. If any of these setbacks is not met, SCDER will assess the performance level of the OWTS in question, and will notify the public water well owner and the California Department of Public Health within 72 hours of the finding.

8. Minimum OWTS Design and Construction Standards

8.1 OWTS Design Requirements

8.1.1 Simple dispersal fields do not require engineering design and can be planned by experienced installers. Engineered OWTS design, prepared by a PE (Sanitation), is required for non-standard dispersal field designs, and on areas known to the County to have unfavorable soil and groundwater conditions. Staff of the Department of Environmental Resources has EH and PG certifications. Alternative dispersal field engineered designs must comply with the standard of practice and the California Uniform Plumbing Code.

8.1.2 OWTS shall be located, designed, and constructed in a manner to ensure that effluent does not surface at any time, and that percolation of effluent will not adversely affect beneficial uses of waters of the State.

8.1.3 The design of new and replacement OWTS shall be based on the expected influent wastewater quality (with a projected flow not to exceed 3,500 gallons per day), the peak wastewater flow rates for purposes of sizing hydraulic components, the projected average daily flow for purposes of sizing the dispersal system, the characteristics of the site, and the required level of treatment for protection of water quality and public health. New projects that plan to exceed 3,500 GPD flow require an engineering report to demonstrate their viability, will be evaluated on a case-by-case basis, and will incur additional review fees. New projects that plan to exceed 10,000 GPD flow will also require Waste Discharge Requirements and Monitoring Plans approved by the Regional Water Quality Control Board.

8.1.4 All dispersal systems shall have at least twelve (12) inches of soil cover, except for pressure distribution systems, which must have at least six (6) inches of soil cover.

8.1.5 When the site is underlain by sandy loams, the minimum depth to the anticipated highest level of groundwater below the bottom of the leaching trench shall not be less than 5 feet for

leachfields, or 10 ft for horizontal seepage pits. Special engineered designs for the disposal field are required for soils that are fast draining (gravelly or sandy soils), or for soils that are very slow draining (clayey soils). Engineered designs will be evaluated on a case-by-case basis taking into account percolation rates, application rates, and depth to groundwater.

8.1.6 Dispersal systems shall be either leachfields or horizontal seepage pits. Leachfields shall have a width of no more than 3-ft for leachfield trenches. For "single depth" leachfields (1 ft of gravel under the perforated pipe and 3-ft wide trenches) 3 ft^2 per linear foot shall be used for infiltration calculations. For "double depth" leachfields (2 ft of gravel under the perforated pipe and 3-ft wide trenches) 5 ft^2 per linear foot shall be used for infiltration calculations. Finally, for "triple depth" leachfields (3 ft of gravel under the perforated pipe and 3-ft wide trenches) 7 ft^2 per linear foot shall be used for infiltration calculations.

Minimum infiltration area shall be determined as follows:

Step 1. The field inspector determines if the site has sandy loam or clayey loams. If not, proceed to Step 2. If yes, use the following table to determine minimum septic tank site and infiltration area:

		For sandy loams	For clayey loams
Number of bedrooms	Minimum septic tank capacity (gallons)	Minimum infiltration area (square feet)	Minimum infiltration area (square feet)
1	1,200	250	600
2	1,200	380	660
3	1,500	570	990
4	1,800	760	1,320
5	2,400	950	1,650
6	2,400	1,140	1,980
>6	Consult DER	Consult DER	Consult DER

Step 2. The field inspector determines if results are available of percolation tests performed in the vicinity of the site. If not, proceed to Step 3. If yes, determine application rate by using the formula *y = 5/SQRT(t)*, where t is the infiltration rate in min/in. Then determine infiltration area by using the formula:

$$\text{Infiltration area in square feet} = \frac{(\text{number of bedrooms})*150}{\text{application rate, y}}$$

For example, if percolation rate is 49 min/in, then y = 5/SQRT(49) = 0.71 gpd/ft^2. For a 3 bedroom house the required infiltration area would then be:

$$\text{Infiltration area in square feet} = \frac{(3 \text{ bedrooms})*150}{0.71} = 634 \text{ square feet}$$

Step 3. The field inspector will direct the project owner to conduct a minimum of 3 percolation tests that are uniformly spaced, following the procedures stated in Section 7.4 of this Guidance.

Percolation test results in the effluent disposal area that are faster than 1 minute per inch (1 MPI), or slower than one hundred twenty minutes per inch (120 MPI) indicate the soils are not suitable for standard septic tank design, and DER should be consulted for acceptable alternate designs. If the percolation rate is within 1 and 120 MPI, then follow the calculation procedure of Step 2 to determine minimum infiltration area.

Horizontal seepage pits are allowed only where the vertical distance between the bottom of the pit and the water table is greater than 10 ft, where the soils have low percolation rates, and where there are lot size limitations. Special site conditions will be evaluated on a case-by-case basis.

Evaporation beds are allowed to be wider than 3 feet, if properly designed. Engineered designs will be evaluated on a case-by-case basis.

8.1.7 Leachfields shall not exceed a maximum depth of 10 feet as measured from the ground surface to the bottom of the trench. For systems between 7 and 10 feet deep, there has to be a minimum separation of 10 feet between the bottom of the dispersal trench and the water table.

8.1.8 All new dispersal systems shall have 100 percent replacement area that is equivalent and separate, and available for future use.

8.1.9 No new dispersal systems or replacement areas shall be covered by an impermeable surface, such as paving, building foundation slabs, plastic sheeting, or any other material that prevents oxygen transfer to the soil. Gravel or paving stones interspersed with grass are allowed as cover.

8.1.10 Rock fragment content of native soil surrounding the dispersal system shall not exceed 50 percent by volume for rock fragments sized as cobbles or larger, and shall be estimated using either the point-count or line-intercept methods.

8.1.11 Decreased leaching area for IAPMO certified dispersal systems is allowed, as long as the multiplier is larger than 0.70.

8.2 OWTS Construction and Installation

8.2.1 All new or replacement septic tanks and new or replacement oil/grease interceptor tanks shall comply with the standards contained in Sections K5(b), K5(c), K5(d), K5(e), K5(k), K5(m)(1), and K5(m)(3)(ii) of Appendix K, of Part 5, Title 24 of the 2013 California Plumbing Code or equivalent paragraphs in later editions of the California Plumbing Code.

8.2.2 The access openings of all new septic tanks shall be covered by at least 6 inches of soil to impede accidental access. Aerobic systems shall have watertight risers, the tops of which shall be set at most 6 inches below finished grade.

8.2.3 New and replacement OWTS septic tanks shall be limited to those approved by the International Association of Plumbing and Mechanical Officials (IAPMO), or stamped and

certified by a California registered civil engineer as meeting the industry standards, and their installation shall be according to the manufacturer's instructions.

8.2.4 A Licensed General Engineering Contractor (Class A), General Building Contractor (Class B), Sanitation System Contractor (Specialty Class C-42), or Plumbing Contractor (Specialty Class C-36) shall install all new OWTS and replacement OWTS in accordance with California Business and Professions Code Sections 7056, 7057, and 7058 and Article 3, Division 8, Title 16 of the California Code of Regulations. A property owner may also install his/her own OWTS if the as-built diagram and the installation are permitted, inspected, and approved by the County Department of Environmental Resources at a time when the OWTS is in an open condition (exposed for inspection and not covered by soil).

8.3 OWTS Notifications

8.3.1 In cases of OWTS repairs or new installations within 1,200 ft of the intake of a known public water system, the Department of Environmental Resources (DER) will notify in writing the manager of the public water system. This notification will be within 15 days following the permit request, and the manager will have 15 days to respond to such notification. In the case of a OWTS failure, public well and water intake owners within 1,200 ft, and the California Department of Public Health, will be notified as soon as practicable, but no later than 72 hours upon discovery of a failing OWTS.

8.4 Oversight Responsibility

8.4.1 SCDER expects a very limited number of cases to be transferred from RWQCB oversight to Local Agency oversight, namely packaged treatment plants with a daily flow between 5,000 and 10,000 gallons per day. These plants are currently subject to quarterly monitoring requirements, which SCDER will continue as part of its oversight.

8.5 Consideration of Site Conditions and Engineered Designs Not Covered in these Guidelines

8.5.1 Permit applications that include alternate siting, design, construction, and operation of OWTS not covered in this Tier 2 Guidance will be evaluated on a case-by-case basis, adhering to good civil engineering design, the California Uniform Plumbing Code, the spirit of the Regional Water Quality Control Board's OWTS Policy, and best practices suited to the local conditions of Stanislaus County and the information contained herein.

9. Prohibitions

9.1 The following are prohibited in Stanislaus County

9.1.1 Cesspools of any kind or size.

9.1.2 OWTS receiving a projected flow of over 10,000 gallons per day without approved Regional Water Quality Control Board Waste Discharge Requirements and Monitoring Program.

9.1.3 OWTS that use any form of effluent disposal that discharges on or above the post-installation ground surface such as sprinklers, exposed drip lines, free-surface wetlands, or a pond.

9.1.4 Slopes greater than 30 percent without a slope stability report approved by a registered professional (PE Geotechnical or PG Engineering Geology).

9.1.5 Decreased leaching area for IAPMO certified dispersal systems using a multiplier less than 0.70.

9.1.6 OWTS that use supplemental treatment without requirements for periodic monitoring or inspections.

9.1.7 OWTS dedicated to receiving significant amounts of wastes dumped from RV holding tanks.

9.1.8 Separation of the bottom of the leachfield to groundwater of less than five feet, except for horizontal seepage pits, for which the separation of the bottom of the pit to groundwater shall not be less than 10 feet.

9.1.9 Installation of new or replacement OWTS where public sewer is available. Extraordinary cases where connecting to the public sewer is technically or financially burdensome will be assessed on a case by case basis.

APPENDIX 2. ORIGINAL TEXT OF TIER 1 STANDARDS

7.0 Minimum Site Evaluation and Siting Standards

7.1 A qualified professional shall perform all necessary soil and site evaluations for all new OWTS and for existing OWTS where the treatment or dispersal system will be replaced or expanded.

7.2 A site evaluation shall determine that adequate soil depth is present in the dispersal area. Soil depth is measured vertically to the point where bedrock, hardpan, impermeable soils, or saturated soils are encountered or an adequate depth has been determined. Soil depth shall be determined through the use of soil profile(s) in the dispersal area and the designated dispersal system replacement area, as viewed in excavations exposing the soil profiles in representative areas, unless the local agency has determined through historical or regional information that a specific site soil profile evaluation is unwarranted.

7.3 A site evaluation shall determine whether the anticipated highest level of groundwater within the dispersal field and its required minimum dispersal zone is not less than prescribed in Table 2 by estimation using one or a combination of the following methods:

7.3.1 Direct observation of the highest extent of soil mottling observed in the examination of soil profiles, recognizing that soil mottling is not always an indicator of the uppermost extent of high groundwater; or

7.3.2 Direct observation of groundwater levels during the anticipated period of high groundwater. Methods for groundwater monitoring and determinations shall be decided by the local agency; or

7.3.3 Other methods, such as historical records, acceptable to the local agency.

7.3.4 Where a conflict in the above methods of examination exists, the direct observation method indicating the highest level shall govern.

7.4 Percolation test results in the effluent disposal area shall not be faster than one minute per inch (1 MPI) or slower than one hundred twenty minutes per inch (120 MPI). All percolation test rates shall be performed by presoaking of percolation test holes and continuing the test until a stabilized rate is achieved.

7.5 Minimum horizontal setbacks from any OWTS treatment component and dispersal systems shall be as follows:

7.5.1 5 feet from parcel property lines and structures;

7.5.2 100 feet from water wells and monitoring wells, unless regulatory or legitimate data requirements necessitate that monitoring wells be located closer;

7.5.3 100 feet from any unstable land mass or any areas subject to earth slides identified by a registered engineer or registered geologist; other setback distance are allowed, if recommended by a geotechnical report prepared by a qualified professional.

7.5.4 100 feet from springs and flowing surface water bodies where the edge of that water body is the natural or levied bank for creeks and rivers, or may be less where site conditions prevent migration of wastewater to the water body;

7.5.5 200 feet from vernal pools, wetlands, lakes, ponds, or other surface water bodies where the edge of that water body is the high water mark for lakes and reservoirs, and the mean high tide line for tidally influenced water bodies;

7.5.6 150 feet from a public water well where the depth of the effluent dispersal system does not exceed 10 feet;

7.5.7 Where the effluent dispersal system is within 1,200 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 400 feet from the high water mark of the reservoir, lake or flowing water body.

7.5.8 Where the effluent dispersal system is located more than 1,200 feet but less than 2,500 feet from a public water systems' surface water intake point, within the catchment of the drainage, and located such that it may impact water quality at the intake point such as upstream of the intake point for flowing water bodies, the dispersal system shall be no less than 200 feet from the high water mark of the reservoir, lake or flowing water body.

7.6 Prior to issuing a permit to install an OWTS the permitting agency shall determine if the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and located such that it may impact water quality at the intake point such as being upstream of the intake point for a flowing water body. If the OWTS is within 1,200 feet of an intake point for a surface water treatment plant for drinking water, is in the drainage catchment in which the intake point is located, and is located such that it may impact water quality at the intake point:

7.6.1 The permitting agency shall provide a copy of the permit application to the owner of the water system of their proposal to install an OWTS within 1,200 feet of an intake point for a surface water treatment. If the owner of the water system cannot be identified, then the permitting agency will notify California Department of Public Health Drinking Water Program.

7.6.2 The permit application shall include a topographical plot plan for the parcel showing the OWTS components, the property boundaries, proposed structures, physical address, and name of property owner.

7.6.3 The permit application shall provide the estimated wastewater flows, intended use of proposed structure generating the wastewater, soil data, and estimated depth to seasonally saturated soils.

7.6.4 The public water system owner shall have 15 days from receipt of the permit application to provide recommendations and comments to the permitting agency.

7.7 Natural ground slope in all areas used for effluent disposal shall not be greater than 25 percent.

7.8 The average density for any subdivision of property made by Tentative Approval pursuant to the Subdivision Map Act occurring after the effective date of this Policy and implemented under Tier 1 shall not exceed the allowable density values in Table 1 for a single-family dwelling unit, or its equivalent, for those units that rely on OWTS.

Table 1: Allowable Average Densities per Subdivision under Tier 1.

Average Annual Rainfall (in/yr)	Allowable Density (acres/single family dwelling unit)
0 - 15	2.5
>15 - 20	2
>20 - 25	1.5
>25 - 35	1
>35 - 40	0.75
>40	0.5

8.0 Minimum OWTS Design and Construction Standards

8.1 OWTS Design Requirements

8.1.1 A qualified professional shall design all new OWTS and modifications to existing OWTS where the treatment or dispersal system will be replaced or expanded. A qualified professional employed by a local agency, while acting in that capacity, may design, review, and approve a design for a proposed OWTS, if authorized by the local agency.

8.1.2 OWTS shall be located, designed, and constructed in a manner to ensure that effluent does not surface at any time, and that percolation of effluent will not adversely affect beneficial uses of waters of the State.

8.1.3 The design of new and replacement OWTS shall be based on the expected influent wastewater quality with a projected flow not to exceed 3,500 gallons per day, the peak wastewater flow rates for purposes of sizing hydraulic components, the projected average daily flow for purposes of sizing the dispersal system, the characteristics of the site, and the required level of treatment for protection of water quality and public health.

8.1.4 All dispersal systems shall have at least twelve (12) inches of soil cover, except for pressure distribution systems, which must have at least six (6) inches of soil cover.

8.1.5 The minimum depth to the anticipated highest level of groundwater below the bottom of the leaching trench, and the native soil depth immediately below the leaching trench, shall not be less than prescribed in Table 2.

Table 2: Tier 1 Minimum Depths to Groundwater and Minimum Soil Depth from the Bottom of the Dispersal System

Percolation Rate	Minimum Depth
Percolation Rate ≤1 MPI	Only as authorized in a Tier 2 Local Agency Management Program
1 MPI< Percolation Rate ≤ 5 MP	Twenty (20) feet
5 MPI< Percolation Rate ≤ 30 MI	Eight (8) feet
30 MPI< Percolation Rate ≤ 120	Five (5) feet
Percolation Rate > 120 MPI	Only as authorized in a Tier 2 Local Agency Management Program

MPI = minutes per inch

8.1.6 Dispersal systems shall be a leachfield, designed using not more than 4 square-feet of infiltrative area per linear foot of trench as the infiltrative surface, and with trench width no wider than 3 feet. Seepage pits and other dispersal systems may only be authorized for repairs where siting limitations require a variance. Maximum application rates shall be determined from stabilized percolation rate as provided in Table 3, or from soil texture and structure determination as provided in Table 4.

8.1.7 Dispersal systems shall not exceed a maximum depth of 10 feet as measured from the ground surface to the bottom of the trench.

8.1.8 All new dispersal systems shall have 100 percent replacement area that is equivalent and separate, and available for future use.

8.1.9 No dispersal systems or replacement areas shall be covered by an impermeable surface, such as paving, building foundation slabs, plastic sheeting, or any other material that prevents oxygen transfer to the soil.

8.1.10 Rock fragment content of native soil surrounding the dispersal system shall not exceed 50 percent by volume for rock fragments sized as cobbles or larger and shall be estimated using either the point-count or line-intercept methods.

8.1.11 Increased allowance for IAPMO certified dispersal systems is not allowed under Tier 1.

8.2 OWTS Construction and Installation

8.2.1 All new or replacement septic tanks and new or replacement oil/grease interceptor tanks shall comply with the standards contained in Sections K5(b), K5(c), K5(d), K5(e), K5(k), K5(m)(1), and K5(m)(3)(ii) of Appendix K, of Part 5, Title 24 of the 2007 California Code of Regulations.

8.2.2 All new septic tanks shall comply with the following requirements:
8.2.2.1 Access openings shall have watertight risers, the tops of which shall be set at most 6 inches below finished grade; and

8.2.2.2 Access openings at grade or above shall be locked or secured to prevent unauthorized access.

8.2.3 New and replacement OWTS septic tanks shall be limited to those approved by the International Association of Plumbing and Mechanical Officials (IAPMO) or stamped and certified by a California registered civil engineer as meeting the industry standards, and their installation shall be according to the manufacturer's instructions.

8.2.4 New and replacement OWTS septic tanks shall be designed to prevent solids in excess of three-sixteenths (3/16) of an inch in diameter from passing to the dispersal system. Septic tanks that use a National Sanitation Foundation/American National Standard Institute (NSF/ANSI) Standard 46 certified septic tank filter at the final point of effluent discharge from the OWTS and prior to the dispersal system shall be deemed in compliance with this requirement.

8.2.5 A Licensed General Engineering Contractor (Class A), General Building Contractor (Class B), Sanitation System Contractor (Specialty Class C-42), or Plumbing Contractor (Specialty Class C-36) shall install all new OWTS and replacement OWTS in accordance with California Business and Professions Code Sections 7056, 7057, and 7058 and Article 3, Division 8, Title 16 of the California Code of Regulations. A property owner may also install his/her own OWTS if the as-built diagram and the installation are inspected and approved by the Regional Water Board or local agency at a time when the OWTS is in an open condition (not covered by soil and exposed for inspection).

Table 3: Application Rates as Determined from Stabilized Percolation Rate

Percolation Rate (minutes per Inch)	Application Rate (gallons per day per square foot)		Percolation Rate (minutes per Inch)	Application Rate (gallons per day per square foot)		Percolation Rate (minutes per Inch)	Application Rate (gallons per day per square foot)
<1	Requires Local Manage-ment Program		31	0.522		61	0.197
1	1.2		32	0.511		62	0.194
2	1.2		33	0.5		63	0.19
3	1.2		34	0.489		64	0.187
4	1.2		35	0.478		65	0.184
5	1.2		36	0.467		66	0.18
6	0.8		37	0.456		67	0.177
7	0.8		38	0.445		68	0.174
8	0.8		39	0.434		69	0.17
9	0.8		40	0.422		70	0.167
10	0.8		41	0.411		71	0.164
11	0.786		42	0.4		72	0.16
12	0.771		43	0.389		73	0.157
13	0.757		44	0.378		74	0.154
14	0.743		45	0.367		75	0.15
15	0.729		46	0.356		76	0.147
16	0.714		47	0.345		77	0.144
17	0.7		48	0.334		78	0.14
18	0.686		49	0.323		79	0.137
19	0.671		50	0.311		80	0.133
20	0.657		51	0.3		81	0.13
21	0.643		52	0.289		82	0.127
22	0.629		53	0.278		83	0.123
23	0.614		54	0.267		84	0.12
24	0.6		55	0.256		85	0.117
25	0.589		56	0.245		86	0.113
26	0.578		57	0.234		87	0.11
27	0.567		58	0.223		88	0.107
28	0.556		59	0.212		89	0.103
29	0.545		60	0.2		90	0.1
30	0.533					>90 - 120	0.1

Table 4: Design Soil Application Rates

(Source: USEPA Onsite Wastewater Treatment Systems Manual, February 2002)

Soil Texture (per the USDA soil classification system)	Soil Structure Shape	Grade	Maximum Soil Application Rate(gallons per day per square foot) [1]
Coarse Sand, Sand, Loamy Coarse Sand, Loamy Sand	Single grain	Structureless	0.8
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	Single grain	Structureless	0.4
Coarse Sandy Loam, Sandy Loam	Massive	Structureless	0.2
	Platy	Weak	0.2
		Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Fine Sandy Loam, very fine Sandy Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Loam	Massive	Structureless	0.2
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Silt Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.4
		Moderate, Strong	0.6
Sandy Clay Loam, Clay Loam, Silty Clay Loam	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	0.2
		Moderate, Strong	0.4
Sandy Clay, Clay, or Silty Clay	Massive	Structureless	Prohibited
	Platy	Weak, Moderate, Strong	Prohibited
	Prismatic, Blocky, Granular	Weak	Prohibited
		Moderate, Strong	0.2

APPENDIX 3. GEOGRAPHIC SOIL ASSOCIATIONS

The soils in Stanislaus County can be grouped in soil associations. As shown schematically in the figure below, each soil association consists of soils formed from similar parent material with only minor or local differences in drainage and stage of profile development, except where erosion has exposed the sediments beneath high alluvial terraces. Under the latter circumstances, relatively young soils have been formed in association with old, terrace soils.

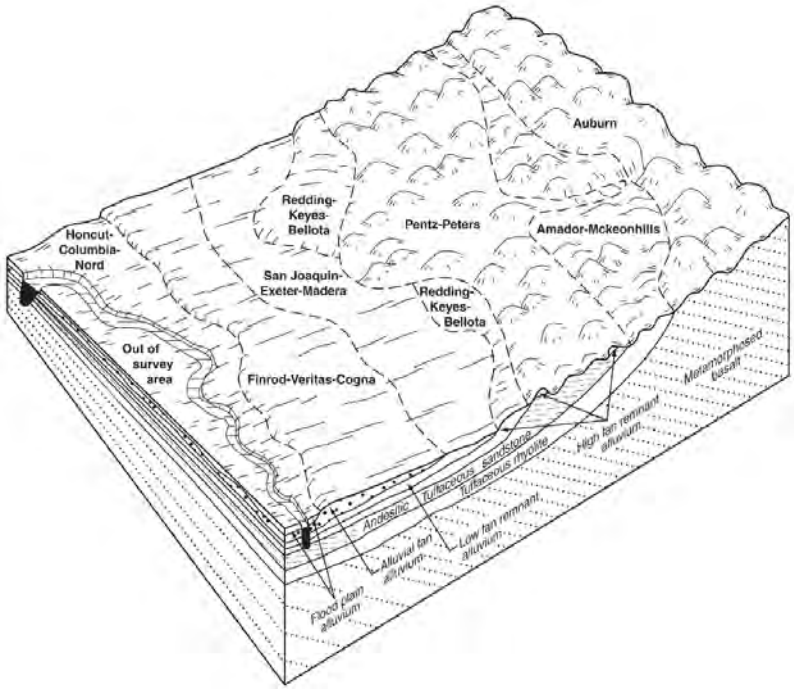


Figure A3-1. Relation between bedrock geology and soil associations in northern Stanislaus County (USDA-NRCS, 2007)

Northern Stanislaus County

The soils in northern Stanislaus County can be grouped into 14 geographic soil associations, as shown in Figure 9. A brief description of each association follows:

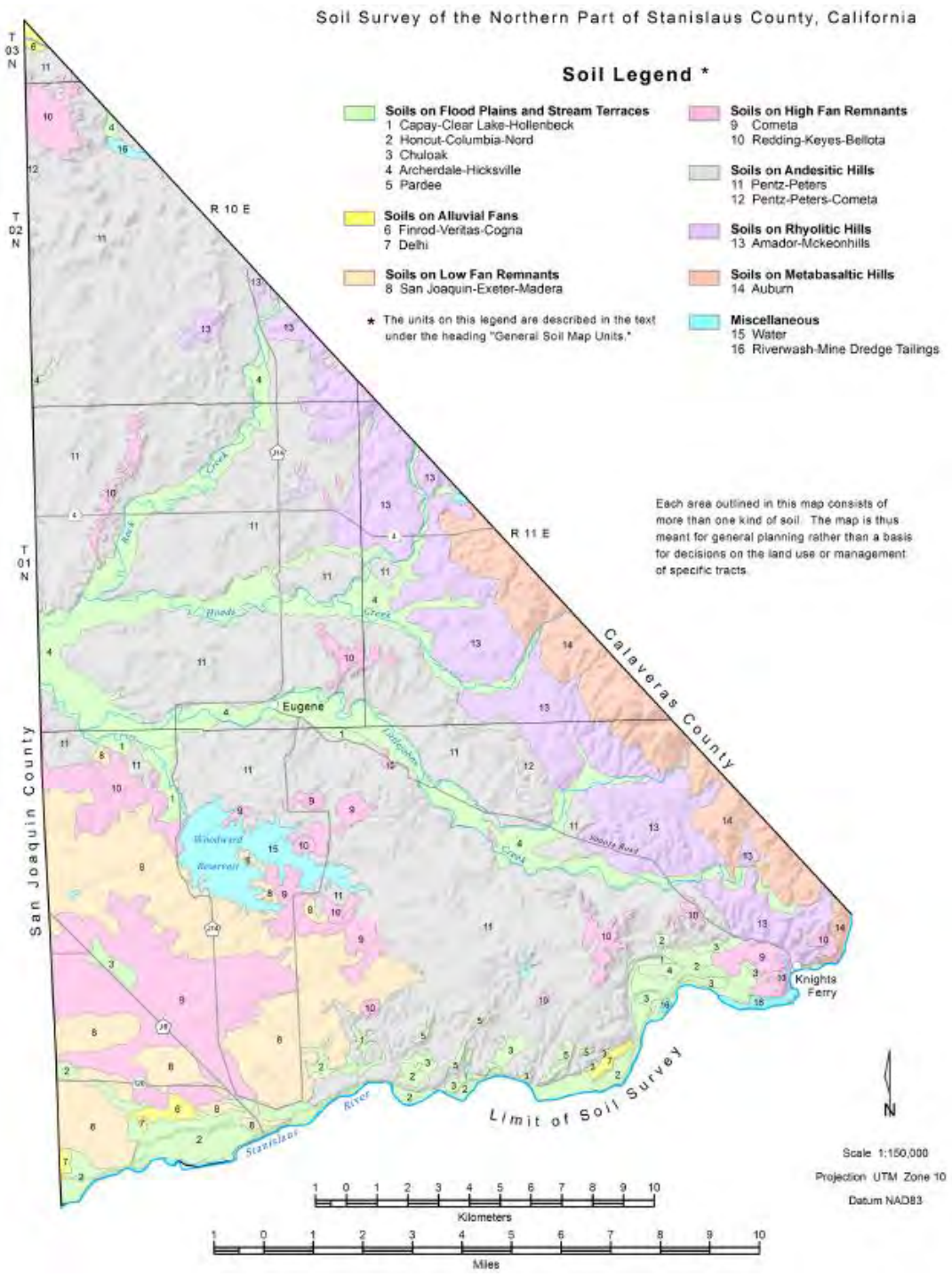


Figure A3-2. Geographic soil associations of northern Stanislaus County (USDA-NRCS, 2007).

Soils on Flood Plains and Stream Terraces

1. Capay-Clear Lake-Hollenbeck. Very deep and deep, nearly level and gently sloping, poorly drained to moderately well drained soils that formed in alluvium derived mainly from

metamorphic and volcanic rock sources; in back swamps on flood plains along creeks that drain rangeland.

2. Honcut-Columbia-Nord. Very deep, nearly level, somewhat poorly drained to well drained soils that formed in alluvium derived from granitoid and mixed rock sources.
3. Chuloak. Very deep, nearly level, moderately well drained soils that formed in alluvium derived from granitoid rock sources.
4. Archerdale-Hicksville. Very deep, nearly level and gently sloping, well drained and moderately well drained soils that formed in alluvium derived from metamorphic and volcanic rock sources.
5. Pardee. Shallow, nearly level and gently sloping, well drained soils that formed in alluvium derived from mixed rock sources.

Soils on Alluvial Fans

6. Finrod-Veritas-Cogna. Very deep and deep, nearly level, well drained soils that formed in alluvium derived from metamorphic and volcanic rock sources.
7. Delhi. Very deep, nearly level, somewhat excessively drained soils that formed in windblown, sandy alluvium derived from granitoid rock sources.

Soils on Low Fan Remnants

8. San Joaquin-Exeter-Madera. Moderately deep to a duripan, nearly level to gently rolling, moderately well drained soils that formed in alluvium derived from granitoid and mixed rock sources.
10. Redding-Keyes-Bellota. Moderately deep and shallow, gently sloping to strongly sloping, moderately well drained soils that formed in fine-loamy alluvium derived from mixed rock sources.

Soils on Andesitic Hills

11. Pentz-Peters. Shallow, gently sloping to steep, well drained soils that formed in material weathered from andesitic, tuffaceous sandstone.
12. Pentz-Peters-Cometa. Shallow and moderately deep, gently sloping to steep, well drained and moderately well drained soils that formed in material weathered from andesitic, tuffaceous sandstone.

Soils on Rhyolitic Hills

13. Amador-Mckeonhills. Shallow and moderately deep, moderately sloping to moderately steep, well drained soils that formed in material weathered from tuffaceous rhyolite and mudstone.

Soils on Metabasaltic Hills

14. Auburn. Shallow, moderately sloping to steep, well drained soils that formed in material weathered from metamorphosed basalt.

Of these soil associations, numbers 7 and 8 present special challenges for the design of leach fields. Soil 7 has very high infiltration rates and may thus not be suitable for traditional leach fields (but they may be suitable for mounded leach fields). In contrast, duripans (i.e., hardpans) found in soil 8 may require special design to facilitate infiltration.

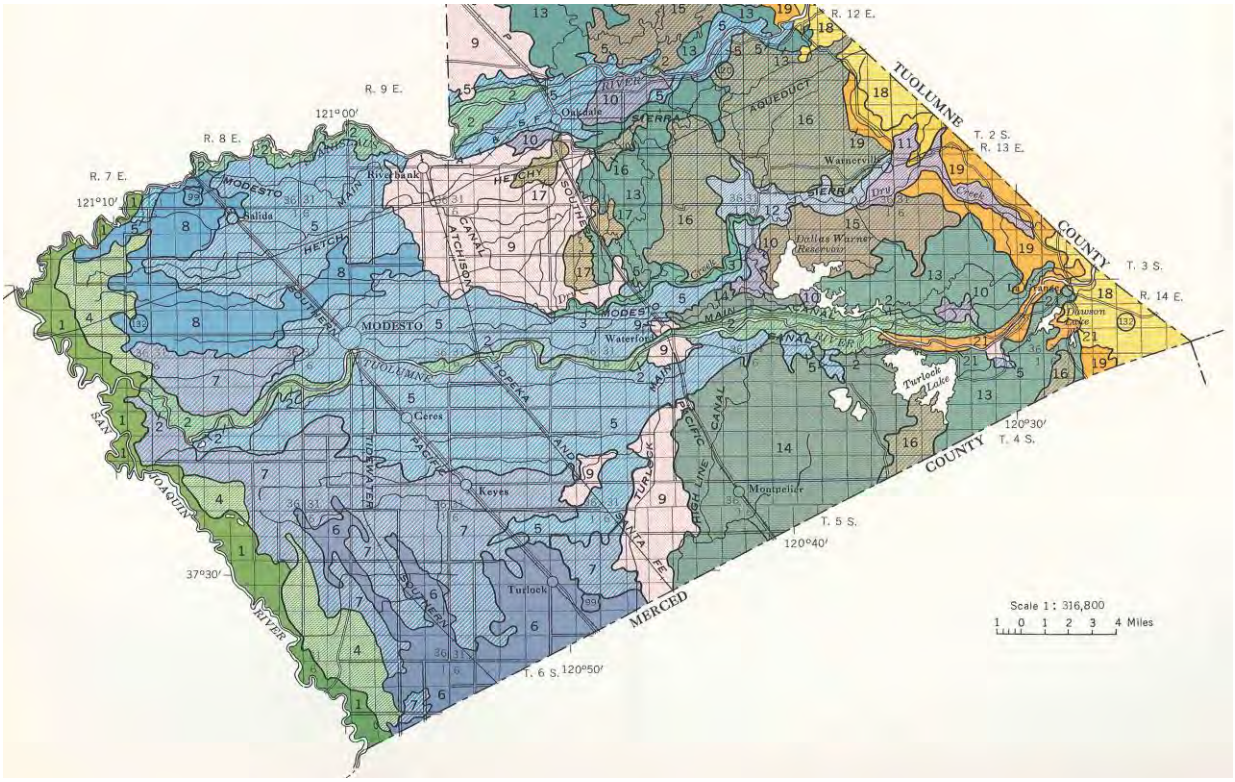
Eastern Stanislaus County

Before development, the flood plains of the major rivers, the San Joaquin, Tuolumne, and Stanislaus, were subject to overflow during periods of high rainfall or rapid snow melt in their watersheds. The fresh alluvium added by each flood retarded or prevented the formation of distinct horizons. The flood plains are nearly level except where they are cut by channels and oxbow depressions.

The water table often rises during periods of rapid runoff, even when floods do not occur. Along the San Joaquin and the lower reaches of the Stanislaus and Tuolumne rivers, soils are generally mottled as a result of these wet periods. A rank growth of grasses, herbaceous plants, and willows has given rise to soils that are high in organic-matter content. Where the soils drain quickly, they are not mottled, and contain somewhat less organic matter.

The flood plains of minor streams, such as Dry Creek, are subject to floods of only short duration, and the soils remain wet long enough to become mottled only in local areas. The rate of deposition of fresh alluvium is slow, and some of the soils have weakly developed profiles.

The soils in eastern Stanislaus County can be grouped into 20 geographic soil associations, as shown in the following figure. Note from the associated soil description that soil associations 1, 2, 7, 12, 13, and 17 may require special attention when designing a leach field because of potentially slow percolation; that soil associations 9, 11, 14, 15, and 16 may require special attention because duripans may hinder infiltration; that soil association 6 requires special attention because of very high percolation rates; and that soil associations 18 and 19 require special attention because the soils tend to be shallow and rocky.



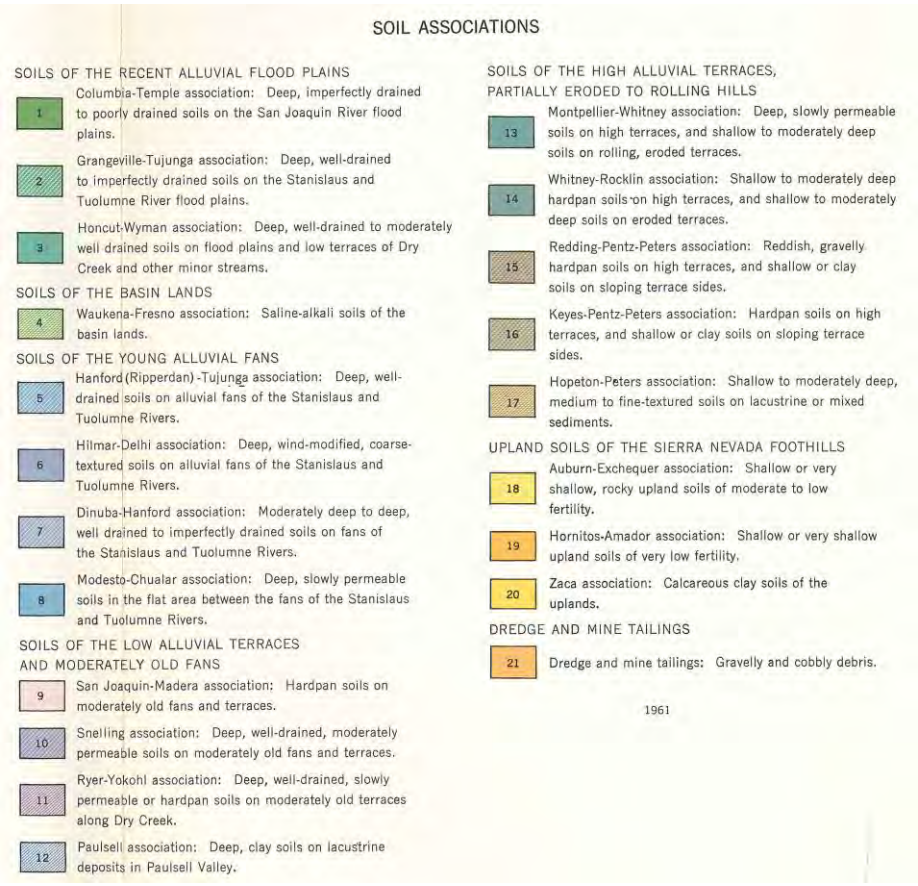


Figure A3-3. Geographic soil associations of eastern Stanislaus County (Arkley, 1964).

Western Stanislaus County

The soils in western Stanislaus County, between the San Joaquin River and Highway 5 can be grouped into five geographic soil associations, as shown in the following figure. A brief description of each association follows:

Soils of the Basin and Basin Rim Lands

1. Columbia-Sacramento. Very deep, nearly level, moderately coarse to fine textured, moderately well to poorly drained soils on the flood plain of the San Joaquin River.
2. Camarillo-Orestimba. Nearly level, medium textured, somewhat poorly to poorly drained, salt affected soils on low lying lands adjacent to the San Joaquin River flood plain.

Soils of the Recent Alluvial Fans

3. Vernalis-Salado. Very deep, very gently sloping, moderately coarse to moderately fine textured, well drained soils on alluvial fans of small streams.
4. Myers-Stomar. Very deep, nearly level, well drained but slowly permeable, clayey soils between or on the lower parts of small stream fans.

Soils of the Older Alluvial Fans

5. Zacharias-Positas. Very deep to moderately deep, nearly level to gently rolling, well drained, gravelly soils.

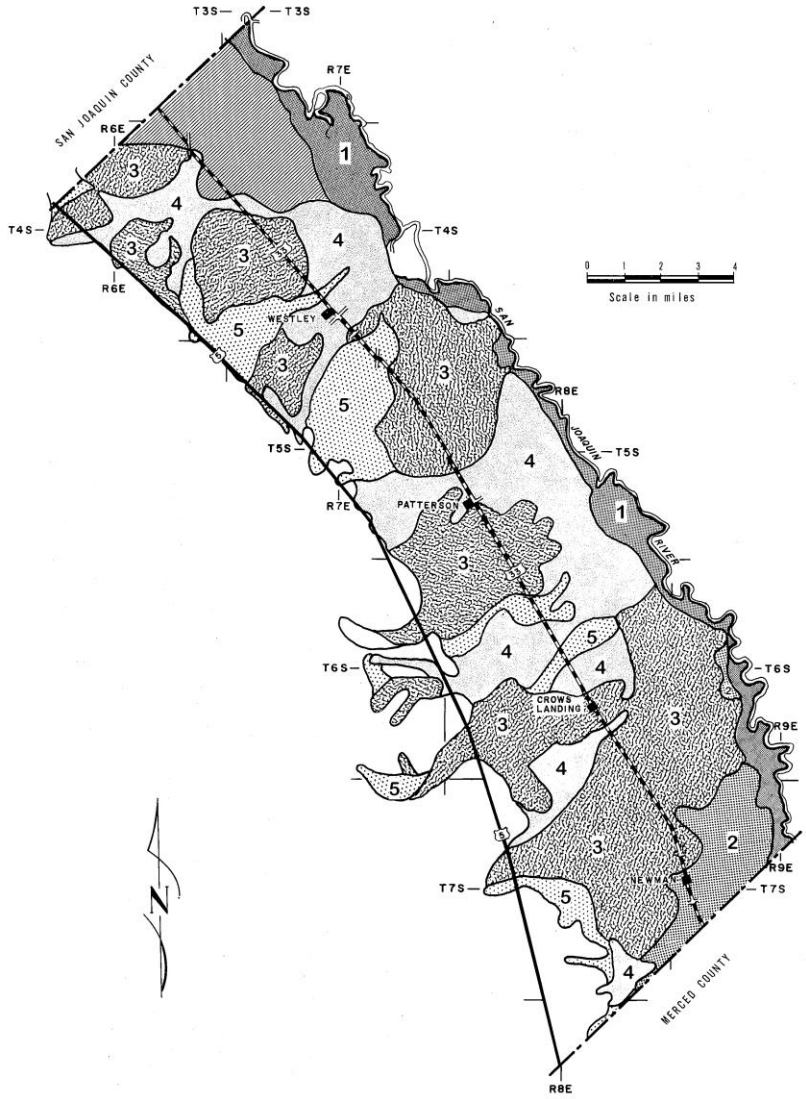


Figure A3-4. Geographic soil associations of western Stanislaus County (USDA-NRCS, 2007).

Note from the associated soil description that soil associations 1, 2, and 3 may require special attention when designing a leach field because of potentially slow percolation; and that soil association 5 requires special attention because of very high percolation rates.

Westernmost Stanislaus County

The soils in westernmost Stanislaus County, west of Highway 5 have not been formally mapping, so each proposed OWTS site requires individual attention. Generally, the soils in this portion of the county are very thin to inexistent on the typically steep slopes, but can be very thick in the valley floors. Because most of the rock exposed are marine shales and siltstones, or heavily weathered metabasalts, the soils in valley floors tend to be clayey and have slow percolation rates.

APPENDIX 4. SETBACKS FROM POTABLE WATER INTAKE STRUCTURES

WOODWARD RESERVOIR

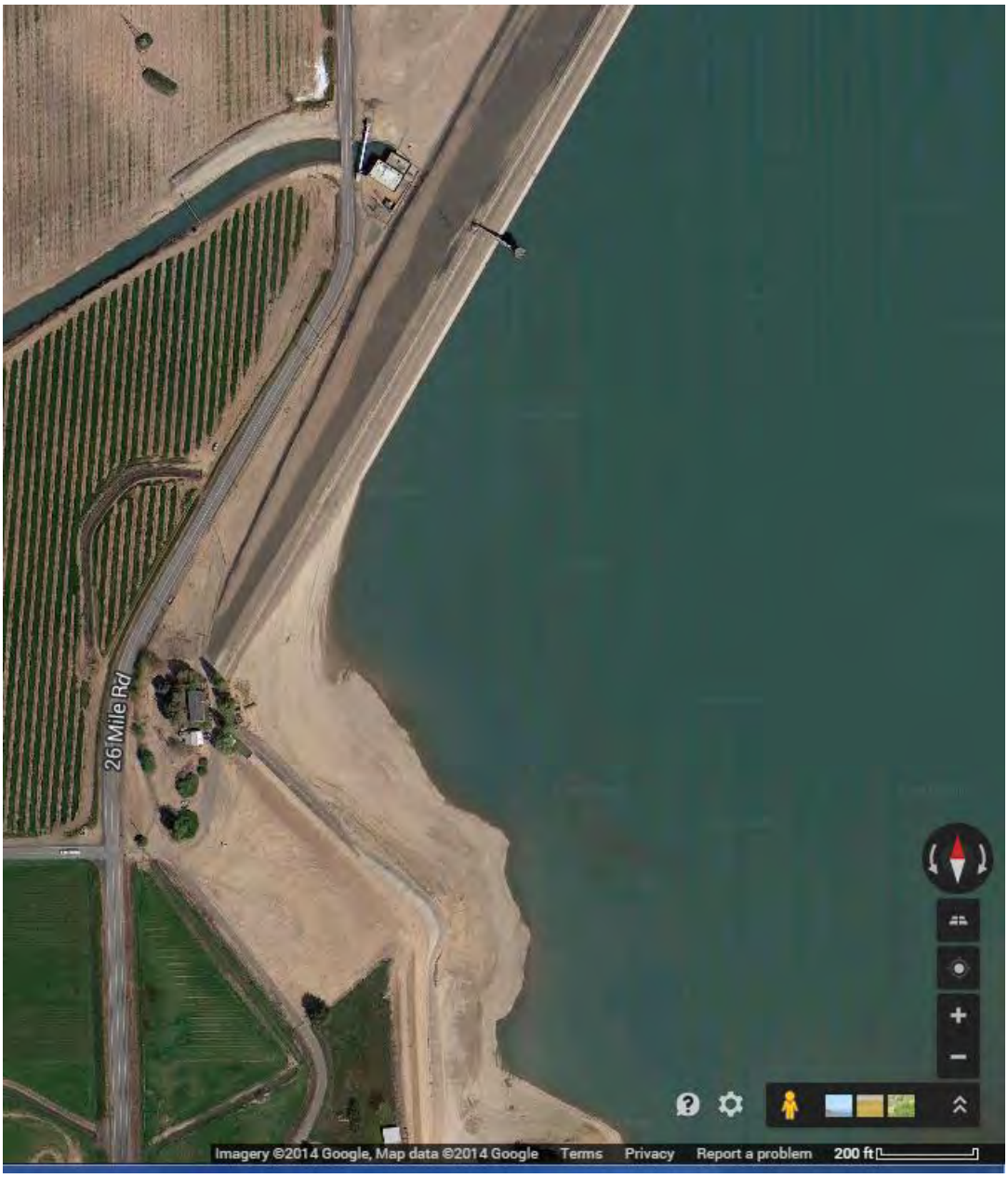
The following aerial image shows the southern portion of the Woodward Reservoir, the raw water intake tower (A-3 location), and a residence that likely has a septic system (B-1 location). The distance between the residence and the intake structure is 1,150 ft. The structure at C-2 appears to be a campground toilet (likely a septic vault) located 1,850 ft from the intake structure.

1 2 3

A

B

C



During the summer months the water treatment plant uses the upper intake structure, which is located behind a water quality wall that allows for public recreation in the reservoir while still being used for drinking water. The upper intake structure is near the inlet to the reservoir, about 6,800 ft east of location A-3.

During the winter months and at lower reservoir elevations the lower intake structure is used (A-3), which is the original water effluent structure of the reservoir, built in the early 1900's. With regard to this intake structure, the residence is subject to the rules stated in item 7.5.7 of Tier 1, which require a minimum separation of 400 ft and the high water mark. The residence is less than 100 ft from the high water mark of the reservoir. However, it is our professional opinion that effluent from the septic tank is not likely to affect the use of the water, because the water drawn from this structure is purified at the South San Joaquin Irrigation District Nick C. DeGroot Water Treatment Plant.

MODESTO RESERVOIR

The following aerial image shows the south shore of the Modesto Reservoir. The raw water intake for the Modesto potable water treatment plant is roughly indicated by the white square at A-2, 150 ft due north of the small dock at location B-2. A residence that likely has a septic system is located at B-1. The distance between the two is 700 ft.

1 2

A

B

With regard to this intake structure, the residence is subject to the rules stated in item 7.5.7 of Tier 1, which require a minimum separation of 400 ft and the high water mark. The residence is about 200 ft from the high water mark of the reservoir. However, it is our professional opinion that effluent from the septic tank is not likely to affect the use of the water, because the water drawn from this structure is purified at the Modesto Regional Water Treatment Plant.

LA GRANGE

The following aerial image shows the community of La Grange, CA, developed on the southern bluff of the Tuolumne River. This community derives its potable water from the TID main canal. The yellow circle indicates the location of the water intake point, which is upstream of the community and its OWTS.

KNIGHTS FERRY

The following aerial image shows the community of Knights Ferry, CA, developed on the northern shore of the Stanislaus River. This community derives its potable water from the Stanislaus River. The yellow circle indicates the location of the water intake point.

The Knights Ferry Water Treatment Plant receives its raw water from the Oakdale Irrigation District. From March thru October the WTP receives its water from OID's North Main Canal which is located to the north (upgradient) of Knights Ferry. From November thru February they receive water from the Stanislaus River. The river water is pumped up to the WTP for processing, and the intake location is upgradient from the town, making contamination by septic water extremely unlikely.

APPENDIX 5
CALCULATED DEVELOPMENT DENSITY IN LIGHT OF POTENTIAL NITRATE IMPACTS TO GROUNDWATER

Hantzsche and Finnemore (1992) addressed the common planning dilemma of determining acceptable development densities in light of potential nitrate impacts to groundwater. These authors stated that "From the standpoint of ground-water nitrate-nitrogen impacts, the critical minimum gross acreage per developed lot, A, may be defined as that which would result in a value of n_r [resultant average concentration of nitrate-nitrogen in recharge water] equal to 10 mg/l, the commonly accepted drinking-water limit." They estimated the value of A, by first setting an expression for n_r as follows:

$n_r = \{[I*n_w*(1-d)] + Rn_b]\}/(I+R)$; where I = volume rate entering the soil averaged over the gross developed area, in inches per year; n_w = total nitrogen concentration of waste water, in mg/l; d = fraction of nitrate-nitrogen loss due to denitrification in the soil; R = average recharge rate of rainfall (plus irrigation excess in the case of agricultural land use), in inches per year, and n_b = background nitrate-nitrogen concentration of rainfall recharge at the water table, exclusive of waste-water influences, in mg/l.

By setting $I = 0.01344*W/A$; where W is the average daily waste-water flow per dwelling unit, in gallons; and 0.01344 is a conversion factor having units acre•inch•day/yr•gal

Rearranging the first equation one obtains the expression: $A = [(0.01344*W)*(n_w-d*n_w-n_r)]/[R*(n_r-n_b)]$

Following Hantzsche and Finnemore (1992), we set W at 150 gallons per day per dwelling unit, on the basis of an average expected occupancy of three persons per residence and 50 gal/person/day.

Total nitrogen concentration of waste water, n_w, has been reported to range from 25 mg/l to as much as 100 mg/l (US EPA, 1980). For this document, we set n_w = 50 mg/l.

The value of n_r is, simply, the weighted average nitrate-nitrogen concentration of percolating rainfall (plus irrigation excess) and waste water, which for the purposes of this document we have set at 20 mg/l.

Broadbent and Clark (1967) used the term denitrification to refer to the biochemical reduction of nitrate and nitrite to volatile nitrous oxide and molecular nitrogen, and concluded that denitrification removes 1 to 75% of the nitrate-nitrogen load of percolating water, with values of 10 to 25% being typical. For this document, we set nitrogen loss due to denitrification at d = 0.25.

As shown in Figure 3, average annual precipitation throughout Stanislaus ranges from 10 to 18 inches/yr. Assuming 10% of that precipitation infiltrates, natural recharge throughout the County could be expected to range from 1 to 2 inches/yr. In the valley floor, however, the rate of recharge is much larger due to infiltration of excess irrigation water. About 1,000,000 acre-ft are delivered each year to the farms of Modesto and Turlock Irrigation Districts. Assuming that 30% of this water infiltrates over an area of 100,000 acres for MID, and 200,000 for TID, then the 300,000 acre-ft that infiltrate would be

equivalent to an additional recharge of 1 ft or 12 inches per year in the irrigated portions of the County. Based on this, we use R = 10 inches per year in this analysis as a somewhat conservative value.

Background nitrate-nitrogen loading, n_b, typically falls in the range of 0.5 to 1.0 mg/l for undeveloped land, but in an agricultural area like Stanislaus County it is likely to range between 10 and 20 mg/l. For this document, we set n_b = 15 mg/l.

Based on the quoted values, A is calculated as:

A = [(0.01344*150)*(50-0.25*50-20)]/[10*(20-15)] = 0.7 acres per dwelling unit …… (1)

The following table summarizes the criteria used in Stanislaus County to determine the minimum acreage of subdivision dwelling units:

Table A5-1: Allowable average densities per subdivision under current practice and proposed Tier 2.

Depth to the water table (ft bgs)	Allowable Density (acres for each dwelling unit)
5 ft or less, and water supply by onsite well	3 acres
Over 5 ft but less than 12 ft, and water supply by onsite well	2 acres
12 ft and over, water supply by onsite well, and subdivision outside of a sanitary sewer service area	1 acre plus 9,000 sq. ft for each bedroom in excess of four
12 ft and over, all main buildings connected to a public supply system, subdivision within an adopted sanitary sewer service area, but “dry sewers” not required. No OWTS are allowed.	20,000 sq. ft, plus 4,500 sq. ft for each bedroom in excess of three
12 ft and over, all main buildings connected to a public supply system, “dry sewers” required. No OWTS are allowed.	Single family dwellings – 9,000 sq. ft; two-family dwellings – 13,500 sq. ft; multiple family dwellings – 13,500 sq. ft plus 4,500 sq. ft for each dwelling unit in excess of three, plus 1,000 sq. ft for each bedroom in excess of an average of two per unit

Comparing the 0.7 acres calculated above with the minimum number of acres allowed per dwelling unit (1 to 3 acres), it is clear that the criteria used by Stanislaus County are more stringent than acreage calculated based on potential nitrogen-loading to groundwater. A similar conclusion was reached by Hantzsche and Finnemore (1992) when they analyzed the data for the area of Chico, California, which has conditions similar to those of Stanislaus County.

REFERENCES

Broadbent, F.E., Clark, F., 1967, Denitrification: in *Soil Nitrogen*, W.V. Bartholomew and F.E. Clark (eds.), American Society of Agronomy, Inc., Madison, WI. Agronomy Series, No. 10, p. 344-359.

Hantzsche, N.N., Finnemore, E.J.,1992, Predicting groundwater nitrate-nitrogen impacts: Groundwater v.30, no.4, p. 490-499.

US EPA, 1980, Design manual for on-site wastewater treatment and disposal systems: Report No. EPA-625/1-80-012, 390 pp.

3800 CORNUCOPIA WAY, STE. C
MODESTO, CA 95358-9492

STANISLAUS COUNTY
DEPARTMENT OF ENVIRONMENTAL RESOURCES

PHONE 525-6700
7:30-8:30 AM or
4:00-5:00 PM

PERMIT NO.	ISSUED DATE
ER	
APN:	APPLICATION DATE
FEE	RECEIVED BY

APPLICATION FOR SEPTIC PERMIT

LOCATION — HOUSE NUMBER — STREET — TOWN

NEAREST CROSS STREET — SUBDIVISION — LOT — BLOCK

OWNER — MAILING ADDRESS — PHONE NUMBER

CONTRACTOR — MAILING ADDRESS — PHONE NUMBER

PROPOSED CONSTRUCTION

Septic Tank ☐ Existing ☐ Replacement Capacity _____ Gal.

Leach Line ☐ Addition ☐ Replacement _____ Sq. Ft.

Length _____ Width _____ Depth of Rock _____

Seepage Pit(s) No. _____ Length _____ Width _____ Depth of Rock _____ Cu. Yds. _____

LICENSED CONTRACTORS DECLARATION

I hereby affirm that I am licensed under provisions of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code, and my license is in full force and effect.

License Class _____ License No. _____

Date: _____ Contractor _____

OWNER-BUILDER DECLARATION

I hereby affirm that I am exempt from the Contractor's License Law for the following reason(Sec. 7031.5, Business and Professions Code: Any city or county which requires a permit to construct, alter, improve, demolish, or repair any structure, prior to its issuance, also requires the applicant for such permit to file a signed statement that he is licensed pursuant to the provisions of the Contractor's Law(Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code) or that he is exempt therefrom and the basis for the alleged exemption. Any violation of Section 7031.5 by any applicant for a permit subjects the applicant to a civil penalty of not more than five hundred ($500.00) dollars.

( ) I, as owner of the property, or my employees with wages as their sole compensation, will do the work, and the structure is not intended or offered for sale (Sec. 7044, Business and Professions Code: The Contractor's License Law does not apply to an owner of property who builds or improves thereon, and who does such work himself or through his own employees, provided that such improvements are not intended or offered for sale. If, however, the building or improvement is sold within one year of completion, the owner-builder will have the burden of proving that he did not build or improve for the purpose of sale.)

( ) I, as owner of the property, am exclusively contracting with licensed contractors to construct the project (Sec. 7044, Business and Professions Code: The Contractor's License Law does not apply to an owner of property who builds or improves thereon, and who contracts for such projects with a contractor licensed pursuant to the Contractor's License Law.

( ) I am exempt under Sec. _____ B & PC for this reason: _____

Date: _____ Owner: _____

WORKER'S COMPENSATION DECLARATION

I hereby affirm that I have a certificate of consent to self-insure, or a certificate of Worker's Compensation Insurance, or a certified copy thereof (Sec. 3800, Lab. C).

Policy No. _____ Company _____

( )Certified copy is hereby furnished.

( )Certified copy is filed with the Environmental Resources department of Stanislaus County.

Date: _____

CERTIFICATE OF EXEMPTION FROM WORKERS' COMPENSATION INSURANCE

(This section need not be completed if the permit is for one hundred ($100.00) dollars or less.

I certify that in the performance of the work for which this permit is issued, I shall not employ any person in any manner so as to become subject to the Worker's Compensation Laws of California.

Date: _____ Applicant: _____

NOTICE TO APPLICANT: If, after making this Certificate of Exemption, you should become subject to the Worker's Compensation provisions of the Labor Code, you must forthwith comply with such provisions or this permit shall be deemed revoked.

CONSTRUCTION LENDING AGENCY

I hereby affirm that there is a construction lending agency for the performance of the work for which this permit is issued (Sec. 3097,Civ. C)

Lender's Name _____

Lender's Address _____

I CERTIFY THAT I HAVE READ THIS APPLICATION AND STATE THAT THE ABOVE INFORMATION IS CORRECT. I AGREE TO COMPLY WITH ALL CITY AND COUNTY ORDINANCES AND STATE LAWS RELATING TO BUILDING CONSTRUCTION, AND HEREBY AUTHORIZE REPRESENTATIVES OF THIS COUNTY TO ENTER UPON THE WITHIN MENTIONED PROPERTY FOR INSPECTION PURPOSES.

DATE: _____ SIGNATURE OF APPLICANT OR AGENT _____

Provide the following details on PLOT MAP below:
1. Names of streets or roads nearest to or bounding property.
2. Outline of the property, giving dimensions & north direction.
3. Outlines & locations of all existing & proposed structures.
4. Diagram existing sewage disposal system & proposed changes.
5. Location of all wells within a radius of 150 ft.

PLOT PLAN

4019-395

FOR DEPARTMENT USE ONLY

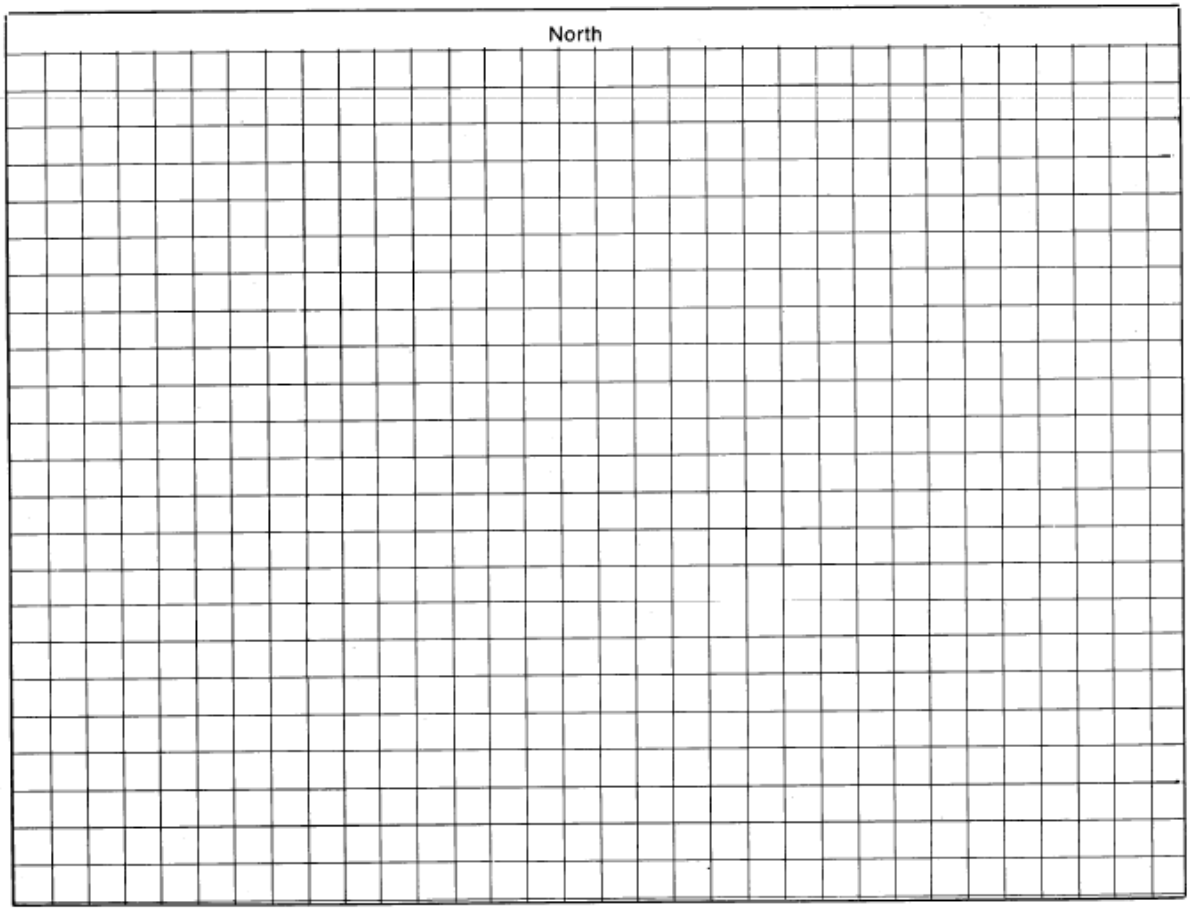
Application Approved by _____ Final Inspection by _____ Date _____

(No septic system permitted if public sewer is available within 200 feet.)

FOR DEPARTMENT USE ONLY

SERVICE REQUEST

Inspection Requested By _____ Date _____ Appointment Time _____



SEPTIC TANK

Distance from Closest Well _____ ft.

Liquid Capacity _____ gal.

Foundation _____ ft. Material _____

Nearest Lot Line at Front ☐ Side ☐ Rear ☐ _____ ft.

DISPOSAL FIELD

Distance from Closest Well _____ ft.

Depth, Rock to Finish Grade _____ inches

Nearest Lot Line at Front ☐ Side ☐ Rear ☐ _____ ft.

Foundation _____ ft. Number of Lines _____

Trench Width _____ inches Rock Under Pipe _____ inches

Leaching area _____ sq. ft.

SEEPAGE PITS

Distance From Closest Well _____ ft.

Water Table Depth (if known) _____ ft.

TOTAL LEACHING AREA OF SYSTEM = _____ sq. ft.

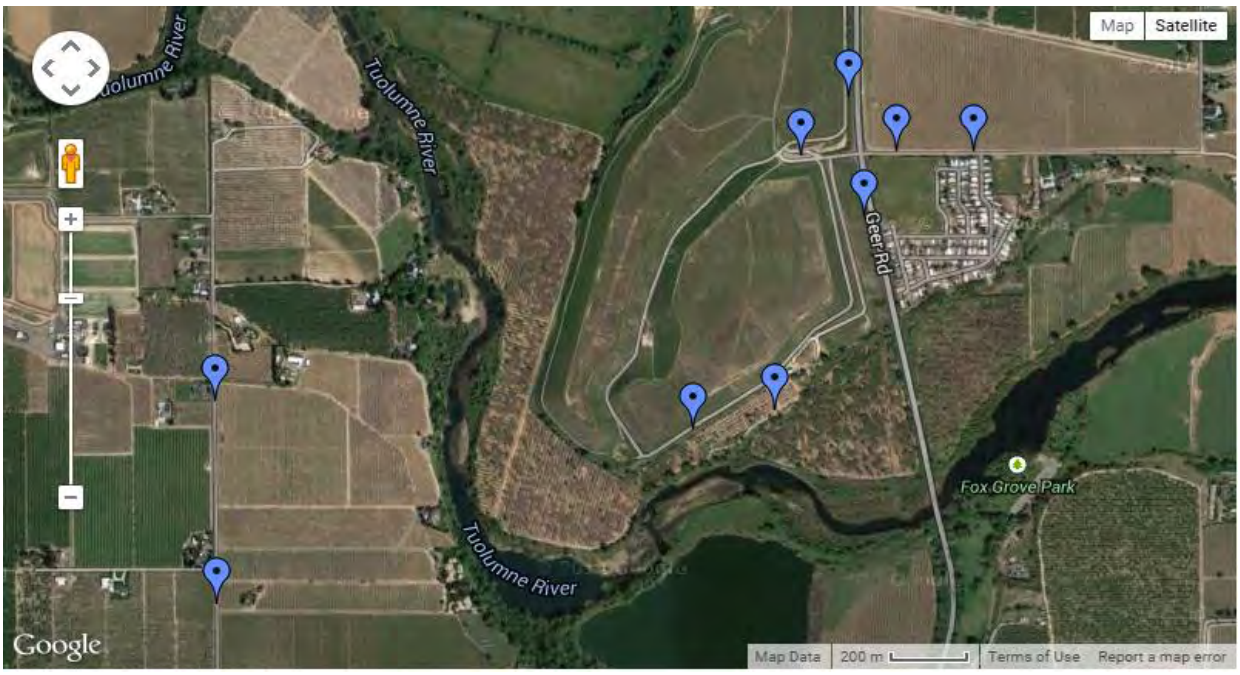
Dimensions _____ x _____ x _____ ft. Cu. Yds. _____

Nearest Lot Line at Front ☐ Side ☐ Rear ☐ _____ ft.

APPENDIX 7
ANALYSIS OF CLUSTERS OF WELLS WITH HIGH NITRATE CONTENT

Geer Road Landfill

The most prominent cluster of wells with high nitrate contents is that of the monitoring wells surrounding the Geer Road Landfill, as shown by the blue arrows in the aerial photograph.



All of these wells are designated as shallow (i.e., they are screened at the water table), and had nitrate contents in the range of 67.5 to 126 mg/l. They are all coupled with a corresponding deep well, which in all cases had values lower than 45 mg/l. For this cluster, then, the likely source is shallow contamination derived from the landfill.

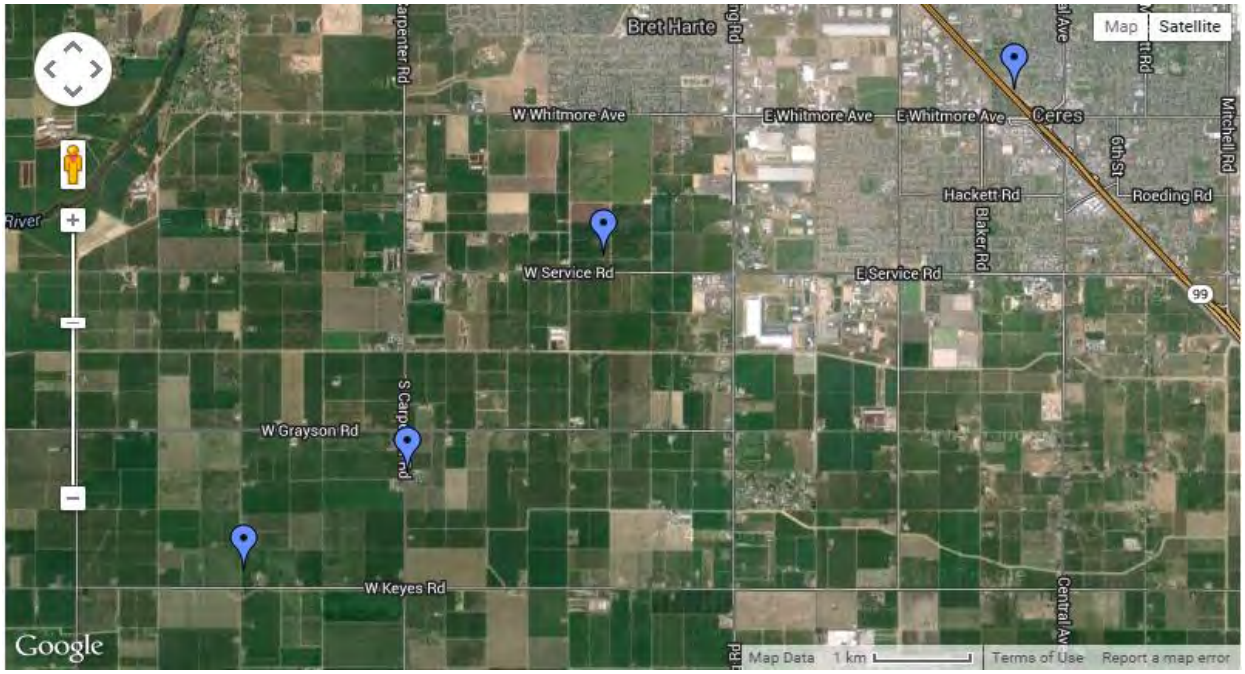
Fink Road Landfill

The cluster of wells with high nitrate content off Highway 5, in the southwest portion of the County, are all against the edge of the Fink Road Landfill.

Nitrate contents in these wells range between 49.5 and 81 mg/l.

Mid-County "Flow line"

Four wells with high nitrate contents (49.1 to 54 mg/l) appear to be in line, parallel to the regional groundwater flow lines.



Except for the well in the northeast corner, which is in the middle of the urban area of Ceres, the rest of the wells are clearly in agricultural land, where fertilizer application reasonably can be inferred to be the source of the contamination. The well in the northeast corner serves a rural residence in the middle of Ceres, and the source of nitrate could well be a septic tank.

APPENDIX 8
MEASURE X

16.10.040 Primary and secondary on-site wastewater treatment notification.

A. To provide all property owners with constructive notice of Stanislaus County's Measure X guidelines concerning primary and secondary on-site wastewater treatment requirements, the ordinance codified in this chapter shall be recorded with the clerk-recorder of the county.

B. For all discretionary approvals of parcel maps or subdivision maps requiring primary and secondary on-site wastewater treatment, the County Department of Planning and Community Development shall include as a condition of approval that the final recorded map shall contain the following statement:

> As per Stanislaus County Code Sections 16.10.020 and 16.10.040, all persons purchasing lots within the boundaries of this approved map should be prepared to accept the responsibilities and costs associated with the operation and maintenance of the required primary and secondary on-site wastewater treatment system. All persons are required to provide adequate maintenance and operate the onsite wastewater treatment system as prescribed by the manufacturer, so as to prevent groundwater degradation.

C. The County Department of Public Works Development Services Division [now Department of Planning and Community Development Services] shall provide all applicants for building permits for new residential construction or commercial project construction with a "primary and secondary on-site wastewater treatment notice" in substantially the form provided in subsection F of this section.

D. Commencing in the year 2004, and every year thereafter, the Department of Environmental Resources shall annually mail a copy of the "primary and secondary on-site wastewater treatment notice," in substantially the form provided in subsection F of this section, to all owners of real property in Stanislaus County required to have primary and secondary on-site wastewater treatment.

E. The clerk-recorder of the county shall include a "primary and secondary on-site wastewater treatment notice," in substantially the form provided in subsection F of this section, with any land sale contract, grant deed, quitclaim deed or any other instrument of conveyance returned to the grantee by the clerk-recorder after recording.

F. The "primary and secondary on-site wastewater treatment notice" shall contain, and be substantially in the form of, the following:

STANISLAUS COUNTY
PRIMARY AND SECONDARY ONSITE WASTEWATER
TREATMENT NOTICE

As per Stanislaus County Code
Sections 16.10.020 and 16.10.040

In June of 1990 Measure X, a voter initiative, was passed. Measure X went into effect July 13, 1990. The Stanislaus County Board of Supervisors has adopted guidelines for implementation of Measure X.

Except for those properties excluded pursuant to the Measure X guidelines, all owners of property on lots subdivided after July 13, 1990, all owners of new residential sized parcels created from agricultural designated parcels after July 13, 1990, and all new commercial or industrial projects requiring building permits are required to dispose of all liquid waste through an approved primary and secondary on-site wastewater treatment system. The resident and/or property owner shall be responsible for the operation and maintenance of the primary and secondary on-site wastewater treatment system. The resident and/or property owner shall operate and maintain the primary and secondary wastewater treatment system as prescribed by the manufacturer specifications and system design. Groundwater degradation caused by improper operation and maintenance of the primary and secondary on-site wastewater treatment system shall be unlawful.

G. The County Department of Environmental Resources shall be responsible for the printing of the "primary and secondary onsite wastewater treatment notice" set forth in subsection F of this section and shall supply the department of public works development services division and the clerk-recorder with notices as needed. (Ord. CS 893 §2, 2004).

MOST FREQUENTLY ASKED QUESTIONS

1. What is Measure X?
   The Measure X voters' initiative was passed and went into effect July 13, 1990. Property on lots subdivided after July 13, 1990, all owners of new residential sized parcels created from agricultural designated parcels after July 13, 1990, and all new commercial or industrial projects requiring building permits are required to dispose of all liquid waste through an approved primary and secondary onsite wastewater treatment system. The Stanislaus County Board of Supervisors has adopted guidelines for implementation of Measure X.

2. What is primary and secondary treatment of sewage?
   It is a wastewater system providing additional treatment to household wastewater. Basically, the system includes two components. Each component plays a different role in treating the effluent before it is discharged into a leach field, resulting in a clear effluent. The final effluent strength needs to meet Environmental Protection Agency (EPA) standards. National Sanitation Foundation (NSF) Standard 40 Class I lists the systems that meet EPA performance standards.

3. How different is that from a conventional septic system?

It is different in the way the effluent is treated for a second time to reduce the Biochemical Oxygen Demands (BOD), Total Suspended Solids (TSS) and Total Nitrogen (TN).

4. Can you give some examples of these kinds of systems?
   Aerobic treatment units, sand filters, textile media, etc. Contact the Department of Environmental Resources (DER) for a copy of an approved list.

5. Can I install a septic tank in conjunction to these types of units?
   Yes.

6. How much will these types of systems cost?
   The system will cost $5,000-$10,000 for residential. Commercial use may differ due to the amount of wastewater treated per day.

7. Can I install my own system?
   Yes, under proper permit and inspection.

8. Will these systems require to be monitored on a regular basis? By whom?
   Yes, these systems do require regular monitoring and maintenance to ensure they are working properly. To ensure the system is working according to manufacturer design and specifications, NSF approval standards require the manufacturer to provide an initial service contract for the first two years. Four inspections/service calls are to be conducted by the contracted service provider over the first two-year period, once every six months.

   Once the initial contract has expired, the system owners can choose to continue a service contract or maintain the system themselves.

   "As per Stanislaus County Code 16.10.020 and 16.10.040, all persons purchasing lots within the boundaries of this approved map should be prepared to accept the responsibilities and costs associated with the operation and maintenance of the required primary and secondary onsite wastewater treatment system. All persons are required to provide adequate maintenance and operate the onsite wastewater treatment system as prescribed by the manufacturer, so as to prevent groundwater degradation."

9. Are there certain things that should not be put in the system?
   Do not flush the following: coffee grounds, dental floss, disposable diapers, kitty litter, sanitary napkins, tampons, cigarette butts, condoms, gauze bandages, fat, grease, oil, paper towels, and never flush chemicals, such as paints, varnishes, thinners, waste oils, photographic solutions, or pesticides. These items can overtax or destroy the biological digestion taking place within your system.

10. Can I discharge my water softener to these systems?
    Yes. Researchers from NSF found that brine had no negative effects on the bacterial population living in an aerobic treatment environment, even when the system was loaded with twice the normal amount of brine. The tests determined water softener wastes actually help with treatment processes.

11. Will a garbage disposal adversely affect the operation of this type of system?

There are no State statutes or administrative rules limiting the use of a garbage disposal when onsite sewage treatment systems are used. However, it is strongly recommended that you do not use a garbage disposal when you discharge sewage into an onsite treatment system. Excessive use of garbage disposal can cause an onsite sewage disposal system to prematurely fail.

GUIDELINES

To assist in the interpretation and implementation of the Measure X initiative, the following guidelines are provided by the Department of Environmental Resources:

When is primary and secondary sewage treatment needed?

1. For any new residential subdivision approved after July 13, 1990.

2. For any new residential sized parcels (A-2-3 or A-2-5 parcels included) created from agricultural parcels, after July 13, 1990. In certain situations, parceling may result in one of the residential parcels being eligible to use a traditional septic tank.

3. For any new commercial or industrial project requiring building permits, or
   - However, existing commercial/industrial subdivision with a "vested" map is exempt from the secondary treatment requirement.

4. For any structural expansion or alteration requiring sewage disposal, resulting in greater than 50% expansion of improved square footage existing as of November 8, 1988.

When can a traditional septic tank and leach field be used?

1. For one single-family dwelling in an existing pre-July 13, 1990 recorded residential lot.

2. For single-family dwellings appropriate for the agricultural acreage designation (i.e., second dwelling on an A-2 zoned parcel of 20 acres or more).

3. For housing of agricultural workers and their families.

4. For serving an agriculture related operation (i.e., restrooms for grading stations; hulling/drying operations; agricultural equipment repairs. etc.).

5. For a public emergency situation as determined by the Board of Supervisors.

6. For low density recreational use operations generating a low volume of wastewater (i.e., small campgrounds; fish for fee ponds, public parks, etc.).

7. For very low income housing (i.e., 50 percent or less of the area median income, adjusted for family size).

What are secondary wastewater treatment systems?

1. For the individual residential project, secondary treatment can be achieved by off-the-shelf units certified by the National Sanitation Foundation (NSF) as meeting Standard Number 40 for individual aerobic wastewater treatment plants. Such plants utilize aeration of the wastewater and specialized clarification to provide a wastewater effluent meeting EPA standards.
    - A list of approved treatment systems is available at the Department of Environmental Resources.

2. For individual commercial and industrial projects, appropriate sized off-the-shelf secondary treatment units or for large waste flows, a package treatment plant will be required. Such units must be NSF approved and/or must meet US EPA Secondary Treatment Guidelines. As with individual residential treatment plants, a permit to operate is required. In order to obtain the permit or renew the permit, a service contract for the monitoring and maintenance of the treatment unit must be provided or a plan of operation must be provided that will ensure compliance with Measure X treatment requirements.
    - DER will monitor the treatment plant's operation and maintenance records. An administrative fee is to be collected by DER.

3. For multiple property residential or commercial projects, centralized package treatment plant systems can be used. Monitoring and maintenance aspects of such systems may be addressed by the formation of or annexation to a community service area or equivalent as determined by Stanislaus County.

If you have any questions regarding the above, contact Bella Badal, PhD., R.E.H.S. at 525-6700.

http://www.stancounty.com/ER/lw-20-measure-x.shtm

APPENDIX 9
REPORTS RE: 2014 OWTS DATA

DEPARTMENT OF ENVIRONMENTAL RESOURCES

3800 Cornucopia Way, Suite C Modesto, CA 95358-9492
Phone: 209.525.6700 Fax: 209.525.6774

May 11, 2015

Ms. Jami Aggers, Director
Stanislaus County Dept. of Environmental Resources
3800 Cornucopia Way, Suite C
Modesto, CA 95358

REVIEW OF 2014 OWTS PERMIT ACTIVITY

Per the requirements of the Stanislaus County "Guidance to the Construction and Operation of Onsite Wastewater Treatment Systems", this report presents the results of my annual review of the database of OWTS permit activity. The database includes 161 permits issued by SCDER, in 2014, for the repair, replacement, or destruction of one or more components of the OWTS. 9 of these permits were cancelled, leaving a total of 152 permits.

During 2014, 2 permits were issued for repairs to existing septic systems. 1 of these permits was cancelled, leaving a total of 1 permit for septic tank repairs. For this one case the repairs were inspected and approved by SCDER, and it can now be considered a Tier 2 case. This year no case in this category has been flagged as Tier 4.

During 2014, 44 permits were issued for replacement of the leach field of existing septic systems. 1 of these permits was cancelled, leaving a total of 43 permits for leach field replacement. 41 of these repairs were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The 2 cases where a permit was issued but the job was not inspected have been flagged as Tier 4 cases for future inspection.

During 2014, 4 permits were issued for destruction of an existing septic system. None of these permits were cancelled, leaving a total of 4 permits for OWTS destruction. 3 of these

destructions were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The one case where a permit was issued but the job was not inspected has been flagged as a Tier 4 case for future inspection.

During 2014, 111 permits were issued for additions to existing septic systems. 7 of these permits were cancelled, leaving a total of 104 valid permits. 96 of these repairs were inspected and approved by SCDER, and they can now be considered Tier 2 cases. The remaining 8 cases where a permit was issued but the job was not inspected have been flagged as a Tier 4 case for future inspection.

Respectfully submitted,

/S/

Dr. Horacio Ferriz, PG, CEG

Permit ID	Date Issued	Street Num	Street	City	Date Septic Permit Cancelled	Repair	Replace	Destruction	New	Septic Capacity	Leach Line SqFt	Leach Line Length in ft	Leach Line Width in ft	Leach Line Depth of Rock Pack in inches	Number of Horizontal Seepage Trenches	Length of Horizontal Seepage Trench in ft	Width of Horizontal Seepage Trench in ft	Depth of seepage pit in feet	Volume of Horizontal Seepage Trench in cubic yards	Date the Inspector Approved	Tier
14-2	1/2/2014	6925	KIERNAN AVE	SALIDA		N	N	N	Y			25	3	3							2
14-3	1/2/2014	8501	BECKWITH RD	SALIDA	1/13/2014	N	N	N	Y			50	3	3							NA
14-1	1/3/2014	3400	WASHINGTON RD	HUGHSON		N	Y	N	N	1500										1/8/2014	2
14-4	1/9/2014	6219	GEER RD	TURLOCK	5/1/2014	N	Y	N	N	1200		60	3	3							NA
14-5	1/13/2014	1800	GRIMES	MODESTO		N	N	N	Y			30	3	3						1/14/2014	2
14-6	1/13/2014	6842	BECKWITH	MODESTO		N	Y	N	N	1500		25	3	3						1/13/2014	2
14-7	1/13/2014	1604	OHIO	MODESTO		N	N	N	Y			25	3	3						1/14/2014	2
14-8	1/14/2014	5254	TULLY RD	HUGHSON		N	N	N	Y		350	50	3	3							2
14-10	1/15/2014	307	GOODWIN	MODESTO		N	N	N	Y										40	1/16/2014	2
14-9	1/15/2014	3154	PARADISE RD	MODESTO	2/4/2014	N	N	N	Y						1	15	3	10			NA
14-11	1/22/2014	1200	COUNTRYVIEW	MODESTO		N	N	N	Y							20	3	9	20	2/4/2014	2
14-12	1/23/2014	1518	MITCHELL RD	TURLOCK		N	N	N	Y											1/29/2014	2
14-13	1/27/2014	2554	IOWA	MODESTO		Y	N	N	N	1200	190									1/29/2014	2
14-14	1/31/2014	613	FRAZINE	MODESTO		N	N	Y	N												4
14-15	2/3/2014	7566	GRAYSON RD	HUGHSON		N	Y	N	N	1200	380	55	3	3						2/3/2014	2
14-16	2/4/2014	3660	VAN DUSEN	RIVERBANK		N	N	N	Y						1	20	3	10			2
14-17	2/4/2014	4701	CALIFORNIA	RIVERBANK		N	N	N	Y						1	20	3	10		2/4/2014	2
14-18	2/5/2014	7341	ELEANOR	OAKDALE		N	N	N	Y						2	20	2	12	25		2
14-19	2/6/2014	5331	AVE B	MODESTO		N	N	N	Y			60	3	2						2/14/2014	2
14-20	2/10/2014	27701	HIGHWAY 33	NEWMAN		N	Y	N	N	1600	574	82	3	3						2/10/2014	2
14-21	2/10/2014	2300	DAVIS WY	MODESTO		N	N	N	Y		204	48	3							2/11/2014	2
14-22	2/10/2014	817	TURNER ST	MODESTO		N	N	N	Y		204	48	3							2/13/2014	2
14-23	2/13/2014	3660	VAN DUSEN	RIVERBANK		N	N	N	Y						1	20	3	9		2/13/2014	2
14-24	2/18/2014	639	ANDERSON	NEWMAN		N	Y	N	N	1500		85	3	3						2/19/2014	2
14-25	2/19/2014	5743	TULLY RD	MODESTO		N	Y	N	N	1200	252	60	3							2/19/2014	2
14-26	2/19/2014	1313	LAURIE	MODESTO		N	Y	N	N	1500										2/24/2014	2
14-27	2/19/2014	1415	1/2 MONO DR	MODESTO		N	N	N	Y						1	20	3	9	20	2/24/2014	2
14-28	2/20/2014	807	COLORADO AVE	MODESTO		N	N	N	Y						1	20	9	10	20	2/21/2014	2
14-29	3/3/2014	807	GRAYSON RD	MODESTO		N	N	N	Y		150	50	3	1.5						3/3/2014	2
14-30	3/6/2014	4699	HWY 108	OAKDALE		N	N	N	Y						1	10	3	9		3/6/2014	2
14-31	3/6/2014	7008	CARVER RD	MODESTO		N	Y	N	N	2000		83	3	3						3/12/2014	2
14-32	3/7/2014	3731	SWANSON	DENAIR		N	Y	N	N	1600	574	82	3	3						3/7/2014	2
14-33	3/7/2014	5919	MAIN	TURLOCK		N	Y	N	N	1200		130	3	1						3/12/2014	2
14-34	3/10/2014	2637	RIVER RD	MODESTO		N	N	N	Y		119	7	3	3						3/10/2014	2
14-35	3/11/2014	2213	CHRISTMAS TREE CT	RIVERBANK		N	N	N	Y			32	2							3/12/2014	2
14-36	3/12/2014	225	KEYES RD	MODESTO		N	Y	N	N	1500		83	3	3						3/13/2014	2
14-37	3/17/2014		NA		8/25/2014	N	N	N	Y												NA
14-38	3/17/2014	2506	KIERNAN	MODESTO		N	N	N	Y		450	65	3	3						3/18/2014	2
14-39	3/18/2014	4737	TOOMES	SALIDA		N	N	N	Y						1	20	3	10		3/18/2014	2
14-40	3/18/2014	3312	BLAKER	TURLOCK		N	N	N	Y	1200	320									3/18/2014	2
14-41	3/18/2014	5213	GRAYSON RD	MODESTO		N	Y	N	N	1200	350	75		1.5						4/3/2014	2
14-42	3/19/2014	701	ADKINSON	MODESTO		N	N	N	Y		161	23	3	3						3/20/2014	2
14-43	3/21/2014	7901	HILLCREST DR	MODESTO		N	Y	N	N	1900	760	70	11	1						3/25/2014	2
14-44	3/21/2014	9813	FOX BOROUGH DR	OAKDALE	4/2/2014	N	N	N	Y						1						NA
14-45	3/24/2014	4719	NORTH AVE	TURLOCK		N	Y	N	N	1500	350	50	3	3						3/24/2014	2
14-46	3/25/2014	3331	DEWITT RD	MODESTO		N	Y	N	N	1500	570	85	3	3						3/27/2014	2
14-47	3/27/2014	142	SANA ROSA AVE	MODESTO		N	N	Y	N											3/28/2014	2
14-48	3/31/2014	1401	FAUSTINA	MODESTO		N	N	N	Y		280	40	3	3						4/2/2014	2
14-49	4/2/2014	11121	WALNUT	OAKDALE		N	N	N	Y						1	40	30	10	40	4/4/2014	2
14-50	4/3/2014	2219	TEMPERATE	MODESTO		N	N	N	Y			20	3	2						4/3/2014	2
14-51	4/7/2014	12031	YOSEMITE	WATERFORD		N	N	N	Y						1	40	3	10	40	4/8/2014	2
14-52	4/7/2014	6039	LEEDOM	HUGHSON		N	N	N	Y							9	20	3			2
14-53	4/8/2014	2941	WARING RD	DENAIR		N	N	N	Y			35	3	2						4/8/2014	2
14-54	4/10/2014	433	7TH ST	MODESTO		N	N	N	Y		100	100	3	5						4/10/2014	2
14-55	4/10/2014	11254	PIONEER RD	OAKDALE		N	Y	N	N	1500					1	20	3	9		4/10/2014	2
14-56	4/14/2014	7260	CRANE RD	OAKDALE		N	N	N	Y						1	20	3	10	20	4/15/2014	2
14-57	4/14/2014	13219	LAKE RD	HICKMAN		N	N	N	Y							15	3	15	20	4/15/2014	2
14-58	4/21/2014	16300	ORANGE BLOSSOM RD	OAKDALE	4/22/2014	N	N	N	Y		700	100	3	3							NA
14-59	4/21/2014	6149	ELEANOR	OAKDALE		N	N	N	Y		120	40	3	3						4/25/2014	2
14-60	4/22/2014	1301	TAMARISK	MODESTO		N	N	N	Y		150	50	3							4/22/2014	2
14-61	4/23/2014	424	SHIRE WY	MODESTO		N	Y	N	N	3000	950	136	3	3						4/28/2014	2
14-62	4/24/2014	4501	KENTUCKY	RIVERBANK		N	Y	N	N	1500	350	50	3	3						4/24/2014	2
14-63	4/25/2014	10610	GIBBS	OAKDALE		N	Y	N	N	1500	560	80	3	3						4/28/2014	2
14-64	5/1/2014	600	GLENWOOD	TURLOCK		N	N	N	Y		300	60	3	2						5/2/2014	2
14-65	5/1/2014	4306	SANTA FE	HUGHSON		N	N	N	Y		350	50	3	3						5/5/2014	2
14-66	5/1/2014	16843	SONORA RD	OAKDALE		N	N	N	Y		400				1	24	3	15	40	5/2/2014	2
14-67	5/6/2014	5212	MILNES RD	MODESTO	5/6/2014	N	N	N	Y						1	20	3	10	20		NA
14-68	5/7/2014	5212	MILNES RD	MODESTO		N	N	N	Y		210	30	3	3						5/9/2014	2
14-69	5/8/2014	3918	TOPEKA	RIVERBANK		N	Y	N	N	1600	380	55	3	3						5/13/2014	2

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14-70	5/15/2014	42	SEAMAN	OAKDALE		N	N	N	Y						1	20	3	9		5/15/2014	2
14-71	5/19/2014	521	HATCH RD	MODESTO		N	N	N	Y						1	20	3	10	20	5/27/2014	2
14-72	5/20/2014	15701	26 MILE RD	OAKDALE		N	N	N	Y						1	20	3	10	20	5/26/2014	2
14-73	5/20/2014	10843	STONE RD	OAKDALE		N	Y	N	N	1500										5/22/2014	2
14-74	5/22/2014	1331	KNOX RD	OAKDALE		N	N	N	Y			20	3	3						5/22/2014	2
14-75	5/22/2014	724	7TH ST	TURLOCK		N	Y	N	N	1800	770	110	3	3						5/23/2014	2
14-76	6/2/2014	1109	FAUSTINA RD	MODESGTO		N	N	N	Y						1	36	3	10	40	6/4/2014	2
14-77	6/2/2014	17837	WARD AVE	PATTERSON		N	N	N	Y		280	40	3	3						6/5/2014	2
14-79	6/5/2014	4931	MESA DR	OAKDALE		N	Y	N	N	1900	760	110	3	3							4
14-80	6/5/2014	1337	RIVER RD	MODESTO		N	N	N	Y						1	20	3	9	20	6/6/2014	2
14-81	6/5/2014	2437		MODESTO		N	Y	N	N	1800										6/6/2014	2
14-82	6/5/2014	10067	SERVICE RD	HUGHSON		N	N	N	Y			50	3	3						6/10/2014	2
14-83	6/6/2014	3306	BECKWITH	MODESTO		N	N	N	Y			50	3	1						6/25/2014	2
14-84	6/10/2014	3941	ROSELLE	RIVERBANK		N	Y	N	N	1200	320	65	3	2						6/10/2014	2
14-85	6/10/2014	20118	HWY 33	CROWS LANDING		N	N	N	Y			50	3	3						6/13/2014	2
14-86	6/11/2014	1319	CANAL ST	MODESTO		N	N	N	Y						1	30	3	9		6/12/2014	2
14-87	6/13/2014	2351	REDWOOD	CERES		N	N	N	Y	1200	750	150	3	2						6/17/2014	2
14-88	6/24/2014	206	BAROZZI	MODESTO		N	N	Y	N											7/1/2014	2
14-89	6/24/2014	4601	MORROW	MODESTO		N	Y	N	N	1500		82	3	3							4
14-90	6/30/2014	3524	FAITH HOME	CERES		N	Y	N	N	1200		50	3	3						7/3/2014	2
14-91	6/30/2014	2737	NORTH AVE	MODESTO		N	Y	N	N	1800	570	82	3	3						7/3/2014	2
14-92	6/30/2014	4401	GEER RD	HUGHSON		N	N	N	Y			83	3	3						7/1/2014	2
14-93	7/1/2014	3201	GOLF RD	TURLOCK		N	N	N	Y			40	3	1						7/1/2014	2
14-94	7/1/2014	5443	CENTRAL	CERES		N	N	N	Y			25	3	3						7/7/2014	2
14-96	7/1/2014	912	LOLETTA	MODESTO		N	N	N	Y						1	15	36	8		7/2/2014	2
14-97	7/2/2014	4961	GRIFFIN RD	HUGHSON		N	N	N	Y		200	40	3	3						7/2/2014	2
14-98	7/9/2014	801	STEWART	MODESTO		N	Y	N	N	1250	150	50	3							7/10/2014	2
14-99	7/14/2014	779	WELLSFORD	EMPIRE		N	N	N	Y											7/14/2014	2
14-100	7/16/2014	4717	GRATTON	DENAIR		N	N	N	Y						1	20	3	9	20	7/15/2014	2
14-101	7/16/2014	609	ELM AVE	MODESTO		N	N	N	Y			120	3	2						9/12/2014	2
14-102	7/22/2014	631	STUHR RD	NEWMAN		N	N	N	Y			20	3	3						7/22/2014	2
14-103	7/23/2014	2225	VIVIAN	MODESTO		N	N	N	Y		150	30	3	1						7/23/2014	2
14-104	7/29/2014	11867	ORANGE BLOSSOM	OAKDALE		N	N	N	Y			25	3	3						7/29/2014	2
14-105	7/29/2014	1736	CALIFORNIA AVE	MODESTO		N	N	N	Y			25	3	3						7/31/2014	2
14-106	7/31/2014	1720	VERNON	MODESTO		N	N	N	Y			40	3	3						8/1/2014	2
14-107	8/4/2014	2412	HART RD	MODESTO		N	N	N	Y			25	3	3						8/5/2014	2
14-108	8/5/2014	4001	LITT	MODESTO		N	N	N	Y		210	30	3	3						8/5/2014	2
14-109	8/5/2014	4212	DALE RD	MODESTO		N	N	N	Y			50	3	3						8/8/2014	2
14-110	8/5/2014	1412	FIRST ST	TURLOCK		N	N	N	Y			100	3	1						8/19/2014	2
14-111	8/6/2014	8319	MONTE VISTA	DENAIR		N	N	N	Y			50	3	3						8/7/2014	2
14-112	8/12/2014	429	RYDER	MODESTO		N	Y	N	N	1500	420	70	2	3						8/12/2014	2
14-113	8/13/2014	1608	WOODWORTH AVE	CERES		N	N	N	Y		210	30	3	3						8/13/2014	2
14-114	8/19/2014	901	ATLANTIC	MODESTO		N	Y	N	N	1200										8/21/2014	2
14-115	8/21/2014	3261	ESTA	MODESTO	8/25/2014	N	N	N	Y												NA
14-116	8/22/2014	1101	AVALON AVE	MODESTO		N	Y	N	N	1200	380	55	3	3						5/17/2014	2
14-117	8/26/2014	3024	HAWKEYE	TURLOCK		N	N	N	Y			20	3	2						8/26/2014	2
14-118	8/26/2014	7712	HWY 33	WESTLEY		N	Y	N	N	1500	30	85	3	3						8/27/2014	2
14-119	8/28/2014	7012	PARKRIDGE	RIVERBANK		N	N	N	Y			20	3	3						8/28/2014	2
14-120	8/28/2014	5612	WOODLAND AVE	MODESTO		N	N	N	Y			25	3	3						9/9/2014	2
14-121	8/28/2014	1961	HART RD	MODESTO		N	Y	N	N	1500		25	3	3						9/3/2014	2
14-123	9/3/2014	2200	LAS PALMAS	PATTERSON		N	Y	N	N	1500		45	3	3						9/4/2014	2
14-124	9/5/2014	1321	STOCKTON ST	MODESTO		N	N	N	Y					1		15	3	12	20	9/5/2014	2
14-125	9/8/2014	1411	PELTON #C	MODESTO		N	Y	N	N	1800					1	40	3	10	40	9/26/2014	2
14-126	9/15/2014	627	GALAXY	MODESTO		N	N	N	Y						1	40	3	10	40		2
14-127	9/15/2014	523	ROSEMORE	MODESTO		N	Y	N	N	1200	230	36	3	3						9/16/2014	2
14-128	9/16/2014	8154	PARADISE	MODESTO		N	N	N	Y			26	3	3						9/16/2014	2
14-129	9/22/2014	3612	WAVERLY	HUGHSON		N	Y	N	N	1500	570	82	3	3						9/22/2014	2
14-130	9/22/2014	1620	WAVERLY	MODESTO		N	N	N	Y						1	15	3	9	15	9/23/2014	2
14-131	9/23/2014	10249	RODDEN	OAKDALE		N	Y	N	N	1500										9/26/2014	2
14-132	9/24/2014	2601	OAKHURST	OAKDALE		N	N	N	Y			30	3	3						9/30/2014	2
14-133	9/29/2014	29954	YOSEMITE	LA GRANGE		N	N	N	Y						1	20	3	9	20	10/27/2014	2
14-134	10/1/2014	4724	GREENLEAF CT	MODESTO		N	N	N	Y			100								10/7/2014	2
14-135	10/7/2014	4420	BLAKER	CERES		N	Y	N	N	1500	570	82	3	3						10/10/2014	2
14-136	10/7/2014	1101	GREENWAY	TURLOCK		N	N	N	Y			100	3	1						10/8/2014	2
14-137	10/13/2014	2308	EVELLE	TURLOCK		N	N	N	Y			82	3	3						10/13/2014	2
14-138	10/21/2014	2424	MABLE	MODESTO		N	N	N	Y			20	3	3						10/21/2014	2
14-139	10/23/2014	4936	DUNN RD	MODESTO		N	N	N	Y			36	3	3						10/23/2014	2
14-140	10/23/2014	603	INDIANA	MODESTO		N	Y	N	N	1200		50	3	3						10/24/2014	2
14-141	10/27/2014	3939	MINNEAR RD	RIVERBANK		N	N	N	Y				5	3						10/27/2014	2

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14-142	10/27/2014	1220	SAM AVE	MODESTO	10/30/2014	Y	N	N	N												NA
14-143	10/29/2014	6912	LON DALE	OAKDALE		N	N	N	Y											11/19/2014	2
14-144	10/29/2014	1412	1ST ST	TURLOCK		N	N	N	Y			100	3	1						10/30/2014	2
14-145	11/6/2014	1613	COLIN LN	MODESTO		N	N	N	Y						1	15	3	12	20	11/7/2014	2
14-146	11/12/2014	1010	ALAMO	MODESTO		N	N	Y	N											11/13/2014	2
14-147	11/18/2014	5906	HWY 108	OAKDALE		N	N	N	Y						1	18	3	10	20	11/18/2014	2
14-148	11/19/2014	8901	MAIN ST	TURLOCK		N	N	N	Y		420	60	3	3						11/19/2014	2
14-149	11/24/2014	2835	BERKELEY	TURLOCK		N	N	N	Y		180	60	3	2						11/24/2014	2
14-150	11/24/2014	1538	MADDUX	MODESTO		N	N	N	Y											11/26/2014	2
14-151	11/25/2014	8201	LAUGHLIN	OAKDALE		N	N	N	Y			25	3	3						11/26/2014	2
14-152	11/26/2014	4430	WASHINGTON	TURLOCK		N	N	N	Y		150	50	3	1						11/26/2014	2
14-153	12/1/2014	12515	RANCHERIA WY	OAKDALE		N	N	N	Y			40	3	9						12/10/2014	2
14-154	12/3/2014	3442	MCDONALD	MODESTO		N	N	N	Y			50	3	3						12/3/2014	2
14-155	12/3/2014	627	641 GALAXY WY	MODESTO		N	N	N	Y						1	40	3	9	40	12/18/2014	2
14-156	12/15/2014	7831	WREN	OAKDALE		N	Y	N	N	1900	1320	190	3							12/23/2014	2
14-157	12/17/2014	426	ELM AVE	MODESTO		N	N	N	Y							40	3	9	40	12/19/2014	2
14-158	12/18/2014	12805	DEAN	KNIGHT'S FERRY		N	N	N	Y		660	110	2	3.5						12/19/2014	2
14-159	12/18/2014	3872	REDWOOD RD	CERES		N	N	N	Y			50	3	3						12/23/2014	2
14-160	12/22/2014	2629	PARKDALE	MODESTO		N	N	N	Y		380	55	3	3						12/23/2014	2
14-161	12/29/2014	5536	HINDS	OAKDALE		N	Y	N	N	1800	600				1	60	3	8	60	12/29/2014	2
14-162	12/29/2014	4318	ZEFRING	MODESTO		N	N	N	Y			52	3							12/30/2014	2

DEPARTMENT OF ENVIRONMENTAL RESOURCES

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May 11, 2015

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REVIEW OF NITRATES IN GROUNDWATER IN STANISLAUS COUNTY

Per the requirements of the Stanislaus County "Guidance to the Construction and Operation of Onsite Wastewater Treatment Systems", this report presents the results of my annual review of the database of nitrate content in wells. The database includes 185 of the 195 wells that are used for Public Water Supply in unincorporated areas of the County, and an additional 283 GAMA wells, for a grand total of 478 wells. The 2014 database of 478 wells is more restricted than the 2013 database of 538 wells, likely because some wells went dry or were not sampled in 2014.

The first time I analyzed the distribution of nitrate in wells (Figure 1), using data collected in the last quarter of 2013, I concluded that:

> Of the total database of 538 monitored wells (343 wells monitored by the GAMA project, and 195 wells monitored by Stanislaus County), 310 (58%) had nitrate contents below 22.5 mg/l (green symbols in Figure 6), 194 (36%) had nitrate contents between 22.5 and 45 mg/l (yellow symbols), and only 34 (6%) had nitrate contents higher than 45 mg/l (red symbols). Of the latter, 16 wells are associated to the two County landfills and define the two clusters seen on Figure 1 (north of Hughson for the Geer Rd. Landfill, and south of Patterson for the Fink Rd. Landfill).
>
> Landon et al. (2011) used the GAMA database (Landon and Belitz, 2008) to examine the relations between hydrogeologic factors, reduction-oxidation (redox) conditions, and temporal and spatial distributions of nitrate (NO_3). They concluded that groundwater is predominantly oxic and modern, but some zones have anoxic conditions. Anoxic conditions are found near the valley trough, in areas with shallow depth to water. Anoxic conditions favor the reduction of NO_3 to N_2 primarily due to

denitrification (Korom, 1992). In denitrification, bacteria use the oxygen in the nitrate ion to oxidize organic carbon to CO_2, thus releasing biologically inert molecular nitrogen. Increasing NO_3 concentrations over time were slightly less prevalent in anoxic than oxic groundwater. Spatial and temporal trends of NO3 are primarily controlled by water and NO_3 fluxes of modern land use.

At this time the overall picture of nitrate contamination in the aquifer suggests a modest impact, and as such does not warrant active remediation efforts. At this time the County will adopt "natural attenuation with monitoring" as its remediation strategy, and will perform an annual review of the GAMA and in-house databases as a mitigation effort, attentive to sudden increases in the number of contaminated wells, or in the intensity of contamination in known impacted wells. Public health is protected by the existing requirement that wells with nitrate content above MCL must have well-head treatment units, and that the outflow from such units must have concentrations below MCL before it is used as domestic water supply.

To further investigate the potential link between OWTS and nitrate contamination in wells, using satellite images we examined the location of each of the 82 wells monitored by the County that had nitrate contents above 22.5 mg/l. Among these 82 well locations, we distinguished those in which the surrounding land use was for agriculture, dairy farming, lawn expanses (golf courses or memorial parks), fringe urban, and urban. We also distinguished between "low OWTS use" (e.g., single homes or churches), and "high OWTS use" (e.g., mobile home parks). Animal waste associated to dairy farming, and fertilizers used in agriculture and lawn expanse land uses, were considered to be the most likely source of nitrate contamination, so those sites were not investigated further. Finally, we flagged those wells that were located in fringe urban or urban settings and had a "high OWTS use" designation, as being the most likely cases for OWTS impact on groundwater. 31 of the wells fall in this "suspect" category (15% of the grand total of 195 monitored wells).

Following a similar approach, I started by plotting degree of impact using data collected in the last quarter of 2014. The corresponding map is shown in Figure 2. As can be seen by comparing the two maps, the distribution of nitrate impacts has not changed significantly in the course of a year.

Of the total 2014 database of 478 monitored wells, 293 (61.3 %) had nitrate contents below 22.5 mg/l (green symbols in Figure 2), 153 (32.0 %) had nitrate contents between 22.5 and 45 mg/l (yellow symbols), and only 32 (6.7 %) had nitrate contents higher than 45 mg/l (red symbols). Of the latter, 8 wells are associated to the two County landfills and define the two clusters: north of Hughson for the Geer Rd. Landfill (poorly seen because they are masked by green symbol wells), and south of Patterson for the Fink Rd. Landfill on Figure 2.

Comparing Figures 1 and 2, one can see that a smaller number of wells with more than 45 mg/l (red) are present in the 2014 database (but a caveat is that the 11 "red" wells on the location of the Geer Rd. Landfill are masked by the numerous "green" wells).

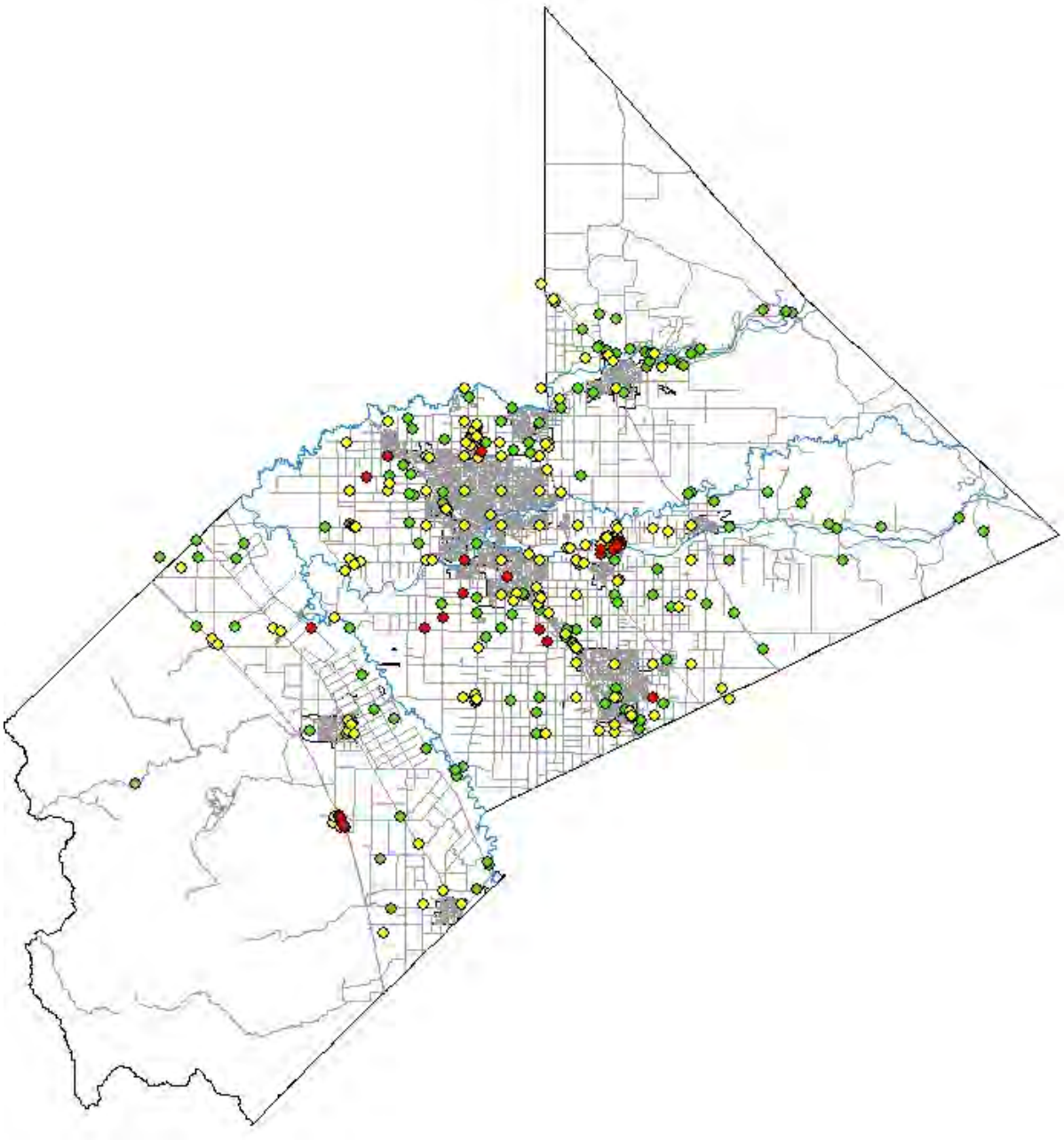


Figure 1. Relative concentration of nitrate in wells sampled during 2013 (SCDER, 2014). In green are shown wells with less than 22.5 mg/l nitrate, in yellow wells with nitrate contents between 22.5 and 45 mg/l, and in red wells with more than 45 mg/l nitrate.

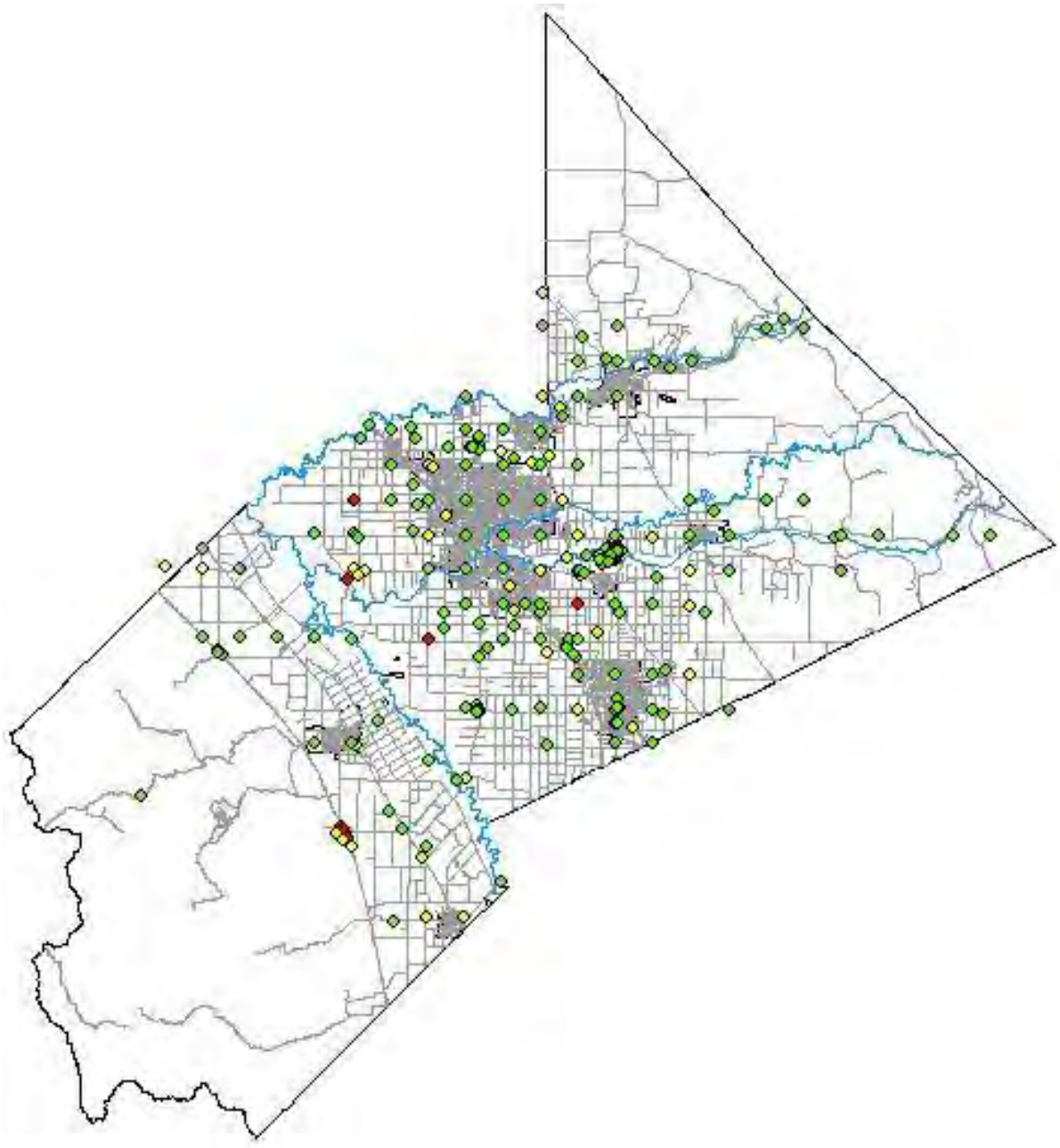


Figure 2. Relative concentration of nitrate in wells sampled during 2014. In green are shown wells with less than 22.5 mg/l nitrate, in yellow wells with nitrate contents between 22.5 and 45 mg/l, and in red wells with more than 45 mg/l nitrate.

Data Comparison

345 wells had data available from the last quarter of 2013 and the last quarter of 2014. Of these, 20 wells (5.8%) exhibited an increase of more than 50% in nitrate value (these wells were the subject of the statistical analysis described in the next section). 97 wells (28.1%) had a modest increase of less than 50%, and the remaining 228 wells (66.1%) showed no significant change or a considerable decrease in nitrate concentration.

The comparison between the 345 wells is shown in the table at the end of this report.

Protocol of Statistical Analysis

Because of spatial variability and the slow movement of groundwater across the county, I used intrawell correlation (also referred to as trend analysis) to evaluate changes in the nitrate content of the 20 wells that exhibited an increase of more than 50% in nitrate value. In this method of statistical analysis, new measurements in a well are compared to the history of that particular well over the last 13 monitoring periods. Intrawell correlations completely remove the spatial component of variation from the comparison. One problem with this approach is that if previous contamination exists, the method will not detect it unless it significantly increases. Thus, the protocol of statistical analysis should use separate algorithms to identify releases both in terms of their absolute magnitude (e.g., by establishing predictive intervals based on the historical spread of the data), and in terms of cumulative increases (e.g., by quantifying changes in the trends of the data). The combined analysis can be performed using the standard techniques of linear regression for trend analysis, as presented in most introductory statistics textbooks (e.g., Brase and Brase, 1991).

ASTM (1996) has noted that, when justified, intrawell comparisons are generally preferable to their interwell counterparts because they completely eliminate the spatial component of variability. Due to the absence of spatial variability, the uncertainty in measured concentrations is decreased, making intrawell comparisons more sensitive to real releases (that is, decrease the chances of false negatives), and false positive results due to spatial variability are completely eliminated.

The following protocol is proposed for the statistical analysis of water quality data at the Site:

1. Group data by quarter.

2. Cull from the database data older than 14 reporting periods (the data will still be retained in the archival database). The 14th period is the data for the current monitoring period. The previous 13 data points constitute the database on which the intrawell comparison will be based. There are four reasons for limiting the analysis to the 14 most recent data points. First, thirteen samples provide a 99% confidence nonparametric prediction limit (Gibbons, 1994), which is adequate for water quality monitoring. Second, the use of old data generally introduces so much variability that prediction intervals become too wide to be of any practical benefit (this is in part due to improvements in the sensitivity of analytical methods as time goes by). Third, all time-based estimators are more accurate if the value to be predicted is closer to the mean time value of the database; in other words,

by using databases that extend too far into the past one actually decreases the precision of the estimate (see discussion about the least-squares estimator in bullet 7 below). Fourth, the goal of compliance monitoring is to decide if anomalous concentrations of an analyte have been detected in the short, immediate term (i.e., in the current monitoring period), ideally without bias from the condition of the well three years ago.

3. Wells with less than 8 data points need to be analyzed by non-statistical methods, since no meaningful statistics can be performed for them.

4. Replace non-detects (NDs) by the method detection limit (MDL). Experience shows that it is better to use the MDL for the current monitoring period for this replacement throughout the 14-period database, because changes in the MDL over time could trigger a spurious result. Alternatively one could replace NDs by MDL/2, but this practice is not recommended as it has the tendency to broaden the prediction limit.

5. Screen data for outliers, using visual inspection or box-and-whiskers plots. If an outlier is suspected review the lab reports to verify that it is not a typographic error. If it is not, document the outliers in the statistical report, and then remove them from the working database (the data will be retained and reported in the archival database). Outliers can be real values, albeit extreme, but generally have the tendency to broaden the prediction limits, sometimes to the extent that the prediction limits lose their practical value.

6. Screen data for historical trends, using a least-squares trend estimator. The derivation of the linear least-squares estimator is presented in a number of basic statistics books. A straightforward explanation is presented in the book by Brase and Brase (1991, p. 454-469), in which the following summary is based. In brief, suppose Y (the concentration of an analyte) varies linearly with time, x. In this case, the value of concentration with respect to time can be estimated by the model $y^* = a + bx \pm \varepsilon$, where y^* is an estimate of Y, and y is the actual value measured for a given time x, and ε is the random error between y^* and y.

   The objective is to find a linear equation that is the best representation of the observed values. To find the line with the best fit we use the least squares criterion, which says that the line we fit to the data points must be such that the sum of the squares of the differences between y^* and y should be as small as possible. By minimizing the sum of the squares, we are in effect not allowing positive and negative difference values to cancel out one another in the sum. It is in this way that we can meet the least squares criterion of minimizing the sum of the squares over all data points.

Techniques of calculus can be applied to show that the line that meets the least squares criterion is as follows

$$y^* = a + bx \pm \varepsilon$$

where

$b = SS_{xy}/SS_x$ — b is the slope of the best fit line

$a = \bar{y} - b\bar{x}$ — a is the y-intercept

ε = error term

and

$\bar{y}$ = mean of y values

$\bar{x}$ = mean of x values

$SS_{xy} = \Sigma xy - (\Sigma x \Sigma y)/n$ — n is the number of observations (n = 13 in our case)

$SS_x = \Sigma x^2 - (\Sigma x)^2/n$

From the standpoint of analyzing trends, a positive value of b would indicate an increasing trend, a small value of b (positive or negative) would indicate no trend or a stable condition, and a negative value would indicate a decreasing trend. In terms of no impact to groundwater, one would expect to see decreasing or flat trends. A mild increasing trend could be indicative of seasonal variation. A pronounced increasing trend would be indicative of progressive deterioration of water quality, which would trigger evaluation of environmental controls and or practices.

For assessment of trend we use only the 13 historic data points, and do not include the data point for the current monitoring period.

7. Calculate a prediction interval against which the data for the current quarter can be compared. Having obtained the model estimator y^*, one would then want a method for measuring the spread of a set of values about the least squares line. The standard method accepted by all statisticians uses the *standard error of estimate*. Let

$$y^* = a + bx$$

be the predicted value from the least squares line. Then, $y - y^*$ is the difference between the y value of the data point (x,y), and the y^* value of the point on the least squares line with the same x. The quantity $y - y^*$ is known as the *residual*. To avoid the difficulty of having some positive and some negative values, we square the residuals, then we sum the squares and, for technical reasons that require a lengthy mathematical derivation, divide this sum by n-2. Finally we take the square root to obtain the *standard error of estimate*, which is traditionally denoted as S_e:

$$S_e = SQRT[\Sigma(y - y^*)^2 /(n-2)] \quad \text{- - - - - - - - - -} \quad (1)$$

The formula for the standard error of estimate is reminiscent of the formula for the standard deviation.It too is a measure of dispersion. However, the standard deviation involves differences of data values from a mean, whereas the standard error of estimate involves differences between observed and predicted *y* values for a given *x*.

The actual computation of S_e using the formula given above is quite long because the formula requires us to use the least squares equation to compute a predicted value y^* for each *x* value in the data pairs. There is an equivalent computational formula that is used instead:

$$S_e = SQRT[(SS_y - bSS_{xy})/(n-2)] \quad \text{- - - - - - - - - -} \quad (2)$$

where

$b = SS_{xy}/SS_x$ — *b* is the slope of the best fit line

$SS_{xy} = \Sigma xy - (\Sigma x \Sigma y)/n$ — n is the number of observations (n = 13 in our case)

$SS_y = \Sigma y^2 - (\Sigma y)^2/n$

$SS_x = \Sigma x^2 - (\Sigma x)^2/n$

With a considerable amount of algebra it can be shown that equations (1) and (2) are equivalent. Formula (1) shows the strong similarity between the standard error of estimate and the standard deviation, and formula (2) is a shortcut calculation formula because it involves few subtractions.

Remembering that the estimator y* includes a term for random error,

$$y^* = a + bx \pm \varepsilon$$

the theory of errors tells us that for a specific *x*, a confidence interval for *y* is given by the formula:

$$y^* - E \leq y \leq y^* + E$$

where

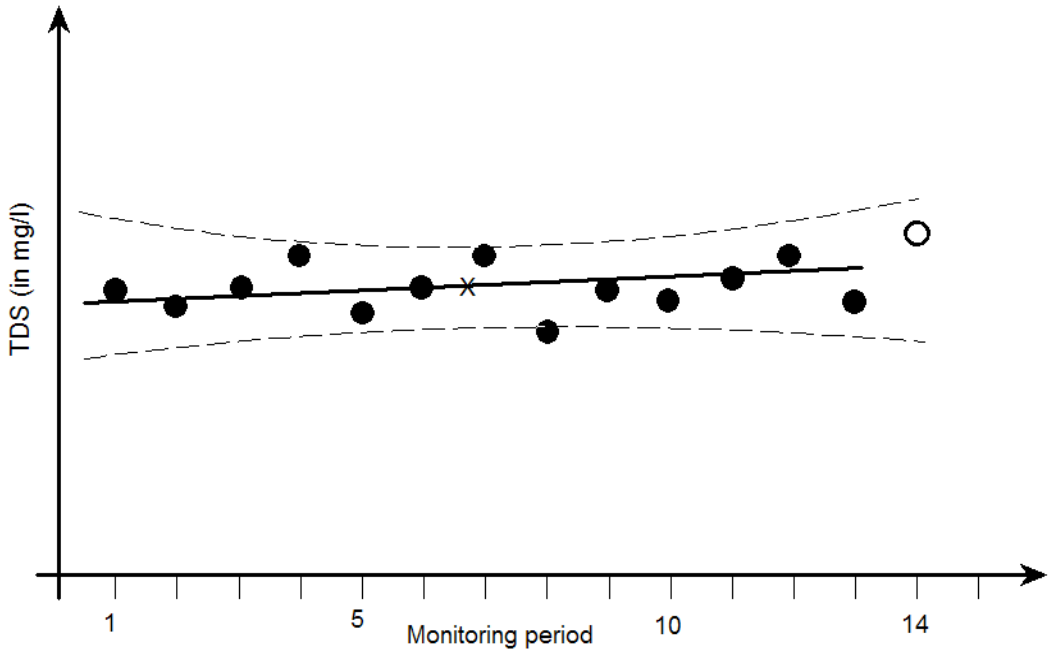
$$E = t_{0.05} S_e * SQRT[1 + 1/n + K] \quad \text{- - - - - - - - - -} \quad (3)$$

$t_{0.05}$ = the value from Student's t distribution using n-2 degrees of freedom, at a significance level α of 0.05 (i.e., a confidence interval of 95%).

S_e = the standard error of estimate [see equation (2)]

$$K = [(x-\bar{x})^2/SS_x]$$

Equation (3) is equivalent to the formula suggested by U.S. EPA (1989, p.5-24 to 5-28) for the calculation of prediction intervals, with the number of future observations *m* being set to 1, and with the adjustment K, recommended by most statisticians for increased uncertainty as the difference between *x* and $\bar{x}$ becomes larger (Brase and Brase, 1991, p. 468). The factor K reflects the general property that confidence intervals are narrower the nearer we are to the mean of the *x* values. As we move away from the mean value, the confidence interval for y becomes wider. This situation is illustrated schematically in the following figure (dashed lines bound the confidence interval), and is another reason for limiting the number of data points to no more than 13 (with the current monitoring period being the 14th data point).



Although the previous expressions may appear complicated, they can be easily stated in a few Excel formulas. For calculation of the upper-prediction interval estimator we use only the 13 historic data points, and do not include the data point for the current monitoring period.

8. Compare the value obtained during the current monitoring period (i.e., the 14th observation), with the value obtained using the upper-prediction interval estimator:

$$y^*_{14} + E = a + bx + E \qquad \text{for } x = 14$$

If the 14th observation, y_{14} is larger than $y^*_{14} + E$, then one concludes that there has been a statistically significant increase in the concentration of that particular analyte at that particular well.

Statistical Results

The table in the following page summarizes the results of the statistical analysis, together with the interpretation of each of the 20 wells under consideration. Yellow highlights indicate rising trends, or cases where the most recent results are outside of the confidence interval defined by the data from previous monitoring events. The first note refers to the scatter of the data (low, medium, or high); highly scattered data is more likely to produce false positive results (i.e., the suspicion that impact as occurred when in reality it has not). The second note alerts the reader to the possibility that a high value is due to it being an outlier (obvious outliers have been removed as shown by the light pink shading), or belonging to a database with many high values, or many low values, or with obvious internal trends (e.g., the data from well 5010300-002 is low and flat for the first 7 periods, but becomes progressively higher in the course of the last 7 periods.

Results of statistical trend analysis of NO3 values (in mg/l)

Event	041032025	5000060-002	5000237-001	5000049-001	5010005-001	5000066-001	5010010-129	5010010-172	5000290-001	5010010-070
1		6.5	8.7	3.4	1	8.6	8.32		44.7	1
2		7.6	10.5	7.3	4	4.6	9.25	7	44.9	14
3	7.2	6.8	9.1	2	1	6.8	19.6	2	22	14
4	3.9	7	10.5	5.4	6.46	6.5	14	2.46	40.9	20
5	7.4	7.8	10	10.2	12.1	6.6	14.4	5.36	40.2	23.9
6	12.3	10.5	10.7	8.9	13.2	6.7	11.2	3	14.8	23.8
7	7.6	6.9	9.5	2	10.3	5.8	20.5	4.56	16.8	23.6
8	7	4.7	9.7	2	15.5	7.4	15.8	3.26	35.2	2.53
9	7.5	7.8	16	5.5	15.1	5	19.3	6.15	42.9	7.61
10	8.7	7.8	11.8	10.2	7.26	5	16.3	1.74	18.8	17.5
11	7.4	7.4	13	14.8	7.7	7.3	9.4	6.33	17.5	21.5
12	7.1	9.9	2	7.8	11.9	6.4	10.2	5.71	14.5	19.8
13	6.1	6.4	8.3	5.7	5.18	5.3	10.7	6.42	33.7	6.37
14	17.4	10.1	7.9	11.5	10.1	30.2	25	12	44.8	21.6
Slope	0	0.054	-0.08	0.36	0.561	-0.09	0	0.154	-1.52	0.164
UP value	13.5	11.75	17.79	18.63	24.25	9.6	25.14	10.51	48.33	38.04
Current	17.4	10.1	7.9	11.5	10.1	30.2	25	12	44.8	21.6
Slope	Flat	Mild up	Neg	Up	Up	Neg	Flat	Up	Neg	Up
Scatter	Low	Low	Med	High	High	Low	Med	Med	Med	High
UP concl	Above	Below	Below	Below	Below	Above	Below	Above	Below	Below
Notes	Outlier				Seasonality?	Outlier	Outlier?	Outlier?	Seasonality?	

Event	MW-18S	MW-21S	PZ-3	MW-28D	MW-14SR	MW-8S	5000117-001	5010300-002	5010023-002	5010017-012
1	6.3				8.55	9	16.3	1	1	5
2		9.9			7.65	4.95	14.3	0.8	8	7.2
3		9			3.78	5.85	7	0.9	12	7.6
4		1.89			2.16	4.185	28.8	1	12	6.9
5	3.87	2.835	6.75		0.945	5.4	28.1	0.9	12.1	8.7
6	2.97	1.98	7.65	58.5	1.485	7.2	36.8	0.9	14.9	7.5
7	4.275	6.3	2.565	12.15	1.98	7.65	18.4	1	16	11.2
8	2.34	1.35	1.17	13.95	0.9	4.32	23.7	1.9	14.3	9.2
9	3.33	6.75	3.87	45	1.035	9	35.6	0.5	11.7	8
10	2.115	0.765	2.61	18.9	3.735	9	26.7	2.1	12.4	6.4
11	4.095	1.665	5.4	11.7	2.205	10.8	14.5	2.9	9.03	8.5
12	6.3	0.99	3.645	19.8	3.105	10.8	28	4.5	16.6	9.2
13	3.78		4.95	29.7	2.43	13.95	32.3	4.7	6.6	9.7
14	7.2	4.365	5.4	63	6.75	11.25	36	7.3	21.4	17.2
Slope	-0.084	-0.637	-0.202	-2.336	-0.338	0.536	1.045	0.287	0.355	0.223
UP value	7.49	7.3	9.6	69.91	6.17	17.11	52.92	6.1	24.55	13.21
Current	7.2	4.37	5.4	63	6.75	11.25	36	7.3	21.4	17.2
Slope	Neg	Neg	Neg	Neg	Neg	Up	Up	Up	Up	Up
Scatter	Med	Med	Med	High	Med	Low	High	Low	High	Low
UP concl	Below	Below	Below	Below	Above	Below	Below	Above	Below	Above
Notes	Old outliers	Old outliers	Old outliers	Data missing	Low values			Two trends		Two trends

The intent of statistical comparisons is to have a sensitive tool to alert the environmental manager about the need to adjust a land application or farming practice. However, in keeping this tool sensitive we also make it susceptible to false positives due to outliers, laboratory errors, or clerical mistakes. Experience shows that the best approach when identifying a potential problem is to put the parameter and well in observation for the following three monitoring periods, to see if the trend persists. The following table, which will be updated annually, will track the wells under observation, and record the final resolution of the 3-quarter observation period.

Well	Placed on observation	1st quarter	2nd quarter	3rd quarter	Conclusion
041032025	4th Q 2014 for exceeding upper limit of confidence interval				
5000049-001	4th Q 2014 for rising trend				
5010005-001	4th Q 2014 for rising trend				
5000066-001	4th Q 2014 for exceeding upper limit of confidence interval				
5010010-172	4th Q 2014 for exceeding upper limit of confidence interval and rising trend				
5010010-070	4th Q 2014 for rising trend				
MW-14SR	4th Q 2014 for exceeding upper limit of confidence interval				
MW-8S	4th Q 2014 for rising trend				
5000117-001	4th Q 2014 for rising trend				

5010300-002	4th Q 2014 for exceeding upper limit of confidence interval and rising trend				
5010023-002	4th Q 2014 for rising trend				
5010017-012	4th Q 2014 for exceeding upper limit of confidence interval and rising trend				

Conclusions

345 wells had data available from the last quarter of 2013 and the last quarter of 2014. Of these, 20 wells (5.8%) exhibited an increase of more than 50% in nitrate value. 97 wells (28.1%) had a modest increase of less than 50%, and the remaining 228 wells (66.1%) showed no significant change or a considerable decrease in nitrate concentration.

The whole database available for the 20 wells that had significant increases in their nitrate values was assessed with statistical trend analysis. 12 of these wells had either a rising trend, and/or had a last value that exceeded the upper limit of the 95% confidence interval of the trend. These wells will be placed in observation for three consecutive quarters to see if the rising trend continues into the future.

Respectfully submitted,

/S/

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Table 1. Wells compared for nitrate content in the last quarter of 2013 and the last quarter of 2014. The yellow highlight identifies the 20 wells in which there was more than a 50% increase in nitrate concentration.

APPROXIMATE LATITUDE	APPROXIMATE LONGITUDE	WELL NAME	Nitrate in 2013 in mg/l	Nitrate in 2014 in mg/l	Percent difference
37.814	-120.85	5000060-002	6.4	10.1	58%
37.843	-120.929	5000277-002	25.3	25.2	0%
37.785	-120.85	5010014-005	18	13	-28%
37.785	-120.85	5000175-001	17.5	16.8	-4%
37.785	-120.85	5000447-001	12	6.7	-44%
37.785	-120.85	5000237-003	9.5	8.4	-12%
37.785	-120.85	5000237-004	9.3	8.7	-6%
37.785	-120.85	5000237-001	2	7.9	295%
37.785	-120.81	5000435-002	37.4	27.7	-26%
37.785	-120.81	5000433-001	31	15.5	-50%
37.785	-120.81	5000272-001	20.4	17.4	-15%
37.785	-120.81	5000433-003	19.4	18.6	-4%
37.785	-120.81	5000015-002	14.7	9.7	-34%
37.785	-120.81	5000433-002	17.3	15.1	-13%
37.785	-120.81	5000433-005	11.2	12.2	9%
37.785	-120.81	5000237-002	8.5	2.4	-72%
37.785	-120.81	5000049-001	5.7	11.5	102%
37.785	-120.771	5000014-002	4.5	3.2	-29%
37.785	-120.81	5000433-004	3.2	2.3	-28%
37.785	-120.81	5000049-002	4.8	2.1	-56%
37.785	-120.771	5000433-007	18.1	19.7	9%
37.785	-120.771	5000433-006	15.6	21.4	37%
37.785	-120.771	5000317-002	9.5	7.6	-20%
37.756	-121.008	5010029-002	32.6	7.08	-78%
37.756	-121.008	5010029-004R289	6.64	6.77	2%
37.756	-121.008	5000099-003	6.3	6.3	0%
37.756	-120.929	5000048-003	32.9	23.4	-29%
37.756	-120.89	5000048-002	21.9	26.4	21%
37.756	-120.89	5000016-001	15.2	14.3	-6%
37.756	-120.89	5010014-010	3.8	3.7	-3%
37.756	-120.85	5010014-011	28	9.2	-67%
37.756	-120.85	5010014-008	16	16	0%
37.756	-120.85	5010014-009	11	10	-9%
37.756	-120.85	5010014-006	10	10	0%
37.756	-120.85	5010014-007	5.5	5.2	-5%
37.746501	-120.908816	062-010-026	26.4	23.4	-11%

37.738663	-120.906957	062-017-007	10.9	8.1	-26%
37.729814	-121.067554	003-021-017	3	3	0%
37.727	-121.088	5010005-009	25	3.72	-85%
37.727	-121.088	5010005-006	20.7	25.9	25%
37.727	-121.088	5010005-008	15.9	10.2	-36%
37.727	-121.008	5000411-004	43.8	37.7	-14%
37.727	-121.008	5000411-001	39.6	36.7	-7%
37.727	-121.008	5000067-005	23.7	25.1	6%
37.727	-121.008	5000346-001	21.1	21	0%
37.727	-121.008	5000563-001	20.4	14.9	-27%
37.727	-121.008	5000067-001	19.7	23.2	18%
37.727	-121.008	5010029-001R271	2.12	2.48	17%
37.727	-120.969	5010018-007	21.7	14.8	-32%
37.727	-120.969	5010018-008	18.9	11.1	-41%
37.727	-120.969	5000017-002	18.6	11.3	-39%
37.727	-120.969	5010018-005	17.1	2.3	-87%
37.727	-120.969	5010018-003	9.8	8.6	-12%
37.727	-120.929	5010018-004	21.4	8.8	-59%
37.727	-120.929	5010018-002	12.7	5.9	-54%
37.727	-120.929	5010018-006	5.1	1	-80%
37.722441	-120.995563	004-070-010	9.9	12.3	24%
37.720322	-121.0628	003-018-005	2.3	2.7	17%
37.714252	-121.000645	004-095-011	18.7	18.8	1%
37.71264	-121.002449	004-094-039	16.6	12.9	-22%
37.712283	-121.003531	004-097-019	16.4	13	-21%
37.710138	-120.971447	082-004-039	28	23	-18%
37.698	-121.088	5010005-007	49.1	21.7	-56%
37.698	-121.088	5000335-001	6.3	9.4	49%
37.698	-121.088	5010005-005	6.02	5.54	-8%
37.698	-121.088	5010005-001	5.18	10.1	95%
37.698	-121.048	5010010-053	39.4	36.3	-8%
37.698	-121.048	5010010-044	29	31.8	10%
37.698	-121.008	5000426-001	43.6	50.9	17%
37.698	-121.008	5010010-052	36.7	30.7	-16%
37.698	-121.008	5010010-045	33.2	31.8	-4%
37.698	-121.008	5010010-027	31.2	34.8	12%
37.698	-121.008	5000189-006	30.3	30.2	0%
37.698	-121.008	5000189-004	24.9	17.1	-31%
37.698	-121.008	5000189-005	16.2	15.3	-6%
37.698	-121.008	5010010-130	9.65	5.32	-45%
37.698	-121.008	5010010-050	9.25	9.39	2%
37.698	-121.008	5000066-001	5.3	30.2	470%

37.698	-120.969	5000368-001	33.5	25.2	-25%
37.698	-120.969	5010010-041	19.9	21.5	8%
37.698	-120.969	5010010-129	10.7	25	134%
37.698	-120.969	5010010-221	4.52	4.65	3%
37.698	-120.929	5000284-001	26	26.6	2%
37.698	-120.929	5000467-001	23.3	33	42%
37.698	-120.929	5000211-004	22.9	17.8	-22%
37.698	-120.929	5010010-062	13.2	12.4	-6%
37.698	-120.929	5010010-068	10.6	5.8	-45%
37.696277	-121.044439	003-022-002	31.6	28.5	-10%
37.669	-120.691	5000164-002	2	1	-50%
37.669	-120.652	5000164-003	2	1	-50%
37.669	-120.652	5000164-004	2	1	-50%
37.669	-120.929	5010010-043	24.8	24.3	-2%
37.669	-120.929	5010010-047	22.1	21.8	-1%
37.669	-120.929	5010010-127	21.4	20.7	-3%
37.669	-120.929	5010010-048	14.3	14.6	2%
37.669	-120.771	5000481-001	18	17	-6%
37.669	-121.127	5000499-001	44.7	55.4	24%
37.669	-121.088	5000404-002	25	11.7	-53%
37.669	-121.088	5000258-001	2	2.1	5%
37.669	-121.048	5010010-035	27.6	26.9	-3%
37.669	-121.048	5010010-124	2.08	1.11	-47%
37.669	-121.008	5010010-018	30.6	30.8	1%
37.669	-121.008	5010010-019	28.2	25.5	-10%
37.669	-121.008	5010010-131	9.16	7.44	-19%
37.669	-120.969	5010010-187	39	1.9	-95%
37.669	-120.969	5010010-189	29.4	22.8	-22%
37.669	-120.969	5010010-097RW65	14.4	9.75	-32%
37.669	-120.969	5010010-172	6.42	12	87%
37.664759	-121.059768	081-003-014	15	9.7	-35%
37.660751	-120.747445	015-013-040	8.5	7	-18%
37.641814	-121.06459	007-024-006	18.7	15.3	-18%
37.64	-120.85	5000090-002	26.2	34.5	32%
37.64	-120.969	5000110-001	31.1	21.4	-31%
37.64	-120.85	5000154-001	10.1	10.5	4%
37.64	-121.127	5000290-001	14.5	44.8	209%
37.64	-121.008	5000388-001	37.3	43.3	16%
37.64	-120.771	5010006-001	21	27.6	31%
37.64	-120.731	5010006-003	19.6	23.6	20%
37.64	-120.771	5010006-004	20.5	25.3	23%
37.64	-120.771	5010006-005	10.4	8.73	-16%

37.64	-120.771	5010006-006	20.5	17.7	-14%
37.64	-120.771	5010006-012	22.7	17.7	-22%
37.64	-121.008	5010010-003	15.5	20.7	34%
37.64	-121.008	5010010-006	25.1	24.4	-3%
37.64	-120.969	5010010-008	22.3	18.5	-17%
37.64	-121.008	5010010-009	5.67	4.3	-24%
37.64	-121.008	5010010-012	25.2	24.1	-4%
37.64	-120.929	5010010-042	34.4	29.1	-15%
37.64	-120.929	5010010-049	20.4	3.5	-83%
37.64	-121.008	5010010-061	2.35	0.8	-66%
37.64	-121.008	5010010-070	6.37	21.6	239%
37.64	-121.048	5010010-146	25.9	27.8	7%
37.64	-121.008	5010010-148	19.4	11.5	-41%
37.64	-121.048	5010010-149	17.7	23	30%
37.64	-121.008	5010010-151	1.42	1.68	18%
37.64	-120.929	5010010-169	33.8	20	-41%
37.64	-120.929	5010010-170	6.42	6.42	0%
37.64	-120.969	5010010-171	8.28	8.73	5%
37.64	-120.929	5010010-178	32.4	28.9	-11%
37.64	-120.929	5010010-184	25.6	27.2	6%
37.64	-120.969	5010010-185	10.2	8.72	-15%
37.64	-120.929	5010010-186	33.3	35.6	7%
37.64	-120.89	5010010-191	35.9	35.8	0%
37.64	-120.969	5010010-192	30.9	34.3	11%
37.64	-120.969	5010010-193	32.9	27.1	-18%
37.64	-120.929	5010010-194	30.5	33.4	10%
37.64	-120.969	5010010-196	25.9	29.1	12%
37.64	-120.929	5010010-226	27.3	27.3	0%
37.64	-120.731	5010042-002RW02	0.4	0.4	0%
37.64	-120.573	5010300-005	1	1	0%
37.637662	-121.122524	012-050-011	10	8	-20%
37.63121883	-120.848266	MW-18S	4.095	7.2	76%
37.63121878	-120.8482652	MW-18D	23.85	7.65	-68%
37.63090226	-120.8513046	MW-17S	43.65	9.45	-78%
37.63090157	-120.8513039	MW-17D	25.65	8.55	-67%
37.6308363	-120.8567751	PZ-2	25.65	24.75	-4%
37.63065413	-120.8480594	MW-21S	1.665	4.365	162%
37.63065316	-120.8480597	MW-21D	17.1	13.95	-18%
37.6295979	-120.8544931	PZ-1	12.6	9.45	-25%
37.6295886	-120.8608817	PZ-6	12.15	12.6	4%
37.6295839	-120.8591392	PZ-4	23.85	23.85	0%
37.62908592	-120.8480424	MW-22D	3.42	1.485	-57%

37.62908591	-120.8480435	MW-22S	32.85	12.6	-62%
37.62884706	-120.8608991	MW-27S	9.45	4.41	-53%
37.62883404	-120.8608817	MW-27D	27.45	10.35	-62%
37.62830095	-120.8527976	MW-26D	25.2	11.7	-54%
37.62829133	-120.8527742	MW-26S	5.4	6.3	17%
37.6282168	-120.8567183	PZ-3	1.17	5.4	362%
37.62746809	-120.8481141	MW-13S	99	72	-27%
37.62619759	-120.8446942	MW-24D	19.35	16.65	-14%
37.62619745	-120.8446102	MW-24S	108	108	0%
37.62618433	-120.8467841	MW-16S	108	108	0%
37.6261138	-120.8494322	MW-7D	4.005	0.495	-88%
37.62610075	-120.8494329	MW-7S	76.5	85.5	12%
37.62534441	-120.8553088	MW-3S	16.65	10.35	-38%
37.62532128	-120.8553199	MW-3D	7.2	2.7	-63%
37.62470703	-120.8476646	MW-19D	5.4	3.6	-33%
37.62470682	-120.8476658	MW-19S	67.5	72	7%
37.6242866	-120.8475861	MW-12S	54	41.85	-23%
37.62406239	-120.8658056	MW-28S	22.95	29.7	29%
37.6240463	-120.8658057	MW-28D	13.95	63	352%
37.623839	-120.880681	018-063-026	40	1	-98%
37.62294036	-120.8481705	MW-11S	23.4	13.95	-40%
37.62283342	-120.8561377	MW-4S	1	1	0%
37.62280839	-120.8577191	MW-23D	3.555	1.35	-62%
37.62277274	-120.8561756	MW-4D	5.85	2.61	-55%
37.6227706	-120.8577553	MW-23S	6.3	0.2655	-96%
37.62268949	-120.8561788	MW-25D2	0.63	0.765	21%
37.62267025	-120.8561842	MW-25D3	0.261	0.243	-7%
37.62153992	-120.8538211	MW-14SR	1.98	6.75	241%
37.62138592	-120.8498253	MW-1S	23.85	23.85	0%
37.62136543	-120.8498443	MW-1D	21.15	9	-57%
37.62134	-120.900487	018-001-079	44.6	41.8	-6%
37.62046271	-120.8657616	MW-29S	72	67.5	-6%
37.62044922	-120.8657614	MW-29D	24.3	10.8	-56%
37.62040208	-120.8568714	MW-8S	4.32	11.25	160%
37.62024461	-120.8501709	MW-10S	67.5	67.5	0%
37.61981547	-120.8524631	MW-2S	126	108	-14%
37.61979653	-120.8524921	MW-2D	85.5	37.35	-56%
37.61951934	-120.8520303	MW-5S	58.5	76.5	31%
37.61877813	-120.8543737	MW-9S	5.4	6.3	17%
37.61766454	-120.8579953	MW-15D	0.315	0.2385	-24%
37.61580905	-120.8656919	MW-30S	81	45	-44%
37.61579301	-120.8656916	MW-30D	18.45	19.8	7%

37.611	-120.969	5010010-135	34.9	48.7	40%
37.611	-120.969	5010028-022	30	30	0%
37.611	-120.969	5010010-136	13.4	13.1	-2%
37.611	-120.969	5010010-134	10.2	10.8	6%
37.611	-120.969	5010028-023	7.4	7.4	0%
37.611	-120.969	5010028-014	5.4	7.6	41%
37.611	-120.969	5010010-132	2.04	0.71	-65%
37.611	-120.969	5010010-137	0.4	0.4	0%
37.611	-120.929	5010028-016	23	25	9%
37.611	-120.929	5010028-028RW28	23	24	4%
37.611	-120.89	5000470-002	39	38	-3%
37.611	-120.89	5010008-003	33.8	26.4	-22%
37.611	-120.89	5000117-001	23.7	36	52%
37.611	-120.771	5010026-001	28.3	34.8	23%
37.611	-120.731	5010026-003	11.6	1.02	-91%
37.611	-120.731	5010026-004	1.06	0.89	-16%
37.611	-120.612	5010300-002	4.5	7.3	62%
37.60918	-121.115577	017-003-005	43.9	41.2	-6%
37.608792	-120.883545	018-017-001	2	1	-50%
37.606169	-121.122036	017-027-038	41	30.2	-26%
37.604093	-120.806632	019-018-040	14	19	36%
37.601293	-121.132156	017-027-036	42.6	49.6	16%
37.597189	-120.962348	040-008-010	49.1	39.1	-20%
37.582	-121.008	5010010-040	49.6	47	-5%
37.582	-120.969	5000003-002	42.4	40.6	-4%
37.582	-120.969	5010028-027	13	14	8%
37.582	-120.929	5010028-021	29	26	-10%
37.582	-120.89	5010008-006	38.4	46.7	22%
37.582	-120.81	5000273-001	1	1	0%
37.582	-120.771	5000219-001	30.4	31.8	5%
37.582	-120.85	5000033-002	14.8	14.8	0%
37.582	-120.85	5010008-005	10.3	6.1	-41%
37.575897	-120.846684	045-009-008	5.4	5.5	2%
37.574979	-120.754568	019-030-001	15	13	-13%
37.574457	-120.930251	041-019-010	27.3	15.9	-42%
37.574055	-121.030564	017-052-018	3.4	3.2	-6%
37.56487	-120.957565	041-032-025	7	17.4	149%
37.562014	-121.029907	041-024-003	54	21	-61%
37.553	-121.286	5000158-001	14.3	17	19%
37.553	-121.286	5000202-001	2	1	-50%
37.553	-121.246	5000202-002	20.3	15.8	-22%
37.553	-121.206	5010007-001	26	19	-27%

37.553	-121.206	5010007-002	24.4	24	-2%
37.553	-121.167	5010033-002	78.4	75.8	-3%
37.553	-121.167	5010033-001	67.3	42.5	-37%
37.553	-121.167	5010033-004	23	21.3	-7%
37.553	-121.127	5000167-002	20.3	20	-1%
37.553	-121.048	5000109-002	54	56	4%
37.553	-120.969	5000286-003	8.2	8.2	0%
37.553	-120.969	5000077-001	4.5	3.6	-20%
37.553	-120.929	5000217-001	49.9	39.9	-20%
37.553	-120.929	5000057-001	41.1	14.4	-65%
37.553	-120.929	5000057-003	37.9	36.4	-4%
37.553	-120.929	5010009-005	22.6	29.3	30%
37.553	-120.929	5010009-007	10.5	8.9	-15%
37.553	-120.929	5010009-006	3.5	3.2	-9%
37.553	-120.89	5010009-012RW10	3.7	3.4	-8%
37.548233	-120.901869	045-052-026	33.3	30.5	-8%
37.545761	-120.983939	041-046-020	20	4.5	-78%
37.5417	-120.921152	041-054-014	50.3	39.9	-21%
37.541107	-120.893588	045-053-039	4	6	50%
37.537677	-120.891012	045-062-018	31.5	25.1	-20%
37.526937	-120.795969	024-028-032	1	1	0%
37.524	-120.89	5010019-035	30.9	33.4	8%
37.524	-120.89	5010019-028 M	15.2	16.5	9%
37.524	-120.85	5010019-032	32.9	36.1	10%
37.524	-120.85	5010019-003	31.3	27.4	-12%
37.524	-120.85	5010019-027	19.7	19.3	-2%
37.524	-120.85	5010019-019	19.6	19.4	-1%
37.524	-120.85	5010019-020	18.7	21.5	15%
37.524	-120.85	5010019-031	13	13.6	5%
37.524	-120.81	5010019-039RW39	24.5	29.4	20%
37.524	-120.81	5010021-007	22	25	14%
37.524	-120.81	5010021-010AR10	21	23	10%
37.524	-120.81	5010021-009AR09	14	16	14%
37.524	-120.771	5010021-008	33	27	-18%
37.4959463	-120.847135	AT-5	17.1	17.1	0%
37.4957994	-120.8469794	AS-5	36.45	36.45	0%
37.4957539	-120.8469183	AS-4	27.9	27.9	0%
37.4957407	-120.846984	AS-2	30.6	30.6	0%
37.4956528	-120.84732	AT-7	5.85	5.85	0%
37.4955187	-120.8471611	AT-8	2.52	2.52	0%
37.4952847	-120.8464964	AT-9	38.7	38.7	0%
37.4952399	-120.8472864	AT-10	3.015	3.015	0%

37.495	-121.008	5000255-001	44.7	1	-98%
37.495	-120.929	5000101-001	2	1	-50%
37.495	-120.89	5010019-004	28.9	28.6	-1%
37.495	-120.85	5010019-030	33.1	28.7	-13%
37.495	-120.85	5010019-029	27.4	14.7	-46%
37.495	-120.85	5010019-033	23.3	23.8	2%
37.495	-120.85	5000454-001	23	27.3	19%
37.495	-120.85	5010023-001	19	8.15	-57%
37.495	-120.85	5010019-013	15.9	15.9	0%
37.495	-120.85	5010019-015	9.7	14.4	48%
37.495	-120.85	5000072-001	4.6	6.6	43%
37.495	-120.85	5010019-036	3.6	2.1	-42%
37.495	-120.81	5000116-001	167	170	2%
37.495	-120.81	5000507-001	29.7	34.3	15%
37.495	-120.81	5010019-014	27.5	31.3	14%
37.495	-120.81	5010019-008	22.3	24.1	8%
37.495	-120.81	5010023-002	6.6	21.4	224%
37.495	-120.731	5000440-001	27.2	28.2	4%
37.495	-120.731	5000440-003	22.6	20	-12%
37.495	-120.731	5000440-002	19.8	19.8	0%
37.495	-120.89	5010019-034	22.4	26.4	18%
37.494586	-120.995052	022-036-015	20	18	-10%
37.493263	-120.99419	022-039-005	24	21	-13%
37.493056	-120.958168	022-043-003	1	1	0%
37.492655	-120.994211	058-006-001	24.6	25.5	4%
37.490292	-120.799379	024-045-012	13.6	7.8	-43%
37.47992	-120.832358	043-017-021	25.7	27.8	8%
37.479082	-120.831426	043-017-004	36.5	27.7	-24%
37.466	-121.167	3910023-004RW3	0.4	0.4	0%
37.466	-121.127	5000271-001	40.3	29.5	-27%
37.466	-121.127	5010017-002	36.4	34.6	-5%
37.466	-121.127	5010017-009	29.8	29.1	-2%
37.466	-121.127	5010017-014RW08	11.9	11.5	-3%
37.466	-121.127	5010017-012	9.7	17.2	77%
37.466	-121.127	5010017-005	6.2	6.1	-2%
37.466	-120.85	5000225-001	38.5	24.5	-36%
37.466	-120.85	5000402-001	35.3	42.8	21%
37.466	-120.85	5000332-001	29	28	-3%
37.466	-120.85	5010019-022	13.5	19.2	42%
37.46429	-120.922145	058-014-007	34.3	22	-36%
37.437	-121.008	5000076-002	17.9	25.8	44%
37.433903	-121.015366	057-001-005	1	1	0%

37.39482681	-121.1372246	MW-26	81	72	-11%
37.39399	-121.072809	027-012-056	15.3	18.2	19%
37.39364362	-121.1364636	MW-13	72	58.5	-19%
37.39279645	-121.1356028	MW-25	63	72	14%
37.39141179	-121.1348306	MW-14	67.5	67.5	0%
37.38927117	-121.1332067	MW-18	67.5	67.5	0%
37.38919851	-121.1419872	MW-12	44.1	44.55	1%
37.38694291	-121.1317913	MW-19	49.5	49.5	0%
37.38455858	-121.1307164	MW-16	76.5	99	29%
37.3844909	-121.1348816	MW-17	35.55	36	1%
37.370991	-121.053692	027-018-028	41.7	40.2	-4%
37.321	-121.008	5010013-004	32.3	34.1	6%
37.321	-121.008	5010013-006	27	31.9	18%
37.31711	-121.082365	026-020-021	9.2	6.7	-27%
37.321	-121.048	5010013-005	26	24.2	-7%

345	wells total
20	> 50% increase
97	> 0% but <50% increase
37	0% change
153	<0% but >-50%
38	>-50%

Highlighted in yellow