2019

Clear Lake Nutrient TMDL Agriculture Technical Report

New vineyard development with straw and cover crop in Clearlake, CA

Lake County Farm Bureau Education Corporation

5/31/2019

Table of Contents

I. Overview ……..…… 2

II. Watershed Areas: Geology and Climate …… 3

III. Agriculture and Land-Use …….. 5

IV. Programs adopted since TMDL Research that Promote or Require Agricultural BMPs …… 8

Irrigated Lands Regulatory Program ……..……..……. 8
Lake County Grading Ordinance ……... 10
Winegrape Sustainability Programs ……..…….. 11

V. Best Management Practices in Lake County ……..…….. 12

Cultural Practices in Vineyards …… 12
Cultural Practices of Pear and Walnut Growers …… 13
2015 Farm Evaluation Data ……... 15

VI. Effectiveness of Management Practices …….. 16

VII. Calculating Phosphorus Load Reductions in Agriculture …… 18

Assumptions …… 18
Method ……. 19
Results …….…. 20
Conclusion …… 22

VIII. References …… 24

Figures and Tables

Figure 1: *Geologic Map of Lake County* …… 4
Figure 2: *Annual Precipitation and AVAs* …….….. 5
Figure 3: *Agricultural Land-use and Monitoring Sites* ……... 6
Figure 4: *2017 Productive Acres by Crop* ……... 6
Figure 5: *Lake County Crop Acreage 2000-2017* …….…. 7
Figure 6*: Management Practice Verification Flowchart* ……... 9
Fig. 7-15: *Best Management Practice examples in Lake County agriculture* …… 12
Figure 16: *Effectiveness of Sediment Control Measures* ……. 16
Figure 17: *NCRCD RUSLE Model* ……. 17
Figure 18: *Sediment Catchment Basin* …… 18
Figure 19: *Map of Amber Knolls* …… 20

Table 1: *Load Reduction Calculations* …….. 23

Appendices

Appendix A: *Management Practices Field Verification Form*…….…….. 26
Appendix B: *Farm Evaluation Survey Results* …….. 29
Appendix C: *Surface Water Quality Monitoring*…… 33
Appendix D: *NRCS RUSLE2 Data* ……... 37
Appendix E*: Lake County Grading Ordinance* ……. 44

I. Overview

Lake County is a unique rural area encompassing 1,329 square miles (850,560 total acreage) in the coastal ranges north of Napa County. Agriculture constitutes a small portion of total land use in the county and is found mostly on the porous volcanic soils of the hills and the rich soils of Big Valley, Scotts Valley and Middle Creek Basin. Of the 850,560 acres of Lake County, there are approximately 14,392 bearing acres in agricultural production (Lake County Crop Report 2017). That number includes dry-farmed pasture, which is not included in the Irrigated Lands Program. 10,073 acres were irrigated according to the 2015 Farm Evaluations which is roughly 1.2% of Lake County's total acreage. Dry farmed walnuts, winegrapes and hay crops make up for the majority of the unirrigated agricultural acres in production.

Winegrapes are Lake County's biggest crop both in value and acreage. In 2017, there were 8,771 bearing acres of vineyards which constitute 60 % of Lake County's productive agricultural acres. Walnuts, pears and hay crops account for a lesser portion of agriculture. Other land uses in Lake County include non-irrigated rangeland, rural residential development, and native woodlands, chaparral, grasslands, and wetlands.

The Clear Lake Watershed TMDL Monitoring Program was originally developed to monitor gauged streams to develop a scientifically defensible estimate of mercury (total and methyl) and nutrient loading to Clear Lake. The TMDL was later expanded and refined to monitor phosphorus and iron; two nutrients likely responsible for the toxic blue-green algae blooms in Clear Lake. The 2012 Clear Lake TMDL update found that phosphorus naturally occurs in the soils surrounding Clear Lake, and was likely entering the lake through streams and tributaries. Lake County conducted a monitoring program in 2007 and 2008 in the three largest tributaries of Clear Lake. Based on three stream gages, the total phosphorus loading from the watershed was estimated at 90,000 to 125,000 kilograms per year, which were roughly 20-43% less than previous estimates (CVRWQCB 2012). The TMDL Order in 2006 found that a 40% reduction in phosphorus loading to Clear Lake would significantly reduce the frequency of algae blooms. This order was the result of research in Lake County that concluded in 2001.

Efforts to implement the Clear Lake TMDL have largely involved the Middle Creek Flood Damage Reduction and Ecosystem Restoration Project which has aimed to acquire 1,650 acres of reclaimed land at the north end of Clear Lake and restore it to wetlands. Restoring wetlands on the north end of the lake has been estimated to potentially reduce phosphorus loading by 40% as the Middle/Scotts Creek watershed contributes over 1/2 of the total sediment load to the lake (CVRWQCB 2012).

Additional efforts to implement the Clear Lake TMDL involve load allocations for other potential source categories. These include US Forest Service (USFS), BLM, Lake County, Cal Trans, the cities of Clearlake and Lakeport (for storm water), cannabis production and irrigated agriculture. Non point-source dischargers, including irrigated agriculture, US BLM, USFS and Lake County were given an 85,000 kg/year average annual phosphorus load. The compliance date for the TMDL was June 2017. In January 2019, the Lake County Farm Bureau Education Corporation was delivered a State Water Resources Control Board 13267 Order on behalf of irrigated agriculture. This order required a technical report that assesses all management practices and agricultural operations that have been implemented to reduce phosphorus loads to Clear Lake and to quantitatively show evidence of load reduction as a result of those practices.

Since 2005, the Lake County Farm Bureau Education Corporation (LCFBEC) has been responsible for implementing the Irrigated Lands Regulatory Program (ILRP) as part of the Sacramento Valley Water

Quality Coalition. This has included grower outreach and education through grower meetings and seminars, collection of farming practice data, and monitoring of Middle Creek and McGaugh Slough. The implementation of the Irrigated Lands Regulatory Program in Lake County has used a management practice-based approach to preventing sediment, nutrient and pesticide discharges to surface water. In addition to surface water monitoring, the program has been expanded to include management practice verification and field inspections.

Best management practices (BMPs) that are protective of water quality have been implemented and improved since 2001, especially in the Lake County winegrape industry which has been the main driver in Lake County agriculture since a wave of pear and walnut orchard conversions starting in 2000. Lake County vineyard BMPs are promoted by the Lake County Winegrape Commission include soil management, cover cropping for erosion control and irrigation and nutrient management practices (Larry Walker Associates, 2011). Additionally, nearly 60% of Lake County winegrape acreage is enrolled in a certified sustainability program which require erosion control, irrigation efficiency and pesticide/nutrient application BMPs. The Lake County Grading Ordinance, which was established in 2007 also requires BMP implementation in ag-land conversions to mitigate erosion (County of Lake, 2007). Nearly 13% of current Lake County acreage was developed under the Lake County Grading Ordinance. The implemented best management practices as a result of crop type changes, the ILRP, certified sustainability programs and Lake County Grading Ordinance have resulted in as high as a 99.5% reduction in sediment erosion in certain areas around Lake County and an average 43% reduction in sediment erosion across the watershed (NRCS 2019). Overall, qualitative and quantitative data show that agriculture has a decreasing impact on the nutrient loading in the lake.

II. Watershed Areas: Geology and Climate

Lake County lies in the coastal range north of Napa. In general, the county can be characterized by broad valleys surrounded by rolling hills, rugged mountains, volcanic terrain and uplifted hills. Franciscan complex hills form the base for the county's geology with volcanic and tertiary sediments deposited in the late Quaternary. The Clear Lake volcanic field runs in a north-east direction, traversing the county through the middle. Included in the Clear Lake Volcanic Field are Cobb Mountain, the Red Hills and Mt Konocti. The volcanic field, which saw activity from the late Pliocene to early Holocene, consists of lava domes, cinder cones, and maars with eruptive products varying from basalt to rhyolite (USGS 2008). Cobb Mountain and Mount Konocti are the two highest peaks in the volcanic field, at 4,724 feet and 4,285 feet respectively (USGS 2008).

The volcanic soils of the Red Hills area have excellent drainage and poor water retention capacity (NRCS 1989). These soils are characteristically gravelly and have erosive soils. Examples include Aiken, which formed on basalt; Arrowhead, which formed on obsidian; and Soda Bay, which formed on scoria (LCWC 2012). Lake County hillside volcanic soils are red, a color often associated with old, highly weathered soils. However, the Clear Lake volcanics are recent in geologic origin. The scoria formations near High Valley and the lower arm of Clear Lake are as young as 10,000 years. (LCWC 2012). Winegrapes are the primary crop grown in the Lake County volcanics deposits. Dry-farmed

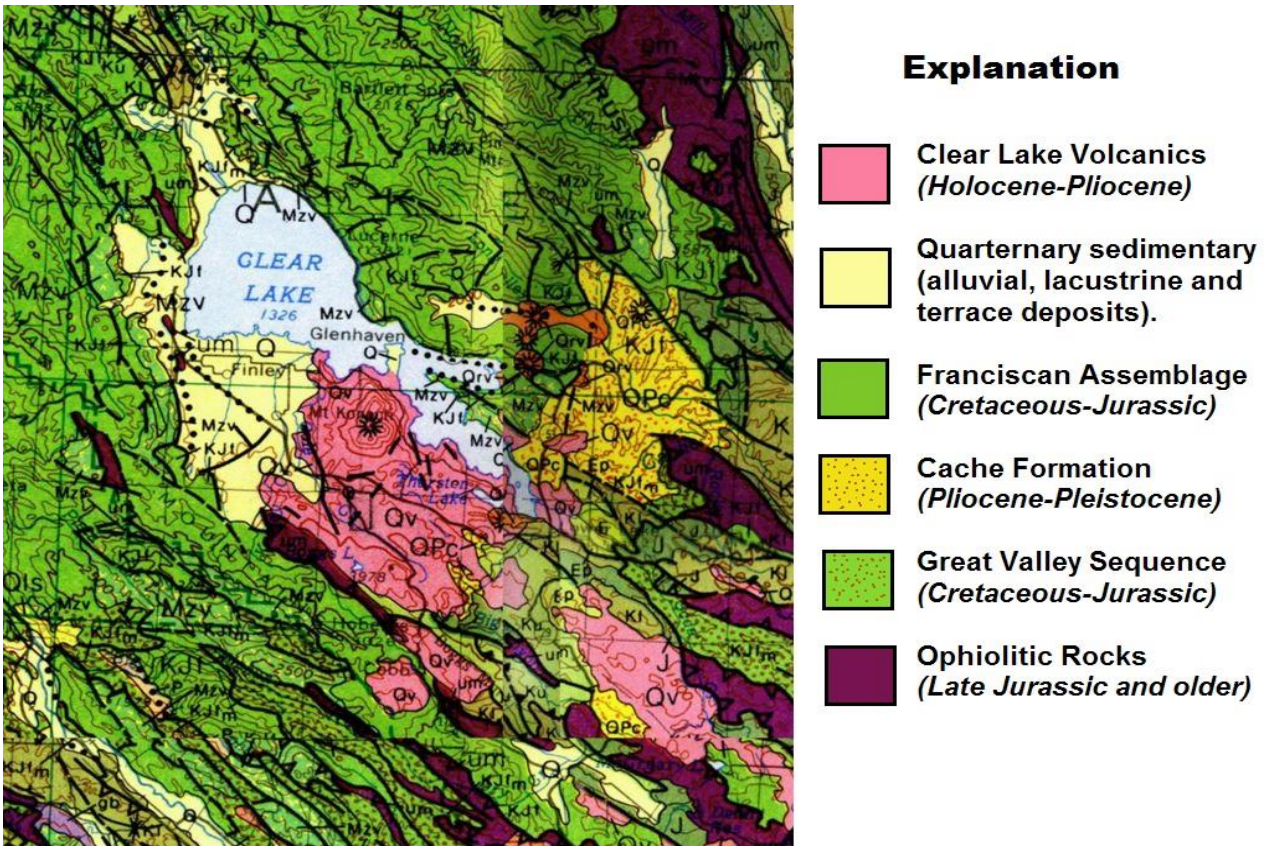


Figure 1: Geologic map of Lake County. Principle agricultural areas occur in Big Valley on alluvial, lacustrine and terrace deposits, in Upper Lake on alluvial deposits and in the Red Hills area in the Clear Lake Volcanic Field. (Sims 1988).

walnuts were popular in these areas until an estimated 2400 acres were converted into winegrapes in the early 2000s.

Mountain valleys around Clear Lake, including Big Valley District, Upper Lake Valley, Clover Valley, Bachelor Valley, and Scotts Valley, are level with deep alluvial deposits. The soils often have layers with differing gravel content and amounts of sand, silt, and clay, created by the movement of stream courses in the past. Well-drained alluvial soils found in these areas include Still and Lupoyoma loams (LCWC 2012). The principal valleys of Big Valley and Upper Lake are filled with unconsolidated sediment more than 500 ft. thick in some places (NRCS 1989). Internal soil drainage is poor in the soils that lie in the depressional areas of the valleys (NRCS 1989). Big Valley and Upper Lake are the two main agricultural areas of the county which grow a fair representation of the three main crop types: walnuts, pears and winegrapes.

Hillside soils formed on sandstone and shale are found in the Franciscan complex hills. The Kelsey Bench area, which now primarily grows winegrapes, includes some of these deposits. These soils are well-drained and frequently shallow, with underlying sandstone found at a depth of two to four feet. Common soil types include Maymen, Mayacama, and Hopland (LCWC 2012). These soils are found on the western hills surrounding Clear Lake.

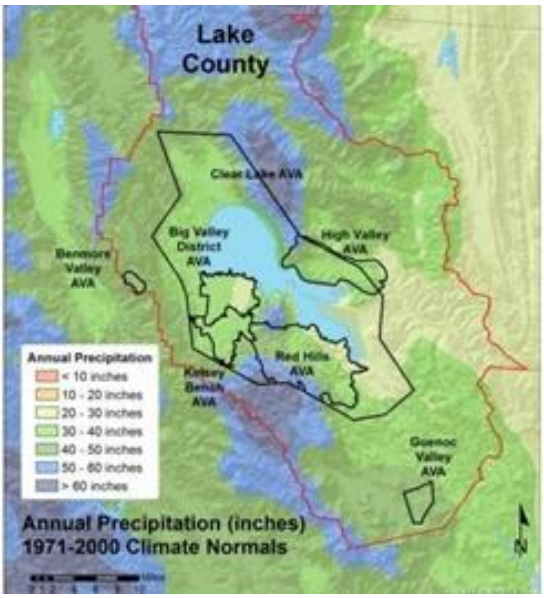


Figure 2: Lake County annual precipitation (1970-2000 climate normal) with the 7 regional Lake County AVAs. (Data source: Daly et al 2008).

The climate of Lake County is characterized by warm, dry summers and cool, moist winters. Lake County also enjoys a plethora of microclimates in its hills and valleys. The average annual precipitation ranges from 25 inches in the valleys to 60 inches or more in the mountains (NRCS 1989). The growing season, which is the average number of days between the last freeze in the spring and the first freeze in the fall varies from 150 to 210 depending on location, and air drainage patterns (NRCS 1989). The evaporation rate is high because of high summer heat and low humidity.

Erosion risk in Lake County is primarily confined to the wet winter season. For this reason, Lake County grading projects are confined to a window that opens in the late spring and closes in the fall. By the time initial rainfall begins, usually in November or December, cover crops and straw are providing ample control of runoff and erosion.

III. Agriculture and Land Use

Lake County agriculture originated with cattle operations in the early to mid-1800s and was followed by orchard operations that mainly included pears, walnuts, and plums for the prune market. Vineyards were planted in the 1870s in numerous areas of the county and by the early 20th century the area was earning a reputation for producing some of the world's best wines (LCWC 2014). In the 1930s and 1940s, the Red Hills, Kelsey Bench, Lower Lake and Clearlake areas were broadly planted with dry-farmed walnuts. In 2001, the Lake County pear industry suffered a rapid and near-catastrophic decline and orchards were removed for vineyard planting. This coincided with a wave of walnut orchard to vineyard conversions creating the Red Hills and Kelsey Bench appellations.

The major agricultural areas in the county are in Big Valley, the Red Hills, Upper Lake and Scotts Valley. Winegrapes are the predominant crop grown in the Red Hills area. In Big Valley, Upper Lake and Scotts Valley, a mix of winegrapes, walnuts, pears and hay crops are grown. There are some isolated orchards and vineyards in Lower Lake and Clear Lake as well. The American Viticultural Association has established 7 wine-growing regions in Lake County distinct in growing conditions and terroir. The Clear Lake AVA encompasses the general growing region around the lake. The biggest wine-producing AVAs are Big Valley, Kelsey Bench and Red Hills. Both Big Valley and Kelsey Bench AVAs have alluvial and lacustrine-type soils, while Red Hills enjoys well-drained volcanic soils and steeper topography. These areas receive similar amounts of precipitation except in the higher elevations.

There is a sizable portion of Lake County agriculture that is dry-farmed. In 2017, there were 14,392 acres in agricultural production (Lake County Crop Report 2017), and 10,053 acres enrolled in the

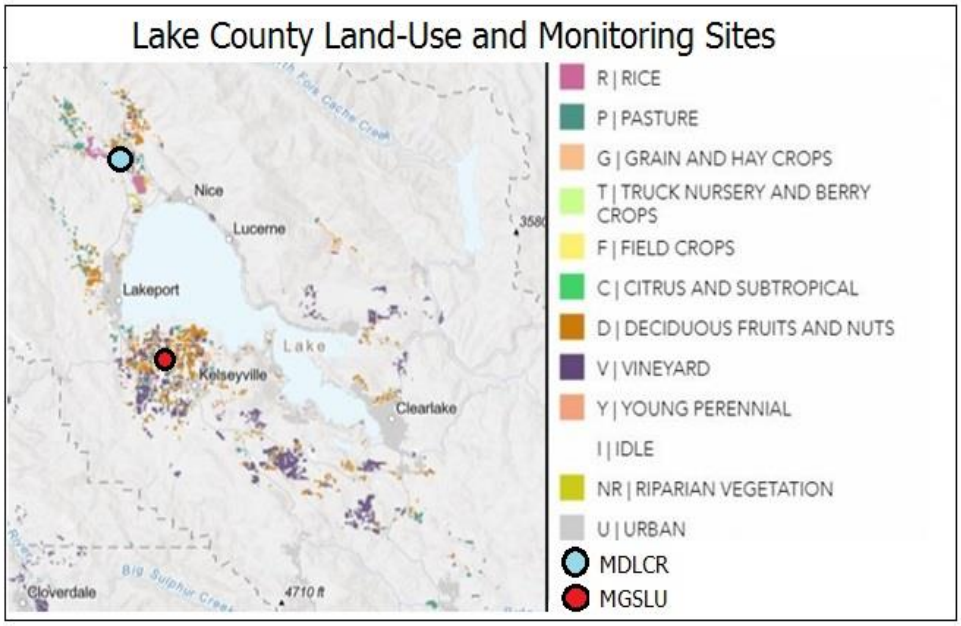
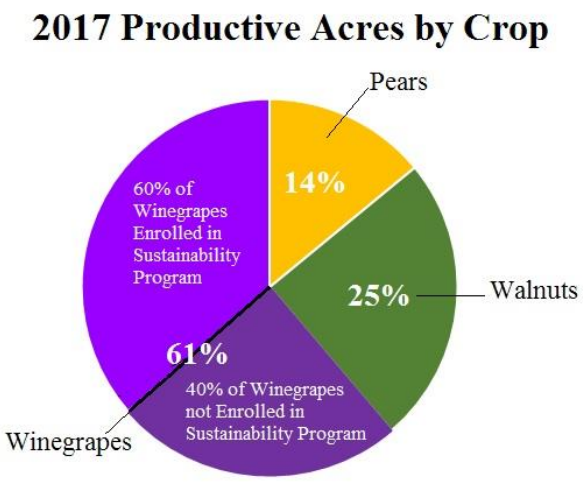


Figure 3: The majority of Lake County agriculture lies in Big Valley and the Middle Creek watershed basin in Upper Lake. Winegrapes are primarily grown in the hillside areas outside of those two basins. The ILRP Monitoring sites are located in Finley and Upper Lake. The Middle Creek monitoring site (MDLCR) is the representative monitoring site. McGaugh Slough (MGSLU) runs through Big Valley (Map Source: DWR Statewide Crop Mapping).

Irrigated Lands Program. The roughly 4300 acres of dry-farmed agriculture is mostly pasture hays and some walnuts. Of irrigated agriculture, 61% of Lake County's productive acres is winegrapes.

Lake County's agricultural landscape has changed dramatically since 2001. In the 1990s, Lake County agriculture was dominated by pears in Big Valley and Upper Lake, and dry-farmed walnuts in the hills. Walnuts dominated the Red Hills region up until the year 2000, which was graded and planted in walnuts as early as the 1930s. In the 1990s, winegrapes were grown in the valleys and were primarily white wine varietals. In 2000, there were approximately 4200 and 4500 acres of pears and walnuts respectively and about 3800 acres of winegrapes.

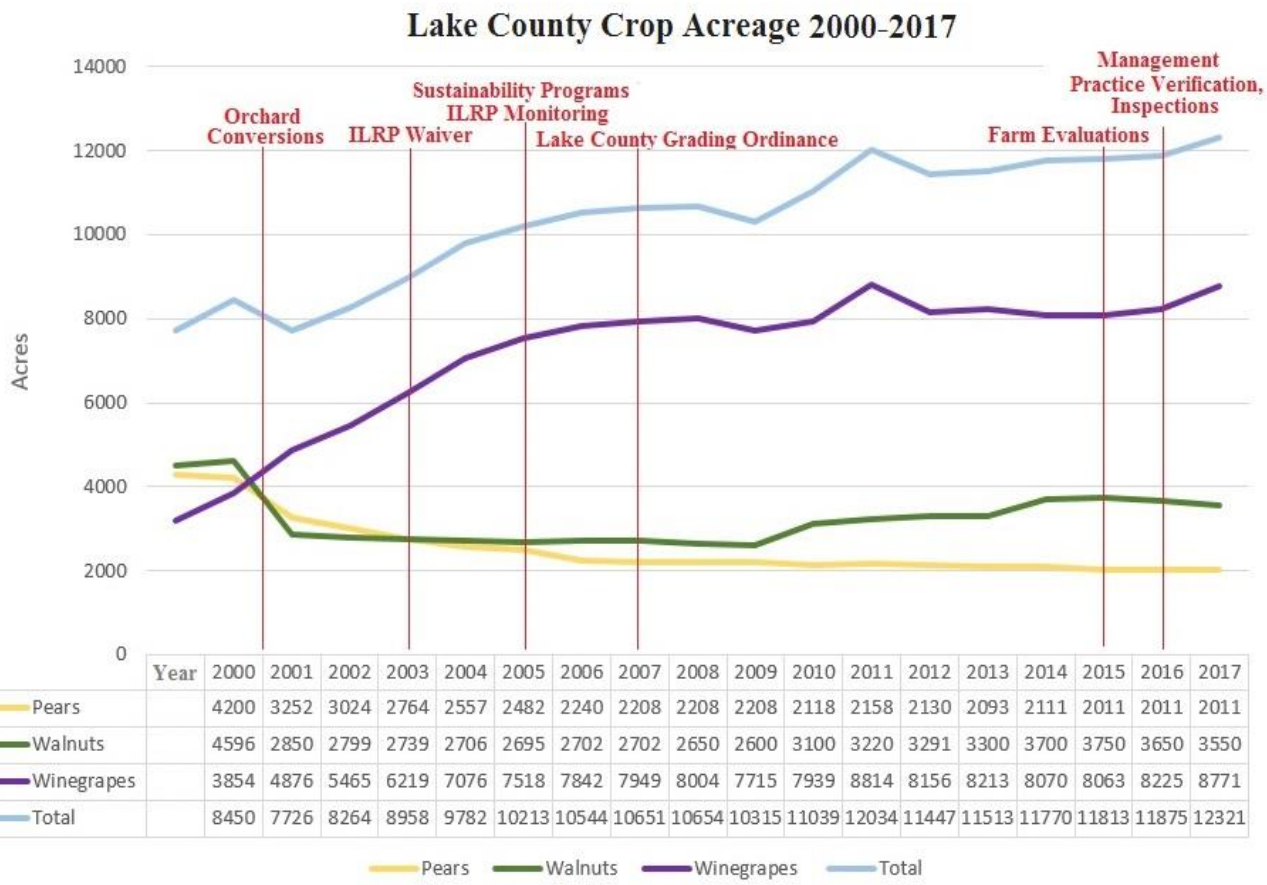


Winegrapes accounted for over half of all acres in agricultural production in 2017. (Data source: Lake County Crop Report 2017). Winegrapes enrolled in a Sustainability Program through CSWA accounted for nearly 40% of all irrigated agriculture in Lake County.

In July 2000, the California pear industry suffered a devastating blow with the bankruptcy of Tri Valley Growers, a grower-owned business that canned half of the nation's peaches, pears and apricots (Conrad 2000). Nearly 1/3 of California's pear harvest had no market. Because Lake County pears are harvested late compared to the Northwest and Sacramento Valley districts, Lake County pear growers suffered disproportionately. Lake County winegrape growers also began to see increased price per ton for white varietals, so pulling pears and planting winegrapes in Big Valley, Scotts Valley and Upper Lake was an economical choice. At the same time, farmers began growing red winegrape varietals in the volcanic soil of Red Hills, Perini Road area, Lower Lake and Clearlake. Dry-farmed walnuts were pulled in large tracts all over the Red Hills area and winegrapes were planted. By 2010,

the Red Hills appellation was almost entirely winegrapes. By 2009, productive walnut acreage had dropped to around 2600; a 43% decrease from year 2000. Most of those productive acres were pulled from Red Hills, but there were also acres converted in the Kelsey Bench area and Big Valley. It is also worth noting that some walnut acres converted in this time were not counted as productive acres in the crop report; they were either abandoned or brushed over. Walnut prices rose again in the mid-2000s, so Lake County saw a modest trend in walnut re-planting, mostly in Big Valley. These were irrigated walnuts and grown with cover crops.

During the same period of time, winegrape acreage has increased nearly 60%.



Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pears	4200	3252	3024	2764	2557	2482	2240	2208	2208	2208	2118	2158	2130	2093	2111	2011	2011	2011
Walnuts	4596	2850	2799	2739	2706	2695	2702	2702	2650	2600	3100	3220	3291	3300	3700	3750	3650	3550
Winegrapes	3854	4876	5465	6219	7076	7518	7842	7949	8004	7715	7939	8814	8156	8213	8070	8063	8225	8771
Total	8450	7726	8264	8958	9782	10213	10544	10651	10654	10315	11039	12034	11447	11513	11770	11813	11875	12321

Figure 5: Productive acres in Lake County by crop type from 2000 to 2017. These numbers reflect irrigated and dry-farmed acreage in the three major crops. Orchard conversions started between 2000 and 2001 and continued throughout the early decade. Shown on graph are the introduction of important programs that established best management practices in the growing winegrape industry and the rest of Lake County agriculture. (Data source: Lake County Crop Reports, 2010-2017)

IV. Programs Developed Since TMDL Research that Promote or Require Agricultural BMPs

As Figure 5 outlines, the past 15 years have seen the introduction of multiple programs, regulations or ordinances that promote BMPs in Lake County agriculture. Many of these BMPs are specific to erosion control.

Irrigated Lands Regulatory Program

The Irrigated Lands Regulatory Program (ILRP) is responsible for regulating ALL discharges (real or potential) off irrigated agricultural lands. Central Valley farmers fund the program through acreage, state and administrative fees which pay for the following mandatory regulatory elements:

- Grower Farm Evaluations – identifying practices on farm
- Nitrogen Management Plans – nutrient budgeting to avoid leaching into groundwater.
- Surface Water Quality Monitoring – monitoring discharges
- Sediment Erosion and Control Plan – preventing discharges
- Groundwater Assessment Reports/CV SALTS/RUSLE2 Model – research
- Inspections – confirming program compliance
- Clean-up/Abatement Orders – addressing issues on an individual scale
- Water Quality Management Plans – addressing issues on watershed scale
- Education and Outreach – grower education

In 2003, the Central Valley Water Board adopted conditional Waiver of Waste Discharge Requirements (WDRs) to regulate agricultural discharges to surface waters. The Lake County Agricultural Watershed Group was established as a member of the Sacramento Valley Water Quality Coalition in 2003. In 2006, the Lake County Farm Bureau Education Corporation (LCFBEC) was formed by the Lake County Farm Bureau as a response to an extension of the conditional waiver. Surface water quality monitoring started in 2005 in Lake County and by 2015, all growers were required to submit Farm Evaluations.

In February 2016, LCFBEC submitted a Management Practice Verification alternative to the full suite of water quality monitoring. This was available to Lake County because of low intensity agricultural land-use across the watershed, a low threat of pesticide discharges from irrigated lands, and minimal history of pesticide, nutrient, copper, metals or toxicity water quality exceedances. This proposal was approved by the Central Valley Regional Water Quality Control Board in September 2016. Field verification visits were implemented in 2017. In 2017 and 2018, LCFBEC conducted field visits during wet winter conditions to assess erosion control management practice implementation. In 2018, LCFBEC made the decision to conduct field verification visits during the growing season to assess cultural practices. These field visits were modeled on the Management Practices Verification Plan outlined in the 2016 Reduced Monitoring Proposal. Results from these field verification visits showed that farmers were implementing BMPs they claimed to be utilizing in their 2015 Farm Evaluations.

In addition to BMP verification visits, the Central Valley Water Board also conducted Irrigated Lands inspections in 2017 and 2018 during the height of the wet season. Inspectors found no evidence of in field erosion or run-off, even on wet days. Inspectors toured both valley operations and vineyards on steep, erosive hillsides.

Lake County water quality monitoring through the ILRP has reached its 14th year. Monitoring sites are located at Middle Creek (MDLCR) in Upper Lake as the representative monitoring site and at McGaugh Slough (MGSLU) in Big Valley. Both monitoring sites capture a similar proportion of Lake County agriculture with Middle Creek's site being skewed slightly towards walnuts. Before BMP verification

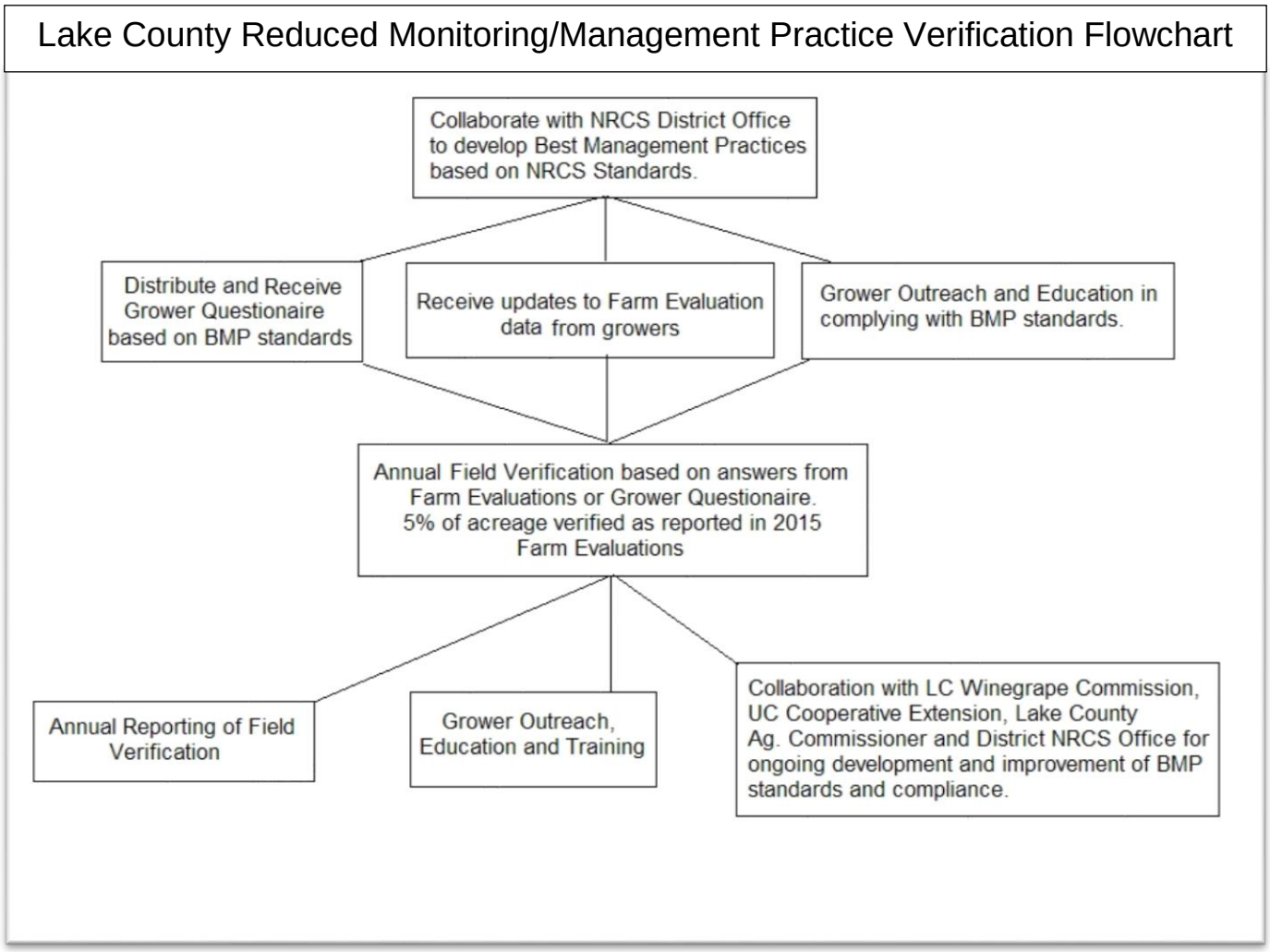


Figure 6: Reduced Monitoring/Management Practices Alternative Flow Chart as developed in the 2016 Lake County Reduced Monitoring Management Practices Proposal. The Management Practice Verification form is in Appendix A.

implementation, monitoring was performed 6 times per year in both wet and dry conditions, including in stagnant pools. Despite this, there is a low to minimal exceedance history across the watershed in pesticides, nutrients, metals and toxicity (see Appendix C). There have been zero exceedances from phosphorus, nitrate or nitrite. There was one nitrate + nitrite as N exceedance taken in a stagnant pool during the summer. The only two pesticide exceedances have been for DDT in 2010 and Malathion in 2012, both in Middle Creek. Per 2012 Lake County Pesticide Use Reports there were 20 lbs. Malathion registered for walnuts and 112 lbs. for structural pest control. There were no registered uses of DDT in 2010 as DDT is a legacy pesticide. This could suggest use further up the Middle Creek watershed from illegal cannabis. There have been exceedances from parameters that suggest stagnant condition like dissolved oxygen, conductivity and pH and e coli. However, in the absence of animal agriculture, it's hard to make a direct link between e coli exceedances and Lake County agriculture.

In the ILRP, if a watershed experiences a second exceedance in any parameter, a Management Plan is triggered. This requires extra monitoring, point-source determination and grower outreach in watershed above the exceedance point. The Management Plan is deemed complete after two years with no exceedance, otherwise the Management Plan continues. Lake County has never had a Management Plan triggered for agricultural-specific parameters.

Since monitoring of the Middle Creek and McGaugh Slough sites began, there have been no substantial exceedances that suggest that Lake County irrigated agriculture is contributing to water quality degradation. Water Quality testing results from 2005-2015 can be found in Appendix C.

A large portion of LCFBEC's administration of the ILRP is grower education and outreach. LCFBEC holds annual grower meetings in conjunction with the Lake County Agricultural Department to discuss requirements under the Irrigated Lands Program. In December 2018, LCFBEC presented information about specific management practices important to sediment erosion, nutrient management and irrigation efficiency. LCFBEC will continue to utilize these annual meetings to educate growers on implementation of management practices outlined in the Farm Evaluations. Other outreach strategies include published information and pamphlets. The Lake County Farm Bureau publishes a bi-monthly newsletter and features a grower outreach and education section in every issue. In this section of the newsletter, the Lake County Farm Bureau will continue to focus on helping growers meet BMP objectives. The newsletter reaches 500 Farm Bureau members in Lake County and is available online for free viewing.

LCFBEC also promotes the use of NRCS programs in grower development of best management programs. Through its ongoing, existing free technical assistance program, NRCS is available to assist growers with on-farm management practice evaluations and planning assistance on a continual basis as a part of its ongoing conservation program. Growers needing to improve their existing conservation systems or needing to implement management practices can also apply for incentive funding grants through NRCS's Farm Bill programs, such as EQIP. Growers in Lake County also rely heavily on the UC Cooperative Extension and will be encouraged to continue to do so.

LCFBEC continues to collaborate with the Lake County Winegrape Commission in the promotion of their sustainability programs and to capture and increasing number of winegrape growers. LCFBEC plans to promote these programs through information provided in the bi-monthly newsletters.

Collaboration continues with UC Cooperative Extension advisors, the Lake County Ag Commissioner and local PCAs and CCAs in specific areas such as determining nitrogen removed values from pear harvest yields and management practices related to nutrient and erosion control management.

Lake County Grading Ordinance

In 2007, the County of Lake adopted an Agricultural Grading Ordinance (see Appendix E) which stipulates management practices for agricultural grading operations and rural development. Under the ordinance, a grading permit is required for any grading or clearing of non-current agricultural land or for ponds and resevoires over 1 acre foot in capacity. Under the current Grading Ordinance (Chapter 30, adopted July 17, 2007) implementation of BMP's is required for new agricultural properties (native vegetation to agriculture) and conversions of deep rooted crops (orchard to vineyard) on soils with a moderate to severe hazard rating. Detailed in this ordinance are restrictions to grading on certain soil types, proximities to waterways or riparian habitats and required mitigation practices for revegetation and dust control.

Ordinance exemptions exist only when the following criteria are met: crop conversions do not expanding current footprint; grading is not within thirty feet of the top of bank of a water body; grading does not remove stable woody root systems extending at least twelve inches below the soil surface; grading does not occur on soils with a moderate or severe erosion hazard rating; grading does not occur during winter period and does not cut or fill slope with a 2:1 or greater ratio. Finally, the ordinance

outlines restrictions and mitigations on roadways and infrastructure to reduce erosion hazard on access roads.

Since implementation in 2007, 1842 acres have been developed under the Lake County Grading Ordinance (Lake County Community Development 2018). The county's grading ordinance protects the watershed and streams against erosion and run-off by imposing strict agricultural grading guidelines.

Winegrape Sustainability Programs

Since 1991, the Lake County Winegrape Commission (LCWC) has provided education and outreach to growers regarding best management practices that are protective of water quality and that promote erosion control. The LCWC is committed to ensuring Lake County vineyard operations continue to work toward the goal of certified sustainability, which they define as "being environmentally sound, socially equitable, and economically viable." (LCWC 2014). The first sustainability programs were implemented in 2005 under guidance of the LCWC.

Since 2005, 5266 acres (60% of LC vineyard acreage) have been enrolled in either California Sustainable Winegrowing Alliance (CSWA), Fish Friendly Farming, Lodi Rules or Sustainable in Practice (SIP). While these programs differ slightly, an independent third-party auditor will review the plan, conduct onsite visits, evaluate and validate practices, and help draft a continuous improvement plan for the coming year. More acreage is expected to be enrolled following July 2019 audits. There is an ever-increasing economic incentive to becoming sustainably certified. Wineries demand certified sustainable winegrapes in increasing numbers every year, so the general trend will be towards more vineyards certifying.

CSWA is the most popular sustainability program in Lake County vineyards. There are 58 prerequisite vineyard practices for CSWA certification in Year 1. Requirements range from erosion control/soil management to IPM practices, water use, materials used and ecosystems management. Examples of soil management requirements include:

- Temporary drainage structures such as hay bales or shoveled diversion ditches utilized during the winter.
- Action(s) taken to eliminate obvious sources of erosion (e.g., out-sloped or vegetated roads, vegetated or hardened ditches, incorporated riprap into culvert outflows)
- Irrigation practices and/or property location or design causes no rills or gullies to form due to concentrated flows from rainfall or applied water
- Preventive techniques (e.g., cover crops, vegetated, rocked, or solid surfaced ditches) in place to reduce rainfall runoff, minimizing off-site movement of silt, pesticides, and/or fertilizers
- If applicable, engineered drainage systems (culverts, drop inlets, diversions) in place for hillside or terraced sites to minimize off-site movement of silt, pesticides, and/or fertilizers.

(Source: CSWA SWP Workbook)

There are 140 BMPs for winegrape growing in CSWA's Workbook. Following the initial enrollment, an independent auditor will review vineyard practices for the following year. The grower must demonstrate continuous improvement for Year 2 certification.

The LCWC reports that more than 70 percent of Lake County growers have participated in their Code of Sustainable Winegrape Practices Self-Assessment Workbook and expect to increase that number every year (LCWC 2014).

Figure 7: Straw is laid down on the avenues during development until gravel and water bars are used to protect against sediment run-off.

Figure 8: Wattles are used on slopes and in the avenues as standard practice.

Figure 9: Cover crops and improved avenues and service roads are covered practices in the CSWA program.

V. Best Management Practices in Lake County

Under the Irrigated Lands Regulatory Program, the first Farm Evaluations were required of growers in 2015. These Farm Evaluations identified management practices on 93% of acreage enrolled in the Irrigated Lands Program in 2015. Since 2015, approximately 3000 additional acres have been enrolled in the program. However, an update is not scheduled until at least 2020, under the current regulations. Because 2015 is the baseline year for polling specific management practices in the Farm Evaluations, it is impossible to know the acre amount covered under specific management practices before the adoption of the TMDL. However, there have been general trends in crop type, management practices within those crop types and regulations imposed upon agriculture since TMDL adoption that have caused an overall watershed reduction in phosphorus loading due to erosion.

Best management practices used by winegrape growers capture a majority of Lake County irrigated agriculture. Through the Lake County Winegrape Commission, growers have access to the latest research in viticulture, real-time weather data and grower education. Pear growers in Big Valley have also been at the forefront of integrated pest management practices that reduce the amount and frequency of pesticide application. Pesticide use has declined in recent years, with sulfur applied on winegrapes as the most highly used pesticide. Walnut growers in Lake County have moved away from steep slope dry farming and heavy till to no till valley operations with cover crops.

<u>Cultural Practices and Erosion Control in Lake County Vineyards</u>

Figure 10: Vineyard growers promote cover crops between the rows year long.

Winegrape growers take great steps to reduce erosion in the vineyards, as soil depth can be shallow in the Red Hills and Kelsey Bench AVAs. Waddles are used both in vineyards and along avenues to keep sediment in place, especially during new vineyard development. It is standard practice to grow cover crops between rows and to either seed with a grass mix or native cover crop, such as the wild mustard pictured in Figure 10. On the valley floors, such as

in Big Valley, Scotts Valley and High Valley, cover crops grow readily. In the Red Hills, straw is used as a standard practice to protect the soil until grass can seed.

Figure 11: Orchard grass used as a cover crop in Big Valley.

Figure 12: Straw placed in this vineyard has facilitated the seeding and growth of a cover crop.

Vineyards that get developed or converted in the Red Hills area usually fall under the Lake County Grading Ordinance and must adhere to strict standards of grading and mitigation. The grading ordinance also outlines restrictions and mitigations on roadways and infrastructure in the vineyards to reduce erosion hazard on access roads. These provisions outlined in the ordinance serve to protect water quality from sediment run-off and protect the vineyards from loss of top-soil.

In the large Red Hills vineyards such as Amber Knolls, any potential water run-off from winter storms is diverted into a water catchment system producing effectively zero off-site runoff from the vineyards and avenues. While smaller vineyards may not have these sophisticated catchment systems, the majority of irrigated vineyard acreage in the Red Hills AVA falls under these management systems.

Erosion control management practices are implemented to limit the amount of sediment runoff and fertilizer runoff. A 2007 survey conducted by the Lake County Farm Bureau Education Corporation indicated that 90% of vineyard acreage is maintaining a permanent or winter annual cover crop.

Drip irrigation systems are the standard for Lake County vineyards as they provide a precise and uniform amount of water that can be managed in real time. These sophisticated systems allow growers to use only enough water that the vine needs. They also conserve water by watering in small, consistent quantities, which greatly reduces losses from evaporation and effectively produces no water run-off (LCWC 2014).

Figure 13: Straw is laid down in a new vineyard development in the Red Hills.

Cultural Practices of Pear and Walnut Growers

Pears are most productive on loam-textured, deep uniform soils, which is why pear orchards are predominently found in Big Valley and Scotts Valley. Sprinkler irrigation is the predominant form of irrigation. Flood irrigation continues to fall out of fashion; this practice is used only on a few isolated and out-dated orchards in Big Valley accounting for 8 % of the acres (FE 2015). According to Rachel Elkins, pomologist and advisor for the Lake County Cooperative Extension, flood irrigation had begun to go out of practice in the 1990s, and by the year 2001, she

estimates less than 20-30% of Lake County pear orchards were flood irrigated. The drop to 8% represents one or two isolated orchards that have since been converted or will be converted by the 2020 Farm Evaluations. This conversion from flood irrigated to sprinkler irrigation in pears has reduced erosion in the Big Valley area due to soil loss from flood irrigation.

Figure 14: Pear orchards have year-round no- till cover crops, like the orchard grass in this Big Valley orchards. Wind turbines are used as frost protection.

Wind turbines are used in the orchards as a primary method for frost protection. Cover crops in the form of orchard grass are used as common practice in the pear orchards resulting in excellent soil retention. Orchard grasses in the pear orchards are rarely tilled. Given the standard practice of cover crops and the flat topography in Big Valley, there is very low probability of surface water run-off in the pear orchards.

Lake County pear growers were at the forefront of pest management research in the late 1990s to control codling moth using pheromone mating disruption. Due to the success and overwhelming implementation of pheromone puffers in the orchards, Lake County pear growers have been able to reduce their pesticide application by 75% since 1990 (CDPR). Other integrated pest management practices include the use of owl boxes to help control ground squirrels and other rodents and reduce the need for baiting or other forms of eradication. (Guisti 2011).

As mentioned previously, walnut production has faced a huge shift in Lake County. There were many walnut orchards planted in the Red Hills area from the 1930s to the 1950s. Orchards planted on erosive slopes in the Red Hills were commonly tilled 2 or 3 times per year to prepare the orchard for harvest. At the first rain, freshly tilled soil which was also impacted from heavy farm equipment was especially susceptiable to erosion. Local farmers remember large rills and ditches coming off Red Hills area prior to vineyard conversions. These orchards have been steadily converted into winegrapes over the years due to the superior winegrape growing conditions and economic factors in the area.

Figure 15: Orchard grass in the walnut orchards during the early summer and early fall after harvest. The orchard on the right was hand-picked.

Since widescale conversion, most irrigated walnuts orchards in Lake County are located on the valley floor and usually have a cover crop of orchard grass. The grass is mowed during harvest to accommodate the machinery which comes into vacuumn the fallen nuts in non-handpicked orchards. A majority of irrigated walnut orchards are located in the Middle Creek drainage in Upper Lake and in Big Valley.

2015 Farm Evaluation Data

Of the 10,073 acres enrolled in the Irrigated Lands Program in 2015, the Lake County Agricultural Lands Watershed received Farm Evaluations back from 9,375 acres. The next Farm Evaluation update is due in 2020. Since the 2015 Farm Evaluation update, around 3000 acres have been enrolled in the Irrigated Lands Regulatory Program in Lake County. Overall acreage employing each management practice discussed below has likely increased since 2015 as the popularity of sustainability programs increases and more new projects are developed under the Lake County Grading Ordinance.

In these Farm Evaluation summaries, a series of management practices were self-identified by the grower. Due to Lake County's Reduced Monitoring Program, LCFBEC is required to do an annual field verification of management practices in 5% of the enrolled acres identified in the Farm Evaluations. Since the Reduced Monitoring Management Practice Verification program started in 2016, LCFBEC has verified that 2102 acres are employing management practices claimed in their Farm Evaluations. This represents 21% of enrolled Farm Evaluation acres. Overall, the majority of Lake County growers are implementing management practices that protect against sediment erosion and water quality degradation.

According to the Farm Evaluations, there were cover crops or native vegetation cover in almost 80% of acreage (7500 acres), and 70% of acreage (6562 acres) used drip or micro-irrigation to mitigate surface water run-off. 90% of vineyard acreage maintains an annual or winter cover crop. There was also no irrigation drainage due to field or soil conditions in 70% of acreage reported and no storm drainage due to field or soil conditions in 16% of acres. Growers reported that they practiced minimum tillage to reduce erosion risk in 75% of the acreage reported (7031 acres).

When asked if their farm has the potential to discharge sediment, 72% of acreage reported no potential (6750 acres). However, the Lake County Farm Bureau office received calls from growers who were confused by the question as 'potential' is an indeterminate term. Since 2015, LCFBEC has encouraged growers to answer that question with 'probability' instead of 'potential.' It is LCFBEC's opinion that given management practices and soil conditions, the percentage of farms with no potential to discharge sediment is higher than 72%.

The following erosion control practices were incorporated in at least 2200 acres: vegetated buffer strips, vegetated ditches, stabilized banks and sub-surface pipelines.

The following erosion control practices incorporated in at least 1500 acres: sediment catchment ponds, berms to catch sediment at the low end of the field.

In the category of "Pesticide Management Practices," between 80 and 90% of reported acreage followed the County permit, followed label restrictions, monitored rain forecasts, monitored wind conditions, attended trainings, avoided surface water when spraying and used end of row shutoff when spraying. Pesticides were not applied to 10% of the acreage. 87% of growers use a PCA to help develop their crop fertility plan, while 25% used a professional soil scientist. Only 4% of growers reported using no professional help in developing a crop fertility plan.

In the category of "Nitrogen Management" between 50 and 70% of acreage split fertilizer applications, used tissue/petiole testing, soil testing and fertigation as part of standard nitrogen management practices. Nitrogen was not applied in 5% of acreage. Lake County growers work closely with their PCAs to develop nitrogen management plans, as captured in 87% of acreage above.

Drip irrigation as a primary method of irrigation was reported in 65% of acreage with 52% reporting sprinkler as their secondary method of irrigation. Micro-irrigation systems are used almost exclusively for wine grape irrigation, although a small percentage of vineyards utilize overhead sprinklers for early spring frost protection of grapevines.

The full results of the 2015 Farm Evaluations can be found in Appendix B.

VI. Effectiveness of Management Pracitices

According to the US EPA's guide *"National Management Measures for the Control of Nonpoint Pollution from Agriculture",* effectiveness of erosion control practices depends on the nature of the soil particles to be controlled; the types of practices or controls being considered; site-specific conditions (e.g. crop rotation, topography, tillage, harvesting method); and operation and maintenance (US EPA 2003). This guide makes a point that BMPs must be site-specific for maximum effectiveness.

Figure 16 shows broad estimates from the US EPA's guide based on management practice type as reported in research literature. These numbers should be viewed as a starting point, as there is tremendous variation in effectiveness based on soil type, slope, field layout and other management practices employed.

The USDA's Universal Soil Loss Equation (RUSLE2) model evaluates management practice effectiveness on a field-by-field basis by inputting the following factors: rainfall and runoff; soil

Table 4c-1. Relative Gross Effectivenessa of Sediment[b] Control Measures Pennsylvania State University, 1992b).

Practice Category[c]	Runoff Volume	Total[d] Phosphorus	Total[d] Nitrogen	Sediment
		(% reduction)		
Reduced Tillage Systems[e]	reduced	45	55	75
Diversion Systems[f]	reduced	30	10	35
Terrace Systems[g]	reduced	70	20	85
Filter Strips[h]	reduced	75	70	65

a Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.

b Includes data where land application of manure has occurred.

c Each category includes several specific types of practices.

d Total phosphorus includes total and dissolved phosphorus; total nitrogen includes surface-delivered organic-N, ammonia-N, and nitrate-N.

e Includes practices such as conservation tillage, no-till, and crop residue use.

f Includes practices such as grassed waterways and grade stabilization structures.

g Includes several types of terraces with safe outlet structures where appropriate.

h Includes all practices that reduce contaminant losses using vegetative control methods.

Figure 16: Agricultural practice relative effectiveness from the US EPA's guide to preventing agricultural pollution. (Source: US EPA 2003).

erodibility; slope length; slope steepness; cover and management; and support practice. Generalized soil loss savings by specific management practices are difficult to calculate using the RUSLE2 model, since specific factors must be inputted into the equation. However, in Lake County, growing areas can be averaged based on soil type, slope and generalized practices based on crop type. These averages are crucial to LCFBEC's sediment loading calculations across the watershed as around 7300 and 7350 acres respectively are using cover crops and minimum tillage practices to control erosion according to the 2015 Farm Evaluations.

RUSLE Cover Management Factors for Construction Sites

Vegetative cover	C factor	Percent reduction of soil loss
None (fallow ground)	1.0	0
Native vegetation (undisturbed)	0.01	99
Temporary ryegrass, 90% (perennial)	0.05	95
Temporary ryegrass, 90% (annuals)	0.1	90
Permanent seedlings (90%)	0.01	99
Sod (laid immediately)	0.01	99
Mulching (for slopes 2:1 or less)	**C factor**	**Percent reduction of soil loss**
Hay (0.5 tons/acre)	0.25	75
Hay (1.0 tons/acre)	0.13	87
Hay (1.5 tons/acre)	0.07	93
Hay (2.0 tons/acre)	0.02	98
Other	**C factor**	**Percent reduction of soil loss**
Competent gravel layer	0.05	95
Rolled erosion control fabrics	for slopes > 2:1; variable C by type	

Figure 17: Northwest California Resource Conservation and Development District's averages for management practices on grading projects and construction sites using the RUSLE model. (Source: NCRCD 2016)

Figure 17 shows RUSLE model calculations as they pertain to construction and grading from the Northwest California Resource Conservation and Development District in 2016. These figures are helpful in averaging the effect of erosion control methods in agricultural grading projects, vineyard avenues on steep slopes and agriculture-related development around Lake County.

There are also generalizations that can be made in irrigation methods and erosion control. A study by the USDA Agricultural Research Service in Idaho found that soil erosion is generally greater from surface irrigation, such as flood irrigation because water flows over the soil during irrigation. Other irrigation methods such as sprinkler or drip can reduce or minimize surface run-off. Particularly, the research found that soil run-off was 6 to 20 times higher in the inflow side of the field versus the field average on a 1% slope (Bjorneberg 2013). It is important to note, that these statistics were based on furrow irrigation rather than orchard irrigation with a cover crop down the center strip. However, the same study found that close-growing crops like alfalfa (Medicago sativa L.) or wheat (Triticum aestivum L.) on fields with 1% slope had annual soil loss of around 0.45 tons per acre (Bjorneberg 2013). Furthermore, while soil erosion is typically not a concern where field slopes are less than 0.5%, erosion tends to increase exponentially for increasing inflow rate and field slope, with an exponent between 1 and 3 for flow rate, and between 2 and 3 for slope. (Bjorneberg 2013). Lake County pears generally tended to be flood irrigated until a switch to sprinklers in the 1980s. By the end of the 1990s, as Rachel Elkins estimates, 20-30% of Lake County pears were flood irrigated. By 2015, 8% were flood irrigated.

Finally, sediment catchment ponds are a practice employed by 752 acres in Lake County. A study conducted in Belgium looked at trap efficiency estimates in natural ponds, sediment catchment ponds and dams. In its example of a small catchment pond in Belgium, the study found that based on different

Figure 18: A reservoir catches any potential water runoff in the vineyards and avenues of Amber Knolls in the Red Hills.

sediment trapment efficiencies, the pond's sediment yield was around 2.83 tons/acre/year (Verstraeten and Poesen 2000). TE efficiency ranged from 44 to 94% dependent on characteristics of the reservoir (Verstrateten and Poesen 2000). Reservoirs built specifically for sediment catchment would fall on the high end of the spectrum. According to the Natural Resources Conservation Service, "The efficiency of sediment removal in a basin is affected by the detention time of runoff, the type of dewatering device, the presence of a permanent pool in the basin, a decrease in turbulence in the basin and soil particle size (NRCS 2000).

VII. Calculating Phosphorus Load Reductions in Agriculture.

Assumptions

When calculating reductions in agricultural phosphorus loading to Clear Lake between 2001 and 2018, there are a number of assumptions that need to be made. Because there was no survey to discern actual agricultural practices at the conclusion of the TMDL research, a simple basin-wide calculation is very difficult. However, there is enough evidence between specific examples of crop changes and regulatory and industry-imposed practices to make a good empirical case for systemic load reduction.

The first assumption is that nearly all phosphorus load from agriculture comes from sediment erosion. The 2012 TMDL update confirmed that sediment erosion is the primary cause of phosphorus loading from all nonpoint sources contributors, including agriculture. Lake County's soil is high in naturally-occuring phosphorus, and for that reason, phosphorus as fertilizer is not applied widely or in large amounts in traditional Lake County agriculture. Plants generally have enough available P in the soil. Local plant pathologist and certified crop advisor Dr. Broc Zoller corroborates the fact that neither winegrapes, pears or walnuts in Lake County need large amounts of phosphorus as an added nutrient and to add unneccessary material is not economical. In a 14 year history of surface water quality monitoring, there has never been a water quality exceedance for phosphorus in the agricultural areas. Local agricultural materials companies confirmed that phosphorus as fertilizer is used sparingly on Lake County's main agricultural crops. The nutrient is used locally on crops such as cannabis which is grown in imported soil. While legal cannabis operations have strict guidelines from the State Water Board regarding imported soil/nutrient erosion prevention, it is possible that limited amounts of phosphorus as fertilizer have entered Lake County watersheds through illegal cannabis operations over the years. It is difficult, if not impossible, to quantify this number.

The second assumption is that acres developed under the Lake County Grading Ordinance, Irrigated Lands Program and maintained under sustainability programs will reduce more sediment loading through implementation of BMPs. This number is also hard to quantify, as it is difficult to prove a negative. We know what management practices a particular development employed because the Grading Ordinance required it. But we don't know what management practices there would have been absent of the ordinance. For the sustainability programs, we can make reasonable assumptions based on the fact that CSWA requires a cover crop in vineyards. Cover crops are considered to be the most effective water quality protection measure as they provide effective control of soil detachment and also enhance soil

infiltration rates. This is well-documented by the USDA's Universal Soil Loss Equation. According to the Farm Evaluations in 2015, 90% of Lake County vineyards are using a cover crop. If 100% of Lake County's certified sustainable acres are using a cover crop, then the 10% of non-cover cropped vineyards lie in those 3500 acres of vineyards not enrolled in a sustainability program, which is 25% of that acreage. It's reasonable to expect that the sustainability programs force some level of management practive development on growers. In other words, in vineyards not certified under a sustainability program, 25% of acreage is not planted with a cover crop. This is consistent with the Lake County average of all crops in the Farm Evaluation. Absent of sustainability programs, it's reasonable to expect that the number of acres with year round cover crops would be closer to the county average. Therefore, specific cultural practices of winegrape growers as promoted through the Lake County Winegrape Commission and CSWA have reduced potential erosion through these industry-imposed standards.

The third assumption is that the NRCS Universal Soil Loss Calculation (or RUSLE2 Model) is the best available science for calculating and comparing sediment delivery against specific agricultural practices. RUSLE2 estimates rates of rill and interrill soil erosion caused by rainfall, its associated overland flow and is land-use independent.

The fourth assumption is that acreage conversions are approximated to LCFBEC's best ability using local knowledge from land-owners, farmers, PCAs and residents. Data regarding the exact composition of Lake County agriculture 18 years ago is not available. However, crop reports and local knowledge can contribute enough information to make a reasonable assumption at the watershed level. LCFBEC determined that it was better to calculate erosion reductions in a specific case where unknown factors could be controlled. In LCFBEC's initial calcualtion with NRCS, the "before and after" management practices were known quantities, the acres were verifiable by land-owners and the exact year of conversion was known. Taking this specific case and applying it broadly was assumed to be more accurate and defensible than starting from the watershed level. In this way, specific soil types and the histories of agriculture in specific areas of the county could be accounted for.

Method

LCFBEC worked with the local NRCS District Conservationist in calculating three scenarios based on the largest potential impact to sediment load reductions into Clear Lake between 2001 and 2018. This impact is the broad-scale conversion of high-till, dry-farmed walnuts with no cover crop to drip irrigated winegrapes with low till and/or no till practices and year round cover crop. There is ample evidence via direct local knowledge and the Lake County crop reports for broad-scale conversions in the Red Hills, Kelsey Bench and Big Valley. Using the RUSLE2 model, the local NRCS calculated the reductions in sediment loading between these two crop types for Red Hills soils and slope, Kelsey Bench soils and slope and Big Valley soils and slope. These three geographic areas capture the soils types and slopes in virtually all of Lake County growing areas. Red Hills' steep slopes and volcanic soils are similar to the Clearlake area; Kelsey Bench is a good approximate for other alluvial areas with sloping topography; and Big Valley's dense soil types and low slope are the same in Scotts Valley and Upper Lake.

LCFBEC surveyed as many residents, farmers and land-owners as possible to come up with acreage estimates based on specific parcels they remember as converted. Time range was limited back to 2001. In some cases, respondents could not remember the exact year that the orchard was converted, and the crop report shows that some conversion was happening prior to 2001. This was accounted for to the best of LCFBEC's ability. It is important to note, however, that the total drop in walnut acreage between 2001 and 2006 does not reflect the true amount of walnut acres converted. Concurrent to orchard conversion was orchard planting in the valley areas. Also, some of the walnuts converted were not

identified as ‘current productive acres’ in the crop reports.

After these surveys were done and calculations applied, LCFBEC looked at other factors across the watershed and attempted to apply reasonable rates of erosion reduction (e.g the number of acres with a sediment catchment basin, acres enrolled in a sustainability program with a cover crop vs. acres not enrolled in a sustainability program and flood irrigation conversions). These calculations are not a complete representation of the sediment loading reductions Lake County agriculture has made since 2001, but they are the most verifiable and empirically defensible. In these calculations, LCFBEC made estimates based on the total acreages of the three irrigated crops in Lake County. Dry-farmed pasture was not included in these estimates, as the acreage has stayed relatively steady, management practices have not changed, and pasture is mostly located on the valley floor with low erosion potential.

Results

LCFBEC and NRCS started with a small case study. Prior to 2001, the “Amber Knolls’ area of Red Hills was a dry-farmed walnut orchard dating back to the 1930s and 1940s. The orchards were disced in May and in September and rolled with heavy equipment in October for harvest. The discing was done to remove weed growth and rolled and graded for ease of hand-pick harvesting. At first rain, tilled soil was easily transported off hillside. In 2001, these orchards were removed and approximately 500 acres of vineyard was established with year around no-till cover crops and drip irrigation. Figure 19 shows the area.

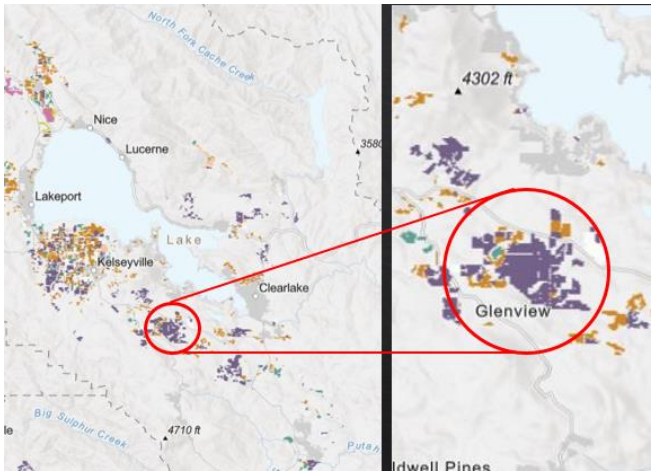


Figure 19: Amber Knolls in the Red Hills which served as the test area for calculating sediment reductions in walnut to vineyard conversions. It’s important to note, that according to local knowledge, most of the Red Hills vineyard acreage was converted from walnuts. Also of note is the fact that conversion is ongoing. Areas of tan represent existing walnut orchards that have either been converted since this 2014 data or will most likely be converted in the future. The most recent walnut to vineyard conversion was in 2018. (Map Source: 2014 Statewide Crop Mapping).

The RUSLE2 Model calculated a sediment delivery reduction from 12 tons/acre/year to 0.064 tons/acre/year in that specific case. This is a 99.46% reduction in sediment loading on those 500 acres from simply changing crop type and employing management practices. This assumed a 15% average slope steepness and a soil type of Glenview/Arrowhead complex very gravelly loam.

LCFBEC surveyed vineyard owners and farmers in the Red Hills, Perini Rd., Lower Lake and Clearlake areas to find other specific examples of walnuts converted to vineyards with similar management practices. GIS was used to calculate acres in cases where the land-owner did not remember the specific acreage of the block converted. LCFBEC was able to identify 2387 acres that were converted. This can be an underestimate of the walnut orchards converted, as LCFBEC was conservative on counting acreages that might have been converted before the TMDL research was concluded in 2001.

Similar calculations were made for conversions from high-till, no cover crop walnut orchards to no-till vineyards with cover crop in the Kelsey Bench Area. Assuming a 10% average slope steepness with a soil type of Forbesville loam, there was a reduction from 13 tons/acre/year to 0.035 tons/acre/year. This is a 99.73% reduction on those acres with no-till cover crop. Some acreage in the Kelsey Bench area is

managed like the Big Valley, in which there is an annual cover crop, however the middle rows get tilled during the early summer. In these acreages, there was a reduction of 29.2% from 13 tons/acres/year to 9 tons/acre/year. LCFBEC determined that 475 Kelsey Bench acres were converted from walnuts. Approximately 30% of Kelsey Bench vineyards, or 142 acres employ the till style with annual cover crop.

In Big Valley, there was a 28.5% reduction in going from high till walnuts to vineyards with a cover crop that get tilled in the spring. This was a reduction from 1.4 tons/acres/year to 1.0 tons/acres/year. This calculation assumed a Cole Clay loam and 2% slope. Most winegrapes in Big Valley are tilled at least once per year, so NRCS did not calculated the difference between walnuts and no till on the valley floor. LCFBEC calculated a trend in dry-farmed walnuts to winegrapes on the valley floors around Lake County: Big Valley, Upper Lake and Scotts Valley. A modest estimate was around 550 acres for these three areas. The NRCS RUSLE2 data is located in Appendix C.

LCFBEC also considered reductions from other management practices. In looking at the conversion of flood irrigation to sprinkler and micro-irrigation in pears, LCFBEC considered this from Bjorneberg, 2001: "Sediment cannot be transported without runoff. Runoff is planned with many surface irrigation schemes in order to irrigate all areas of the field adequately. Under ideal conditions, properly designed and managed sprinkler irrigation systems will not have any runoff from the irrigated area." While the 0.45 tons/acres/year was estimated for alfalfa crops, it's reasonable to assume that this could also roughtly approximate flood irrigation in a low slope orchard with a permanent cover crop. Given the percentage decrease from around 20% (600 acres) flood irrigated in 2001 to 8% in 2015, LCFBEC calculates a 15% reduction in erosion on 600 acres from flood irrigation to sprinkler.

In calculating erosion reduced through sediment catchment basins, LCFBEC estimated an average sediment delivery budget of 0.064 tons/acre/year for the hillside slopes based on the NRCS calculations for vineyards with no-tilled cover crops, as most sediment catchment ponds occur in these areas. In addition to this generalized sediment transport coming off the productive zone, LCFBEC calculated an erosion rate for unimproved vineyard avenues and roads based on MacDonald and Coe 2015. They found sediment transport in the north coast of California was approximately 0.5-50 tons/acre of road/year. Assuming an average road density of 4 km km^{-2} and an average road width of 6 m, these rates would apply to 2.4% of the catchment area. In the Farm Evaluation, 1400 acres claimed to use sediment catchment basins or holding ponds. However, LCFBEC can only confirm that about 700 acres employed a sediment catchment basin after 2001. Therefore, a 94% reduction on 14 acres (2.4% of 700 acres) of surface roads and a 94% reduction on those 700 productive acres. For the productive acres, an estimated 41.21 tons/year of sediment was trapped by sediment catchment basins.

To summarize:

- 2387 acres had a 99.46% reduction in sediment loading from walnuts to vineyard in the Red Hills
- 333 acres had a 99.75% reduction in sediment loading from walnuts to no till vineyard in Kelsey Bench
- 142 acres had a 29.2% reduction in sediment loading from walnuts to tilled vineyard in Kelsey Bench
- 550 acres had a 28.5% reduction in sediment loading from walnuts to tilled vineyard in Big Valley.
- 600 acres had a 15% reduction in sediment loading in switching from flood irrigated pears to sprinkler or drip

- 700 acres had a 94% reduction in sediment loading due to sediment catchment basins
- 14 acres of agricultural roads had a 94% reduction in sediment loading due to sediment catchment basins.

In total, 4726 acres had a combined weighted 77% reduction in erosion. Adjusting to 2017 irrigated acreage, this represents an approximately 30% loading reduction from agriculture across the watershed.

This overal reduction percentage does not take into account potential sediment loading reductions from the Lake County Grading Ordinance or the Winegrape Sustainability Programs. As stated earlier, it is difficult to prove a negative and claim theoretical practices if those programs were not in place. However, the probability that additional agricultural load reductions have resulted from these programs is high.

For example, the NCRCD RUSLE model calculated a 90% sediment erosion reduction using an annual ryegrass cover crop and a 99% reduction using perenial cover crop (NCRCD 2016). 5266 acres have been enrolled in a sustainability program since 2005 and as stated above, 100% of those acres use a cover crop. Compare this to just 77% of general Lake County agriculture and 75% of winegrape acreage not enrolled in a sustainability program. In the absence of sustainablitiy programs and management practice promotion from the Lake County Winegrape Commission, it's reasonable that winegrapes would follow the 75% cover cropping trend of the rest of Lake County agriculture and winegrapes not currently enrolled in a sustainability program. Currently, 90% of Lake County winegrapes use a cover crop. This is a gap of 1315 acres that theoretically are employing a cover crop solely due to their certification in a sustainability program. A 90% erosion reduction on 1315 acres bumps Lake County agriculture's loading reduction to 40%.

There have been 1842 acres developed under the Lake County Grading Ordinance since 2007. NCRCD calculated a 75-98% reduction in soil loss just with the presence of hay mulching, which is required in the ordinance. It is disingenuous to claim that all 1842 developed acres would have not used hay mulching in the absense of the Lake County Grading Ordinance, but a certain percentage might have. Assuming even a modest number of 25% of acreage that might not have developed using hay mulch on 460 acres, it increases Lake County agriculture's loading reduction to 43%. See Table 1 for detailed calculations.

Conclusion

Since 2001, Lake County farmers and ranchers have implemented management practices in compliance with the Clearlake TMDL's objective through the reduction of sediment erosion, and therefore phosphorus loading to the lake. Through various calculations on management practices, LCFBEC and Lake County NRCS estimate Lake County's sediment loading reduction at anywhere from 30-43% since TMDL research concluded in 2001. These numbers took conservative estimates into account, wherever possible.

The Lake County Farm Bureau Education Corporation is dedicated to continued grower education and a management practice promotion that both fulfills the requirement and is protective against water quality degradation.

Calculating Watershed Sediment Reduction Rates

Reducing Practice	**Acres**	**Reduction Percentage**	**Constant Erosion Rate (in tons/acre)**	**Theoretical Erosion (in tons)**
Red Hills	2387	99.46	1	12.88
Kelsey Bench no till	333	99.75	1	0.832
Kelsey Bench till	142	29.2	1	100.5
Big Valley	550	28.5	1	393.25
Flood to Sprinkler	600	15	1	510
Sediment Basins	700	94	1	42
Sediment Basins-roads	14	94	1	0.84
Sustainability Programs	1315	90	1	131.5
Grading Ordinance	460	98	1	9.2
Totals	6501	n/a	n/a	1201.002
Acreage not reduced	5820	0	1	5820
			Total Erosion:	7021.002
2017 Productive Acres	12,321		1	12,321
Erosion reduction			7021.002/12,321	43% overall reduction

Table 1: Erosion reduction assuming a 1 ton/acre/year erosion rate for simplicity of calculation.

.

References

Bjorneberg, David L. "Irrigation: Erosion" Encyclopedia of Soil Science Northwest Irrigation and Soils Research, United States Department of Agriculture–Agricultural Research Service, Kimberly, Idaho, U.S.A. 2013.

California Department of Pesticide Regulation "1990-2012 Lake County Pesticide Use by Commodity"; http://www.cdpr.ca.gov/docs/pur/pur13rep/top_5_ais_sites_lbs13.pdf

California Department of Pesticide Regulation 2013 Pesticide Use Report by County; 2013 http://www.cdpr.ca.gov/docs/pur/pur13rep/top_5_ais_sites_lbs13.pdf

Central Valley Regional Water Quality Control Board "Clear Lake TMDL 5 year update". September 2012 http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/clear_lake_nutrients/cl_update_stfrpt_2.pdf

Central Valley Regional Water Quality Control Board Order No. R5-2014-0030, Waste Discharge Requirements General Order, Adopted on 12 March 2014, 7.4 MB*, PDF (PDF info) **- Revised by Order R5-2015-008** http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2014-0030.pdf

County of Lake Grading Ordinance, County of Lake County Ordinance No. 2830, § 1, 7-17-2007 https://www.municode.com/library/ca/lake_county/codes/code_of_ordinances?nodeId=COOR_CH30GROR

Conrad, Katherine "Tri Valley Growers Files for Bankruptcy" BizJournals 2000 https://www.bizjournals.com/eastbay/stories/2000/07/17/story4.html

Daly, C., M. Halbleib, J.I. Smith, W.P. Gibson, M.K. Doggett, G.H. Taylor, J. Curtis, and P.A. Pasteris. "Physiographically-sensitive mapping of temperature and precipitation across the conterminous United States." Int. J. Climatology. 28:2031-2064. 2008

Elkins, Rachel "Areawide Implementation of Mating Disruption in Pears Using Puffers", Pomology Farm Advisor University of California Cooperative Extension March 2002.

EPA Office of Pesticide Programs. Pesticide re-registration eligibility decisions (REDs) fact sheets 2000, online.

Flood Protection Corridor Program. County of Lake March 26, 2015. http://www.co.lake.ca.us/Government/Directory/Water_Resources/Department_Programs/Flood_Protection_Corridor_Program.htm#sthash.q4v8WSLm.dpuf

Giusti, Greg. (2011). "Managing Vertebrate Pests in an Organic Vineyard". Organic Winegrowing Manual. University of California Agriculture and Natural Resources. Publication #3511: 145-151

Global Volcanism Program "Clear Lake". Smithsonian Institution. Retrieved 2008-08-19.

http://westernfarmpress.com/lake-county-s-walnut-harvest-likely-be-even-later

Jones, Gregory V. "Climate Characteristics of Winegrape Production in Lake County, California", Southern Oregon University, December 1 2014. http://www.lakecountywinegrape.org/wp-content/uploads/2015/07/report-climate-characteristics-for-winegrape-production-lake-county-ca-july-2015.pdf

Lake County Department of Agriculture Lake County Crop Report, 2000-2017.
http://www.co.lake.ca.us/Assets/Agriculture/docs/2012report.pdf
http://www.co.lake.ca.us/Assets/Agriculture/docs/2013report.pdf
http://www.co.lake.ca.us/Assets/Agriculture/docs/2014report.pdf
http://www.co.lake.ca.us/Assets/Agriculture/docs/2015report.pdf
http://www.co.lake.ca.us/Assets/Agriculture/docs/2016report.pdf
http://www.lakecountyca.gov/Assets/Departments/Agriculture/docs/Crop+Reports/2017.pdf

Lake County Winegrape Commission Sustainably Managing Water Use, Lake County Winegrape Commission Video Series. November 30, 2014. http://www.lakecountywinegrape.org/sustainably-managing-water-use/

Lake County Farm Bureau Education Corporation, "Lake County Reduced Monitoring Management Practices Alternative." 2016.

Lake County Community Development, Interview with Planner on Lake County Grading Ordinance. 2018

Larry Walker Associates, 2011. "Clear Lake Nutrient TMDL Progress Information Request", Memorandum to Bruce Houdesheldt, NCWA. November 23, 2011

McGourty et al. "Vineyard Water Use in Lake County, California" Glenn McGourty, Ryan Keiffer, Dr. Broc Zoller, UCCE Mendocino and Lake Counties, December 1, 2014. http://www.lakecountywinegrape.org/wp-content/uploads/2014/08/Lake-County-Vineyard-Water-Use-UC-Cooperative-Extension-December-1-2014.pdf

McDonald, Lee H and Coe, Drew ER "Road Sediment Production and Delivery Processes and Management" Colorado State University 2015.

NRCS Soil Survey of Lake County United States Department of Agriculture 1989.

NRCS "Sediment Basin" NRCS Conservation Practice Standard. 2000.

Sims, John "Late Quaternary Climate, Tectonism, and Sedimentation in Clear Lake, North California Coastal Ranges" US Geological Survey, Palo Alto California 1988.

State Water Resources Control Board "Clear Lake Watershed TMDL Monitoring Program" 2009.http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/clear_lake_nutrients/index.shtml

Tree Fruit Research and Extension Center, "Alternative controls to Fire Blight" Washington State University 2014.

UC IPM "Pear Pest Management Guidelines" UC Davis Integrated Pest Management, November 2011. http://www.ipm.ucdavis.edu/PMG/r603301111.html

US EPA "National Management Measures for the Control of Nonpoint Pollution from Agriculture" U.S. Environmental Protection Agency, Office of Water. EPA-841-B-03-004. July 2003. https://www.epa.gov/sites/production/files/2015-10/documents/covers.pdf

USDA NRCS Field Office Technical Guide (FOTG 2009), 2009, http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=CA.

USGS U.S. Geological Survey Geographic Names Information System: Cobb Mountain. Retrieved 2008-08-19.

Western Farm Press "Lake County's Walnut Harvest likely to be even later" 2015, online

Verstraeten, Gert and Poesen, Jean "Estimating trap efficiency of small reservoirs and ponds: methods and implications for the assessment of sediment yield" Progress in Physical Geography 24, 2 pp. 219–251 2000. https://journals.sagepub.com/doi/abs/10.1177/030913330002400204

Zoller, Broc "Codling Moth mating disruption in Lake County" Presentation given at 2015 AgVenture Class, August 14, 2015.

Appendix A: Management Practices Field Verification Guide

LAKE COUNTY FARM BUREAU EDUCATION CORP.

Lake County Farm Bureau Education Corporation

Management Practice Field Verification

For 2018-2019 Field Verification Visits

Member ID: _____ Verified Acreage: _____

- ☐ FE Completed
- ☐ NMP Completed
- ☐ Sediment Erosion and Control Plan self-certification signed

FE/NMP Consultation Date _____

Date of Field Visit: _____

Field Visit Verification:

Management Practice	Identified on FE	Verified in Field	Notes
Pesticide Application Practices			
County Permit Followed			
Follow label instructions			
Sensitive Areas Mapped			
Attend Trainings			
End of Row Shutoff when spraying			
Avoid Surface Water when spraying			
Reapply Rinsate to treated field			
Target Sensing Sprayer Used			
Use Drift Control Agents			
Monitor Wind Conditions			
Use Appropriate Buffer Zones			
Use Vegetated Drain Ditches			
Monitor Rain Forecasts			
Use PCA Recommendations			
Chemigation			
No Pesticides Applied			
Who develops Nutrient Plan?			

Does Farm have potential to discharge sediment:			
Management Practice	**Identified in FE**	**Identified in Field**	**Notes**
Irrigation Practices (Primary and Secondary)			
Drip			
Micro-sprinkler			
Furrow			
Sprinkler			
Border Strip			
Flood			
Irrigation Efficiency Practices			
Laser levelling			
Use of Et in scheduling irrigation			
Water application scheduled to need			
Use of Moisture probe			
Soil Moisture Neutron Probe			
Pressure Bomb			
Other			
Nitrogen Management Practices			
Cover Crops			
Split Fertilizer Applications			
Soil Testing			
Tissue/Petiole Testing			
Variable Rate Applications using GPS			
Foliar N Application			
Irrigation Water N Testing			
Fertigation			
Do not apply N			
Irrigation Well Practices			
Cement Pad			
Ground Sloped Away from Wellhead			
No Standing Water around Wellhead			
No Debris or Refuse around Wellhead			
Air Gap			
Backflow Valve			
Abandoned Well Practices			
Wellhead capped or destroyed?			
Sediment Erosion and Control Practices			
Cover Crops			
In-furrow dams			
Time between pesticide application/irrigation			
Short irrigation runs			

PAM used in furrow			
Drip or micro-irrigation			
Management Practice	**Identified in FE**	**Identified in Field**	**Notes**
Tailwater Return System			
Catchment Basin			
No Irrigation Drainage due to field conditions			
Field borders			
Vegetated Ditches			
Hedgerows or Trees			
Soil Penetration methods used			
Crop rows graded and banked			
Creek banks stabilized			
Subsurface pipelines used			
Berms constructed at low points			
Minimum tillage			
Field is lower than surrounding terrain			
No storm drainage due to field conditions			
Roads and Site			
Pesticides stored in contained, covered location			
No discharge at Mixing/Loading sites			
Service Roads are armored			
Service Roads are strawed in winter			
Service Roads are closed in winter			

Additional management practices/paperwork verified:

_____

_____

_____

_____

Notes:

_____

_____

_____

_____

_____

Verifier Signature:

_____, _____. _____

Name Title Date

Appendix B: Lake County Farm Evaluation Data 2015

Baseline Summary of Agricultural Practices Implemented in Lake County

PRACTICE CATEGORY / **Individual Practice**	**Acres Reported**	**Percent of Total Acres Reported (9,375 acres)**
PESTICIDE APPPLICATION PRACTICES		
County Permit Followed	8,377	89.4
Follow Label Restrictions	8,362	89.2
Monitor Rain Forecasts	8,154	87.0
Monitor Wind Conditions	8,090	86.3
Attend Trainings	8,057	85.9
Avoid Surface Water When Spraying	7,917	84.4
End of Row Shutoff When Spraying	7,895	84.2
Use Appropriate Buffer Zones	7,018	74.9
Use PCA Recommendations	5,994	63.9
Reapply Rinsate to Treated Field	5,052	53.9
Use Drift Control Agents	3,965	42.3
Use Vegetated Drain Ditches	3,555	37.9
Sensitive Areas Mapped	1,696	18.1
Chemigation	1,502	16.0
No Pesticides Applied	948	10.1
Target Sensing Sprayer used	803	8.6
Other1	673	7.2
WHO DO YOU HAVE HELP DEVELOP YOUR CROP FERTILITY PLAN?		
Pest Control Advisor (PCA)	8,140	86.8
Certified Crop Advisor (CCA)	4,442	47.4
Professional Soil Scientist	2,345	25.0
Professional Agronomist	1,391	14.8
Certified Technical Service Providers by NRCS	663	7.1
None of the above	359	3.8
No Selection	77	0.8
Independently Prepared by Member	15	0.2
DOES YOUR FARM HAVE THE POTENTIAL TO DISCHARGE SEDIMENT TO OFF-FARM SURFACE WATERS?		
No	6,777	72.3
Yes	2,597	27.7
IRRIGATION PRACTICES		
Drip	6,109	65.2

PRACTICE CATEGORY		
Individual Practice	**Acres Reported**	**Percent of Total Acres Reported (9,375 acres)**
Sprinkler	2,615	27.9
Flood	760	8.1
Micro Sprinkler	360	3.8
No Selection	53	0.6
SECONDARY IRRIGATION		
Sprinkler	4,850	51.7
No Selection	4,193	44.7
Micro Sprinkler	802	8.6
Flood	109	1.2
Drip	101	1.1
Border Strip	5	0.1
IRRIGATION EFFICIENCY PRACTICES		
Water application scheduled to need	6,790	72.4
Use of moisture probe	3,176	33.9
Use of ET in scheduling irrigations	2,863	30.5
Pressure Bomb	2,447	26.1
Soil Moisture Neutron Probe	1,910	20.4
Other	1,170	12.5
Laser Leveling	613	6.5
No Selection	150	1.6
NITROGEN MANGEMENT METHODS TO MINIMIZE LEACHING PAST THE ROOT ZONE		
Cover Crops	6,542	69.8
Split Fertilizer Applications	6,432	68.6
Tissue/Petiole Testing	5,592	59.7
Soil Testing	5,190	55.4
Fertigation	4,934	52.6
Irrigation Water N Testing	2,143	22.9
Foliar N Application	1,886	20.1
Do Not Apply Nitrogen	496	5.3
Other	376	4.0
Other2	96	1.0
No Selection	93	1.0
Variable Rate Applications using GPS	12	0.1
DO YOU HAVE ANY IRRIGATION WELLS ON PARCELS ASSOCIATED WITH THIS SURVEY?		
Yes	8,457	90.2
No	864	9.2

PRACTICE CATEGORY		
Individual Practice	**Acres Reported**	**Percent of Total Acres Reported (9,375 acres)**
No Selection	32	0.3
ARE YOU AWARE OF ANY KNOWN ABANDONED WELLS ASSOCIATED WITH THIS SURVEY?		
No	6,090	65.0
Yes	2,502	26.7
No Selection	760	8.1
WELLHEAD PROTECTION PRACTICES		
Good “Housekeeping” Practices	8,346	89.0
Backflow Preventive / Check Valve	7,419	79.1
Ground Sloped Away from Wellhead	7,395	78.9
Standing water avoided around wellhead	6,994	74.6
Cement Pad	6,227	66.4
Air Gap (for non-pressurized systems)	3,699	39.5
N/A (Has No Irrigation Wells)	864	9.2
No Data Entered	16	0.2
ABANDONED WELL PRACTICES		
N/A (Has No Abandoned Wells)	6,066	64.7
Destroyed - Unknown method	2,471	26.4
No Data Entered	815	8.7
IRRIGATION PRACTICES FOR MANAGING SEDIMENT AND EROSION		
Use drip or micro-irrigation to eliminate irrigation drainage.	6,376	68.0
No irrigation drainage due to field or soil conditions.	6,202	66.2
The time between pesticide applications and the next irrigation is lengthened as much as possible to mitigate runoff of pesticide residue.	3,105	33.1
Shorter irrigation runs are used with checks to manage and capture flows.	2,599	27.7
No Selection	791	8.4
Catchment Basin.	754	8.0
Tailwater Return System.	519	5.5
Use of flow dissipaters to minimize erosion at discharge point.	262	2.8
In-furrow dams are used to increase infiltration and settling out of sediment prior to entering the tail ditch.	123	1.3
Other	62	0.7
CULTURAL PRACTICES TO MANAGE SEDIMENT AND EROSION		
Cover crops or native vegetation are used to reduce erosion.	7,284	77.7
Minimum tillage incorporated to minimize erosion.	7,052	75.2

PRACTICE CATEGORY		
Individual Practice	**Acres Reported**	**Percent of Total Acres Reported (9,375 acres)**
Soil water penetration has been increased through the use of amendments, deep ripping and/or aeration.	3,050	32.5
Vegetated ditches are used to remove sediment as well as water soluble pesticides, phosphate fertilizers and some forms of nitrogen.	2,847	30.4
Subsurface pipelines are used to channel runoff water.	2,479	26.4
Creek banks and stream banks have been stabilized.	2,366	25.2
Vegetative filter strips and buffers are used to capture flows.	2,239	23.9
No storm drainage due to field or soil conditions.	1,521	16.2
Hedgerows or trees are used to help stabilize soils and trap sediment movement.	1,473	15.7
Sediment basins / holding ponds are used to settle out sediment and hydrophobic pesticides such as pyrethroids from irrigation and storm runoff.	1,449	15.5
Berms are constructed at low ends of fields to capture runoff and trap sediment.	1,335	14.2
Field is lower than surrounding terrain.	1,146	12.2
Storm water is captured using field borders.	1,031	11.0
Crop rows are graded, directed and at a length that will optimize the use of rain and irrigation water.	649	6.9
No Selection	464	4.9
Other	20	0.2

Appendix C: Lake County Surface Water Monitoring Data 2005-2015

PARAMETERS	Unit	Middle Creek U/S Hwy 20		McGaugh Slough Finley Rd		Total # Analyses	Total # Exceedance	Minimum Result	Maximum Result
		Dry	Wet	Dry	Wet				
GENERAL									
Alkalinity	mg/L			2	2	4		36	354
Color	CU	1	2	2	2	7		4	150
Dissolved Oxygen	mg/L	35	26	12	10	83	19	2.32	13.5
Electrical Conductivity	µS/cm	35	26	12	10	83	9	93	1329
Hardness as CaCO3	mg/L	5	3	2	2	12		36	462
pH	-log[H+]	35	26	12	9	82	2	6.12	8.57
Total Dissolved Solids	mg/L	5	6	2	2	15	1	90	630
Dissolved Organic Carbon	mg/L			1	1	2		4.4	13
Total Organic Carbon	mg/L	32	24	2	2	60		0.49	15
Total Suspended Solids	mg/L	32	26	2	2	62		<4.2	260
Turbidity	NTU	32	26	2	2	62		<0.03	110
Ultraviolet Absorption (254nm)	ABS/cm			1	1	2		0.13	0.47
PATHOGENS									
E. coli	MPN/100mL	32	26	2	3	63	9	5.2	2419.6
Fecal Coliforms	MPN/100mL	3	1			4		30	240
WATER COLUMN TOXICITY									
Ceriodaphnia Survival	% of control	6	5	2	2	15	1	6.7	105.6
Pimephales Survival	% of control	5	2	2	2	11		94.7	102.6
Selenastrum Growth	% of control	11	8	2	1	22		131.6	436.3
PESTICIDES									
Aldicarb	µg/L	1	2	1		4		<0.2	<0.2
Aldrin	µg/L	6	5	1	1	13		<0.001	<0.009
Allethrin	µg/L			2	1	3		<0.005	<0.005
Ametryn	µg/L	2	3	1	1	7		<0.005	<0.005
Aminocarb	µg/L	1	2	1		4		<0.2	<0.2
Atraton	µg/L	2	3	1	1	7		<0.005	<0.005
Atrazine	µg/L	2	3	1	1	7		<0.005	<0.005
Azinphos methyl	µg/L	4	3	2	2	11		<0.01	<0.05
Barban	µg/L	1	2	1		4		<1.75	<1.75
Benomyl/Carbendazim	µg/L	1	2	1		4		<0.2	<0.2
Bifenthrin	µg/L			2	1	3		<0.005	<0.005
Bromacil	µg/L	1	2	1		4		<0.2	<0.2
Carbaryl	µg/L	1	2	1		4		<0.05	<0.05
Carbofuran	µg/L	1	2	1		4		<0.05	<0.05
Chlordane, cis	µg/L	6	5	1	1	13		<0.001	<0.007
Chlordane, trans	µg/L	6	5	1	1	13		<0.001	<0.006
Chlorothalonil	µg/L	2	1			3		<0.1	<0.1
Chloroxuron	µg/L	1	2	1		4		<0.2	<0.2
Chlorpropham	µg/L	1	2	1		4		<0.4	<1.75
Chlorpyrifos	µg/L	8	5	2	2	17		<0.005	0.0016

Cyanazine	µg/L	2	3	1		6		<0.005	<0.005
Cyfluthrin	µg/L			2	1	3		<0.005	<0.005
Cypermethrin	µg/L			2	1	3		<0.005	<0.005
Dacthal	µg/L	5	4	1		10		<0.005	<0.008
DDD(o,p)	µg/L	6	5	1	1	13		<0.001	<0.005
DDD(p,p)	µg/L	6	5	1	1	13		<0.001	<0.003
DDE(o,p)	µg/L	6	5	1	1	13		<0.001	<0.005
DDE(p,p)	µg/L	6	5	1	1	13		<0.001	<0.004
DDT(o,p)	µg/L	6	5	1	1	13		<0.001	<0.003
DDT(p,p)	µg/L	6	5	1	1	13	1	<0.007	0.0095
Deltamethrin	µg/L			2	1	3		<0.005	<0.005
Demeton	µg/L	6	4	2	2	14		<0.001	<0.01
Diazinon	µg/L	8	5	2	2	17		<0.005	<0.005
Dichlorvos	µg/L	8	5	2	2	17		<0.003	<0.02
Dicofol	µg/L	5	4	1		10		<0.01	<0.05
Dieldrin	µg/L	6	5	1	1	13		<0.001	<0.005
Dimethoate	µg/L	6	3	2	2	13		<0.003	<0.005
Disulfoton	µg/L	6	4	2	2	14		<0.001	<0.01
Diuron	µg/L	1	2	1		4		<0.2	<0.2
Endosulfan I	µg/L	6	5	1	1	13		<0.001	<0.005
Endosulfan II	µg/L	6	5	1	1	13		<0.001	<0.004
Endosulfan sulfate	µg/L	6	5	1	1	13		<0.001	<0.005
Endrin	µg/L	6	5	1	1	13		<0.001	<0.007
Endrin Aldehyde	µg/L	6	5			11		<0.001	<0.009
Endrin Ketone	µg/L	6	5	1	1	13		<0.001	<0.006
Esfenvalerate/Fenvalerate	µg/L			1		1		<0.005	<0.005
Ethoprop	µg/L	6	4	2	2	14		<0.001	<0.01
Fenchlorphos	µg/L	6	4	2	2	14		<0.002	<0.01
Fenitrothion	µg/L	1	1			2		<0.01	<0.01
Fenpropathrin	µg/L			2	1	3		<0.005	<0.005
Fensulfothion	µg/L	6	4	2	2	14		<0.001	<0.01
Fenthion	µg/L	6	4	2	2	14		<0.002	<0.01
Fenuron	µg/L	1	2	1		4		<0.2	<0.2
Fluometuron	µg/L	1	2	1		4		<0.2	<0.2
Glyphosate	µg/L	1	3			4		<4.0	<4.0
HCH, alpha	µg/L	6	5	1	1	13		<0.001	<0.005
HCH, beta	µg/L	6	5	1	1	13		<0.001	<0.008
HCH, delta	µg/L	6	5	1	1	13		<0.001	<0.005
HCH, gamma	µg/L	6	5	1	1	13		<0.001	<0.005
Heptachlor	µg/L	6	5	1	1	13		<0.001	<0.008
Heptachlor epoxide	µg/L	6	5	1	1	13		<0.001	<0.007
Hexachlorobenzene	µg/L	1	1			2		<0.001	<0.001
Hexazinone	µg/L	2	1			3		<0.1	<0.1
L-Cyhalothrin	µg/L			1	1	2		<0.005	<0.005
Linuron	µg/L	1	2	1		4		<0.2	<0.2
Malathion	µg/L	8	5	2	2	17	1	<0.03	0.0115
Merphos	µg/L	2	3	2	2	9		<0.001	<0.01

Methamidophos	µg/L	2	2	2	1	7		<0.05	<0.05
Methidathion	µg/L	6	2	2	2	12		<0.005	<0.01
Methiocarb	µg/L	1	2	1		4		<0.2	<0.2
Methomyl	µg/L	1	2	1		4		<0.05	<0.05
Methoxychlor	µg/L	6	5	1	1	13		<0.001	<0.008
Metolachlor	µg/L	2	2			4		<0.005	<0.26
Mevinphos	µg/L	6	4	2	2	14		<0.005	<0.01
Mexacarbate	µg/L	1	2	1		4		<0.4	<0.4
Mirex	µg/L	3	4	1	1	9		<0.001	<0.001
Molinate	µg/L		1			1		<0.05	<0.05
Monuron	µg/L	1	2	1		4		<0.2	<0.2
Naled	µg/L	2	1			3		<0.2	<0.2
Neburon	µg/L	1	2	1		4		<0.2	<0.2
Nonachlor, cis-	µg/L	3	4	1	1	9		<0.001	<0.001
Nonachlor, trans-	µg/L	3	4	1	1	9		<0.001	<0.001
Oryzalin	µg/L	1	2	1		4		<0.2	<0.2
Oxamyl	µg/L	1	2	1		4		<0.2	<0.2
Oxychlordane	µg/L	3	4	1	1	9		<0.001	<0.001
Oxyfluorfen	µg/L	12	8			20		<0.05	0.0086
Paraquat	µg/L	1	3			4		<0.2	<0.25
Parathion, Ethyl	µg/L	2	2	2	2	8		<0.01	<0.01
Parathion, Methyl	µg/L	6	4	2	2	14		<0.001	<0.01
Pendimethalin	µg/L		1			1		<0.05	<0.05
Permethrin	µg/L			2	1	3		<0.005	<0.005
Perthane	µg/L	3	4			7		<0.005	<0.005
Phorate	µg/L	6	4	2	2	14		<0.005	<0.01
Phosmet	µg/L	6	2	2	2	12		<0.005	<0.05
Prallethrin	µg/L			2	1	3		<0.005	<0.005
Prometon	µg/L	2	3	1	1	7		<0.005	<0.005
Prometryn	µg/L	2	3	1	1	7		<0.005	<0.005
Propachlor	µg/L	1	2	1		4		<0.2	<1.75
Propargite	µg/L		1			1		<0.05	<0.05
Propazine	µg/L	2	3	1	1	7		<0.005	<0.005
Propham	µg/L	1	2	1		4		<0.4	<1.75
Propoxur	µg/L	1	2	1		4		<0.2	<0.2
Secbumeton	µg/L	2	3	1	1	7		<0.005	<0.005
Siduron	µg/L	1	2	1		4		<0.2	<0.2
Simazine	µg/L	4	4	1	1	10		<0.12	0.224
Simetryn	µg/L	2	3	1	1	7		<0.005	<0.005
Sulprofos	µg/L	6	4	2	2	14		<0.002	<0.01
Tebuthiuron	µg/L	1	2	1		4		<0.2	<0.2
Terbuthylazine	µg/L	2	3	1	1	7		<0.005	<0.005
Terbutryn	µg/L	2	3	1	1	7		<0.005	<0.005
Tetrachlorvinphos	µg/L	6	4	2	2	14		<0.002	<0.01
Thiobencarb	µg/L		4			4		<0.05	<0.05
Tokuthion	µg/L	6	4	2	2	14		<0.003	<0.01
Toxaphene	µg/L	2	4	1	1	8		<0.01	<0.01

Trichloronate	µg/L	6	4	2	2	14		<0.001	<0.01
Trifluralin	µg/L		1			1		<0.001	<0.001
METALS									
Antimony - Dissolved	µg/L	1			1	2		<0.3	0.1
Antimony - Total	µg/L	1			1	2		<0.1	<0.3
Arsenic - Dissolved	µg/L	2	3	2	1	8		0.2	1.3
Arsenic - Total	µg/L	2	3	2	1	8		0.2	2
Beryllium - Dissolved	µg/L	1			1	2		<0.7	<0.12
Beryllium - Total	µg/L	1			1	2		<0.7	<0.12
Boron - Dissolved	µg/L	1	2	1	1	5		24	170
Boron - Total	µg/L	1	3	1	1	6		26	180
Cadmium - Dissolved	µg/L	2	3	2	1	8		<0.04	0.04
Cadmium - Total	µg/L	2	3	2	1	8		<0.04	0.04
Chromium - Dissolved	µg/L	1			1	2		1.7	3.6
Chromium - Total	µg/L	1			1	2		1	5.9
Copper - Dissolved	µg/L	5	3	2	1	11		0.12	2
Copper - Total	µg/L	5	3	2	1	11		0.21	13
Lead - Dissolved	µg/L	2	3	2	1	8		<0.1	0.16
Lead - Total	µg/L	2	3	2	1	8		<0.1	3
Molybdenum - Total	µg/L	3	3			6		0.17	0.31
Nickel - Dissolved	µg/L	2	3	2	1	8		0.8	15
Nickel - Total	µg/L	2	3	2	1	8		1.3	47
Selenium - Dissolved	µg/L	2		2	1	5		<0.98	2
Selenium - Total	µg/L	2		2	1	5		<0.90	0.42
Silver - Dissolved	µg/L	1			1	2		<0.02	<0.02
Silver - Total	µg/L	1			1	2		<0.02	<0.02
Thalium - Dissolved	µg/L	1			1	2		<0.006	<0.01
Thalium - Total	µg/L	1			1	2		<0.01	0.01
Zinc - Dissolved	µg/L	2	3	2	1	8		1	3
Zinc - Total	µg/L	2	3	2	1	8		2	28
NUTRIENTS									
Ammonia, Total as N	mg/L	18	16	3	3	40		<1.0	0.24
Nitrate as N	mg/L	2	4			6		<0.01	0.52
Nitrate+Nitrite, as N	mg/L	30	22	9	7	68	1	<0.02	11
Nitrite as N	mg/L	2	4			6		<0.004	0.012
Orthophosphate, as P - Dissolved	mg/L	18	16	1	1	36		<0.01	0.34
Phosphorus as P, Total	mg/L	32	24	10	7	73		<0.007	1.9
Total Kjeldahl Nitrogen	mg/L	9	9	2	1	21		<0.08	1.1
SEDIMENT TOXICITY									
Hyalella	% of control	6			1	7		83.6	108

Appendix D: NRCS RUSLE2 Calculations

USDA NRCS Natural Resources Conservation Service

Red Hills

RUSLE2 Profile Erosion Calculation Record

Walnuts- Heavy Tillage
Resident cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\139 Glenview-Arrowhead complex, 15 to 30 percent slopes\Glenview Very gravelly loam 50%
Slope length (horiz): 150 ft
Avg. slope steepness: 15 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 3 mo growth	lbs	500
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 9 mo growth	lbs	3000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 12 t/ac/yr
Detachment on slope: 12 t/ac/yr
Soil loss for cons. plan: 12 t/ac/yr
Sediment delivery: 12 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: -- %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
11/1/0	Begin weed growth	Weeds, less than 3 mo growth	25
5/1/1	Disk, offset, heavy		6.5
5/1/1	Begin weed growth	Weeds, less than 9 mo growth	6.5
9/15/1	Disk, offset, heavy		21
10/1/1	Cultipacker, roller		29

USDA NRCS

Red Hills

RUSLE2 Profile Erosion Calculation Record

Info:

Grapes - Middles, no-till cover

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\139 Glenview-Arrowhead complex, 15 to 30 percent slopes\Glenview Very gravelly loam 50%
Slope length (horiz): 150 ft
Avg. slope steepness: 15 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\a.Single Year/Single Crop Templates\Vineyards and Orchards\Middles\Annually-seeded, No-till cover crop mix Chop Prunings CMZ45	vegetations\Fescue, annual (Zorro), winter vineyard cover, CA	pounds	2000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.064 t/ac/yr
Detachment on slope: 0.064 t/ac/yr
Soil loss for cons. plan: 0.064 t/ac/yr
Sediment delivery: 0.064 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: 96 %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/15/0	Begin growth	Fescue, annual (Zorro), winter vineyard cover, CA	96
2/15/1	Add mulch		90
3/15/1	Shredder, flail or rotary, add other cover		97
4/15/1	Shredder, flail or rotary, add other cover		96
5/15/1	Shredder, flail or rotary		98

USDA NRCS Natural Resources Conservation Service

Kelsey Bench

RUSLE2 Profile Erosion Calculation Record

Grapes- Middles, no till cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\133 Forbesville loam, 5 to 15 percent slopes\Forbesville Loam 85%
Slope length (horiz): 150 ft
Avg. slope steepness: 10 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\a.Single Year/Single Crop Templates\Vineyards and Orchards\Middles\Annually-seeded, No-till cover crop mix Chop Prunings CMZ45	vegetations\Fescue, annual (Zorro), winter vineyard cover, CA	pounds	2000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 0.035 t/ac/yr
Detachment on slope: 0.035 t/ac/yr
Soil loss for cons. plan: 0.035 t/ac/yr
Sediment delivery: 0.035 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: 96 %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/15/0	Begin growth	Fescue, annual (Zorro), winter vineyard cover, CA	96
2/15/1	Add mulch		90
3/15/1	Shredder, flail or rotary, add other cover		97
4/15/1	Shredder, flail or rotary, add other cover		96
5/15/1	Shredder, flail or rotary		98

USDA NRCS Natural Resources Conservation Service

Kelsey Bench

RUSLE2 Profile Erosion Calculation Record

Walnuts - Heavy Tillage Resident Cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\133 Forbesville loam, 5 to 15 percent slopes\Forbesville Loam 85%
Slope length (horiz): 150 ft
Avg. slope steepness: 10 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 3 mo growth	lbs	500
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 9 mo growth	lbs	500

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: bury 30% more than normal

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 13 t/ac/yr
Detachment on slope: 13 t/ac/yr
Soil loss for cons. plan: 13 t/ac/yr
Sediment delivery: 13 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: -- %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
11/1/0	Begin weed growth	Weeds, less than 3 mo growth	6.1
5/1/1	Disk, offset, heavy		2.0
5/2/1	Begin weed growth	Weeds, less than 9 mo growth	2.0
9/15/1	Disk, offset, heavy		4.1
10/1/1	Cultipacker, roller		7.5

USDA NRCS

Kelsey Bench

RUSLE2 Profile Erosion Calculation Record

Grapes - Middles tilled annual cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\133 Forbesville loam, 5 to 15 percent slopes\Forbesville Loam 85%
Slope length (horiz): 150 ft
Avg. slope steepness: 10 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\a.Single Year/Single Crop Templates\Vineyards and Orchards\Middles\Annually-seeded, annually-tilled green manure cover crop CMZ45	vegetations\Rye and Hairy vetch, winter cover, mid south	lbs	5000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 3.0 t/ac/yr
Soil loss erod. portion: 9.2 t/ac/yr
Detachment on slope: 9.2 t/ac/yr
Soil loss for cons. plan: 9.2 t/ac/yr
Sediment delivery: 9.2 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: 5.0 %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/15/0	Planting, broadcast seeder	Rye and Hairy vetch, winter cover, mid south	5.0
10/15/0	Harrow, spike tooth, cover seed		5.0
2/15/1	Add mulch		27
3/15/1	Shredder, flail or rotary		89
4/15/1	Disk, offset, heavy		18
5/15/1	Disk, tandem light finishing		9.1
6/15/1	Disk, tandem light finishing		6.3

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Big Valley

Walnuts - Heavy Tillage
Resident cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\123 Cole clay loam, drained\Cole Clay loam 65%
Slope length (horiz): 150 ft
Avg. slope steepness: 2.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 3 mo growth	lbs	500
managements\CMZ 45\c.Other Local Mgt Records\Walnut Middles, heavy tillage	vegetations\Weeds, less than 9 mo growth	lbs	500

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: bury 30% more than normal

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.4 t/ac/yr
Detachment on slope: 1.4 t/ac/yr
Soil loss for cons. plan: 1.4 t/ac/yr
Sediment delivery: 1.4 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: -- %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
11/1/0	Begin weed growth	Weeds, less than 3 mo growth	6.1
5/1/1	Disk, offset, heavy		2.0
5/2/1	Begin weed growth	Weeds, less than 9 mo growth	2.0
9/15/1	Disk, offset, heavy		4.1
10/1/1	Cultipacker, roller		7.5

USDA NRCS Natural Resources Conservation Service

Bog Valley

RUSLE2 Profile Erosion Calculation Record

Grapes · Middles Tilled annual cover

Info:

File: profiles\default

Inputs:
Location: USA\California\Lake County\CA_Lake_R28-32
Soil: Lake County, Ca\123 Cole clay loam, drained\Cole Clay loam 65%
Slope length (horiz): 150 ft
Avg. slope steepness: 2.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 45\a.Single Year/Single Crop Templates\Vineyards and Orchards\Middles\Annually-seeded, annually-tilled green manure cover crop CMZ45	vegetations\Rye and Hairy vetch, winter cover, mid south	lbs	5000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.0 t/ac/yr
Detachment on slope: 1.0 t/ac/yr
Soil loss for cons. plan: 1.0 t/ac/yr
Sediment delivery: 1.0 t/ac/yr

Crit. slope length: 150 ft
Surf. cover after planting: 5.0 %
Avg. ann. total biomass removal: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/15/0	Planting, broadcast seeder	Rye and Hairy vetch, winter cover, mid south	5.0
10/15/0	Harrow, spike tooth, cover seed		5.0
2/15/1	Add mulch		27
3/15/1	Shredder, flail or rotary		89
4/15/1	Disk, offset, heavy		18
5/15/1	Disk, tandem light finishing		9.1
6/15/1	Disk, tandem light finishing		6.3

Appendix E: Lake County Grading Ordinance

**For brevity, sections that do not pertain to agriculture have been omitted.*

ARTICLE I. - GENERAL PROVISIONS

Sec. 30-1. - Title.
1.1 This chapter shall be known and be cited as the "Grading Ordinance" of the County of Lake.

(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-2. - Purpose and Scope.
2.1 This chapter is enacted for the purpose of regulating grading on public and private lands within the unincorporated areas of Lake County. This chapter sets forth rules and regulations to control activities involving excavation, grading and earthwork construction, including fills and embankments; establishes the administrative procedure for the issuance of permits; provides for approval of plans and inspection of grading construction and provides for enforcement and penalties for violation in order to:

(a) Minimize hazards to life and property;
(b) Maintain slope stability, protect against soil erosion and the degradation of Clear Lake, watercourses and other waterbodies from nutrients, sediments or other deleterious materials;
(c) Protect the safety, use and stability of public rights-of-way and drainage courses;
(d) Protect drainage courses and watercourses from obstruction, and protect life and property from the deleterious effects of flooding;
(e) Protect fish, wildlife and their habitats and promote the retention and restoration of riparian vegetation;
(f) Ensure that the intended use of a graded site is consistent with the Lake County General Plan and any applicable area plan;
(g) Protect against the destruction of cultural resources and human burials;
(h) Minimize degradation of air quality from fugitive dust and the release of asbestos from earth disturbance activities in naturally occurring asbestos (NOA) areas.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-4. - General.
4.1 Grading and erosion control plans shall conform to the standards set forth herein. In the event of conflict between the grading standards set forth in this chapter and other requirements of law, the more stringent or protective requirement shall prevail. The following general requirements apply to all grading:

(a) Minimize the amount of soil exposed at any one time by proper coordination of grading and construction.
(b) Divert runoff, away from steep, bare slopes or other critical areas with proper diversion structures such as barriers, berms, ditches, or other devices.
(c) Design grading slopes to be compatible with adjacent area and to cause minimal disturbance to the terrain and natural features.
(d) Prevent silt, sedimentation, dust or other materials exceeding the natural background levels from leaving the disturbed area through the use of best management practices.
(e) Retain as much natural vegetation as possible on site to stabilize hillsides, retain moisture, minimize erosion and siltation and preserve natural habitat.
(f) Conduct routine site inspections to ensure that erosion and dust control measures are in place and functioning properly and to correct problems where needed.
(g) Grading proposed in areas of naturally occurring asbestos (NOA) shall comply with the asbestos dust mitigation measures.
(h) Certain projects may be required to obtain coverage under the construction general permit for discharges of storm water administered by the Regional Water Quality Control Board. As a grading permit condition of approval, applicants may be required to file a notice of intent (NOI) to comply with the construction general permit.

(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-6. - Erosion Hazard Rating.
6.1 The erosion hazard rating (EHR) system is used to classify the erodibility of soils based on their classification in the current Lake County soil survey. The classification organizes soils into three (3) categories: slight, moderate, and severe erosion hazard rating. The classification is determined from evaluation of a combination of the erodibility of the particular soil profile and the percent slope on which it is found. The system was developed in conjunction with the Natural Resources Conservation Service and can be found in Appendix A codified at the end of this chapter.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-7. - Cultural Resources.
7.1 Historical, archaeological, paleontological, and Native American sites shall be protected to the maximum extent possible. Pursuant to California Code of Regulations, Title 20, Section 2501 et seq., all information pertaining to cultural resource documentation associated with any grading permit application is considered confidential.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-8. - Watercourses and Drainage.
8.1 Watercourse Corridors.

8.1.1 Watercourse Corridors are determined as a function of Erosion Hazard Rating and the watercourse classification according to Table 1 below. Lakes that provide fish habitat shall be treated as Class I watercourses for the purposes of this section. Lakes, vernal pools and wetlands that do not provide fish habitat but do provide habitat for aquatic non-vertebrates or macro-invertebrates shall be treated as Class II watercourses. Lakes, wetlands and vernal pools providing no habitat for aquatic life shall be treated as Class III watercourses. Corridors are measured outward from the top of the bank of a watercourse or the high water mark of a lake, wetland or vernal pool.

Table 1. Watercourse Setbacks

Table 1. Watercourse Setbacks

Erosion Hazard Rating	Class I	Class II	Class III	Class IV
(See Appendix A)				
Slight	50 ft	50 ft	20 ft	0 ft
Moderate	75 ft	50 ft	35 ft	0 ft
Severe	100 ft	100 ft	50 ft	0 ft

8.2 Standards.

8.2.1 No person shall level, cause to be leveled or move, excavate, remove, dredge, pile, stockpile or otherwise change or cause to change the drainage patterns within his or their lands in any manner which changes the place of entry of such waters to his land, or to change the velocity and/or place of exit of waters from his land so as to cause damage to adjacent properties.

8.2.2 Fill placed in the FEMA-mapped floodplain shall be consistent with the requirements of Chapter 25 of the Lake County Code, Floodplain Management.

8.2.3 Excavated materials shall not be deposited or stored in or alongside watercourses, or where the materials may be displaced by high water or storm runoff mechanical disturbance, or wind erosion.

8.2.4 All soil disturbances shall use appropriate BMPs to the maximum extent practicable to prevent or minimize the discharge of sediments to the County's storm water conveyance system.

8.2.5 Critical areas such as watercourse corridors and drainage channels shall be protected against erosion and construction site runoff.

8.2.6 Unless otherwise indicated on the approved grading plan, drainage devices and terracing shall conform to the provisions of this section for cut and fill slopes steeper than three (3) units horizontal in one (1) unit vertical (33.3%). Cut and fill slopes shall be provided with subsurface drainage as necessary for stability.

8.2.7 All drainage devices shall be designed to carry surface water to the nearest practicable drainage facility approved by the Administrative Official. Erosion in the area of discharge shall be prevented by installation of non-erosive down drains or other devices.

8.2.8 Where necessary, check dams, riprap, interceptor drains, terraces or other devices or methods shall be employed to control erosion and ensure stability.

8.2.9 When drainage swales are used to divert surface waters, they shall be vegetated or protected, as necessary.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-9. - Driveways and Roads.
9.1 New road construction in state responsibility areas (SRA) areas shall be implemented according to standards and guidelines specified in Chapter 7 of Public Resources Code, Section 4290 and 4291, California Department of Forestry and Fire Protection, Fire Safe Regulations.

9.2 New road construction occurring concurrent with or as a result of the development of a subdivision shall conform to the Subdivision Ordinance, Chapter 17, of the Lake County Code and the Lake County Road Design and Construction Standards.

9.3 Driveways shall be constructed and surfaced in accordance with requirements of the Lake County Zoning Ordinance.

9.4 New road construction should be minimized by using existing roads when possible.

9.5 Roads should be contoured to the landscape to the maximum extent possible so as to minimize cuts, fills and vegetation clearing.

9.6 In-stream crossings shall be avoided whenever possible. Stream crossings should be designed to be consistent with the Lake County Hydrology Design Standards. California Department of Fish and Game Streambed Alteration Agreements are required for diversion or obstruction of the natural flow of, or substantial change or use of any material from the bed, channel, or bank of any watercourse or lake, or the deposit or disposal of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any watercourse or lake. A 404 permit may also be required from the United States Army Corps of Engineers as well as a 401 Water Quality Certification from the California Regional Water Quality Control Board.

9.7 Road design should avoid flood plains, landslide or slip prone geologic areas, areas of highly erodible soils and mapped NOA areas when possible.

9.8 Road width and gradient should be minimized.

9.9 For commercial use, a driveway access grade of no more than eight (8) percent shall be allowed for the first forty (40) feet, thereafter a grade of over twelve (12) percent shall not be acceptable without prior approval of the Community Development Department and the Department of Public Works.

9.10 Private roads and driveways to residences shall have a gradient that is not to exceed sixteen (16) percent unless approved by the local fire district, California Department of Forestry and Fire Protection, or the Administrative Official.

9.11 All single lane roads shall provide for turnouts for passing. Turnouts should be located within visible distance of the others to allow for safe passing.

9.12 Dead end roads shall provide turnarounds at the end of the road.

9.13 Encroachment permits from the Lake County Department of Public Works or California Department of Transportation are required when any road or driveway intersects county or state roadways, or for any work within the County or State right-of-way.

9.14 No driveway shall be allowed to encroach closer than twenty (20) feet to the end or beginning of the radius on any street corner unless approved by the Department of Public Works.

9.15 The width of a driveway providing access to a parking lot from the public street or between separate parking areas on a site is to be a minimum of twelve (12) feet for one-way access, twenty (20) feet for multiple-family residential, and commercial or industrial two-way access.

9.16 No driveway entering onto a right-of-way shall exceed a width of thirty (30) feet.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-10. - Bridges.
10.1 Bridges built to span a watercourse shall be constructed to avoid altering the stream channel wherever possible. As much native riparian vegetation as possible shall be retained. All bridge plans shall be designed by a registered civil engineer. The bridge shall be constructed in compliance with requirements, when necessary, of the California Department of Fish and Game, the United States Army Corps of Engineers, Lake County Hydrology Design Standards, the Lake County Floodplain Management Ordinance and any other agency with jurisdiction over the project.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-11. - Cuts and Fills.
11.1 General. Cuts and fills shall be limited to the minimum amount necessary to provide stable embankments and conform to the standards within this section.

11.1.1 Grading project design and implementation shall maximize the retention of natural landforms and features. Contours, elevations and shapes of finished surfaces shall be blended with adjacent natural terrain to the maximum extent feasible.

11.1.2 Subsurface Drainage. Cut and fill slopes shall be provided with subsurface drainage as necessary for stability.

11.1.3 All slopes shall be monitored and maintained by the permittee to assure the success of the erosion control measures and/or revegetation. Temporary or permanent irrigation shall be provided where necessary to assure the successful establishment of vegetation.

11.1.4 The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. The protection for the slopes shall be installed as soon as practicable and prior to final inspection.

11.1.5 Any area proposed for cut or fill shall be cleared. For the purposes of this section, clearing shall consist of removal and disposal of all trees, roots, brush or other vegetation, as well as the removal of any down timber, and debris.

11.1.6 All topsoil should be stockpiled separate from other spoils so as to preserve the resource for revegetation and contained using approved BMPs to prevent sediment-laden storm water from leaving the site.

11.2 Cuts. Unless otherwise recommended in an approved soils engineering or engineering geology report, cuts shall conform to the provisions of this section.

11.2.1 The slope of the cut shall be no steeper than is safe for the intended use and shall be no steeper than two (2) units horizontal in one (1) unit vertical fifty (50) percent unless the permittee furnishes a soils engineering and/or geology report affirming the stability and safety of a steeper slope.

11.2.2 The toe of the cut shall be made no closer to the property boundary line than one-half (½) the height of the slope with a minimum of two (2) feet and a maximum of ten (10) feet. The setback may be increased if interceptor drains are required. Setback dimensions shall be horizontal distances measured perpendicular to the property boundary.

11.2.3 The Administrative Official may approve alternative setbacks. The Administrative Official may require an investigation and recommendation by a qualified engineer or engineering geologist to demonstrate that the intent of this section has been satisfied.

11.2.4 Trenches and pits shall be promptly backfilled and compacted to reduce the risk of erosion.

11.2.5 Excavated materials removed during grading operations shall be handled in accordance with the following methods:

(a) Stockpile sufficient topsoil onsite if necessary to use on area to be revegetated.
(b) Locate and protect stockpiled soil, using approved BMPs, so that it will not erode as a result of wind or rain.
(c) Apply mulch or other protective coverings on stockpiled material that will be exposed through the winter season.
(d) Dispose of material not intended to be used onsite in a manner and location approved by the Administrative Official and in compliance with the asbestos dust mitigation plan, if applicable.

11.3 Fills. Unless otherwise recommended in the approved soils engineering report, fills shall conform to the provisions of this section. In the absence of an approved soils engineering report, these provisions may be waived by the Administrative Official for minor fills not intended to support structures.

11.3.1 The source for all fill materials shall be identified and submitted with the application. The Ultramafic, Serpentine Rock and Soils Map of Lake County shall be consulted to determine the potential for serpentine in fill materials. Use of serpentine material as fill shall require an Asbestos Dust Mitigation Plan. Import of serpentine fill shall require a Lake County Air Quality Management District-issued plan.

11.3.2 Fill slopes shall not be constructed on natural slopes steeper than one (1) unit vertical in two (2) units horizontal fifty (50) percent. The ground surface shall be prepared to receive fill by removing vegetation, unsuitable fill, topsoil and other unsuitable materials, scarifying to provide a bond with the new fill and, where the slopes are steeper than one (1) unit vertical in five (5) units horizontal twenty (20) percent and the height is greater than five (5) feet, by benching into sound bedrock or other competent materials as determined by the soils engineer.

11.3.3 When fill is to be placed over a cut, the bench under the toe of a fill in a slope steeper than five (5) units horizontal in one (1) unit vertical twenty (20) percent shall be at least ten (10) feet wide, but the cut shall be made before placing the fill and acceptance by the soils engineer or engineering geologist or both as a suitable foundation for fill.

11.3.4 The toe of the fill slope shall be made no closer to the property boundary line than one-half (½) he height of the slope with a minimum of two (2) feet and a maximum of twenty (20) feet. Setback dimensions shall be horizontal distances measured perpendicular to the property boundary. Where a fill slope is to be located near the site boundary and the adjacent off-site property is developed, special precautions shall be incorporated in the work as the Administrative Official deems

necessary to protect the adjoining property from damage as a result of such grading. These precautions may include but are not limited to:

(a) Additional setbacks;
(b) Provisions for retaining or slough walls;
(c) Stabilization of the fill slope surface to minimize erosion;
(d) Provisions for the control and protection of surface waters. The Administrative Official may approve alternative setbacks. The Administrative Official may require an investigation and recommendation by a qualified engineer or engineering geologist to demonstrate that the intent of this section has been satisfied.

11.3.5 Unsuitable materials shall not be permitted in fills. Unsuitable fill materials include: rocks or other irreducible materials exceeding twelve (12) inches in diameter, broken asphalt, vegetation and brush, soils high in organic material or other materials not capable of proper compaction, not conducive to stability or having the potential for environmental impact.

11.3.6 Except as permitted by the Administrative Official, no rock or similar irreducible material with a maximum dimension greater than twelve (12) inches shall be buried or placed in fills. However, the Administrative Official may permit placement of larger rocks when the soils engineer properly devises a method of placement, and continuously inspects its placement and approves the fill stability. The following conditions shall also apply:

(a) Prior to issuance of a grading permit, potential rock disposal areas shall be delineated on the grading plan.
(b) Rock sizes greater than twelve (12) inches in maximum dimension shall be ten (10) feet or more below grade, measured vertically.
(c) Rocks shall be placed so as to assure filling of all voids with well-graded soil.
11.3.7 All fills shall be planted, mulched and maintained or otherwise protected from the effects of storm runoff and wind erosion.

11.3.8 All fills shall be compacted to a minimum of ninety percent of maximum density. All fills shall be tested for relative compaction by a qualified geotechnical testing agency, unless waived by the Administrative Official.

Compaction Exceptions:

(a) Compaction may be less than ninety (90) percent of maximum density within six (6) inches of the slope surface when surface material is placed and compacted by a method acceptable to the Administrative Official for the planting of slopes.
(b) Fills not intended to support structures or roads may not need to be compacted to these standards if the Administrative Official determines that such compaction is unnecessary for safety and the purpose of the grading project.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-12. - Dams and Reservoirs.
12.1 The proposed site of the reservoir or dam should avoid locations:

(a)Identified as a lake, marsh, Class I or II Watercourse, wetland, identified on the Lake County General Plan Critical Resource Area Map, or any vernal pool habitat areas unless the project is reviewed subject to CEQA; or
(b)Identified on any published geology or soils map as prone to slip or landslide without the preparation of a geotechnical report.

12.2 All construction operations shall be so conducted as to avoid stream sedimentation in accordance with the requirements of the State Water Resources Control Board and the Department of Fish and Game.

12.3 All cuts or fills shall be carried to lines, grades, and dimensions shown on the approved site plan.

12.4 Areas to be cleared shall consist of the reservoir area, site of dam embankment, a twenty-five (25) foot strip adjoining the downstream toe of the dam embankment, spillway area, and borrow and stockpile areas. Clearing shall consist of removal and disposal of all trees, brush, down timber, and debris.

12.5 The entire foundation area for the dam embankment and other structures and all portions of the borrow areas shall be grubbed. Grubbing of foundation areas shall consist of the removal of all stumps and roots one and one-half (1 ½) inches or more in diameter to a depth of three (3) feet below natural ground surface. The borrow areas shall be grubbed to the extent necessary to obtain material free of stumps and roots. The entire area to be occupied by the foundation of the dam shall be stripped to material having strength parameters equal to or greater than those required of the embankment material.

12.6 It is the intent of these standards that all required excavation materials suitable for embankment shall be utilized in the permanent construction. Suitable materials shall be excavated separately from the materials to be wasted. The suitable materials shall be segregated by loads during the excavation operations and shall be placed in the designated final locations directly from excavation. Excavated materials, if any, which are unsuitable for, or in excess of, dam embankment or other construction requirements, shall be disposed of within the vicinity as directed. Waste areas shall be left reasonably smooth, shall be sloped to drain, and shall be revegetated or surfaced according to the appropriate standards.

12.7 The source for all material necessary for construction of required embankments shall be identified and submitted with the application. Use of material from approved borrow areas shall be stripped of all topsoil containing humus, roots, rubbish, and other materials not suitable for placing in the compacted fill. Materials containing brush, root, sod, or other perishable materials will not be considered suitable. The sequence of stripping operations shall be coordinated with the excavation and fill so as to effect required moisture control with minimum addition of moisture to the excavated material.

12.8 Embankments shall be constructed to the lines and grades and cross-sections indicated on the approved site plan. The applicant shall maintain and protect the embankment in a satisfactory condition at all times until final completion and acceptance of all work by the Lake County Community Development Department.

12.9 The planting of trees and shrubs is not allowed on embankments and within fifteen (15) feet of the toe of the dam.

12.10 Approval of an application to construct a dam or reservoir does not grant the right to appropriate water. For information concerning water rights, applicants are referred to Division 1 of the Water Code and to the State Water Resources Control Board.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-13. - Clearing of Vegetation.
13.1 Native vegetation shall be retained and protected, where its removal is not necessary to implement the grading project or to meet fire safety regulations.

13.1.1 Where vegetation must be removed, the method shall be one that minimizes the erosive effects of the removal.

13.1.2 When vegetation is to be removed, the location of mature trees, defined as greater than five (5) inches diameter at breast height (DBH), that are to be removed and retained shall be clearly indicated. Vegetation to be preserved shall be clearly flagged or fenced off before any clearing or land disturbance begins.

13.1.3 Clearing shall be staged so as to minimize soil exposure during any one time, particularly during the winter season.

13.1.4 Cleared vegetation should be disposed of by chipping and spreading as mulch wherever feasible.

13.1.5 If vegetation disposal is proposed to be accomplished through burning, material to be burned shall be piled in a manner and in such locations as will cause the least fire risk and damage to adjacent vegetation as well as neighboring residences. Burning shall comply with the Lake County Air Quality Management District and local fire district regulations and permits.

13.2 Rangeland Management.

13.2.1 Rangeland management constitutes land management practices including, but not limited to, burning, chipping, chaining and grubbing, that are related to fire control and clearing of understory vegetation without disturbing mature trees as defined by exceeding five (5) inches diameter at breast height (DBH). Rangeland management activities do not constitute agricultural activities under this chapter and past rangeland management activities do not fall under the definition of agricultural grading.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-14. - Revegetation.
14.1 Whenever possible, topsoil onsite shall be separated and stored, protected from erosion and storm water runoff utilizing approved BMPs appropriate to the site conditions, in preparation of revegetation.

14.2 All land clearing that is not intended to support a structure shall be revegetated, preferably with native species consistent with fire safe practices, unless otherwise determined by the Administrative Official to be impractical due to site characteristics.

14.3 Temporary vegetation such as annual grasses and legumes shall be planted on sites that will not be brought to final grade by the end of the grading season or for sites that are likely to be re-disturbed.

14.4 Whenever practical, mulching, seeding, plantings of shrubs and trees and/or other stabilization measures shall be used for slope protection and for stabilization of soil storage areas and sediment containment systems. Preference should be given to using native, locally adapted grasses, shrubs and trees whenever feasible. Drought tolerant and fire-resistant native plants species shall be encouraged. Plants shall be maintained and watered at intervals sufficient to assure survival and growth.

14.5 Vegetation shall be maintained until permanent establishment is achieved. Temporary or permanent irrigation shall be provided where necessary to assure the successful establishment of vegetation.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-15. - Dust Control.
15.1 Dust control measures shall be implemented on all sites to minimize fugitive dust emissions from the project site.

15.2 Asbestos dust mitigation measures shall be utilized for all grading located where naturally occurring asbestos is disturbed.

15.3 Dust control is considered a temporary measure and shall be used as an interim treatment between site disturbance and final construction, paving or revegetation.

15.4 Dust control measures may consist of approved chemical, structural, or mechanical methods and shall be reapplied at the necessary intervals to prevent wind erosion.

15.5 Proper equipment and adequate water and/or dust palliatives, minimized vehicular speeds, installation and maintenance of cover crops and avoidance of work during periods of sustained high winds shall be used to minimize airborne particulates.

15.6 Adequate dust control measures shall prevent dust from exiting the project site and prevent the occurrence of a detriment, nuisance, or annoyance or endanger the comfort, repose, health, safety of any considerable number of persons or the public or cause, or have the tendency to cause, injury or damage to business or property.

15.7 All grading operations on a project should be suspended when winds carry dust beyond the project site property lines despite the implementation of dust control measures or, in mapped NOA areas, when sustained wind speeds exceed ten (10) mph, unless adequate dust control can be maintained to prevent visible dust generation.

15.8 If the grading project is located in a mapped NOA area or if soils containing greater than one-quarter (0.25) percent asbestos are subject to disturbance, grading activities shall meet the requirements of the asbestos dust mitigation plan.

15.9 Serpentine materials shall not be used for surfacing and are required to be encapsulated and maintained with non-asbestos containing cover material that will prevent the release of asbestos fibers pursuant to the specifications of the approved plan.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-16. - Exemptions.
16.1 Grading activities exempt from the requirement to obtain a grading permit shall conform to the standards set forth in Chapter 29 of the Lake County Code—the Lake County Storm Water Ordinance and shall implement Best Management Practices and Asbestos Dust Mitigation requirements where applicable for the duration of the project, including, but not limited to pre-construction, construction and post construction activities.

16.2 Exemption from the requirements of obtaining a grading permit shall not be deemed to grant authorization for any work to be done in violation of the provisions of this chapter or any other laws or ordinances of this jurisdiction.

16.3 Grading activities determined to be exempt from this chapter remain subject to the requirements of other county, state, and other federal agencies. Applicants are encouraged to consult with Community Development Department staff regarding permits that may be required from other agencies.

16.4 The following activities are exempt from the requirement to obtain a grading permit:

16.4.1 The clearing of not more than ten thousand (10,000) square feet of vegetation, provided that:

(a) Such clearing is not otherwise exempt from the requirement to obtain a grading permit,
(b) Does not exceed the other criteria for simple grading, and
(c) Is not in addition to other clearing of vegetation on the same parcel per grading season, pursuant to this exemption.

16.4.2 (a) Routine mechanical practices including, but not limited to: discing, harrowing, raking, chiseling, or plowing to till the soil for the production of agricultural crops on land historically used for that purpose.

(b) Agricultural grading also includes grading to support, keep, replace, maintain or continue existing agricultural operations, including drainage and erosion control facilities, irrigation systems, agricultural roads, and ponds or reservoirs not exceeding one (1) acre foot in capacity.
The construction of agricultural roads, reservoirs, ponds and buildings in mapped NOA areas are not exempt from asbestos dust mitigation plan requirements.

Grading proposed on lands where such practices have not been implemented and cannot be field verified by the Administrative Official shall not fall under this exemption.

16.4.3 All crop conversions involving agricultural grading are exempt provided the grading activities:

(a) Do not expand the footprint of the existing farming activity or operation.
(b) Do not occur within thirty (30) feet of the top of bank of a watercourse, wetland, lake or vernal pool.
(c) Do not remove previously cultivated trees, vines or other plants having stable woody root systems extending at least twelve (12) inches below the soil surface and occur on soils with a moderate or severe erosion hazard rating.
(d) Do not occur during the winter period.
(e) Do not create any cut or fill slope of a ratio greater than two is to one (2:1).

16.4.4 If the crop conversion meets all the above criteria, but not subsection 16.4.3(c) of this section, it shall be deemed simple grading only.

16.4.5 Grading for the creation of building pads, provided the grading is incidental to and regulated under a valid County building permit or has been issued an agricultural exempt building permit, does not exceed the criteria for simple grading, and is not located in a mapped NOA area. However, grading for the creation of such building pads within a watercourse corridor, as established in Table 1 in Section 30-8.1.1, on lots in recorded subdivisions shall not trigger the need for a grading permit provided the grading:

(a) Does not occur on soils with a severe erosion hazard rating or in a mapped NOA area,
(b) Does not propose to remove riparian vegetation, and
(c) Does not exceed any other criterion for simple grading set forth in Section 30-19.1.

16.4.6 Grading for the creation of building pads within a watercourse corridor in recorded subdivisions with soils having a severe erosion hazard rating or in a mapped NOA area shall be deemed simple grading only, provided the grading:

(a) Does not exceed any other criteria for simple grading set forth in Section 30-19.1, and
(b) Does not propose to remove riparian vegetation. If the proposed grading exceeds other criteria for simple grading, the building pad shall be deemed either standard or complex grading depending upon the criteria established in this article. Building pads that propose to remove riparian vegetation shall be deemed complex grading.

16.4.7 The excavation of material below finished grade for sewage disposal systems, tanks, vaults, basements, or swimming pools where such excavation is authorized and under the provisions of a valid County building permit; or Environmental Health Division permit.

16.4.8 The stockpiling of rock, sand or aggregate involved in the construction of a building authorized by a valid County building permit.

16.4.9 Cuts less than two (2) feet in depth or which do not create a cut slope exceeding five (5) feet in height and steeper than two (2) horizontal to one (1) vertical, which does not exceed fifty (50) cubic yards and do not alter any drainage course.

16.4.10 Fills less than one (1) foot in depth and placed on undisturbed natural terrain with a slope no greater than five (5) horizontal to one (1) vertical, or less than three (3) feet in depth, not intended to support structures, not exceeding fifty (50) cubic yards and not obstructing or altering any drainage course.

16.4.11 Surface mining conducted in accordance with County and State Surface Mining and Reclamation Act regulations.

16.4.12 Tunnels (including wine caves) when such activities are under the direction of a civil engineer.

16.4.13 Grading for water well pads or utilities.

16.4.14 Temporary holes or trenches located outside of any watercourse corridor, for geotechnical, geological, or archeological exploration, under the direction of soil engineers or engineering geologists, not exceeding one hundred (100) cubic yards of material.

16.4.15 Grading for activities related to clearing of understory vegetation in an area up to but not exceeding, three (3) acres, without disturbing mature trees as defined by a trunk of five (5) inches diameter at breast height (DBH), and leaving at least fifty (50) percent crown cover. This exemption does not apply to the following circumstances:

(a) Grading on soils with a severe erosion hazard rating.
(b) Grading within a watercourse corridor as defined within this chapter.

(c) Grading in an area with the potential for the presence of special status plant or animal species as indicated by the CNDDB or the Lake County General Plan.

16.4.16 Any grading or related activity conducted as part of a County of Lake public works project or activities related to maintenance or repair of an existing County facility, including, but not limited to public roads, emergency access roads, bridges, levees and flood control facilities, undertaken by a public agency.

16.4.17 Grading occurring in conjunction with a Lakebed Administrative Encroachment Permit pursuant to the Clear Lake Shoreline Ordinance, Chapter 23 of the Lake County Code.

16.4.18 Grading that is for the construction of improvements for parcel maps and subdivisions for which the Department of Public Works supervises.

16.4.19 Routine maintenance of existing roads, highways, trails, firebreaks and driveways, however, widening or lengthening shall not be exempt.

16.4.20 Grading for new firebreaks that disturb one (1) acre or less, provided firebreak design and standards are consistent with the California Forest Practices Rules and Public Resources Code, Section 4290. Grading for new firebreaks that disturb more than one (1) acre shall be deemed simple grading; provided the grading:
(a) Does not exceed any other criteria for simple grading, and
(b) Does not propose to remove riparian vegetation.

16.4.21 Timber operations as defined in Section 4527 of the Public Resources Code. Operations exempt from a grading permit include, but are not limited to, timber harvest plans, non-industrial timber management plans, and those exempt activities listed in Section 4584 of the Public Resources Code and regulated under 14 CCR 1038 and 14 CCR 1104.1.

16.4.22 Ponds less than one (1) acre foot in capacity and not within the active channel of a Class I or II watercourse are exempt from permit requirements unless the pond is located in a mapped NOA area where an asbestos dust mitigation plan is required. Construction of agricultural ponds shall not impact habitat areas for threatened or endangered species as identified on the California Department of Fish and Game's Natural Diversity Database (CNDDB) in order to qualify for an exemption.

16.5 Notwithstanding, even when exempted from the requirements of a grading permit, should any grading activities encounter human remains, all grading activities shall cease and the Lake County Coroner shall be contacted as well as the Lake County Community Development Department and the local tribal office.

16.6 Notwithstanding, even when exempted from the requirements of a grading permit, all grading activities in mapped NOA areas shall implement NOA control measures consistent with Lake County Air Quality Management District requirements. Exempt grading activities specified in Sections 16.4.2(b), 16.4.11, 16.4.15, 16.4.16, and 16.4.20 may require an asbestos dust mitigation plan and review by the Lake County Air Quality Management District.

16.7 Notwithstanding, even when exempted from the requirements of a grading permit, certain of the above activities may require filing and compliance with the requirements for a construction general permit issued by the California Regional Water Quality Control Board.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30.17. - Permit Requirements.
17.1 If a development permit is required in conjunction with any of the following grading permit categories, the grading permit shall be consistent with and satisfy all the conditions of the development permit.

17.2 Each application for a grading permit shall be completed by the applicant on a form provided by the Lake County Community Development Department, including information necessary to make determinations required by this section and

accompanied by a fee. The completed application shall be submitted to the Community Development Department for processing.

17.3 All applications for a grading permit shall include the following information:

(a) The completed and signed grading permit application form.
(b) At least three (3) sets of the proposed grading plans that contain the following information, to scale, with north arrow:
(1) Name and address of property owner and the individual who prepared the plans.
(2) Assessors parcel number and address of the project site.
(3) Vicinity map indicating location of project site in relation to adjacent roads, and mapped NOA area(s).
(4) Site plan accurately detailing the area to be graded, existing and proposed roads/driveways, structures, watercourses, drainage ditches and drainage structures, springs, seeps, existing drainage patterns and proposed changes to existing drainage pattern, location of large trees, easements/rights-of-way, wells and sewage disposal systems, topographical features such as existing rock outcroppings, type of existing vegetation, and other geologic features.
(5) Existing and proposed land contours with cross-sections showing depths and volumes of cuts and fills, clearly indicating the top and toe of slopes. Contours shall be shown at intervals suitable to ensure clarity.
(6) Estimate of the total surface area to be disturbed, represented in square feet, as well as the estimated volume of earth to be moved, expressed as cubic yards. This may require calculations to support the estimate if deemed necessary by the Administrative Official. Calculations should separately specify amounts of cut and fill.
(7) Schedule for major stages of grading activities.
(8) Source location for any fill material imported to the site or destination location of material to be exported from the site.
(9) Locations of access routes to the site as well as proposed haul routes for import/export of materials.
(10) Excess soil stockpile location, if applicable.
(c) At least three (3) copies of an erosion control and sediment detention plan that describes the measures, where applicable, to:
(1)Protect native and naturalized vegetation;
(2)Minimize disturbance or removal of native vegetation;
(3) Revegetate disturbed area;
(4) Detain sediment;
(5) Protect drainages;
(6) Protect cut and fill slopes;
(7) Dispose of spoil material;
(8) Protect stockpile material;
(9) Control fugitive dust;
(10) Minimize the generation, transport and discharge of other construction-related pollutants;
(11) Monitor the site after construction.
(d) The plan may be presented in narrative and/or graphic form and shall include both construction and post-construction measures that includes the following:
(1) Schedule for the implementation of the control measures.
(2) Description of methods to be used to protect exposed, unstable areas during and post-construction including mulching, seeding, and other BMP surface soil stabilization measures.
(3) Description of temporary and permanent methods to prevent erosion and surface water runoff from cut and fill slopes, including interceptors, diversions, energy dissipaters, and other BMP velocity reducing measures.
(4) Description of temporary and permanent measures to retain sediment onsite, including sediment traps and basins, vegetative filter strips, and other BMP sediment retention measures. Included shall be a schedule for the maintenance of these devices.
(5) Description of temporary and permanent measures for revegetation of surfaces that will not be developed including proposed seed mix, types of plants to be installed, application technique, seed and fertilizer rate, and other BMP revegetation measures. Included shall be a schedule for implementation and maintenance of vegetation.
(6) Descriptions of measures to limit access to the project site, stabilize access points, and limit tracking of sediment onto roadways.
(7) Erosion hazard rating (EHR) for the site.

(e) For projects that trigger regulation under the construction general permit for discharges of storm water administered by the California Regional Water Quality Control Board, the erosion control and sediment detention plan may be incorporated as part of a storm water pollution prevention plan.
(f)Grading applications proposing earth disturbance within an NOA area shall submit three (3) copies of an asbestos dust mitigation plan.
(g)Additional plans, calculations, drawings, or information requested by the Community Development Department, which are necessary to adequately review and evaluate the proposed erosion control measures.

17.4 All records not exempted from disclosure by state or federal law shall be available for public inspection as provided in the California Public Records Act, Section 6250 et seq.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-18. - Levels of Review.
18.1 All grading, not exempt from the requirements of a grading permit, is classified as "Simple Grading," "Standard Grading" or "Complex Grading." Each classification requires a different level of review prior to issuance of a grading permit, i.e., simple grading requires the lowest level of review, standard grading requires a higher level, and complex grading requires the highest level of review.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-19. - Simple Grading.
19.1 Simple grading is grading that (1) is not exempt under Section 30-16.4 from the requirement of a grading permit, and (2) does none of the following:

(a) Clears more than one (1) acre of vegetation.
(b) Disturbs more than five hundred (500) cubic yards of material.
(c) Disturbs more than two hundred fifty (250) cubic yards of material or one-half (½) acre in a mapped NOA area.
(d) Affects any sensitive species or habitat identified by the California Natural Diversity Data Base (CNDDB) or by a biological survey, unless determined by a biological survey that no sensitive species or habitats exist in the area to be graded.
(e) Occurs on slopes greater than twenty-five (25) percent grade.
(f) Creates a filled area for the support of a structure.
(g) Adversely changes any existing drainage.
(h) Occurs in a FEMA mapped floodway.
(i) Occurs within the watercourse corridor of a Class I, II or III watercourse, lake, wetland or vernal pool.
(j) Affects a site with known archaeological or historical resources.
(k) Occurs during the winter period, unless authorized by the Administrative Official.

19.2 An application for a simple grading permit requires the submission of the information described under Section 30.17 "Permit Requirements" and will be exempt from review pursuant to the California Environmental Quality Act (CEQA).
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-20. - Standard Grading.
20.1 Standard grading is grading that (1) is not exempt under Section 30-16.4 from the requirement of a grading permit, (2) is not simple grading, and (3) falls within all of the following criteria:

(a) Clears more than one (1) acre of vegetation, or disturbs the following volumes of material:
(1) Five hundred (500) to one thousand (1,000) cubic yards on soil units with a severe erosion hazard rating.
(2) Five hundred (500) to two thousand (2,000) cubic yards of soil units with a moderate erosion hazard rating.
(3) Five hundred (500) to five thousand (5,000) cubic yards of soil units with a slight erosion hazard rating.
(4) Two hundred fifty (250) to one thousand (1,000) cubic yards of NOA soil, or soil in a mapped NOA area.
(b) Excavates material to a depth not greater than ten (10) feet from original grade, unless engineered plans are provided and approved by the Administrative Official for a deeper excavation.

(c) Creates any cut or fill of a ratio of two is to one (2:1) or less, unless engineered plans are provided and approved by the Administrative Official for a steeper ratio.
(d) Creates a fill depth of eight (8) feet or less, unless engineered plans are provided and approved by the Administrative Official for a greater fill.
(e) Does not adversely impact existing drainage.
(f) Does not occur within the watercourse corridor of a Class I or II watercourse, lake, wetland or vernal pool, unless limited to the construction or alteration of a seawall within a man-made canal that does not remove wetland vegetation.
(g) Does not affect any sensitive species or habitat identified by the CNDDB or by a biological survey, unless determined by a biological survey that no sensitive species or habitats exist.
(h) Does not result in the clearing of oak trees to the extent that the clearing may have a significant effect on oak woodlands as defined in Section 21083.4 of the Public Resources Code.
(i) Does not occur in a FEMA mapped floodway, unless engineered plans are presented and approved by the Administrative Official.
(j) Does not affect a site with known archaeological or historical resources.

20.2 See Section 30-24 "Application Processing and Review" for additional cultural resources requirements pertaining to standard and complex grading projects.

20.3 An application for a standard grading permit requires the submission of the information described under "Permit Requirements" and normally will fall under CEQA Categorical Exemption Section 15304 (Minor Alterations to Land). However, a more detailed review may be required at the discretion of the Administrative Official if site-specific conditions indicate the project may have a significant effect on the environment.

20.4 Any project that qualifies as standard grading shall be noticed to the public as follows before the project is finally determined to be Categorically Exempt under CEQA. Notice shall be sent by first class mail to owners of all parcels within one hundred (100) feet of the property lines of the parcel upon which the grading is proposed at least fourteen (14) calendar days prior to any determination being made by the Administrative Official. Said notice shall briefly describe the proposed project, including the presence of NOA, and indicate the date that the Administrative Official intends to make a determination on the project. The notice shall further indicate that anyone may submit in writing any comments on the proposal to be considered by the Administrative Official.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-21. - Complex Grading.
21.1 Grading that exceeds the limits described above for simple grading and standard grading shall be designated as complex grading and will require the submission of information described under "Permit Requirements" as well as the preparation and completion of an Initial Study pursuant to the California Environmental Quality Act (CEQA). Additionally, the following types of grading will normally require the submission of plans designed and stamped by a qualified professional in the field of civil engineering or engineering geology:

(a) Grading involving the excavation or fill of more than five thousand (5,000) cubic yards of material.
(b) Construction of a reservoir or dam larger than one (1) acre foot or larger than five (5) acre feet if constructed totally below natural grade and not on a watercourse.
(c) Grading of more than one thousand (1,000) cubic yards of material on sites with a severe erosion hazard rating.
(d) Grading that will disturb more than one thousand (1,000) cubic yards of NOA.
(e) Grading resulting in cuts or fills greater than fifteen (15) feet.
(f) Dredging of lake, watercourses, or wetlands.
(g) Grading in areas designated as geologic or landslide hazard areas.
(h) Grading in a FEMA-mapped floodway.

21.2 The Administrative Official may waive the requirements for engineered plans for subsections 21.2(a) through (g) above upon a determination that the plans submitted are adequate and that the scope, location, design and conduct of the proposed activity will pose no substantial impact to the protection of resources, life or property.

21.3 Public notice to neighbors shall be given pursuant to Section 21-57 of the Lake County Zoning Ordinance.

21.4 Application for complex grading may require the submission of additional reports such as a biological or cultural resources survey, geotechnical report, hydrologic study, or other site-specific analyses as deemed necessary by the Administrative Official.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-23. - Grading Season.
23.1 Excavation, filling, vegetation clearing or other disturbance of the soil shall not occur between October 15 and April 15 unless authorized by the Administrative Official. The actual dates of this defined grading period may be adjusted according to weather and soil conditions at the discretion of the Administrative Official.

23.2 All sites shall have erosion control measures in place by the end of the grading season of any given year. Onsite construction slash and debris shall be removed and any remaining spoil piles shall be stabilized or removed.

23.3 Grading during the winter period may be permitted with approval by the Administrative Official. However, no winter grading shall be permitted on sites with a severe erosion hazard rating or within a watercourse corridor.

23.4 In addition to the normal requirements for a grading permit application, the applicant shall submit a statement detailing why it is necessary to conduct winter grading activities.

23.5 If the site will be active during the winter period, permanent sediment and erosion control BMPs shall be in place including, but not limited to paving or rocking of the site entrance or driveway.

23.6 The smallest practicable area of land shall be exposed at any one time and the time of exposure shall be minimized.

23.7 During the winter period, temporary or permanent erosion control measures shall be in place at the end of each workday and prior to any weather event. No grading activities shall take place during major storm events.

23.8 During the winter period, the site shall be regularly monitored by the permittee, especially following any weather event, to monitor the effectiveness of erosion control measures. Erosion control measures that fail or prove to be ineffective shall be modified so as to create an effective means of erosion control and/or sediment retention.

23.9 Grading in mapped NOA areas shall consider the dust suppression advantages of performing the work during damp soil conditions.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-42. - Administration.
42.1 It shall be the duty of the Administrative Official (or appointed designee) to enforce all the provisions of this chapter relative to grading activities regulated by this chapter in the unincorporated areas of the County.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-43. - Penalty.
43.1 Any grading performed in violation of this chapter shall be unlawful and deemed a public nuisance.

43.2 Notwithstanding these regulations, no person shall cause or allow a significant environmental impact to occur as a result of new or continued grading as defined herein, including grading that is exempt from these regulations. In the event that the Administrative Official determines that a significant environmental impact is likely to occur or has occurred as a result of grading activities, the Administrative Official may deny or revoke any grading permit.

43.3 If necessary, the Administrative Official may also require a grading permit for work that is otherwise exempt from these regulations in order to address the identified significant impact.

43.4 It is the intent of this chapter that the conduct of grading exempted or waived from the requirement to obtain a permit shall incorporate practices consistent with the standards incorporated in this chapter.

43.5 A violation of any of the provisions of this chapter, or of any codes adopted by reference in this chapter, is punishable as an infraction or a misdemeanor. Violations prosecuted as an infraction shall be punishable by fines as specified in Government Code Section 25132. Violations prosecuted as misdemeanors shall be punishable, by imprisonment in the County jail for a term not exceeding six (6) months, or by a fine of one thousand dollars ($1,000.00), or both such fine and imprisonment, as well as all administrative costs associated with such prosecution.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-44. - Arrest and Citation Powers.
44.1 The following officers and employees of the Lake County Community Development Department are hereby given arrest and citation powers pursuant to Section 836.5 of the Penal Code.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-45. - Stop Work Orders.
45.1 The Administrative Official may order that any grading operations performed in violation of the requirements of this chapter, the approved plans and specifications, any permit conditions, or any grading operations that have otherwise become hazardous to the property of others or the public welfare be stopped.

45.2 It shall be unlawful and a violation of this code for any person to resume grading operations that were ordered to be stopped, unless the Administrative Official has first required, and the violator has agreed to, any necessary corrective measures, and the Administrative Official has authorized the resumption of work.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-46. - Corrective Action.
46.1 Whenever the Administrative Official finds that a grading operation has become, or is threatening to become, hazardous to the property of others, the public welfare or the environment, or that violates or will violate the provisions of this chapter, the Administrative Official may require that the operator submit for approval, a detailed schedule of specific remedies that can be undertaken immediately to bring the work into compliance with this chapter.

46.2 Within twenty-four (24) hours after acceptance of said remedies by the Administrative Official, the operator/property owner shall at his/her expense undertake the required immediate remedial action as necessary to eliminate the emergency hazard prior to, or concurrent with, any necessary permit application for any further work regulated by this chapter.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-47. - Notice of Violation.
47.1 A notice of violation shall specify the violation and the corrective action required to abate the violation.

47.2 The notice of violation shall also state that failure to abate the violation could subject the responsible party(ies) to administrative and criminal penalties and could result in the imposition of a lien on the property.

47.3 Notice shall be given as specified in Section 13.33.2 of the Lake County Ordinance Code.
(Ord. No. 2830, § 1, 7-17-2007)

Sec. 30-48. - Nuisance and Hazard Abatement.
48.1 Any work done or maintained in violation of the provisions of this chapter and any use of land operated or maintained in violation of the provisions of this chapter are hereby declared to be public nuisances and full abatement and restoration may be required and an assessment of cost may be levied pursuant to Chapter 13 of the Lake County Ordinance Code.

Soil Map unit and Erosion Hazard Rating.

Aiken-Sobrante association, 5 to 15% slopes moderate
102 Aiken-Sobrante association 15 to 30% slopes moderate
103 Asbil clay loam, 5 to 8% slopes moderate
104 Asbil clay loam, 8 to 15% slopes moderate
105 Badland severe
106 Bally Phipps gravelly loams, 2 to 8% slopes slight
107 Bally-Phipps complex, 15 to 30% slopes severe
108 Bally-Phipps Haploxeralfs association, 30 to 75% slopes severe
109 Bamtush-Neuns gravelly loams, 15 to 30% slopes moderate
110 Bamtush-Speaker-Sanhedrin gravelly loams, 30 to 50% slopes severe
111 Bamtush-Speaker-Sanhedrin gravelly loams, 50 to 75% slopes severe
112 Benridge-Konocti association, 15 to 30% slopes severe
113 Benridge-Konocti association, 30 to 50% slopes severe
114 Benridge-Sodabay loams, 8 to 15% slopes moderate
115 Benridge-Sodabay loams, 15 to 30% slopes severe
116 Benridge Variant loam, 2 to 15% slopes moderate
117 Bottlerock-Glenview-Arrowhead complex, 5 to 30% slopes moderate
118 Bottlerock-Glenview-Arrowhead complex, 30 to 50% slopes severe
119 Bressa Millsholm loams, 8 to 15% slopes moderate
120 Bressa Millsholm loams, 15 to 30% slopes severe
121 Clear Lake clay, drained, cool slight
122 Clear Lake Variant clay, drained slight
123 Cole clay loam, drained slight
124 Cole Variant clay loam slight
125 Cole Variant clay loam, calcareous substratum slight
126 Collayomi complex, 50 to 75% slopes severe
127 Collayomi-Aiken-Whispering complex, 5 to 30% slopes moderate
128 Collayomi-Aiken-Whispering complex 30 to 50% slopes severe
129 Collayomi-Whispering complex, 30 to 50% slopes severe
130 Deadwood-Sheetiron association, 50 to 75% slopes severe
131 Fluventic Haplaquolls, nearly level slight
132 Forbesville loam, 2 to 5% slopes slight
133 Forbesville loam, 5 to 15% slopes moderate
134 Forward Variant-Kidd association, 30 to 50% slopes severe
135 Forward Variant-Kidd association, 50 to 75% slopes severe
136 Freezeout-Yollabolly very gravelly sandy loams, 30 to 50% slopes moderate
137 Freezeout-Yollabolly very gravelly sandy loams, 50 to 75% slopes severe
138 Glenview-Arrowhead complex, 5 to 15% slopes moderate
139 Glenview-Arrowhead complex, 15 to 30% slopes severe
140 Glenview-Bottlerock complex, 2 to 5% slopes slight
141 Henneke-Montara complex, 8 to 15% slopes moderate
142 Henneke-Montara-Rock outcrop complex, 15 to 30% slopes severe *
143 Henneke-Okiota complex, 30 to 50% severe *
144 Jafa loam, 2 to 5% slopes slight
145 Jafa loam, 2 to 5% slopes moderate
146 Jafa complex, 5 to 30% slopes severe
147 Kelsey fine sandy loam slight
148 Kidd-Forward complex, 5 to 30% slopes moderate
149 Kidd-Forward complex, 30 to 50% slopes severe
150 Kilaga Variant loam, 0 to 5% slopes slight

151 Konocti-Benridge complex, 50 to 75% slopes severe
152 Konocti-Hambright complex, 5 to 15% slopes moderate
153 Konocti-Hambright complex, 15 to 30% slopes severe
154 Konocti-Hambright-Rock outcrop complex, 30 to 75% slopes severe
155 Konocti Variant-Konocti-Hambright complex, 2 to 15% slopes moderate
156 Konocti Variant-Konocti-Hambright complex, 15 to 30% slopes moderate
157 Landlow Variant silty clay loam slight
158 Lupoyoma silt loam, protected slight
159 Manzanita loam, 2 to 5% slopes slight
160 Manzanita loam, 5 to 15% slopes moderate
161 Manzanita loam, 15 to 25% slopes severe
162 Manzanita gravelly loam, 2 to 8% slopes moderate
163 Manzanita gravelly loam, 8 to 25% slopes severe
164 Maxwell clay loam, 0 to 2% slopes slight *
165 Maxwell clay loam, 2 to 8% slopes moderate *
166 Maymen-Etsel-Mayacama complex, 15 to 30% slopes moderate
167 Maymen-Etsel-Mayacama complex, 30 to 75% slopes severe
168 Maymen-Etsel-Snook complex, 15 to 30% slopesmoderate
169 Maymen-Etsel-Snook complex, 30 to 75% slopessevere
170 Maymen-Etsel-Speaker association, 30 to 50% slopes severe
171 Maymen-Hopland-Etsel association, 15 to 50% slopes severe
172 Maymen-Hopland-Mayacama complex, 9 to 30% slopes moderate
173 Maymen-Hopland-Mayacama association, 30 to 50% slopes severe
174 Maymen-Hopland-Mayacama association, 50 to 75% slopes severe
175 Maymen-Millsholm-Bressa complex, 30 to 50% slopes severe
176 Maywood variant sandy loam slight
177 Millsholm-Bressa loams, 30 to 50% slopes severe
178 Millsholm-Bressa-Hopland association, 30 to 50% slopes severe
179 Millsholm-Squawrock-Pomo complex, 30 to 50% slopes severe
180 Mocho Variant loam slight
181 Neice-Sobrante-Hambright complex, 30 to 75% slopes severe
182 Neice-Sobrante-Hambright complex, 30 to 75% slopes severe
183 Neuns-Bamtush-Deadwood association, 30 to 50% slopes severe
184 Neuns-Deadwood-Bamtush association, 50 to 75% slopes severe
185 Neuns-Decy-Sanhedrin complex, 30 to 50% slopes severe
186 Neuns-Sanhedrin-Deadwood complex, 30 to 50% slopes severe
187 Neuns-Sanhedrin-Deadwood complex, 50 to 75% slopes severe
188 Neuns-Sanhedrin-Speaker gravelly loams, 30 to 50% slopes severe
189 Neuns-Sheetiron-Deadwood complex, 30 to 50% slopes severe
190 Neuns-Sheetiron-Deadwood complex, 50 to 75% slopes severe
191 Neuns-Speaker gravelly loams, 15 to 30% slopes moderate
192 Okiota-Henneke complex, 5 to 30% slopes moderate *
193 Okiota-Henneke-Dubakella association, 15 to 50% slopes severe *
194 Oxalis Variant silt loam slight
195 Phipps complex, 5 to 15% slopes moderate
196 Phipps complex, 15 to 30% slopes severe
197 Phipps complex, 30 to 50% slopes severe
198 Pomo-Bressa loams, 15 to 50% slopes severe
199 Riverwash varies according to water velocities
200 Rock outcrop-Etsel-Snook complex, 50 to 80% slopes severe
201 Sanhedrin-Kekawaka-Speaker complex, 15 to 30% slopes severe
202 Sanhedrin-Kekawaka-Speaker complex, 30 to 50% slopes severe

203 San Joaquin Variant fine sandy loam, 0 to 5% slopes slight
204 Sheetiron-Deadwood association, 30 to 50% slopes severe
205 Sheetiron-Deadwood association, 50 to 75% slopes severe
206 Shortyork Variant-Yorkville-Squawrock association, 15 to 50% slopes severe *
207 Skyhigh-Asbil complex, 8 to 15% slopes moderate
208 Skyhigh-Asbil complex, 15 to 50% slopes severe
209 Skyhigh-Millsholm loams, 15 to 50% slopes severe
210 Skyhigh-Sleeper-Millsholm association, 8 to 15% slopes moderate
211 Skyhigh-Sleeper-Millsholm association, 15 to 30% slopes severe
212 Skyhigh-Sleeper-Millsholm association, 30 to 50% slopes severe
213 Sleeper Variant-Sleeper loams, 5 to 15% slopes moderate
214 Sleeper Variant-Sleeper loams, 15 to 30% slopes severe
215 Sleeper Variant-Sleeper loams, 30 to 50% slopes severe
216 Sobrante-Collayomi-Whispering association, 15 to 30% slopes severe
217 Sobrante-Collayomi-Whispering association, 30 to 50% slopes severe
218 Sobrante-Guenoc-Hambright complex, 2 to 15% slopes moderate
219 Sobrante-Guenoc-Hambright complex, 15 to 30% slopes moderate
220 Sobrante-Hambright-Guenoc complex, 30 to 50% slopes severe
221 Sodabay loam, 5 to 15% slopes moderate
222 Sodabay loam, 15 to 30% slopes severe
223 Sodabay-Konocti association, 5 to 30% slopes severe
224 Speaker-Marpa-Sanhedrin gravelly loams, 30 to 50% slopes severe
225 Speaker-Maymen-Marpa association, 30 to 50% slopes severe
226 Speaker-Maymen-Marpa association, 50 to 75% slopes severe
227 Speaker-Maymen-Millsholm association, 30 to 50% slopes severe
228 Speaker-Sanhedrin gravelly loams, 50 to 75% slopes severe
229 Speaker-Sanhedrin-Maymen association, 30 to 50% slopes severe
230 Speaker-Speaker Variant-Sanhedrin association, 5 to 30% slopes moderate
231 Squawrock-Shortyork Variant gravelly loams, 15 to 30% slopes moderate
232 Still loam slight
233 Still loam, stratified substratum Slight
234 Still gravelly loam slight
235 Still-Talmage complex, 2 to 8% slopes moderate
236 Stonyford-Guenoc complex, 30 to 50% slopes severe
237 Talmage very gravelly sandy loam slight
238 Tulelake silty clay loam, flooded slight
239 Tulelake silty clay loam, protected slight
240 Tyson-Neuns gravelly loams, 30 to 75% slopes severe
241 Vitrandepts-Cinder land complex, 15 to 75% slopes
242 Wappo loam, 2 to 8% slopes moderate
243 Wappo loam, 8 to 15% slopes moderate
244 Wappo variant clay loam, 2 to 8% slopes moderate
245 Whispering-Collayomi complex, 50 to 75% slopes severe
246 Wolfcreek gravelly loam slight
247 Wolfcreek loam slight
248 Xerofluvents, very gravelly slight
249 Xerofluvents-Riverwash complex slight
250 Yollabolly-Freezeout very gravelly sandy loams, 30 to 50% slopes moderate
251 Yollabolly Rock outcrop-Freezeout complex, 50 to 75% slopes severe
252 Yorktree-Hopland-Squawrock complex, 15 to 50% slopes severe
253 Yorkville-Pomo complex, 15 to 50% slopes severe
255 Yorkville Variant clay loam, 2 to 8% slopes moderate *