FEASIBILITY OF GROWING GRAPES IN THE AREA OF

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This report was prepared for [insert name] and is based on data gathered by [insert name] on soils and climatic data obtained from the U.S. Weather Service. These two sets of data are quite detailed and clearly show the soils and climate of this proposed site area. [See Appendix A – Soils Report Summary and Appendix B – Climatic Data.] The author of this report has compiled all other data submitted in this study.
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Section I. Location and Area.

and are named for who arrived in this area from Bordeaux, France, in 1836. Later acquired the name of since anyone who owned a large ranch in California was accorded the title of, and translates to in Spanish. reputedly was the first major producer of champagne in California. In November 1857, a newspaper advertised his champagnes. The town which developed near was known as. It now is about 500 feet below the waters of. The population of this area during the gold rush was not recorded, but when Abraham Lincoln was elected president in 1860, 1500 votes were cast in. Most of the town was destroyed by fire in 1864, but by that time, over $14 million in gold had been extracted from the immediate area.

During the past 100 years, has been used for cattle ranching. In 1971, the dam was completed, which formed the present 22-mile long. This lake is the fourth largest in California.

The history of could be advantageous to any vineyard development, particularly the glamour and romance of winegrape vineyards surrounding a winery (Chateau Don Pedro) would greatly enhance the development of this "budding area."

This property located in on the west side of falls into the California grape pricing District 10, comprising the counties of. (Source: Final Grape Crush Report 1998 crop, California Department of Food & Agriculture, Sacramento, CA.) [See map at page 14] The significance of location in this pricing district will be discussed under Section IX, Marketability of District 10 Wine Grapes.
The soils report attached as Appendix "A" contains more specific information on the location of the property and the complete soils report (which will be delivered independently by Dellavalle) will also contain maps of the subject property. According to the Dellavalle Report, the property topography features slopes of less than 12 percent making it possible for an estimated plantable vineyard acreage of 900 acres. It should be understood that the 900 plantable acreage is not contiguous and will be separated by the limiting features mentioned in the Soil Report resulting in several vineyard blocks, some of which may be small.

CONCLUSION.

BASED ON THE MATTERS SUBSEQUENTLY DISCUSSED IN THIS REPORT, INCLUDING CLIMATE, SOIL, WATER AND OTHER FACTORS, THIS PROPERTY WOULD BE SUITABLE FOR VINEYARD DEVELOPMENT. WHILE NO WINERIES ARE AVAILABLE IN THE IMMEDIATE AREA, THERE ARE WINERIES WITHIN A 50 TO 60 MILE DISTANCE FROM THE PROPERTY AND THEREFORE GRAPES COULD BE DELIVERED TO THEM.

Section II. Climatic Factors.

A. Degree-Days. Climate is the most important limiting factor affecting grape quality for wine making. Traditionally, California's grape growing regions have been classified according to the number of degree-days above 50°F. for the period April 1 to October 31 inclusive. Degree-days are calculated as follows: for example, the month of April has a mean temperature of 60.9°F. The summation (degree-days) would be (60.9 - 50 = 10.9 x 30) equals 327 degree-days.
California has five temperature regions designated according to degree-days as follows:

Region I - Less than 2500 degree-days – is the coolest region in which grapes are grown.
Region II - 2501 to 3000 degree-days.
Region III - 3001 to 3500 degree-days.
Region IV - 3501 to 4000 degree-days.
Region V - Over 4000 degree-days.

Regions I and II are typically found in California’s coastal regions ranging from [ ] to [ ]. The warmer areas of the coastal counties generally fall into a Region IV.

As one moves inland from the coast, the weather is typically warmer, such as the upper [ ] and continues to become warmer as one moves towards the southern end of the [ ]. These are the areas that are typically Regions IV upper [ ] and Region V, lower [ ] to [ ].

TABLE I. Temperature In Heat Summation Units (Degree-Days)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DEGREE-DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>3733</td>
</tr>
<tr>
<td>1995</td>
<td>3498</td>
</tr>
<tr>
<td>1996</td>
<td>3781</td>
</tr>
<tr>
<td>1997</td>
<td>4050</td>
</tr>
<tr>
<td>1998</td>
<td>3501</td>
</tr>
</tbody>
</table>

FIVE-YEAR AVERAGE: 3672 DEGREE-DAYS

Data shown in Table I is an average of heat summation units of the two weather stations located in [ ] and [ ]. [ ] is located geographically almost equal distance between these
two locations. It is also at a midpoint from an elevation standpoint between these two locations.

Table I is illustrative of the moderately warm climate of the eastern portion of the central [foothill region] ranging in elevation from 950 feet to 1100 feet. Heat summation units average 3672 degree-days, which puts this area into a low Region IV or bordering on a high Region III. [See Appendix B for detailed information and calculation.]

Elevation is an important factor as it generally influences a greater temperature differential between daytime and nighttime temperatures, which is a condition that favors higher fruit acid and higher fruit color intensity which both add in a positive way to fruit quality which enhances wine quality.

B. Frost Factor. Another important factor is the frost hazard. Daily climatic readings were observed over a five-year period. Spring frosts can be damaging to a grape crop. Hence, readings commencing in mid-March to mid-May were observed. Damage will occur when temperatures drop below 31°F. depending on duration (time temperature remains below freezing).

During the five year observation period damaging frosts occurred only on March 25 and 26 @ 29°F 1995. Once on March 6 (31°F) 1996 and 5 days in April of 1998 at temperatures just below freezing between 30°F and 31°F. This is not a significant occurrence pattern since the low temperatures are just below 32°F. There is not frost hazard. [See Appendix C.]

C. Heat Factor. Summer temperatures seldom rose above 105°F, hence no harm from heat damage. [See Appendix C.]

D. Wind Factor. Winter winds (Dec, Jan, and Feb) are from the SW and during March and April from the NNW. Wind velocity was not found to be a problem.

E. Precipitation.

Appendix D contains two computations of the average annual precipitation for a five (5) year period. While the results are
similar (31.615 inches per year vs. 32.563 inches per year), the annual precipitation is more consistent when viewed on an April through March year instead of a calendar year. The rain season is from November through March and if the precipitation is heavy in December it tends to be lighter in January, February and March and vice versa. [See Appendix D, page 2.] The following table is a summary of the five-year monthly average based on a calendar year [See Appendix D, page1 for detail.]:

**TABLE II. Precipitation – Monthly 1994 – 1998.**

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Inches of Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>8.078</td>
</tr>
<tr>
<td>February</td>
<td>4.772</td>
</tr>
<tr>
<td>March</td>
<td>3.625</td>
</tr>
<tr>
<td>April</td>
<td>2.291</td>
</tr>
<tr>
<td>May</td>
<td>2.381</td>
</tr>
<tr>
<td>June</td>
<td>0.429</td>
</tr>
<tr>
<td>July</td>
<td>0.017</td>
</tr>
<tr>
<td>August</td>
<td>0.051</td>
</tr>
<tr>
<td>September</td>
<td>0.294</td>
</tr>
<tr>
<td>October</td>
<td>0.914</td>
</tr>
<tr>
<td>November</td>
<td>3.728</td>
</tr>
<tr>
<td>December</td>
<td>5.035</td>
</tr>
</tbody>
</table>

Rainfall during the summer months is minimal and should not cause a problem. 80% of rainfall comes during dormant months of mid-November to March. This is a good feature in that the ground water is being replenished and will be available for spring growth. Because of the sloping topography, I would estimate substantial runoff, hence **effective rainfall** would be about 50%, or about 16 inches that will benefit the vines. Since the property is in a winegrape temperature region rated as a low region IV, the vines irrigation requirement would be between 24 to 30 acre-inches per year. In order to satisfy this requirement, in addition to the effective rainfall, 16 to 20 acre-inches of irrigation for a mature vineyard will be needed during the summer months of May through October.
CONCLUSION.

CLIMATE IS QUITE CONDUCIVE TO GRAPE GROWING IN THIS AREA AND DOES NOT COME INTO PLAY AS A LIMITING FACTOR. IT SHOULD ALSO BE NOTED THAN ALMOST ANY VARIETY CAN BE GROWN ON THIS PROPERTY AND THAT FACTORS OTHER THAT CLIMATE WILL DETERMINE THE VARIETAL SELECTION.

Section III. Soil Limitations Regarding Grape Production.

Soil is an important consideration in growing grapes, particularly in geographic areas where grapes have not been consistently grown. (There is no grape acreage reported in [ ]).

Important considerations are: Soil texture, soil structure and profile, saturation percent, PH, salt (Ec values) alkali (Esp. values) and Boron

Soil samples were taken (49 in all). These sites were excavated down to the maximum depth of five feet or to a depth that may have been limited because of impervious sub soil, such as rock formation, etc. The soil excavations (holes) were visibly inspected for soil profile and structure determinations, etc., and soil samples taken at various depths for chemical analysis. Complete soil data is provided in the Dellavalle Report. [See Appendix A for a summary of the Dellavalle Report.]

CONCLUSION.

I AM IN CONCURRENCE WITH THOSE SOIL FINDINGS AND RECOMMEND FOLLOWING DELLAVALLE'S PREPLANT SOIL PREPARATION RECOMMENDATION AS STATED.
Section IV. Water – Water Quality Limitations and Requirements.

Water availability and its quality is very important. The grapevines are quite sensitive to salt and boron.

I see no real problem with the quality of water other than its low salt content which could cause penetration problems, but this concern can be addressed by the application of Gypsum and other cultural operations which when practiced will assist with water penetration as well as root penetration.

Water availability is essential for irrigation needs during the dry hot rainless months of the growing season.

Temperature Region IV (3672 degree-days) will require 24 to 30 acre-inches of water to mature a full crop of grapes. Even though the rainfall on an annual basis exceeds this requirement, supplemental water through drip irrigation will be required during those non-rainfall months of June, July and August when the vine evapo-transpiration (E.T.) is at its highest rate.

CONCLUSION.

I WOULD ESTIMATE THAT AT LEAST 20 ACRE INCHES (1.66 ACRE FEET) OF SUPPLEMENTAL WATER WOULD BE REQUIRED. THEREFORE, EACH 40 ACRES OF VINES WOULD REQUIRE 67 ACRE FEET PER YEAR.
Section V. Soil Pests and Disease.

Soil type ranging from loam to silty clay loams provides a media for certain pests. The insect phylloxera, for example, prefers heavier Clay type soils, while the various species of nematodes prefer the lighter type sandy soils.

The soil type at the site is predominately of Sandy Clay Loam to Silty clay loam. There is sufficient clay in these two soils that would attract phylloxera should this vine root devastating microscopic insect pest be introduced to the area. Soils of this nature swell upon wetting and crack upon drying, thus, providing pathways for the Phlloxera, a crawling insect to move through the soil cracks and along the vine roots.

Nematodes are round worms which are microscopic and would be attracted to these soils particularly because these loamy soils contain sufficient sand and silt that provides pathways for nematodes to move about the soil (swim) through the soil water surrounding the soil particles.

What this means is that these soils would host the two most serious soil pests that attack vine roots. The positive aspect of this property is that there are no phylloxera present in these soils now and an unknown population of nematodes. A nematode soil analysis should be made prior to rootstock selection.

The only soil borne disease to be concerned with would be oak root fungus. The probability of this is low and inspection of a few trees would determine if indeed the trees were infected.

Ariel photos prior to farming this area would be a source that would provide information regarding if indeed oak trees were once in this property and were subsequently removed. I would not suspect this fungus to be present in this soil. If per chance this fungus were present, it would only be infectious where a diseased oak tree once existed. Spot fumigation would take care of this.
CONCLUSION.

IN SUMMARY ON THIS SUBJECT, THE SOILS ARE SUFFICIENTLY CLEAN. BUT A ROOTSTOCK THAT IS RESISTANT TO BOTH PHYLLOXERA AND NEMATODES WOULD BE RECOMMENDED.

Section VI. Planting Stock. Own Rooted Vines v. Vines on Rootstock with Certified Varietal Clones.

This is perhaps the most important question a new vineyard grower faces. 122,000 acres has been planted during the past 3 years. As the years progress, the new acreage will come into bearing and the supply and demand economics will come into play. Those who will survive the competition will be growers with the heaviest yielding vineyards producing the best quality fruit. Therefore, it is of paramount importance to select vines from sources that can provide heavy producing varietal clones that are certified to be of true variety characteristic and free from degenerative diseases.

Nurseries have in stock dormant bench grafts on rootstock that are certified and provide good resistance to nematodes and resistance to phylloxera. Bench grafts involve the grafting to resistant rootstock of a certified varietal clone. The price of bench grafts are 3 to 5 times as much as "own rooted" vines ($3.00 - $4.00 per plant vs. 75¢ to $1.00), because vines on their own roots are not resistant to nematodes or phyloxera, and the cost of grafting is expensive. ("Own rooted" vines are propagated from vine-cuttings acquired by the vineyard developer or from commercial nurseries.)

Certified vines insure, to a good degree, that the plants are disease-free and bench grafted onto resistant rootstock. This insures a long life for the vineyard. It can never be predicted when the devastating root louse phyloxera will invade a new grape producing vineyard area. An example of this occurred in [redacted] counties when huge plantings of vines were made during the planting boom of the early '70s. Today,
millions of dollars are being spent to replace these own rooted vineyards that are being wiped out by phylloxera.

CONCLUSION.

IT IS STRONGLY RECOMMENDED THAT ALL PLANTINGS BE OF SOIL PEST RESISTANT ROOTSTOCK WITH CERTIFIED VARIETAL CLONES.

Section VII. Biological Factors Affecting the Area.

A. Wildlife.

Birds. Starlings could be a problem if cattle grazing continues on property near the vineyards. Control is difficult. Therefore, consideration should be given to discontinuing leasing for cattle grazing when vineyard development begins.

Rabbits. Rabbits do not appear in the area in any great population. However, should they inhabit the area to a significant degree, milk cartons can give some protection to the new vines.

Squirrels and Gophers. Inhabit the area but not to an extent that eradication measures would be necessary. Traps and use of poison baits can control these pests. The Agriculture Commissioner's office normally can recommend the appropriate methods and devices to control the above-mentioned pests.

Deer. If Deer are present on the property, fencing will be required.

B. Insects. Above ground insect pests should not present a problem at the onset of vineyard establishment and non-chemical control would be preferred so as to allow the buildup of the natural predacious insects. While this is a good idea, the "bad" insects will eventually invade the area and appropriate pest controls will have
to be implemented. The grower will have to be watchful for grape leaf hoppers and mites.

C. Diseases. Those anticipated in the area are Powdery Mildew, Botrytis Rot and Bunch Rot. There are adequate controls for these types of Fungi. Powdery Mildew is by far the most serious and will require control throughout the growing season.

The below ground pests, phylloxera, nematodes and the Oat Root Fungus have been discussed in Section V.

D. Weeds. Noxious weeds such as Bermuda grass, Johnson grass and Nut grass should be eradicated as soon as possible and preferably prior to planting. While eradication is expensive, it is cheaper than fighting them in a maturing vineyard. With the excellent weed control programs available, I do not anticipate any serious weed problem.

CONCLUSION.

THERE ARE ADEQUATE CONTROLS OR STEPS THAT CAN BE TAKEN TO MITIGATE POTENTIAL DAMAGES FROM WILDLIFE, INSECTS, DISEASES AND WEEDS. IF ANY OF THE MATTERS ARE A PROBLEM, THEY SHOULD BE ADDRESSED BEFORE THE VINES ARE PLANTED.

Section VIII. Varietal Considerations.

First and foremost consideration is varietal adaptability to this specific area. From a climate, soil and water standpoint, you should be able to grow any of the major varietals. If the property will support the major varietals and if it is reasonable to assume that the development and cultural costs will be the same regardless of the varietal selected, then the price of the grapes becomes a major factor in the selection of a varietal.
In Section II of this study, I discussed the temperature of Regions I, II, III, IV and V. You will note temperature differences between regions, the coolest being in Region I and the warmest in Region V. Grape prices, irrespective of the wine grape variety, are highest in the cooler regions and lower in the warmer regions.

For example: 1998 – Cabernet Sauvignon grown in the climate Region II, District 4, [insert area], sold for $2257 per ton; Region III, District 6, [insert area] for $1279 per ton; Region IV, District 10, [insert area] for $1079 per ton; Region IV, District 11, [insert area] at [insert area] for $804 per ton; Region IV-V District 12, [insert area] for $731 per ton; Region V, District 13, [insert area] for $676 per ton; and Region V District 14, [insert area] for $691 per ton. [Source: Final Grape Crush Report 1998 Crop California Department of Food & Agriculture, Sacramento, California.] For definition of district boundaries, please see page 14 “Map and Definitions of California Grape Pricing Districts.”

The following Table illustrates the trend for all of the major varietals presently grown in Region 10. While other varietals such as Shiraz or Sangiovese could also be grown on the subject property, there is no price information available for these grapes in District 10, so they were not included.

Table III clearly shows the difference in price between varieties and the difference in price of the same varieties grown in different grape pricing districts. For example, Chardonnay (the most popular white wine variety) sold for $1,844 dollars per ton in District 4, as compared to Sauvignon Blanc, which sold for $1,306 dollars per ton. A much larger differential in price, however, occurs between pricing Districts 4 and 10. As shown in Table III, Chardonnay produced in District 4 sold for $1844 per ton as compared to $1181 in District 10.

The price difference between pricing districts is influenced by the reputation of that district (long track record of high quality wines) perceived by consumers. For example, the [insert appellation] in itself will command the higher price for its wines, which in turn reflect the higher price per ton of grapes produced in the [insert appellation].
TABLE III. 1998 Selected Grape Varieties – Prices by Pricing Districts.

(Price per Ton)

<table>
<thead>
<tr>
<th>Variety</th>
<th>White Wine Type</th>
<th>Red Wine Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chardonnay</td>
<td>$1,844</td>
<td>$2,257</td>
</tr>
<tr>
<td>Sauvignon Blanc</td>
<td>$1,306</td>
<td>$1,279</td>
</tr>
<tr>
<td>Muscat Blanc</td>
<td>$1,246</td>
<td>$1,079</td>
</tr>
<tr>
<td>Merlot</td>
<td>$2,078</td>
<td>$1,409</td>
</tr>
<tr>
<td>Zinfandel</td>
<td>$1,082</td>
<td>$1,085</td>
</tr>
</tbody>
</table>

If price were the sole determining factor, the best varieties in District 10 would be Merlot ($1204/ton), Chardonnay ($1181/ton) and Cabernet Sauvignon ($1079/ton). However, having a firm, long-term purchase contract is even more important than price in making the final varietal selection.

CONCLUSION.

SINCE THE SO-CALLED PREMIUM VARIETIES ARE NOW BEING GROWN IN THE WARMER REGIONS AND WINERY PURCHASE INTEREST HAS INCREASED, A LOGICAL APPROACH FOR VARIETAL SELECTION IS TO GO TO WINERIES OFFERING TERM CONTRACTS AT A GUARANTEED BASE PRICE AND DETERMINE WHAT VARIETIES THEY WILL PURCHASE. THEREAFTER, CONSIDERATIONS SUCH AS PRICE AND AVAILABLE VARIETAL CLONES WOULD BE FACTORS TO WEIGH. FURTHER DISCUSSION WILL BE FOUND IN SECTION IX, MARKETABILITY OF DISTRICT 10 WINE GRAPES.
MAP & DEFINITIONS OF CALIFORNIA GRAPE PRICING DISTRICTS

1. Mendocino County
2. Lake County
3. Sonoma and Marin Counties
4. Napa County
5. Solano County
6. Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, and Santa Cruz Counties
7. Monterey and San Benito Counties
8. San Luis Obispo, Santa Barbara and Ventura Counties
9. Yolo County north of Interstate 80 to the junction of Interstate 80 and U.S. 50 and north of U.S. 50; Sacramento County north of U.S. 50; Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Glenn, Butte, Colusa, Sutter, Yuba, and Sierra Counties.
10. Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne and Mariposa Counties
11. San Joaquin County north of State Highway 4; and Sacramento County south of U.S. 50 and east of Interstate 5
12. San Joaquin County south of State Highway 4; Stanislaus and Merced Counties
13. Madera, Fresno, Alpine, Mono, Inyo Counties; and Kings and Tulare Counties north of Nevada Avenue (Avenue 182)
14. Kings and Tulare Counties south of Nevada Avenue (Avenue 182); and Kern County
15. Los Angeles and San Bernardino Counties
16. Orange, Riverside, San Diego, and Imperial Counties
17. Yolo County south of Interstate 80 from the Solano County line to the Junction of Interstate 80 and U.S. 50 and south of U.S. 50 and Sacramento County south of U.S. 50 and west of Interstate 5
Section IX. Marketability of District 10 Wine Grapes.

The supply of wine grapes is increasing annually in California based on the number of presently planted acres. And non-bearing acres will continue to show substantial increases over the next three years.

TABLE IV. California Wine Grape Acreage (Bearing and Non-bearing)

<table>
<thead>
<tr>
<th></th>
<th>Bearing</th>
<th>Non-bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>White wine varieties</td>
<td>166,005</td>
<td>28,818</td>
</tr>
<tr>
<td>Red wine varieties</td>
<td>176,542</td>
<td>55,916</td>
</tr>
<tr>
<td>Total wine varieties</td>
<td>342,547</td>
<td>84,734</td>
</tr>
</tbody>
</table>

As of 1998 there are 84,734 non-bearing acres of wine grapes in California as reported by the California Agricultural Statistics Service (CASS) (non-bearing acres include planted vines in their 1st or 2nd leaf which have no marketable production). However, when reviewing their survey methods and results of those methods (See Appendix E) there may be in fact a total of 507,000 acres of wine type grapes planted with 385,000 bearing and 122,000 non-bearing.

This means that within three years there will be an additional 150,375,000 gallons of wine produced over the current 437,000,000 gallons of wine that were shipped out of California in 1998. This represents an increase of 34%. This is an unprecedented increase (even if spread over the next three years) considering that California wine shipment increased only 3% from 1997 to 1998. [See Appendix F – “The Gomberg-Fredrickson Report”, as to what happened with wine shipments last year (page two, Volume 18 #12 February 27, 1999) and what has taken place these past seven months (page two, Volume 19 #7 September 24, 1999).] California wine shipments have really flattened out. Zero increase. Considering there will be one third more gallons to sell over what is currently being sold is clearly indicative of overproduction, which will adversely impact grape prices.
Observing various grape districts throughout the State, I still see many new vineyards being planted. I understand that one winery is planting 4,000 acres of Chardonnay this year.

District 10 while very small (less than 1% of California wine grapes) continues to grow in acreage as shown in Table IV.

### TABLE V. District 10 Wine Grape Acreage 1998

<table>
<thead>
<tr>
<th>County</th>
<th>Bearing</th>
<th>Non-bearing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1998</td>
<td>1997</td>
</tr>
<tr>
<td></td>
<td>2,097</td>
<td>404</td>
<td>2501</td>
</tr>
<tr>
<td></td>
<td>407</td>
<td>93</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>784</td>
<td>227</td>
<td>1011</td>
</tr>
<tr>
<td></td>
<td>59</td>
<td>2</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>183</td>
<td>4</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>3</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3,620</td>
<td>733</td>
<td>6351</td>
</tr>
</tbody>
</table>

Source for Table IV: CASS June 1999 – California Grape Acreage

Table IV shows that grapes continue to be planted in District 10 as is indicated with 733 non-bearing acres. Note that [redacted] has 0 acreage. Should this project move forward, [redacted] would have the only vineyard in [redacted].

From the technical data presented in this brief report, there is no question in my mind that quality grapes can indeed be grown in this potential vineyard site area of [redacted].

Marketing is the big factor and getting the interest of a winery interested in expanding their grape source from a “new” area and willing to offer a firm long term contract would be a prerequisite to pursuing this venture.

Before planting more vineyards it would be imperative to have a firm long-term contract with a reputable winery. There may be wineries interested in expanding their wine offerings from a wine
region such as District 10 just to have another appellation as a marketing tool.

Points of discussion regarding long-term contracts should include:

Point One...................... Reputable winery. Select one that has a track record.

Point Two...................... Base price to include inflation. This could be a negotiable point – but could be negated because winery is telling you, you have a guaranteed home for your grapes.

Point Three...................... Be sure you know quality standards expected from winery, e.g. sugar and acid percent and grape defect accepted, etc.

Point Four...................... Hauling allowances if any and acceptability of mechanically harvested fruit.

Point Five...................... Farming practices that winery may demand. For example, cropping level, pest control program, etc.

Point Six ...................... Be constantly aware of the field price for Pricing District 10.

Point Seven ...................... Be mindful of negotiating at what point in time you can negotiate extension of the contract term.

Another avenue to explore would be planting vineyards and building a winery. This avenue would require substantial capital and would require an in-depth study of marketing one’s own wine. Development of a winery is outside the scope of this analysis.
CONCLUSION.

GOOD QUALITY WINE CAN BE MADE IN THIS AREA FROM GRAPE VARIETIES BEST ADAPTED TO THE AREA CLIMATE AND SOILS. VARIETAL SELECTION IS BASED 100% ON WHAT A WINERY WOULD WANT YOU TO PLANT. I CANNOT UNDER ANY CIRCUMSTANCE RECOMMEND PLANTING A VINEYARD ON SPECULATION. IT IS IMPERATIVE THAT YOU HAVE A FIRM LONG-TERM CONTRACT WITH A REPUTABLE WINERY. IT WOULD BE DISASTROUS IN MY OPINION. ON THE OTHER HAND, I WOULD RECOMMEND PLANTING GRAPES FOR A WINERY WILLING TO SIGN A FIRM LONG-TERM CONTRACT (12-15 YEARS).

Section X. Cost of Establishing a Wine Grape Vineyard.

I have included as Appendix G copies of the University of California Cooperative Extension Service "Sample Costs for Establishing and Producing Wine Grape Varieties in the _____ - 1994" and a similar publication produced in 1997. Because of the hilly nature of this property, it is assumed that drip irrigation will be utilized and therefore the applicable pages of these reports are pages 3 and 13 respectively. The 1997 document estimates the investment at $12,877 per acre, including land cost of $4,696 per acre. Thus, the net additional investment if land costs have already been incurred would be approximately $8,181 per acre.

While these UC studies have over many years been proven to be quite accurate, it should be noted that until a specific development plan is prepared for a vineyard, there are many potential variables that could both increase and/or decrease the cost of development. For example, the Dellavalle report recommends deep ripping in some areas. As noted in the first footnote to the 1994 study (at page 3 of the 1994 report) "deep ripping in problem soils could add $400 - $600 per acre."
The cost of the drip irrigation system will vary as to well costs and reservoir costs. According to the Dellavalle report, there are a number of natural ponds on the property and if they can be efficiently utilized they can reduce the cost of establishing the drip irrigation system. The well cost can vary greatly depending on the depth of the well. Apparently, an excellent well has been developed on nearby property formerly owned by the [Redacted] at a depth of 271 feet. On the other hand, this development may require a well at a depth of 800+ feet, which would add substantially to the cost of the irrigation system.

Both the 1994 and 1997 cost samples base their development costs on use of "own rootings" at a cost of $0.64 - $0.70 per plant. Since my strong recommendation is to use rootstock with certified varietal clones at a cost of $3.50 per plant, this would add (based on 565 plants per acre) approximately $1,582 per acre to the development cost.

**CONCLUSION.**

**BECAUSE OF THE NUMBER OF UNKNOWNS, IT IS IMPOSSIBLE AT THIS TIME TO DETERMINE A SPECIFIC COST PER ACRE FOR DEVELOPMENT COSTS, BUT IF A DECISION IS MADE TO FURTHER EXPLORE THE DEVELOPMENT OF WINE GRAPE VINEYARDS, AN ANALYSIS OF THE COSTS WOULD BE PART OF THAT PROCESS.**
Summary of Conclusions.

Section I. Location and Area. Based on the matters discussed in this report, including climate, soil, water and other factors, this property would be suitable for vineyard development. While no wineries are available in the immediate area, there are wineries within a 50 to 60 mile distance from the property and therefore grapes could be delivered to them.

Section II. Climatic Factors. Climate is quite conducive to grape growing in this area and does not come into play as a limiting factor. It should also be noted that almost any variety can be grown on this property and that factors other than climate will determine the varietal selection.

Section III. Soil Limitations Regarding Grape Production. I am in concurrence with those soil findings and recommend following Dellavalle's preplant soil preparation recommendation as stated.

Section IV. Water – Water Quality Limitations and Requirements. I would estimate that at least 20-acre inches (1.66-acre feet) of supplemental water would be required. Therefore, each 40 acres of vines would require 67-acre feet per year.

Section V. Soil Pests and Disease. In summary on this subject, the soils are sufficiently clean. But a rootstock, which is resistant to both phylloxera and nematodes, is strongly recommended.

Section VI. Planting Stock. Own Rooted Vines vs. Vines on Rootstock with Certified Varietal Clones. It is strongly recommended that all plantings be of soil pest resistant rootstock with certified varietal clones.

Section VII. Biological Factors Affecting the Area. There are adequate controls or steps that can be taken to mitigate potential damages from wildlife, insects, diseases and weeds. If any of the matters are a problem, they should be addressed before the vines are planted.
Section VIII. Varietal Considerations. Since the so-called premium varieties are now being grown in the warmer regions and winery purchase interest has increased, a logical approach for varietal selection is to go to wineries offering term contracts at a guaranteed base price and determine what varieties they want to purchase. Thereafter, considerations such as price and available varietal clones would be factors to weigh.

Section IX. Marketability of District 10 Wine Grapes. Good quality wine can be made in this area from grape varieties best adapted to the area climate and soils. Varietal selection should be based 100% on what the contracting winery wants you to plant. I cannot under any circumstance recommend planting a vineyard on speculation. It is imperative that you have a firm long-term contract with a reputable winery. It would be disastrous in my opinion to proceed without a contract. On the other hand, I would recommend planting grapes for a winery willing to sign a firm long-term contract (12-15 years).

Section X. Cost of Establishing a Wine Grape Vineyard. Because of the number of unknowns, it is impossible at this time to determine a specific cost per acre for development costs, but if a decision is made to further explore the development of Wine Grape vineyards, an analysis of the costs would be part of that process.
Appendix A

Summary of Soils Report
September 23, 1999

Re: Tech Center Soils

Dear Mr.:

At your request, has conducted a study of soils and other conditions relating to wine grape production on property known as . The study includes review of a published soil survey of the area, a 1982 study by , evaluation of soil profiles, analysis of soil and water samples, and general observation of the area. The purpose of this report is to present findings and conclusions of the study.

The subject property is located in southwestern . It is situated north of the old between and . The parcel known as Tech Center occupies portions of Sections 22, 27, 28 and 33, Township 2 South, Range 14 East, M.D.B.&M. A location map (Attachment A) is attached for reference. Several intermittent creeks transects the property flowing from generally east to west. Several stock ponds are located on the parcel. The ponds are fed by rain runoff and several springs.

SUMMARY

Soils on the property are loams, clay loams, silty loams and the rocky phase of each, ranging from a few inches to more than 4 feet deep. Frequent rock outcrops occur. Slope ranges from nearly level to steep (2 to 70%). Chemical and physical soil properties are suitable for grape production with acreage limited by slope, proximity to waterways and depth. Effective depth can be increased by alteration of soil profiles, deep ripping. Slope should be less than 12% and minimum depth is about two feet with four or more desirable. While land measurement is beyond the scope of this study, it appears that about 900 acres are suitable for wine grape production.
Water, which will be required for irrigation, is available in ponds, which capture rain runoff and flow from springs. Additional water can be diverted from an underground source, which is adjacent to the property. Water quality is satisfactory for wine grape production. The chief limiting factor with respect to water will be quantity during dry years. Estimation of flow and determination of water rights are beyond the scope of this study and should be determined.

Limitations of concern in order of priority are water quantity, soil slope, proximity to stream channels, soil depth and internal drainage.

SOIL SURVEY

The United States Department of Agriculture, Soil Conservation Service in 1967 published a general soil survey of the area. In 1981, the property owner retained a soil Scientist in order to conduct a reconnaissance soil survey in order to delineate potential cropland. Each survey provided accurate general information. The objective of this study is to determine suitability of the property for wine grape production.

Soils on the property are mapped as Auburn loam, Auburn silty clay loam, Argonaut loam, and Exchequer loam.

According to Auburn loam and Argonaut loam soils occupy low, nearly level terrain on the northwest portion of section 27 and the northeast portion of the section 28. Auburn silty clay loam and Exchequer loam are mapped on the balance of the property.

Auburn soils are well-drained loams and silty clay loams varying in depth from 12 to 36 inches. Color of the surface soil varies from reddish brown or brown to yellowish red and subsoils are brown to pale brown heavy sandy loams and sandy clay loams. Weathered metamorphic rocks underlie auburn soils.

Argonaut soils are well-drained soils varying in depth from 20 to 40 inches. Color of surface soil ranges from brown to yellowish red or reddish brown. Subsoils are yellowish red, yellowish brown and brown silt loam, clay and rocky clay. Argonaut soil are underlain by andisite and related rocks.

Exchequer soils are shallow, yellowish red rocky silt loams ranging from 5 to 12 inches deep.

SITE INSPECTION

Visits were made to the property on July 12 and August 17, 18 and 19, 1999. The purpose of the first visit was to become familiar with the property and to locate sites for backhoe excavation. Forty-nine sites were excavated, observed and backfilled on the second visit. Soil samples were collected from several sites. A water sample was collected from a spring identified as site 18.
Soil profile descriptions (Attachment B), results of soil and water analysis (Attachment C), interpretation guides (Attachment D), and a set of maps with sampling locations and other information (Attachment E) is attached for your reference.

Soils were consistent with published descriptions. A major difference is that soil at some sites is deeper soil than the 24 to 40 inches indicated in the soil survey. Depths ranged from 3 to 48 inches. In a number of sites soils are underlain by sufficiently weathered parent material (rock) to increase effective depth to five or more feet.

Parent material is significantly variable over relatively short distances. All of the soils are derived from bedded (layered) material that has been turned on end. Rock more resistant to weathering underlies shallower soils and in many areas forms tombstone like outcrops. Where rock is less resistant to weathering, soils are deeper. A visual but horizontal example of the type of rock formation occurs along Highway 132 west of the . Visualize the formation rotated so that the bedding is on end and you can visualize variability over short distances.

Soil physical features are satisfactory. Soil water holding capacity is low to moderate, limited by depth. Irrigation will be required for wine grape production. Internal soil drainage is fair to good. Excessively wet soils may be a limitation in some locations during springs and early summers following wet winters. Root penetration will be limited where rocks limit depth.

Soil chemical properties are satisfactory. Neither excess salt, sodium nor boron will limit growth. Nitrogen, phosphorus, potassium, zinc and boron and possibly sulfur are low. Plant nutrition is affected by factors other than soil levels including soil depth, penetrability to roots, rootstock and others. Fertilization at planting and use of tissue analysis to determine fertilizer requirements of established vines is advised.

LIMITING SOIL FEATURES

Where soil depth is less than two feet and limited by intrusion of harder rock, cultivation will be difficult. In some areas, large rocks protrude above the soil surface. Shallow soils will also limit rooting depth, water holding capacity and the ability of soils to support a trellis system.

Shattering rock below intermittently shallow soils can enhance effective depth. Use of a D-8 or larger tractor to pull a shank to a depth of 3 to 5 feet will shatter all but the hardest parent material and rock outcrops. The ripping process will bring many broken rocks to the surface. They along with shattered outcrops will have to be removed. Perhaps they could be crushed and used for road base or other building material.

Slope above 12 to 15 percent presents risks to safety of equipment operators and erosion hazards. A primary risk is to personnel safety when slopes exceed 12 percent. Most areas with excessive slope are on the eastern part of the property projected for residential development. Restricting residential development to areas with slopes exceeding 12 percent can maximize area suitable for vineyard development.
Water movement down slopes is a primary cause of soil erosion. The need to maintain vegetation to prevent erosion precludes frequent cultivation of areas with erosion potential. Vegetation strips along existing streams will prevent erosion and will retain soil eroded from adjacent slopes. Vegetation maintained gentle swales will allow planting and will prevent erosion.

Several small, intermittent streams transect the area. Vegetation should be maintained on these areas to prevent soil erosion, allow surface drainage and to collect erosion from higher adjacent areas. Where impermeable subsoils or rock limits internal drainage, wet soils may occur during and following wet seasons. Irrigation may also result in wet soils in some areas. Wet soils may be unable to support equipment required for control of mildew and other plant pests. Grapevines will not tolerate prolonged periods with saturated soils, particularly during hot weather.

Installation of drain tile in swales and other areas subject to saturated soils will reduce the probability of deleterious effects.

LIMITING WATER FEATURES

Low salt content in water can reduce water penetration. Application of gypsum, maintenance of vegetation or other measures may be required to maintain good water penetration. Water quantity can be a major limitation in years with low rainfall. Diversion of water from creeks is subject to California law beyond scope of this report. Water rights and minimum flow and the amounts of other diversions should be determined prior to planting.

RECOMMENDED PRACTICES

The following practices are recommended to mitigate limitations and to alleviate risks:

1. Omit from consideration for vineyard areas with slopes in excess of 12%, stream channels, areas within 35 feet of stream channels, wet lands, areas with endangered plant species or sensitive habitat.

2. Bulldoze and remove rock outcrops.

3. Rip shallow parent material and rock to a depth of 4 feet. Remove surface rock.

4. Re-vegetate all disturbed areas as soon as practicable.

5. Maintain integrity of existing streambeds, including intermittent streambeds.

6. Install drain tile in areas subject to saturation. Recharge to existing streams.

7. Provide small amounts of nitrogen, phosphorus, potassium, boron and sulfur at planting.

8. Base future nutrient applications on leaf and petiole analysis.
9. Maintain vegetation for at least 35 feet on the side of each streambed, including intermittent streambeds.

CONCLUSION

Soils with alteration, and water quality with amendment, on the property are suitable for wine grape production. Slope, soil depth, rock outcrops and proximity to waterways limit acreage. About 900 acres, more or less, are plantable. Plantable areas will be separated by limiting features resulting in several blocks, some of which may be small.

A more detailed map and acreage estimate can be produced using global positioning equipment at moderate cost.

It has been a pleasure to be of service. Please call if you have questions, or if we can be of additional assistance.

Sincerely,

cc: Vince Petrucci
    Don Jackson

TECHCEI
## Report of Soil Analysis

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Report of Water Analysis

Identification

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Soil analyses provide information on a soil's nutrient-supplying ability, salinity, acidity or alkalinity. Fertilizer and amendment recommendations can be made using soil analyses coupled with the field's crop history, water supply and the general level of management. This interpretation was developed based upon correlation studies conducted under California conditions by university and government researchers.

**SP** SATURATION PERCENTAGE is the number of grams of water required to saturate 100 grams of soil. The water-holding capacity of a soil when irrigated and allowed to drain is approximately half the SP. About half the water-holding capacity is available for crop use. Approximate relationship of SP to soil texture follows:

- Below 20 Sandy or Loamy Sand
- 20 - 35 Sandy Loam
- 30 - 50 Loam or Silt Loam
- 50 - 65 Clay Loam
- 65 - 150 Clay
- Above 150 Usually Peat or Muck

**ESP** EXCHANGEABLE SODIUM PERCENTAGE is the degree to which the soil exchange complex is saturated with sodium. It is used to determine soil permeability and potential phytotoxicity. Organic soils have no minerals, so are not affected by sodium.

- Below 10 No permeability problem; however, sodium sensitive plants may show phytotoxicity such as chlorosis or slight yield reduction.
- 10 - 15 Soils with SP above 50 may have problems with permeability and/or phytotoxicity.
- Above 15 Permeability problems are likely on all mineral soils except those with an SP below 20. Most crops show phytotoxicity.

**pH** DEGREE OF ACIDITY OR ALKALINITY of a saturated soil.

- Below 4.2 Too acid for most crops.
- 4.2 - 5.5 Acceptable for acid-tolerant crops.
- 5.5 - 8.4 Acceptable for most crops.
- Above 8.4 Possible sodium problem; however, sodium problems can occur below 8.4.

**ECe** ELECTRICAL CONDUCTIVITY of the saturation extract is an index of salt content expressed as millimhos per centimeter or decisiemens per meter at 25°C. Salt will restrict crop growth as follows:

- Below 0.5 Water penetration may be impaired.
- 0.5 - 2 Under 2 No salinity problem for most crops.
- 2 - 4 Restricts growth of very salt-sensitive crops.
- 4 - 8 Restricts growth of all but moderately salt-tolerant crops.
- 8 - 16 Restricts growth of all but very salt-tolerant crops.
- Above 16 Only a few salt-tolerant crops grow satisfactorily.

**Cl** CHLORIDE in the saturation extract is expressed in milliequivalents per liter. For most crops, chloride is not a factor when the electrical conductivity is in a safe range.

**Ca**, **Mg**, **Na** ions in the saturation extract are expressed in milliequivalents per liter and are used to calculate ESP.

**GR** GYPSUM REQUIREMENT is the amount of gypsum, or its equivalent, required to furnish sufficient calcium to correct a sodium-caused permeability problem and/or phytotoxicity. It is determined when the ESP is above 10, Ca+Mg is less than three times the ECe or pH is above 8.4. GR is expressed in tons of 100% gypsum per acre-six inches of soil.

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<td>5.5 - 8.4</td>
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<td>Above 8.4</td>
<td>Possible sodium problem; however, sodium problems can occur below 8.4.</td>
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<td>Restricts growth of all but moderately salt-tolerant crops.</td>
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<td>8 - 16</td>
<td>Restricts growth of all but very salt-tolerant crops.</td>
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<tr>
<td>Above 16</td>
<td>Only a few salt-tolerant crops grow satisfactorily.</td>
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**Lime** LIME when reported by one to four pluses (+) indicates that acid-forming amendments (such as sulfur or sulfuric acid) may be used in place of gypsum. The number of pluses estimates the amount of lime present; a minus (-) indicates no lime present. The use of acidifying amendments may cause excessive pH reductions if used in the absence of lime. A numeric lime value is reported when pH is below 6.0. This number indicates the amount of 100% lime (CaCO₃) in pounds per acre-six inches required to adjust pH to 6.0.

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</thead>
<tbody>
<tr>
<td>Above 1</td>
<td>Sensitive crops may show visible injury.</td>
</tr>
<tr>
<td>5</td>
<td>Semi-tolerant crops may show visible injury.</td>
</tr>
<tr>
<td>10</td>
<td>Tolerant crops may show visible injury.</td>
</tr>
</tbody>
</table>

**Boron** in saturation extract is expressed as ppm and is required for crop growth but may be toxic. This test evaluates the soil's potential for boron toxicity. Use a different test to detect deficiencies.

<table>
<thead>
<tr>
<th>B</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 0.5</td>
<td>Not toxic for most crops but may be insufficient for some.</td>
</tr>
<tr>
<td>Above 1</td>
<td>Sensitive crops may show visible injury.</td>
</tr>
<tr>
<td>5</td>
<td>Semi-tolerant crops may show visible injury.</td>
</tr>
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<td>10</td>
<td>Tolerant crops may show visible injury.</td>
</tr>
</tbody>
</table>
NITRATE-NITROGEN is extracted with 1.0 Normal potassium chloride and expressed as ppm. Nitrogen levels are guides to use with tissue analyses, soil profile nitrogen levels and other information.

PHOSPHATE-PHOSPHORUS is extracted with 0.5 Molar sodium bicarbonate solution at pH 8.5 and expressed as ppm. Critical levels are listed below.

POTASSIUM is extracted with 1.0 Normal ammonium acetate solution at pH 7 and expressed as ppm. Critical levels are listed below and should be used with tissue analyses and plant conditions.

Zn, Mn, Fe, Cu are extracted with DTPA-TEA solution and expressed as ppm. Specific critical levels are listed below by crop.

SULFATE SULFUR is extracted with 1 Molar lithium chloride and expressed as ppm. Critical levels are listed below.

The following guide for soil nutrients should be considered along with other factors. Only critical levels listed are supported by correlative information. For critical levels of specific crops not listed, call Dellavalle Laboratory, Inc.

<table>
<thead>
<tr>
<th>CROP</th>
<th>PO₄-P ppm</th>
<th>K ppm</th>
<th>SO₄-S ppm</th>
<th>Zn ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Response likely below 10 50 5 -</td>
<td>Response not likely above 20 80 10 -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barley and Wheat</td>
<td>Response likely below 6 40 5 0.2</td>
<td>Response not likely above 12 60 10 0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>Response likely below 8 80 - 0.4</td>
<td>Response not likely above 12 100 - 0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>Response likely below 6 50 - 0.3</td>
<td>Response not likely above 12 80 - 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton (loamy soils)</td>
<td>Response likely below 5 40 - 0.4</td>
<td>Response not likely above 9 80 - 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton (clay soils)</td>
<td>Response likely below 5 60 - 0.4</td>
<td>Response not likely above 9 100 - 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce (cool season)</td>
<td>Response likely below 15* 50 - 0.5</td>
<td>Response not like above 25 80 - 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce (warm season)</td>
<td>Response likely below 5 50 - 0.5</td>
<td>Response not likely above 9 80 - 1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Plants may be especially responsive to PO₄-P fertilization when planted in cool early spring soils. Suggested PO₄-P levels do not apply if crop follows rice.
AGRICULTURAL WATER INTERPRETATION GUIDE

**EC mmhos/cm**

**ELECTRICAL CONDUCTIVITY** - This is an estimate of the concentration of soluble salts.

The interpretation of EC assumes that 10-20% of the total water applied passes through and below the root zone. In most cases deep percolation losses, due to inefficiency of irrigation practices, will satisfy the leaching requirement for the usual crops.

- Below 0.5: Depending on soil texture, water penetration problems may occur due to low salt content.
- Below 0.75: Low salinity hazard - can be used for most crops.
- 0.75 - 1.5: Medium salinity hazard - can be used for moderately salt tolerant crops.
- 1.5 - 3.0: High salinity hazard - can be used for highly salt tolerant crops.
- Above 3.0: Very high salinity hazard - generally not suitable for continual use except under most favorable conditions. Leaching is necessary.

The EC (mmhos/cm) multiplied by 640 is approximately equal to the concentration of total dissolved solids (TDS) in ppms.

**Ca, Mg, Na meq/l**

**CALCIUM, MAGNESIUM, SODIUM** - Major cations found in most waters. Solid calcium and magnesium carbonates (CaCO₃ and MgCO₃) form when the concentrations of these constituents are sufficiently high. For drip systems, preventative maintenance is necessary to avoid emitter clogging from formation of CaCO₃ and MgCO₃. Sodium is a problem when it is the dominant ion. Calcium, magnesium and sodium are used to calculate SAR.

**SAR**

**SODIUM ADSORPTION RATIO** - A calculated value used to estimate the exchangeable sodium percentage, ESP, of a soil after long-term use of water.

**SAR_adj**

**SODIUM ADSORPTION RATIO ADJUSTED** - This ratio takes into consideration the calcium precipitation from carbonates and bicarbonates. Permeability problems are more probable at a given SAR_adj with waters of low salinity than at high salinity. The relationship between irrigation water SAR_adj and soil ESP (exchangeable sodium percentage) is:

- **SAR_adj**
  - Below 6: No soil permeability problem expected due to sodium.
  - 7 - 9: Possible permeability problems with fine texture soils. (Saturation percentage above 50)
  - Above 9: Permeability problems likely on all mineral soils, with possible exceptions of very coarse textured soils. (Saturation percentage below 20)

**Cl meq/l**

**CHLORIDE** - Fruit crops and many woody ornamentals are chloride sensitive.

- Below 2: Satisfactory for all crops.
- 2 - 10: Range associated with leaf burn on chloride sensitive crops.
- Above 10: Generally unsatisfactory for chloride sensitive crops.

**CO₃²⁻, HCO₃⁻ meq/l**

**CARBONATE PLUS BICARBONATE** - These two major anions are related to the alkalinity of waters and are involved in the formation of CaCO₃ and MgCO₃. Waters relatively high in carbonate or bicarbonate may present special problems.