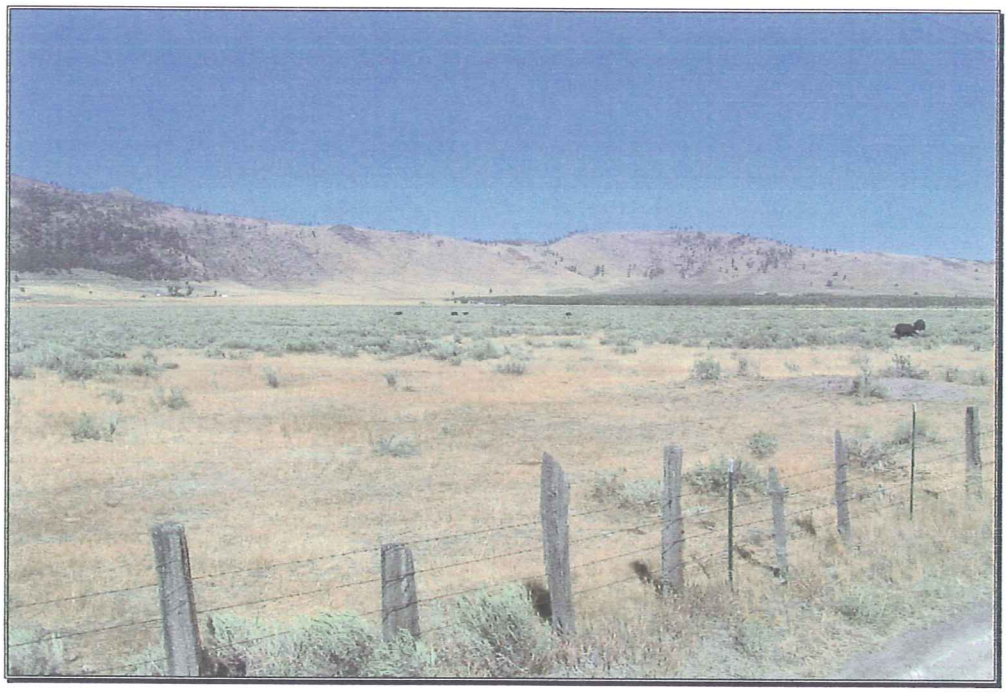
Report

LAND CAPABILITY CLASSIFICATION FIELD INVESTIGATION FOR PORTIONS OF PARCELS APN 010010009 AND 010010012

Prepared for

Sugar Loaf Ranch, LLC
571 Ridge Street
Reno, NV 89501



Denny M. Churchill
Consulting Soil Scientist
145 Cottonwood Court
Quincy, CA 95971
October 30, 2005

Executive Summary

The parcel assessment assembled the most current database for climate, soils, vegetation, landforms, and GIS coverage available to develop an evaluation of land capability class and livestock carrying capacity. The process incorporated information collected from numerous sources, including Plumas County Planning Department, USDA-Forest Service, USDA-Natural Resource Conservation Service (previously known as the Soil Conservation Service), and the University of California Cooperative Extension, just to name a few.

The analysis area is approximately 260 acres, and is located north of Maddalena Road in an area known as the Bonta Ranch. Slopes range from 0-4% and is comprised mainly of low terraces and swales. Vegetation is primarily sage-grass complexes, except in the areas converted to hay production, where a cereal grain-forbs complex prevails.

The original Sierra Valley Soil Survey (USDA-SCS, 1975) had placed most of the analysis area in land capability units III and IV. The soil map units for the analysis area were very broad, and tended to lump a wide variety of soil types into one capability class. This broad approach had a tendency to overlook sizable areas of both poorly and moderately productive lands.

The approach of this analysis was to fine-tune the existing soil survey by re-mapping the analysis area at a more refined scale. Digital orthographic photos (1:5,000 scale) were created using GIS technology, and soil associations or complexes were delineated using the digital images as stereo pairs. The photo delineations were then field verified through a series of representative transects. These transects were comprised of numerous soil hand auger exposures, and recorded soil profile characteristic descriptions. The result of this more detailed approach was an increase in land capability unit VI lands. Most of this reclassification was based on a more realistic evaluation of growth potential, chronic surface erosion, and salinity-alkalinity conditions.

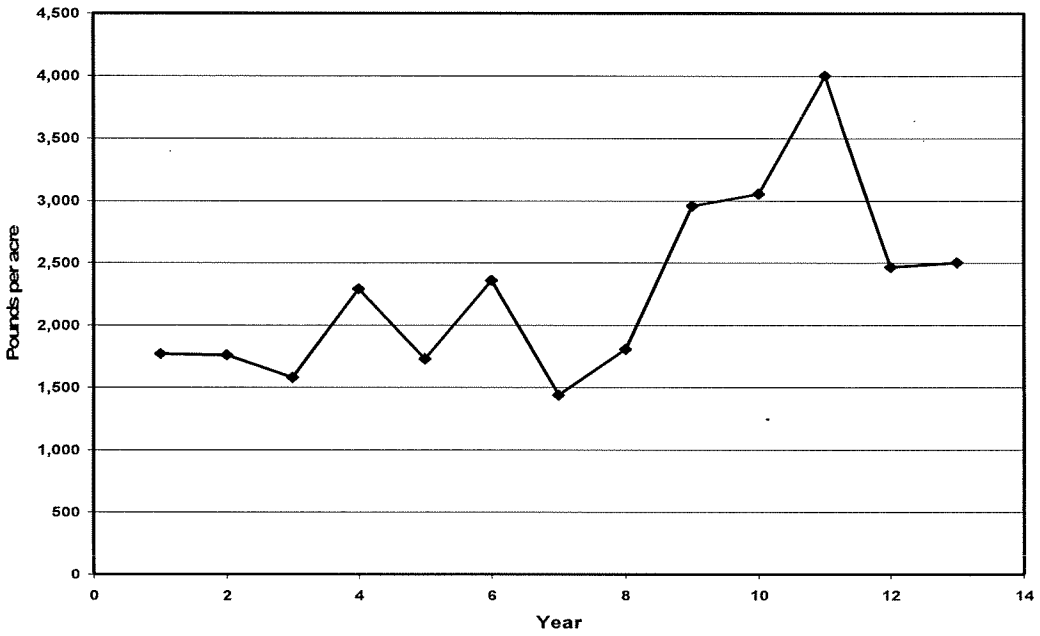
In the original 1975 soil survey, total potential herbage (vegetation suitable for livestock nutritional needs) production had been estimated and portrayed as Range Sites 1 thru 8. These range sites were based on geomorphic position on the landscape, such as intermediate mountains, wet meadows, or stony uplands. Herbage production was portrayed as two production figures (favorable and unfavorable), and was used to reflect the variations in growing conditions (i.e. drought, number of frost-free days, etc.). Range site values are generally not suited to estimate stocking rates or carrying capacity, but do give an observable estimate of potential productivity of the soil complexes within the respective range sites.

Once the soil map units were redefined, representative range transects were randomly located across the analysis area. Enough transects were done within each map unit to adequately define vegetative species composition and the percent of non-productive area (i.e. bare ground, rock outcrops, incised channels, etc.). Browse species were first rated

based on their nutritional value (poor to excellent), and then the carrying capacity (herbage production in pounds) of each soil map unit was estimated.

Carrying capacity was defined as the number of acres required to support an animal unit (generally a mature cow of approximately 1,000 pounds, and a calf as old as 6 months). Total forage required for an animal unit per month is approximately 790 pounds, and defines the animal unit month (AUM). It was determined that less than 1% of the analysis area could provide sufficient monthly forage on 8 acres or less per AUM, and was mostly confined to map unit Sw-C (Smithneck sandy loam, cultivated). The remainder of the analysis area ranged from 9 to greater than 20 acres per AUM. During prolonged dry seasons, these values could be even higher.

Figure 2 – Typical variability in rangeland forage production.



Research on grazing land value has been carried out by the Integrated Hardwood Range Management Program. These have shown how general rangeland site productivity, types of enterprises (such as livestock and hunt clubs), and risk affect land value, and annual lease value. The table and figure below show the results of this research.

Enterprise	Risk*	Good Range Site (1.3 – 2 AUMs per ac)		Poor Range Site (0.4 to 0.7 AUMs per ac)	
		Land Value ($/ac)	Lease value ($/ac/yr)	Land Value ($/ac)	Lease value ($/ac/yr)
Livestock Grazing	No Risk	$375	$15	$125	$5
	w/Risk	$325	$13	$100	$4
Grazing and Hunt Club	No Risk	$550	$22	$270	$11
	w/Risk	$500	$20	$170	$7

*Risk factor evaluated is a 1 in 10 chance of losing money

Report

LAND CAPABILITY CLASSIFICATION FIELD INVESTIGATION FOR PORTIONS OF PARCELS APN 010010009 AND 010010012

Prepared for

Sugar Loaf Ranch, LLC
571 Ridge Street
Reno, NV 89501

October 21, 2005

Denny M. Churchill
Consulting Soil Scientist
145 Cottonwood Court
Quincy, CA 95971

PARCELS APN 010-010-009 AND 012 - LAND CAPABILITY AND CARRYING CAPACITY FIELD INVESTIGATION

Introduction and Background

This report provides a summary of work conducted by Denny M. Churchill, Consulting Soil Scientist, for Sugar Loaf Ranch, LLC, on portions of Plumas County parcels APN 010-010-009 and 010-010-012. Figure 1 displays the boundary of the parcels, and the area to be analyzed. Pre-field work consisted of county planning department visitations, review of the Sierra Valley Area Soil Survey (USDA-SCS, 1975), assimilation of relevant citations and GIS coverage, and aerial photo delineation of potential soil map units at a more rigorous scale than the original soil survey. Field investigations included reconnaissance soil profile determinations using a hand auger, range and vegetation transects, and representative soil profile descriptions.

The goal of this assessment was to evaluate arable[1] lands classified as Agricultural Preserve (AP) at a more refined scale, with the intent of identifying other potential land use opportunities if appropriate. General plan determinations are designed for broad land use interpretations, and are not intended for site-specific use. With that in mind, the approach for this assessment was spatial in nature, and the evaluation criteria were based on the following environmental indicators:

- Land Capability Unit Classification.
- Grazing lands with a carrying capacity of 8 acres or less per animal unit month (AUM).

To assist in this effort, numerous geospatial sources were utilized to identify the analysis area, and display the various types of information available. The Plumas County Assessor's parcel GIS coverage was used to delineate the parcel boundary. The Sierra Valley Soil Survey had been digitized, and is the basis for the delineations of soil type and land capability units under the existing land use classification. Digital Ortho Quarter Quadrangles (DOQQ) are digitized aerial photos that are registered to various coordinate planes (State and UTM to name the most common), were used to delineate soil map units at a finer scale. Additionally, the National USDA-NRCS web site contained a considerable amount of climatic information that was useful in determining growth and yield potential throughout Sierra Valley.

This document represents the results of the analysis, describes the methodology utilized to define the analysis, and assesses the information collected in terms of land use.

[1] Arable lands: Lands so located that production of cultivated crops is economical and practical (Glossary of Soil Science Terms, Soil Science Society of America).

Assessment Methodology

Land Capability Units, Classes and Subclasses

The original soil survey for Sierra Valley was done at a scale of 1:24,000, and was intended for general agriculture and urban planning. The soil delineations were identified by field observation and remotely sensed data. Phases of soil series and miscellaneous soil and land types are included in the map units. At this scale, map units typically are 5-10 acres in size, but can often be larger, as was the case in the Sierra Valley survey. Because of the larger map unit sizes, some areas were considered to be more homogeneous than actually was the case. This leads to fairly large areas classified as the same land capability unit, and would have the same carrying capacity for livestock utilization. The approach for evaluating the analysis area was to fine-tune the existing soil survey using the following approach:

- Map at a scale of 1:6,500.
- Individual soils, along with small areas of inclusions such as rock outcrops, minor areas of other soils, and springs or seeps, were delineated on aerial photos.
- Soils within each delineation were identified by transecting or traversing, with soil boundaries being observed throughout their length. Hand auger holes were dug at specific locations along these transects in order to describe specific soil characteristics, and to identify representative locations for further analysis.
- Once representative sites were identified, that is, locations best displaying the soil and land types of the parcel, soil profile characteristics were identified and described according to appropriate protocol.

Since soil surveys are based on all of the characteristics of soils that influence their use and management, interpretations are needed for each of the many uses. Among these interpretations, the grouping of soils into capability units, subclasses, and classes, is one of the most important. This grouping serves as an introduction of the soil map to farmers and other land users. The relationship of soil-mapping units to capability classification is as follows:

Soil-mapping unit

A soil-mapping unit is a portion of the landscape that has similar characteristics and qualities whose limits are fixed by precise definitions. The most specific management practices and estimated yields are related to the individual map unit.

Capability subclass

Subclasses are groups of capability units, which have the same major conservation attributes, such as:

e – Erosion and runoff
w– Excess water
s – Root-zone limitations
c – Climate

Capability unit

A capability unit is a grouping of one or more individual soil mapping units having similar potentials and continuing limitations and hazards. Capability units with the class and subclass, furnish information about the degree of limitation, kind of conservation problems, and the management practices needed. The following table defines land capability units being used in California.

Table 1 Guide For Placing Soils In Land Capability Units In California (See Appendix A)

Capability Units	Principle Soil Property or Limitation
1	Potential or actual wind or water erosion hazard
2	Drainage or overflow hazard. Somewhat poorly or poorly drained, flooded or ponded.
3	Slowly or very slowly permeable subsoil or substrata.
4	Coarse or gravelly textures.
5	Fine or very fine textures.
6	Salinity or alkali, sufficient to constitute a continuing limitation or hazard.
7	Stones, cobbles, or rocks sufficient to interfere with tillage.
8	Hardpan or hard unweathered bedrock within the root zone.
9	Low inherent fertility, associated with strong acidity, low calcium-magnesium ratio or excess calcium, boron, or molybdenum.
10	High organic matter – peats and mucks.
11	Coarse sandy or very gravelly substrata limiting to root penetration and moisture retention.

Capability class

Capability classes are groups of capability subclasses or capability units that have the same relative degree of hazard or limitation, the risks of soil damage or limitation in use become progressively greater from class I to class VIII. Only information concerning general agricultural limitations in soil use is obtained at the capability class level. The following is the general grouping of capability classes:

Land Suited to Cultivation and Other Uses

Class I – Soils in Class I have few limitations that restrict use.
Class II – Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices.
Class III – Soils in Class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.
Class IV – Soils in Class IV have very severe limitations that restrict the choice of plants, require very careful management, or both.

Land Limited in Use – Generally Not Suited to Cultivation

Class V – Soils in Class V have little or no erosion hazard but have other limitations impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover.
Class VI – Soils in Class VI have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.
Class VII – Soils in Class VII have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.
Class VIII – Soils and landforms in Class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply or to esthetic purposes.

Once the soil mapping units had been refined for the project area, specific climate, landform, and soil properties were used to develop the land capability units. These specific properties were effective rooting depth, evapotranspiration potential, surface soil layer texture, permeability, drainage class, available water holding capacity, slope class, erosion hazard, flood hazard, potential salinity and alkalinity, presence of toxic substances, and length of frost free season. These factors were run through a series of matrices (located in Appendix A), and the land capability class was determined.

Rangeland Carrying Capacity

Range condition surveys were based on the present state of the vegetation, and estimated forage potential. The Sierra Valley Soil Survey discussed at length potential or historic climax plant communities that may have populated Sierra Valley over time, therefore no further discussion of potential plant communities will be made in this report.

Rangeland productivity is a function of soil properties, landform or position on the landscape, and climate. Certain conditions, such as severe erosion, frequent flooding, prolonged drought, and the number of frost-free days, all have an effect on site productivity potential.

During representative soil mapping unit transects described earlier, toe-point tallies (as defined in Range Analysis Handbook, USDA-Forest Service) were performed in order to describe ground surface conditions (% exposed soil, surface gravel pavement, rocks, organic litter, and moss and lichens), percent shrubs, and percent herbaceous species.

From this data collection, an estimate was made of potential forage (dry weight) available for livestock utilization.

In determining the carrying capacity of the land, two sources of information were utilized: Range Analysis Handbook (USDA-Forest Service) mentioned earlier, and the National Range and Pasture Handbook (USDA-Natural Resource Conservation Service).

Determining animal unit equivalents and animal unit months

The animal-unit is a convenient denominator for use in calculating relative grazing impacts of different kinds and classes of domestic livestock and of common wildlife species. For this analysis, carrying capacity was based on the following definition from the NRCS National Range and Pasture Handbook (NRPH): an animal unit (AU) is generally one mature cow of approximately 1,000 pounds and a calf as old as 6 months, or their equivalent. An animal unit month (AUM) is the amount of forage required by an animal unit for one month.

The following table illustrates animal unit needs:

Table 2 Animal Unit Equivalents Guide (USDA-NRCS NRPH, Ch.6, Pg. 6-9)

Kinds/Classes of Animals	Animal-unit equivalents	------Forage consumed (lbs)-------		
		day	month	year
Cow, dry	0.92	24	727	8,730
Cow, with calf	1.00	26	790	9,490
Bull, mature	1.35	35	1,067	12,811
Cattle, 1 year old	0.60	15.6	474	5,694
Cattle, 2 years old	0.80	20.8	632	7,592
Horse, mature	1.25	32.5	988	11,862
Sheep, mature	0.20	5.2	158	1,898
Lamb, 1 year old	0.15	3.9	118	1,423
Goat, mature	0.15	3.9	118	1,423
Kid, I year old	0.10	2.6	79	949
Deer, white-tailed, mature	0.15	3.9	118	1,423
Deer, mule, mature	0.20	5.2	158	1,898
Elk, mature	0.60	15.6	474	5,694
Antelope, mature	0.20	52	158	1,898
Bison, mature	1.00	26	790	9,490
Sheep, bighorn, mature	0.20	5.2	158	1,898
Exotic species (To be determined locally)				

Once the species usage is determined from table 2, the next step is to calculate the estimated grazing capacity rating in terms of acres per animal unit month. The following table was used in the field to estimate that capacity:

Table 3 Grazing capacity computing table – Cattle (USDA-Forest Service, Range Analysis Handbook, Pg. 265.1)

Net pounds Avail. forage	Acres/cow with calf	Net pounds Avail. forage	Acres/cow with calf
19-21	60.00	166-178	7.00
22-23	55.00	179-192	6.50
24-25	50.00	193-209	6.00
26-28	45.00	210-229	5.50
29-32	40.00	230-253	5.00
33-37	35.00	254-309	4.50
38-42	30.00	310-331	3.75
43-46	27.50	332-355	3.50
47-50	25.00	356-383	3.25
51-56	22.50	384-417	3.00
57-61	20.00	418-456	2.75
62-65	19.00	457-504	2.50
66-69	18.00	505-563	2.25
70-73	17.00	564-638	2.00
74-77	16.00	639-736	1.75
78-83	15.00	737-828	1.50
84-89	14.00	829-889	1.40
90-96	13.00	890-960	1.30
97-104	12.00	961-1043	1.20
105-114	11.00	1044-1143	1.10
115-123	10.00	1144-1263	1.00
124-130	9.50	1264-1412	.90
131-137	9.00	1413-1600	.80
138-145	8.50	1601-1846	.70
146-155	8.00	1847-2182	.60
156-165	7.50	2183-2667	.50

To put the last two tables in perspective, the following is a summary of data developed for range site potential, based on landscape position, soil characteristics, and climate. Information was developed during the Sierra Valley Soil Survey (October, 1975), and gives a broad over-view of potential forage production that was likely to occur in the analysis area.

Range site 1: *Intermediate mountains, 12 inch + precipitation zone.* This site consists of sandy loams on fans and foot slopes around the edge of the valley floor, and in or around small valleys in the upland areas. Estimated total annual herbage production is 1,400 pounds per acre in favorable years and 900 pounds per acre in unfavorable years.

Range site 3: *Shallow stony uplands.* This site consists of very stony loams, very cobbly sandy loams or areas where 10 to 25 percent of the surface area is rock outcrops, and is

located on the upland fringe of Sierra Valley. Estimated total annual herbage production 900 pounds per acre in favorable years and 550 pounds per acre in unfavorable years.

Range site 5: *Claypan terraces*. This site consists of loams and sandy loams that generally have a very slowly permeable claypan at 8 to 20 inches, and are located on low benches that merge with the valley floor. Estimated total annual herbage production is 500 pounds per acre in favorable years and 300 pounds per acre in unfavorable years.

Range site 6: *Wet meadows*. This site consists of moderately deep to deep clay loams, clays and mucky silty clays. They are primarily located almost entirely in Sierra Valley in the area of the valley basin north of Sierraville and in broad drainages west of Vinton. the estimated total annual herbage production is 4,500 pounds per acre in favorable years and 3,000 pounds per acre in unfavorable years.

Project Environment

During the course of uplift of the Sierra Nevada and the breakup of the region farther east, not only were the existing drainage lines interrupted, but also closed basins developed on crustal blocks depressed relative to the blocks adjacent to them. Each closed basin became occupied by a lake. Lakes close to the Sierra Nevada, but now extinct, occupied many locations including Sierra Valley, Mohawk Valley, Long Valley, and many other locations in Plumas and Sierra Counties. Lake Beckwourth, as it was called, occupied Sierra Valley. Its shoreline, at an altitude of approximately 5,100 feet, is not easily seen around most of the basin, although it is marked by gravelly terraces that are very old beaches. The area of the lake was approximately 180 square miles, and the outlet was by way of the canyon now followed by the Middle Fork Feather River east of Portola (Durrell, 1987).

Soils within the analysis area developed on terraces and fans bordering Sierra Valley, and the valley bottoms and lowlands. In all cases, these soils are formed from mixed alluvium, either from sediments that in-filled the ancient lake, or recent deposition and colluvium that moved down from the uplands by erosion and gravity. These soils vary from well drained to very poorly drained, range in textures from sandy loams to coarse loamy sands, and some soils have restrictive layers such as cemented hardpans or claypans. Erosion potential is slight to moderate, and is dominated by wind related scouring and deposition. Figure 2 displays the original soil map units from the 1975 soil survey, and the following table summarizes those map units:

Table 4 1975 Soil Map Units for the Analysis Parcels (USDA- SCS, 1975)

Map Unit	Map Unit Components	Land Capability Class	Pasture (Acres/AUM)
Bf	Beckwourth loamy course sand, 0-2% slopes	IVw-4	7

Table 4 1975 Soil Map Units for the Analysis Parcels (USDA- SCS, 1975) continued

Map Unit	Map Unit Components	Land Capability Class	Pasture (Acres/AUM)
BsA	Bidwell sandy loam, sandy substratum, 0-2% slopes	IIIs-0	10
Lo	Loyalton fine sandy loam, 0-2% slopes	IVs-6	4

The climate of the area is cool and semiarid to subhumid. Winters are cold and summers are dry and cool. Data collected at the Sierraville Ranger Station for the period of 1971-2000, showed average annual precipitation was 22.38 inches, with at least 35 days per year when there was at least 1 inch of snow on the ground. Average annual temperature for this same period was 46.3°F, with extremes ranging from 104°F to –29°F. Potential evapotranspiration is estimated to be less than 15 inches per year. Of primary importance is the period of time that is available for biological activity to take place, defined as the "growing season[2]". Estimated length of the growing season for the area is 60 to 90 days, but is more appropriately expressed in terms of frost-free days. From data collected at the Sierraville Ranger Station, table 5 displays daily average temperatures, and the probability of occurrence in a 10 year period:

Table 5 Daily average temperatures (Sierraville Ranger District, 1971-2000)

Probability	# of days >24°F	# of days >28°F	# of days >32°F
9 years in 10	127	95	58
8 years in 10	139	105	67
5 years in 10	162	125	85
2 years in 10	184	145	103
1 year in 10	196	155	112

Results and Discussion

The analysis area is approximately 260 acres in size, and is comprised mostly of valley in-filled sediments that have eroded and redeposited over time. Wind erosion plays a major factor in the physical features observed on the landscape today. Surface loss of topsoil exceeded 6 inches or more in some locations, and the deposition of course sands in some locations created small dunes and hummocks. Well over half of the analysis area had, at one time, been converted to hay production and pasture. This conversion appeared to have included land leveling, some irrigation development, and seeding of cereal grains. As with other areas in Sierra Valley, herbicide application may also have been utilized, in order to increase forage production of desirable plant species.

[2] That portion of the year when soil temperature (measured at 20 inches below the surface) is above biological zero (41°F). Estimated starting and ending dates for the growing season are based on 28°F air temperature thresholds at a frequency of 5 years in 10 (USACE Wetlands Delineation Manual, 1992)

In some locations, salinity and alkalinity conditions are prevalent, and soil productivity is severely reduced. In most cases, soils were moist below 25-30 inches, and there is some evidence that ground water may be present at these depths sometime during the growing season.

Land Capability Classification Evaluation

Figure 3 represents the revised soil map units, based on field investigations done in September of 2005. The following table is a summary of soil map units that were developed based on site-specific observations:

Table 6 Revised Soil Map Units

Map Unit Symbol	Mapping Unit	% of Analysis Area
Bf	Beckwourth loamy coarse sand, 0-2% slopes	35
Bf-C	Beckwourth loamy coarse sand, cultivated, 0-2% slopes	18
Bf-E	Beckwourth-clay bottoms complex, eroded, 0-4% slopes	6
BmA	Beckwourth-Loyalton complex, saline-alkaline, 0-2% slopes	17
BmA-C	Beckwourth-Loyalton complex, saline-alkaline, cultivated, 0-2% slopes	6
OrA	Ormsby loamy coarse sand, 0-2% slopes	10
OrA-C	Ormsby loamy coarse sand, cultivated, 0-2% slopes	7
Sw-C	Smithneck sandy loam, cultivated, 0-2% slopes	1

Map unit Bf: This map unit is located on the lower lake terraces, and was formed in basic alluvium. Beckwourth loamy coarse sand dominates the unit. Slope generally is less than 2%, but there are areas where slopes are up to 4%. There are areas that had been land leveled or graded, and type-converted to cereal grains, but these areas are reverting back to their previous vegetative communities. Included in this map unit are small amounts of Loyalton sandy loam, and Ormsby loamy coarse sand. Vegetation is dominated by native grasses and introduced cereal grains, low sage, and forbs. Surface rock content is less than 5%. Soils are well drained, and erosion is slight to moderate.

Land-capability classification: VIe-4, with inclusions of IVe-1 and VIs-1.

Map unit Bf-C: This map unit is similar to map unit Bf, except it has been subjected to considerable land manipulation such as brushing and land grading, conversion of native vegetation to cereal grains, and some areas may have been irrigated, although irrigation does not appear to have been extensive. It is located mainly on the low lake terraces, and is primarily formed in basic alluvium. Beckwourth loamy coarse sand dominates the unit. Slope is generally less than 2%, but there are minor areas that are 3-4%. Included in this unit are areas of Smithneck sandy loam, and Ormsby coarse loamy sand. Vegetation is dominated by introduced cereal grains, but low sage, rabbit brush and native grasses are beginning to re-occupy the site. Soils are moderately well to well drained, and surface erosion is slight, moderate in the openings.

Land-capability classification: VIe-4, with inclusions of IVe-1.

Map unit Bf-E: This map unit is located on the lower lake terraces, and was formed in basic alluvium. The terrain is irregular and broken, with brush covered hummocks or mounds, interspersed with low swales and poorly drained clay bottoms. This map unit best represents what most of the analysis area looked like prior to land manipulation. The hummocks are dominated by Beckwourth loamy coarse sands, while the low swales are mainly dense clays and coarse sands and gravels. The hummocks are well drained, while the swales are poorly drained. Both water and wind erosion is prevalent throughout this map unit. Vegetation on the hummocks is low sage and rabbit brush, while low forbs and grasses can be found in the swales.

Land-capability classification: VIIe-1, with inclusions of VIe-1.

Map unit BmA: This map unit is on the lower lake terraces, and is a complex comprised primarily of Beckwourth loamy coarse sand, and Loyalton fine sandy loam. The Beckwourth soils are located on broad smooth plains, while the Loyalton soils are adjacent to remnant channels or small flood plains related to the remnant channels. This map unit formed in mixed alluvium. Like map unit Bf-E, this map unit probably represents a good example of the natural landscape prior to manipulation for hay production and pasture. Many areas in this map unit were moderately saline-alkaline, and soil productivity was measurably reduced. A small percentage of this map unit had been manipulated for hay production and pasture, but native vegetation is beginning to dominate the landscape. Vegetation is primarily low sage, rabbit brush, and mixed grasses. Surface rock content is less than 5%. Soils are well drained, and erosion is slight to moderate.

Land-capability classification: VIc-6, with inclusions of IVe-1 and VIIe-1.

Map unit BmA-C: This map unit is similar to map unit BmA, but had historically undergone considerable brushing and grading, along with planting of cereal grains and other grasses. Slope is generally less than 2%. Beckwourth loamy coarse sand dominates the map unit. Included in the map unit are Ormsby coarse loamy sands, and Smithneck fine sandy loam. Ormsby soils are found on low dunes, while Smithneck soils are near remnant channels and small flood plains. Many areas in this map unit were moderately saline-alkaline, and soil productivity was measurably reduced. Vegetation is dominated by non-native cereal grains, but native low sage and grasses are beginning to re-occupy the site. Soils are well drained, and erosion is slight to moderate.

Land-capability classification: VIc-6, with inclusions of IVe-1 and VIe-6.

Map Unit OrA: This map unit is located on lower lake terraces, and developed from mixed alluvium. Eolian or wind deposited sands dominate the landscape. This map unit is comprised primarily of Ormsby loamy coarse sand. Slope is generally less than 2%. Included in this map unit are Beckwourth loamy coarse sands, and unknown poorly drained clay soils. The Ormsby soils are located on remnant dunes, while the Beckwourth soils are on broad, flat plains. The unknown clay soils are of minor extent and are in low swales and depressions. Surface rock content is less than 5%. Vegetation is dominated by

low sage and mixed grasses. With the exception of the low swales, soils are well drained and moderately erosive.

Land-capability classification: VIe-4, with inclusions of IVw-4.

Map unit OrA-C: This map unit is located on lower lake terraces, and developed from mixed alluvium. This map unit is similar to map unit OrA, but had historically undergone considerable brushing and grading, along with planting of cereal grains and other grasses. Slope is generally less than 2%. Included in this map unit are small areas of Beckwourth loamy coarse sands. Ormsby soils are located on remnant dunes, while the Beckwourth soils are on graded hummocks and flat plains. Vegetation is dominated by non-native cereal grains, but low sage, rabbit brush, and native grasses comprise 20-25% of species that are re-occupying the map unit. Surface rock content is less than 5%. Soils are well drained, and moderate to highly erosive.

Land-capability classification: VIe-4, with inclusions of IVe-1 and VIIe-1.

Map unit Sw-C: This map unit is located on lower lake terraces, and developed from mixed alluvium. It is comprised primarily of Smithneck sandy loam, and is of small extent. It is located on low, nearly level plains, and had undergone historical brushing and grading, along with planting of cereal grains and other grasses. Slope is generally less than 2%. Included in this map unit are small incised channels that may have been converted to irrigation ditches in past years. Vegetation is dominated by non-native cereal grains, with some encroachment of native shrubs and grasses. Surface rock content is less than 5%. Soils are moderately well drained, and slight to moderately erosive.

Land-capability classification: IVc-1, with inclusions of IVe-1 and VIe-1.

Carrying Capacity Evaluation

Representative range transects were conducted in order to define both vegetative species composition and range condition. The following table displays the dominant and co-dominant vegetative species in terms of percent occurrence over a 100 foot transect, with estimates made at intervals of 5 feet:

Table 7 Percent occurrence (hits) of dominant and co-dominate species, and bare ground

Transect #	*Low Sage*	*Mules Ear*	*Rabbit Brush*	*Bitter Brush*	*Pasture**	*Grasses/Forbs*	*Bare Ground*
9/19-1	5	0	0	0	35	2	10
9/19-2	8	0	0	0	64	0	18
9/19-3	38	0	12	0	0	54	23
9/20-1	3	0	0	0	62	12	22
9/20-2	19	0	10	0	0	49	24
9/20-3	15	0	5	0	0	10	15

* Cleared and cultivated lands planted in cereal grains and/or alfalfa

In assessing rangeland potential, it is important to evaluate plant species in terms of nutritional values. Over-all browse value is a way to rate various plant species for their ability to satisfy nutritional needs for domestic livestock and wildlife. The dominance of certain species can raise or lower the over-all carrying capacity of the land. The following table lists the dominant and co-dominant browse species observed in the project area:

Table 8 Browse ratings for domestic livestock and deer (Pub. 4010, University of California, 3/93)

	Over-All browse Values*				
Common Plant Name	Cattle	Horses	Sheep	Goats	Deer
Big sage	4-5	5	3-4	3-4	2-4
Silver sage	4-5	5	4-5	4	3-4
Rabbit brush	4-5	5	3-4	3-4	3-4
Bitter brush	2-3	2-3	1	1-2	1
Fescue	1	1	1	1	1
Wheatgrass	1	1	1	1	1
Needlegrass	1-2	1-2	1-2	1-2	1-2
Cheatgrass brome	1-2	1-2	1-2	1-2	1-2

- The over-all rating symbols are: 1= excellent; 2 = good; 3 = fair; 4 = poor; 5 = useless

Livestock have historically grazed the analysis area, and the present plant communities differ greatly from their original, or climax condition. Sage and shrub species have replaced what were once mixtures of grasses, forbs and sparse sagebrush. Even the soils have observable differences, and these are reflected by their ability to produce different kinds and amounts of vegetation. Factors such as erosion, restricted drainage, or salt and alkalinity concentrations have all had a profound affect on the ability of the land to produce sufficient forage. Compound these factors with a high percentage of poor or non-palatable browse species, and the ability of the land to support profitable livestock operations declines.

In the project area, as well as most of Sierra Valley, the single most relevant factor affecting dryland or non-irrigated operations is precipitation. Rainfall is extremely variable, and drought is common in the arid west. The following table will represent estimated animal unit months (AUM) for each of the soil map units. The estimates are based on total annual herbage production for both favorable (average or above average precipitation) years, and unfavorable (less than average precipitation) years. As described for table 2, an animal unit is generally a mature cow of approximately 1,000 pounds and calf as old as 6 months. Total forage required is 790 pounds per month. Figure 5 displays the acres required, by soil map unit, to support the animal unit month (AUM).

Table 9 Estimated carrying capacity (herbage production in pounds)

Soil Map Symbol	Annual herbage production (lbs)		Monthly herbage production (lbs)		Acres/AUM Required
	Favorable year	Unfavorable year	Favorable year	Unfavorable year	
Bf	1100	700	92	58	13-20
Bf-C	1600	900	133	75	9-16
Bf-E	800	400	66	33	16-20
BmA	1100	700	92	58	13-20

Table 9 Estimated carrying capacity (herbage production in pounds) continued

Soil Map Symbol	Annual herbage production (lbs) Favorable year	Unfavorable year	Monthly herbage production (lbs) Favorable year	Unfavorable year	Acres/AUM Required
BmA-C	1600	900	133	75	9-16
OrA	800	400	66	33	16-20
OrA-C	1200	800	100	67	12-18
Sw-C	2000	1200	167	100	7-12

As seen in table 9, map unit Sw-C (Smithneck sandy loam, cultivated, 0-2% slopes) is the only soil map unit in the analysis area that can provide a basic carrying capacity of 8 acres per AUM, and that is only under ideal growing conditions. Since this map unit is not irrigated, productivity is variable and totally dependent on annual climatic conditions.

REFERENCES

Crampton, B. Range Plants. University of California. 1968.

Durrell, C. Geologic History of the Feather River Country, California. University of California Press. 1987.

Stechman, J.V. Common Western Range Plants. California Polytechnic University. 1986.

University of California, Div. of Agriculture and Natural Resources. Pub. 4010, California Range Brushlands and Browse Plants. 1993.

USACE. Corps of Engineers Wetlands Delineation Manual. 1987

USDA-Forest Service. Range Analysis Handbook. 1969.

USDA-NRCS. National Soil Survey Handbook. 1996.

USDA-NRCS. National Range and Pasture Handbook. 1997.

USDA-NRCS. Agriculture Handbook No. 18, Soil Survey Manual. 1993

USDA-SCS. Soil Survey of Sierra Valley, Parts of Sierra, Plumas, and Lassen Counties. 1975

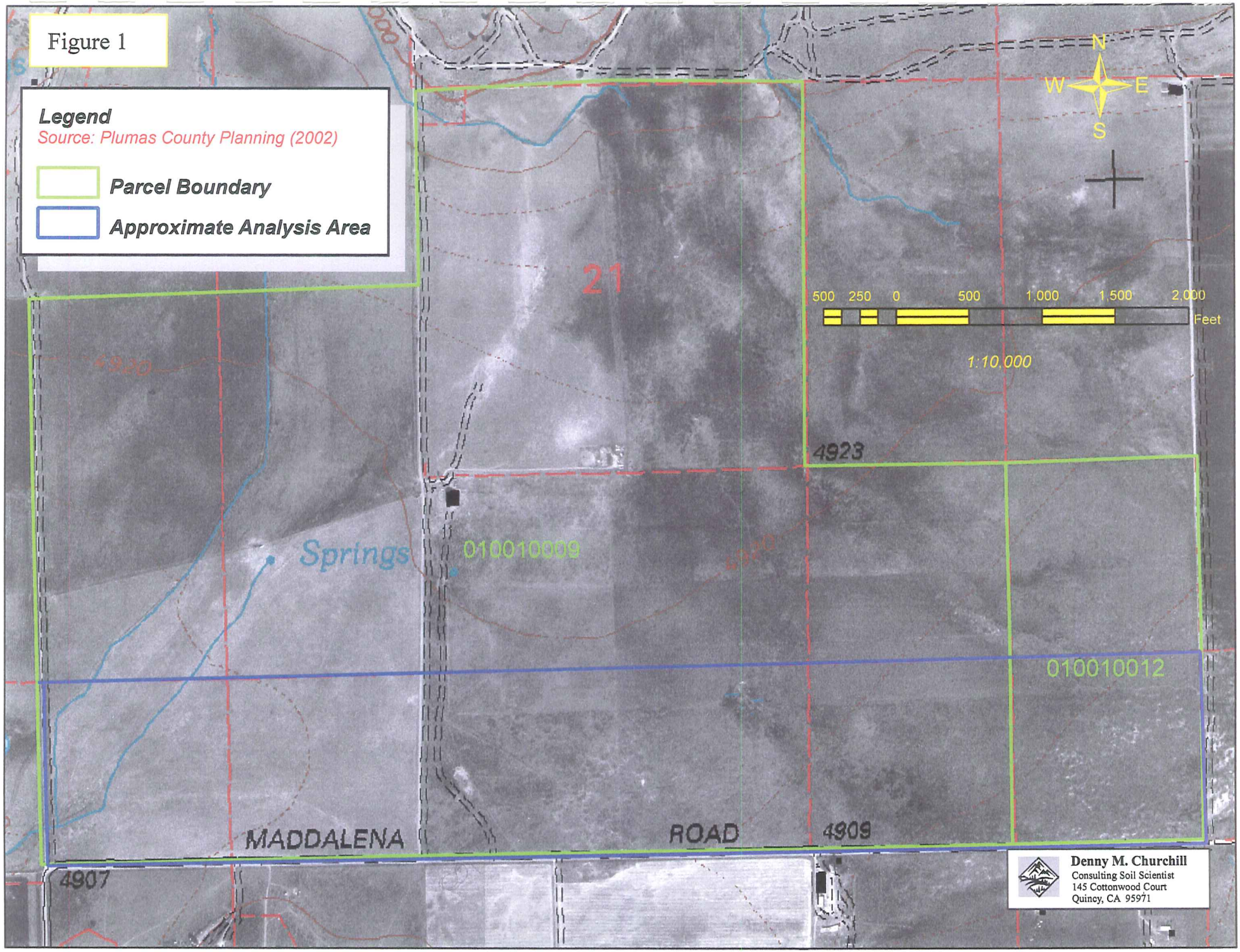


Figure 1
Legend
Source: Plumas County Planning (2002)
Parcel Boundary
Approximate Analysis Area
N
W
E
S
21
500 250 0 500 1,000 1,500 2,000
Feet
1:10,000
4923
Springs
010010009
010010012
MADDALENA
ROAD
4909
4907
4920
Denny M. Churchill
Consulting Soil Scientist
145 Cottonwood Court
Quincy, CA 95971

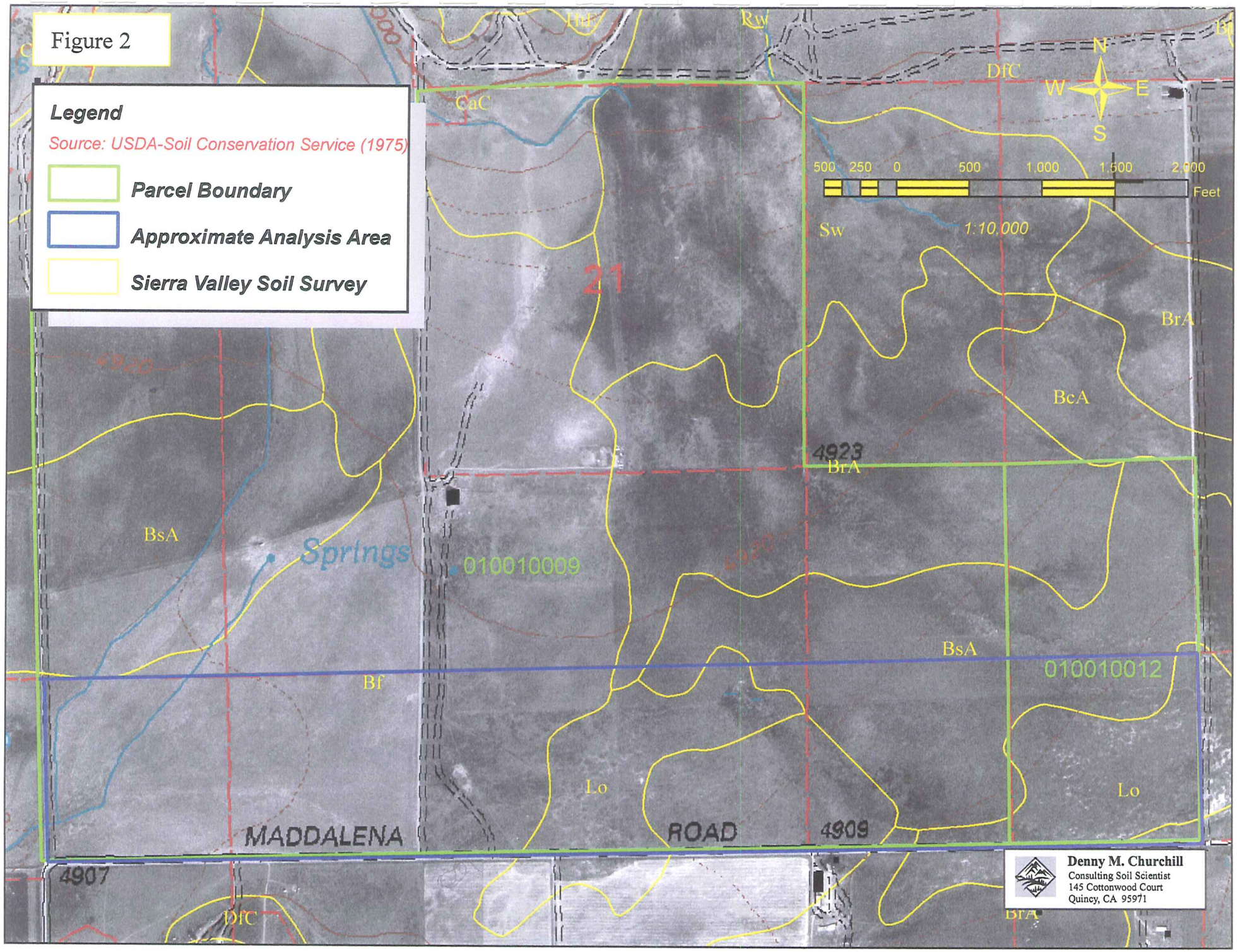
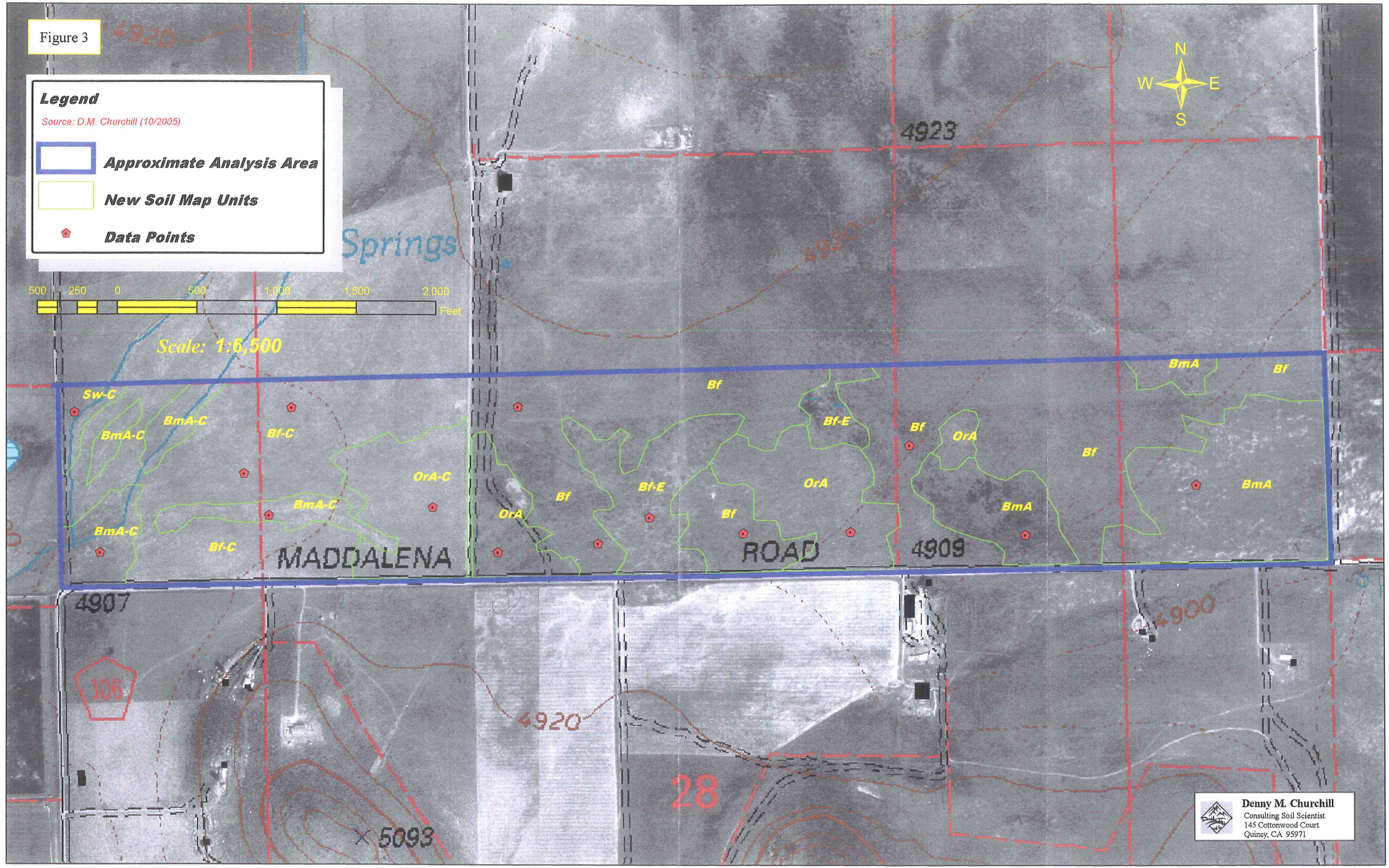


Figure 2
Legend
Source: USDA-Soil Conservation Service (1975)
Parcel Boundary
Approximate Analysis Area
Sierra Valley Soil Survey
N
W
E
S
500 250 0 500 1,000 1,500 2,000
Feet
1:10,000
CaC
DfC
Rw
Sw
21
BrA
BcA
4923
BsA
Springs
010010009
Bf
Lo
MADDALENA
ROAD
4909
4907
010010012
Denny M. Churchill
Consulting Soil Scientist
145 Cottonwood Court
Quincy, CA 95971

Figure 3


Legend
Source: D.M. Churchill (10/2005)
Approximate Analysis Area
New Soil Map Units
Data Points
500 250 0 500 1,000 1,500 2,000
Feet
Scale: 1:6,500
N
W
E
S
4920
4923
Springs
4920
Sw-C
BmA-C
BmA-C
Bf-C
OrA-C
BmA-C
BmA-C
Bf-C
MADDALENA
Bf
Bf
Bf-E
OrA
Bf
Bf-E
OrA
Bf
OrA
BmA
ROAD
4909
BmA
Bf
BmA
4907
106
4920
28
4900
5093
Denny M. Churchill
Consulting Soil Scientist
145 Cottonwood Court
Quincy, CA 95971

APPENDIX A

LAND CAPABILITY CLASSIFICATION

Appendix A: Guide For Placing Soils In Capability Classes In California (USDA- NRCS, California, 1/2004)

Capability Class	Effective Soil Depth (Inches) 1/	Climate Thornthwaite 1948 Indices(in) Irrigated ETp 32F	Dry 4ETa	Suface Layer Texture Irrigated	Dryland	Permeability 2/	Drainage Class 3/	Available Water Capacity 4/	Slope A 5/ 6/ 7/	Slope B 5/ 6/ 7/	Erosion Hazard	Flood Hazard	Salinity ECx1U @ 25°C 8/	Alkali ESP 8/	Toxic Substances 9/	Frost Free Season
1 (I)	≥40	≥20	≥20	Sandy Loam thru Clay Loam	Sandy loam thru Clay Loam	Mod. Rapid thru m Mod. Slow	Well or Mod. Well >60 inches	≥7.5 inch av. AWC ≥0.13 in/in	<2%	<2%	None or Slight	None or Rare	<4 mmhos (none)	None	None	≥140 Days
2 (II)	≥40	≥14	≥16	Loamy Sand thru Clay-may be gravelly	Sandy Loams thru Clay-may be gravelly	Rapid thru Slow	Somewhat Poorly thru Somewhat Excessively >36 inches	≥ 5.0 inch av. AWC ≥ 0.8 in/in	<5%	<8%	None thru Mod.	None thru Occas.	<8 mmhos	< 25	None or Slight	≥ 100 Days
3 (III)	≥20	≥10	≥12	Any, may be Gravelly or Cobbly	Sandy Loam thru Clay (may be gravelly or cobbly)	Rapid thru Very Slow	Poorly thru Excessively >20 inches	≥3.5 inch av. AWC ≥0.6 in/in	<8%	<15%	None thru High	None thru Occas.	<16 mmhos	<50	None thru Mod.	≥80 Days
4 (IV)	≥10	≥6	≥8	Any, may be Very Gravelly, Very Cobbly or Stony10/	Loamy Sand thru Clay,Very Cobbly or Very Stony10/	Any	Poorly thru Excessively >20 inches	≥2.5 inch av. AWC ≥0.04 in/in	<15%	<25%	Any	None thru Frequent 11/	<16 mmhos	<50	None thru Mod.	≥50 Days
5 (V)	≥20	≥6	≥8	Any, may be Ext. Gravelly, Ext. Cobbly or Very Stony	Any, may be Ext.Gravelly, Ext. Cobbly or Very Stony	Any	Any	≥3.0 inch av. AWC	<2%	<2%	None or Slight	Any	<8 mmhos	<25	None or Slight	Any
6 (VI) 12/	≥10	≥4	≥6	Any, may be Ext. Gravelly, Ext. Cobbly or Very Stony	Any, may be Ext. Gravelly, Ext. Cobbly or Very Stony	Any	Any	≥2.0 inch av. AWC	<25%	<50%	Any	Any	Dry land: <16 mmhos Irr: Any	Dry Land: <16 mmhos Irr: Any	Dry Land: Slight Irr: Slight thru Mod	Any
7 (VII) 13/	Any	≥2	≥2	Any	Any	Any	Any	≥1.0 inch av. AWC	<50%	<75%	Any	Any	Any	Any	Any	Any
8 (VIII) 14/	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any

GUIDE FOR PLACING SOILS IN LAND CAPABILITY UNITS IN CALIFORNIA

(July, 1999)

Capability Units	Principle Soil Property or Limitation
1	Potential or actual wind or water erosion hazard.
2	Drainage or overflow hazard. Somewhat poorly or poorly drained, flooded or ponded.
3	Slowly or very slowly permeable subsoils or substrata.
4	Coarse or gravelly textures.
5	Fine or very fine textures.
6	Salinity or alkali , sufficient to constitute a continuing limitation or hazard.
7	Stones, cobbles, or rocks sufficient to interfere with tillage.
8	Hardpan or hard unweathered bedrock within the root zone.
9	Low inherent fertility, associated withy strong acidity, low calcium-magnesium ratio or excess calcium, boron, or molybdenum.
10	High organic matter – peats and mucks.
11	Coarse sandy or very gravelly substrata limiting to root penetration and moisture retention.

Appendix A. - Guide for Placing Soils in Capability Subclasses in California - Guides A and B (USDA-NRCS, California, 1/2004)

(Only soils in capability classes 2 through 8 are assigned to a subclass.)

Soil Properties	Guide A - For placing soils in land capability subclasses where wind velocities are low and/or soils are irrigated. Subclass by Slopes 1/				Guide B - For placing soils in land capability subclasses where high wind velocities occur and the soil is not irrigated. Subclass by Slopes 1/			
	0-2%	2-9%	9-15%	15+%	0-2%	2-9%	9-15%	15+%
1. Moderately slowly, moderate, moderately rapidly, rapidly and very rapidly permeable; moderately well, well, somewhat excessively and excessively drained soils (over 20" deep) with the following surface textures:								
a. Fine and very fine textured	s	e	e	e	s	e	e	e
b. Moderately fine textured	s 2/ 3/	e	e	e	e	e	e	e
c. Medium textured	s 2/ 3/	e	e	e	e	e	e	e
d. Moderately coarse textured, with or without textural B	s 2/ 3/	e	e	e	e	e	e	e
e. Coarse and very coarse textured with textural B	s	e	e	e	e	e	e	e
f. Coarse and very coarse textured with little or no textural B	s	s	s	e	e	e	e	e
2. Slowly and very slowly permeable soils (over 20" deep): 4/								
a. Well and moderately well drained	s	e	e	e	s	e	e	e
b. Somewhat poorly drained	w	e	e	e	w	e	e	e
3. Wet, poorly and very poorly drained soils:								
a. Moderately coarse to fine textured surface soils includes day pans and fragipans	w	w	w	e	w	w	w	e
b. Coarse textured soils with little or no textural B 5/	w	w	w	e	w	w	w	e
c. Deep organic soils 5/	w	w	w	e	w	w	w	e
4. Excessively, somewhat excessively, wed and moderately well drained, shallow and very shallow soils:								
a. 10 to 20" to bedrock	s	e	e	e	s	e	e	e
b. 0 to 10" to bedrock	s	s	s	s 5/	s	s	s	s 6/
5. Somewhat excessively, excessively, wall and moderately well drained saline and sodic soils (moderate to severe salinity and sodicity):	s	e	e	e	s	e	e	e
6. Very and extremely cobbly; very and extremely gravelly; and very and extremely stony surface layers:	s	s	s	s 6/	s	s	s	s 7/
7. Soils subject to damaging overflow:	w	w	w	e	w	w	w	e

1/ For soils in capability classes 2 through 8. Class 1 land excluded.
2/ These soils over 40' deep are generally class 1.
3/ Use 'C' only for dryland if soil is class 1 irrigated.
4/ Permeability of the B horizon or control section.
5/ Including somewhat poorly drained soils.
6/ Subclass "e" if slope is more than 50 percent
7/ Subclass "e" if slope is more than 50 percent.

Capability Subclasses Definitions

e - erosion
w - Excess water
s - Soil limitations w/in the rooting zone
c - Climatic limitations

APPENDIX B

PHOTO LOG

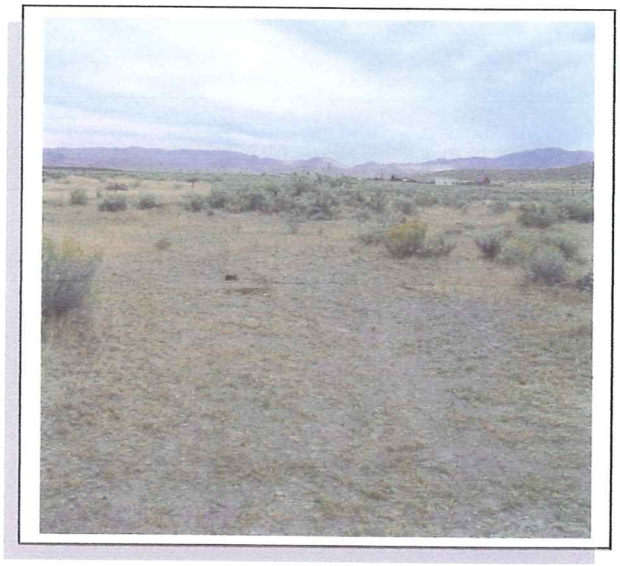
SITE PHOTOS

Beckwourth-Loyalton Complex, cultivated, 0-2% slopes

Beckwourth loamy coarse sand, cultivated, 0-2% slopes

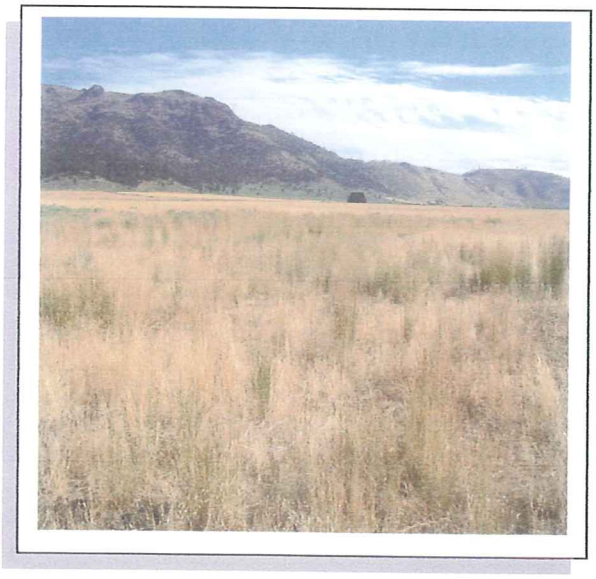
Smithneck sandy loam, cultivated, 0-2% slopes

Ormsby loamy coarse sand, 0-2% slopes



Beckwourth-bottom lands complex, eroded, 0-4% slopes

Typical Beckwourth profile



Northeast from Maddalena Road

Northwest from Maddalena Road