Site Evaluation and Soil Investigation For Nicol Property

Two Parcels 75.8 acres and 49.6 acres

Cunningham Lane
Yamhill County, Oregon

For: Robin and Gorham Nicol

November 24, 2020

By: Andy Gallagher, Red Hill Soils
Corvallis, Oregon

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INTRODUCTION

This report provides detailed soil information for vineyard suitability of the 125 acres Nicol Property on Cunningham Lane, Yamhill County, Oregon that is made up of two parcels: one that is 75.8 acres; and one that is 49.6 acres. Detailed soil mapping in other vineyards of the Willamette Valley has demonstrated that soils are more diverse than they are shown at the scale of the NRCS soil survey. Soil diversity and soil quality within the vineyard can profoundly affect wine grape management and quality. A more precise soil map of relevant soil properties is needed to determine site suitability to winegrapes and to support decision making in developing potential new vineyards and to help meet the goals of wine grape production.

In this investigation terrain and soils were evaluated for suitability for winegrapes. Soils were sampled to classify the soils and terrain including slope gradient and aspect and to make a revised soil map of areas suited to winegrapes. This report gives the results of soil investigations and provides interpretations for vineyard development.

Soil investigations included soil borings from soil pits made across the slopes to sample soil profiles and to record soil properties including parent material, drainage class, depth to bedrock, depth to gravel, surface thickness, soil texture of the surface and the subsoil and available water holding capacity. Borings locations were recorded with a global positioning system (GPS). Three soil pedons were analyzed for soil fertility and chemical properties in the surface layer and in the subsoil layer.

Previous Soil Mapping

The previous NRCS soil survey map of the site showed predominantly clayey soils formed from sedimentary rocks. These soils range from shallow to very deep and from well drained to poorly drained. Large areas on the upper slopes were previously mapped as well drained Melbourne-Goodin Complex and Witham soils and Hazelair soils. Pengra soils were mapped on the footslope on the west side of the parcel. Saum soils were previously mapped in the southeast part of the property.

The geology of this site is colluvium and alluvium from sedimentary rocks. The footslope areas may have thin deposits of the Missoula Flood silt overlying bedrock and clayey paleosol. The lower part of the site below 400 feet would have been inundated by the Ice Age Floods. The north part of Chehalem Valley is constricted just south of Gaston and the flood waters would have been funneled here and pushed against the east side of this narrow valley. The low footslopes would have been scoured by the floodwater and this would likely have removed the upper layers of soils and resulted in soils that are shallow to sedimentary rocks and more resistant clay layers.

The underlying siltstone and sandstones are mostly fissured and crumbly but in places bedrock is more consolidated. Slopes within the surveyed area are typically less than 20 percent slope gradient though slopes go up to 30 percent. There are short steeper slopes that exceed 30 percent slope gradient that are considered too steep for vineyard development. There is about 370 feet of vertical relief with an elevation range from 230 ft up to 600 ft above sea level (Figure 2). Slope aspect is mainly west with gentle roll to either the south and north on parts of the hillslopes.

This site has similar soils and is geologically and topographically similar to Ribbon Ridge and a good case could be made for extending Ribbon Ridge to include this site (Figure 3).

Soil Mapping and Sampling

Twenty soil borings were made on these two properties. Borings were five feet deep soil pits or to the contact with hard bedrock if shallower.

Soils were classified according to USDA-Soil Taxonomy. Soil characteristics were compared to the current Official Series Descriptions (OSD's) from the USDA-NRCS. Slopes were classified using a digital elevation model for slope gradient and slope aspect. Soil colors were determined using a Munsell Color Chart. Available water holding capacity (AWHC) for each soil was estimated based on soil texture, structure, coarse fragments, depth to rock and available water retention data for these soil series.

RESULTS

Summary soil boring data are presented in Table 1. The revised soil map is Figure 4 along with the revised soil legend. Soil boring locations 1-20 are shown on the maps. GPS coordinates are in Table 3.

There are an estimated 25 to 30 acres suitable to winegrowing in Lot 2000, and an estimated 35 to 40 acres suitable in Lot 800.

Soil Classifications and Soil Series Summaries

A Bellpine-Windygap complex (9 acres)

These soils share a deep reddish- brown clayey subsoil and both are formed in colluvium and paleosol. The Windygap soils are deeper than Bellpine, and both are well drained.

Bellpine silty clay loam
Depth to Weathered Siltstone: Moderately deep (20 to 40 inches)
AWHC: Moderate 4 to 8 inches
Drainage Class: well drained
Description: Bellpine soils are on benches, low ridges, and shoulder slopes. These soils have high organic matter in the surface and reddish-brown silty clay loam and clay in the subsoil with siltstone or sandstone below. The bedrock is typically highly weathered and has many fissures and soil-filled cavities with abundant root channels and clay coatings. The soils have moderately low to moderate AWHC and produce moderate vine vigor. They are among the oldest most highly developed and most weathered of the sedimentary rock soils in the Willamette Valley. Bellpine soils are found on some of the best vineyards in the sedimentary soil landscapes of the Willamette Valley.

Windygap silty clay loam
Depth to Weathered Siltstone: Deep >40 inches
AWHC: Moderately high 8 to 10 inches
Drainage Class: well drained
Description: Windygap soils are in the same landscape as Bellpine but are deeper. Like Bellpine they have reddish brown clayey subsoil and overlie siltstone and sandstone. Winegrapes will have more vigor in Windygap soils than in Bellpine.

B Goodin-Willakenzie-Steiwer complex (19 acres)

These soils are well drained and moderately deep to siltstone and sandstone. The Goodin soils are more clayey than Willakenzie and Steiwer. Willakenzie soils have a more development in the subsoil than Steiwer. The Steiwer soil profile is simple with a thick dark silt loam surface and a weakly developed silty subsoil that overlies weathered siltstone and sandstone. There is enough variability within the map unit that these are mapped as a complex. They could be mapped separately but it would take additional soil sampling. These soils will manage similarly but will produce different qualities in wine.

Goodin silty clay loam
Depth to Weathered Siltstone: Moderately Deep 20 to 40 inches
AWHC: Moderately high 5 to 7 inches
Drainage Class: well drained

Description: Goodin soils are in between the Bellpine and the Willakenzie in properties. The Goodin has higher clay content like Bellpine but are similar color and base saturation as Willakenzie. These soils produce moderate vigor in winegrapes.

Willakenzie silty clay

Depth to Weathered Siltstone: Moderately Deep 20 to 40 inches
AWHC: Moderately high 5 to 7 inches
Drainage Class: well drained
Description: Willakenzie soils are loamier and have less clay than both Goodin and Bellpine. Willakenzie is the name many use synonymously with winesoils formed in sedimentary rocks reflecting its importance to the wine industry in Willamette Valley.

Steiwer silt loam

Depth to Weathered siltstone and sandstone: 20 to 40 inches
AWHC: moderately low to moderate 4 to 6 in
Drainage Class: well drained
Description: Stewer soils are on benches, sideslopes above drainageways. These soils have moderate AWHC and vigor potential and are excellent winesoils. They have a high organic matter content in the surface and loamy subsoil. In most cases roots extend into the strongly weathered siltstone. On some sites these are mapped in complex with Chehulpum but here they are mapped with the Willakenzie and Goodin soils. They are excellent winesoils.

C Chehulpum (8 acres)

Depth to Weathered Siltstone: Shallow to siltstone 12 to 20 inches
AWHC: very low to low 2 to 4 inches
Drainage Class: well drained
Description: Chehulpum soils occur on benches, convex nose slopes, sideslopes above drainageways and on prominent narrow ridges. These soils are droughty with low available water holding capacity. In most cases roots extend into the strongly weathered siltstone, the siltstone is finely divided and not root restrictive here. Vine vigor potential is low and more vigorous rootstocks should be used in dryland conditions. This map unit includes inclusions of very shallow soil like boring 5. These soils may be droughty unless irrigated especially during establishment years, until roots fully occupy the site. The rocks range from soft weathered highly fissured siltstone, to strongly banded silty sandstone and hard dark gray sandstone. Though the weathered rocks are near the surface there are many roots that penetrate to 40 inches and more. In some cases, the rocks become more massive with depth and the roots fewer and fewer below 40 inches.

D Dupee (15 acres)

Depth to Weathered siltstone: moderately deep to deep
AWHC: 6 to 9 inches
Drainage Class: somewhat poorly to moderately well drained

Description: These soils are on sideslopes and at the heads and sides of drainage ways. They have clayey subsoil and a well-developed argillic horizon in the subsoil. The lower part of the soil is often formed in a variegated clayey paleosol, a much older soil. Intercept drainage in this area will help reduce soil wetness and transporting water down slope in a pipe to a safe outlet will reduce soil erosion in the drainage ways. Some of the soils here are moderately deep and are transitional to Goodin but with high water table typical of Dupee. Dupee soils occur between the well drained A and B map units and the wetter F map unit. These soils produce fine wine when soil water is managed properly. Many of the vineyards on Ribbon Ridge and Yamhill Carlton District have a Dupee component.

E Carlton (4 acres)

Very deep
AWHC: high 10 inches
Drainage Class: moderately well drained
Description: These soils are on footslopes and on heads and sides of a drainage way. These soils have a thick dark surface layer that is 20 inches or more. They have weakly developed subsoil horizons. Intercept drainage in this area will help reduce soil wetness and small drainage lines connected to a main line can transport water down slope to a safe outlet to reduce water erosion. These soils have high available water holding capacity and will produce a moderately high vine vigor.

F Hazelair (15 acres)

Depth to Weathered Siltstone: 20 to 40 inches
AWHC: 4 to 7 inches
Drainage Class: somewhat poorly drained to moderately well drained
Description: Hazelair soils formed in silty over very clayey sediments and weathered siltstone. The surface is dark colored silty clay loam. The very clayey subsoil has smectitic mineralogy that makes the soils swell when wet and crack when dry. They are wet in the winter and spring and droughty in late summer making them more complicated to manage. Typically, Hazelair soils need artificial drainage and irrigation to produce at their full potential.

G Steep drainageways and poorly drained

This map unit is the areas where the terrain is poorly suited to planting vineyards or where the soils are very clayey and poorly drained. This unit includes steep ravines and short slopes where slope gradients are more than 30 percent.

Bedrock (R and Cr horizon)

In the Sedimentary Rock soils the bedrock layer ranges from soft paralithic (Cr) to hard lithic (R) layers and from shallow Chehulpum to moderately deep Bellpine Willakenzie, Hazelair and Steiwer to deep Dupee and Windygap. The softer paralithic siltstone holds some available water and the many fissures are partly filled with clayey soil material and there is morphological evidence of roots either past or present. The harder rock was observed in a couple pits at depths beyond 40 inches. Siltstone is desirable from the perspective of many winegrowers who generally like the character of wines that have their roots in weathered rock.

Available Water Holding Capacity (AWHC)

Values reported in Table 1 are generally for the soil above the rock contact. In cases where roots extend into the soft sedimentary rock the whole rooting depth is included in the estimate for available water holding capacity The table values are an estimate of the water that can be stored in the soil profile that is available for plant uptake, which is the amount of water held between field moisture capacity and the permanent wilting point (reported in inches of water). For soils where the roots extend deeper into bedrock fissures this is an underestimate. The value reported is calculated from a model based on the sum of the weighted average AWHC for each soil horizon, using values reported in the literature and measured soil profile data at each numbered point.

The AWHC is a function of soil depth, texture, organic matter, bulk density, porosity, and soil osmotic potential. Root restricting layers decrease the depth of the soil profile and the AWHC. The hard bedrock, though fissured, lacks fine pores and therefore restricts the volume of available water the soil can hold.

Clay soils can hold more “total” water because they have greater total pore space. However, because much of the pore space is made up of extremely small pores, clay soils hold a greater proportion water that is unavailable at greater soil moisture tension compared to silt loam for example. Since the majority of grape roots are in the upper soil profile, it can be assumed that the AWHC values for the upper five feet provide a useful relative scale of the variability in water supply available to the vine for the classes used here. Organic matter content and silt content are positively correlated with AWHC.

The shallow Chehulpum soils have the least AWHC. The moderately deep soils like Bellpine and Steiwer have moderate AWHC though these can be droughty especially in the early life of the vines and in very droughty weather cycles. The more clayey Hazelair soils can be droughty as well because they have tight clay, subsoil wetness and strongly acidic subsoils. The deeper clayey soils have a lower effective AWHC in the early years of the vineyard until root systems fully occupy the soil profiles. Variability in AWHC can be addressed with blocking and management practices including combinations of micro-irrigation, vine spacing, canopy management, use of drought tolerant rootstocks, and managed competition from cover crops and weeds. Soils with higher AWHC like the Carlton soils can be managed under dry land conditions, and rootstock selections may favor those that reduce vigor in deep soils.

Managed competition involves selecting combinations of cover crop mixtures, mowing and tillage options that are suitable to the soil water and soil productivity balance.

More vigorous grass cover crops can help reduce water available to vines in deep soils, and in droughty soils less competitive cover crops may be more appropriate and alternate row tillage can be used to further reduce competition. Mulching in the vine row will help conserve soil moisture and may be especially useful on all soils in the establishment year before vines have put down a deep root system.

Soil Drainage

The soil drainage classes on the plantable ground here range from somewhat poorly drained Hazelair to moderately well drained Carlton and Dupee soils to the well drained Bellpine, Windygap, Willakenzie, Chehulpum and Steiwer. All but the well drained soils would benefit from artificial drainage. Artificial drainage or tile drainage reduces the duration and degree of subsoil wetness. Intercept drainage can be used here on wet soils on slopes to capture excess soil water. Intercept drainage is the use of perforated drain lines buried a couple feet deep and that run 1% off the contour line to capture side hill flows. This reduces the contribution of subsurface water from uphill parts of the landscape. Vineyards should not be planted in the drainage ways or in the bottomland areas. Concentrated flows of surface runoff can cause severe erosion in drainageways and these are best left in grass or converted to reservoir.

Soil Quality and Soil Conservation

Soil quality involves managing the physical, chemical, and biological components of the soil towards the goal of overall soil health. Healthy soil has an active and healthy biotic community; it has good tilth and nutrient balance. Tilth is the physical condition of the soil relative to ease of tillage, its suitability as a seedbed and its impedance to seedling emergence and root penetration. Organic soil amendments and additions of calcium as either lime or gypsum can improve soil aggregation, tilth and nutrient status of the soil and can stimulate the biotic community.

Maintaining high soil organic matter is a soil quality target that can be met by using cover crops and compost additions. More aggressive use of cover crops can be used to reduce vine vigor on the deeper soils.

There are some highly erodible slopes on this parcel. There is a severe hazard of soil erosion if the soils are worked late in fall and cover is not established before winter. Cover crop establishment in October is important and placing straw bales in any erosion channels that form in winter can prevent small problems from getting a lot worse

Severe erosion events can be triggered by intense rain falling on saturated or frozen soils, or by rain on snow events. Such conditions may only have a calculated return period of 10 or 20 years, but if a grower is caught with bare sloping ground at such an unfortunate time, a lifetime's worth of soil development can be lost in one year. Soil loss rates from 10 to 100 tons acre^{-1} year^{-1} have been recorded for such events in the Willamette Valley. It is critical to protect these soils from erosion with cover in rainy season.

Soil Analysis

Soils from three soil pedons were sampled at two depths, surface, and subsoil for complete analysis for nutrients and soil chemical properties. The surface layer “A” samples and for the subsoil “B” samples. Sample numbers correspond to soil borings. Lab sample 8A is from boring 8 surface horizon and 8B is from boring 8 subsoil 24-36 in. and so on. Laboratory recommendations were made based on the surface samples, and additional recommendations are made here based on both surface and subsoil samples. Lab reports are attached to this report.

These soils have a range of low to high organic matter (2 to 5 percent) in the surface and medium to high in the subsoil (3 to 4 percent). This represents a good pool of nitrogen, sulfur and other nutrients that can be released from organic matter during the growing season. And the microbes breaking down organic matter help maintain and improve soil structure and soil tilth. Much should be done in management to try and maintain soil organic matter.

The bases are imbalanced in these soils because they are naturally strongly weathered, there is low calcium and medium to very high magnesium. The soil pH is strongly acid and should be raised with the use of lime. Recommendations from the lab are for 2 to 3 tons lime per acre. Probably no more than 3 tons total lime should be added at a time.

Surface and subsoil potassium levels are low to medium and potassium is low for two subsoil samples and high for one. 150 pounds per acre potash fertilizer are recommended.

These soils are low to very low in phosphorus in the surface and subsoil. This is typical of soils in the foothills that are in natural vegetation, but in a productive vineyard there should be a higher level of phosphorus. The lab calls for 300 pounds P_20_5 per acre but it is more common practice to add small amount of P in planting hole and then use foliar sampling to guide P nutrition after vines are planted.

Zinc concentrations are low to very low. Foliar Zn should be used to guide fertilizer treatments the lab recommends 10 pounds per acre. Every surface sample is very low in boron and the recommendation is for 2 pounds actual B per acre.

It appears that there is a need for additional soil fertility in the areas sampled and that foliar nutrients should be checked regularly in the next couple years to check for additional needs.

Lab results are attached to this report.

Table 1. Summary soil boring data

Boring	Soil Series	Surface thickness	Depth to gravel	Depth to sedimentary rock	Depth to smectite clay	Depth to Seasonal high water table	Available water holding capacity
		IN	IN	IN	IN	IN	IN
1	Carlton	20	60	60	-	20	11
2	Chehulpum	14	14	14	-	43	5
3	Hazelair	12	28	28	12	12	5
4	Chehulpum	8	14	14	-	60	4
5	Chehulpum (very shallow)	6	0	11	-	60	4
6	Hazelair	17	34	34	17	17	5
7	Bellpine	13	34	34	-	60	6
8	Dupee	17	60	60	50	17	9
9	Windygap	9	55	55	-	60	9
10	Dupee (moderately deep)	17	31	31	-	24	6
11	Goodin	19	35	35	-	60	7
12	Goodin	14	22	22	-	60	5
13	Dupee (moderately deep)	14	38	38	-	28	8
14	Panther	17	>45	>45	17	9	6
15	Hazelair (deep)	41	41	41	24	24	7
16	Hazelair	15	21	21	15	15	4
17	Chehulpum (very clayey)	9	18	18	9	9	3
18	Steiwer	22	22	22	-	60	5
19	Willakenzie	17	26	26	-	60	5
20	Goodin	16	26	26	-	60	5

Table 2. Soil map units from Figure 4 and soil interpretations.

Map unit	Soil series	Depth class	Drainage class	Vineyard potential
A	Bellpine-Windygap complex	Moderately deep to deep	Well drained	Excellent, moderate vigor, suitable for dry farmed and irrigated
B	Goodin-Willakenzie-Steiwer complex	Moderately deep	Well drained	Excellent, moderate vigor suitable for dry farm and irrigated
C	Chehulpum	Shallow	Well drained	Excellent, lower vigor, often irrigated, but also dry farmed
D	Dupee	Deep to very deep	Somewhat poorly to moderately well drained	Very good, needs artificial drainage and can have higher vigor where soils are very deep
E	Carlton	very deep	Moderately well drained	Good, these soils have moderately high vigor potential and will have less wetness that more clayey Hazelair and Dupee
F	Hazelair	moderately deep	Somewhat poorly to moderately well drained	Need artificial drainage and irrigation to overcome winter wetness and summer drought limitations
G	Steep drainageways and poorly drained soils	--	--	Not suitable because slopes are too steep or because surface water and saturated clayey soils

Table 3. GPS locations of soil borings.

Soil boring	Latitude	Longitude
1	45.390812	-123.091591
2	45.390478	-123.090237
3	45.391183	-123.091611
4	45.390707	-123.089742
5	45.390205	-123.089794
6	45.390663	-123.087856
7	45.390347	-123.086649
8	45.389625	-123.086749
9	45.389263	-123.086246
10	45.389507	-123.083694
11	45.389302	-123.084399
12	45.390693	-123.082536
13	45.39071	-123.081296
14	45.393222	-123.082654
15	45.393658	-123.083322
16	45.39422	-123.083759
17	45.393972	-123.084146
18	45.393217	-123.084129
19	45.392627	-123.084394
20	45.39514	-123.084684

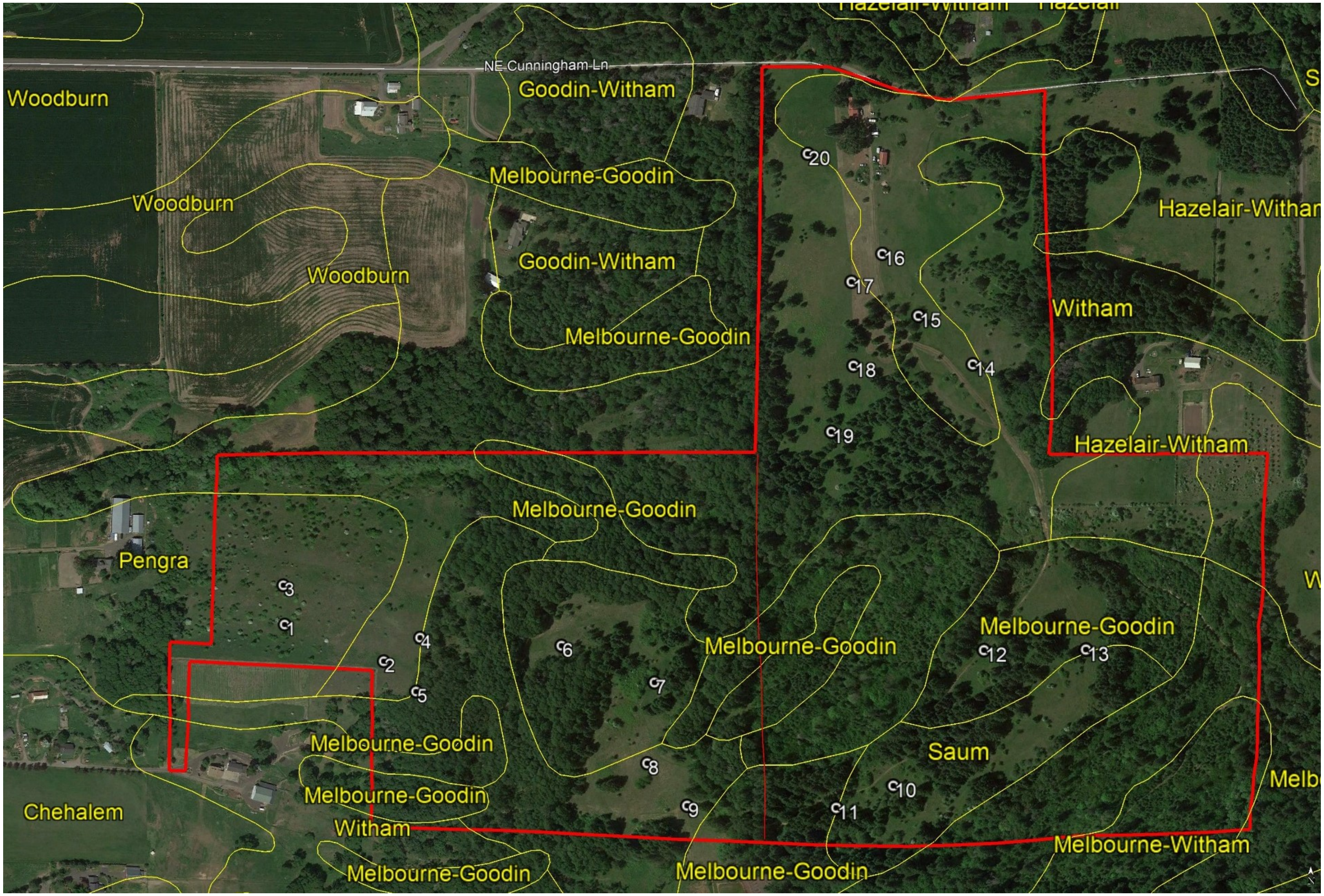

Figure 1. Previous NRCS soil survey of the tract.

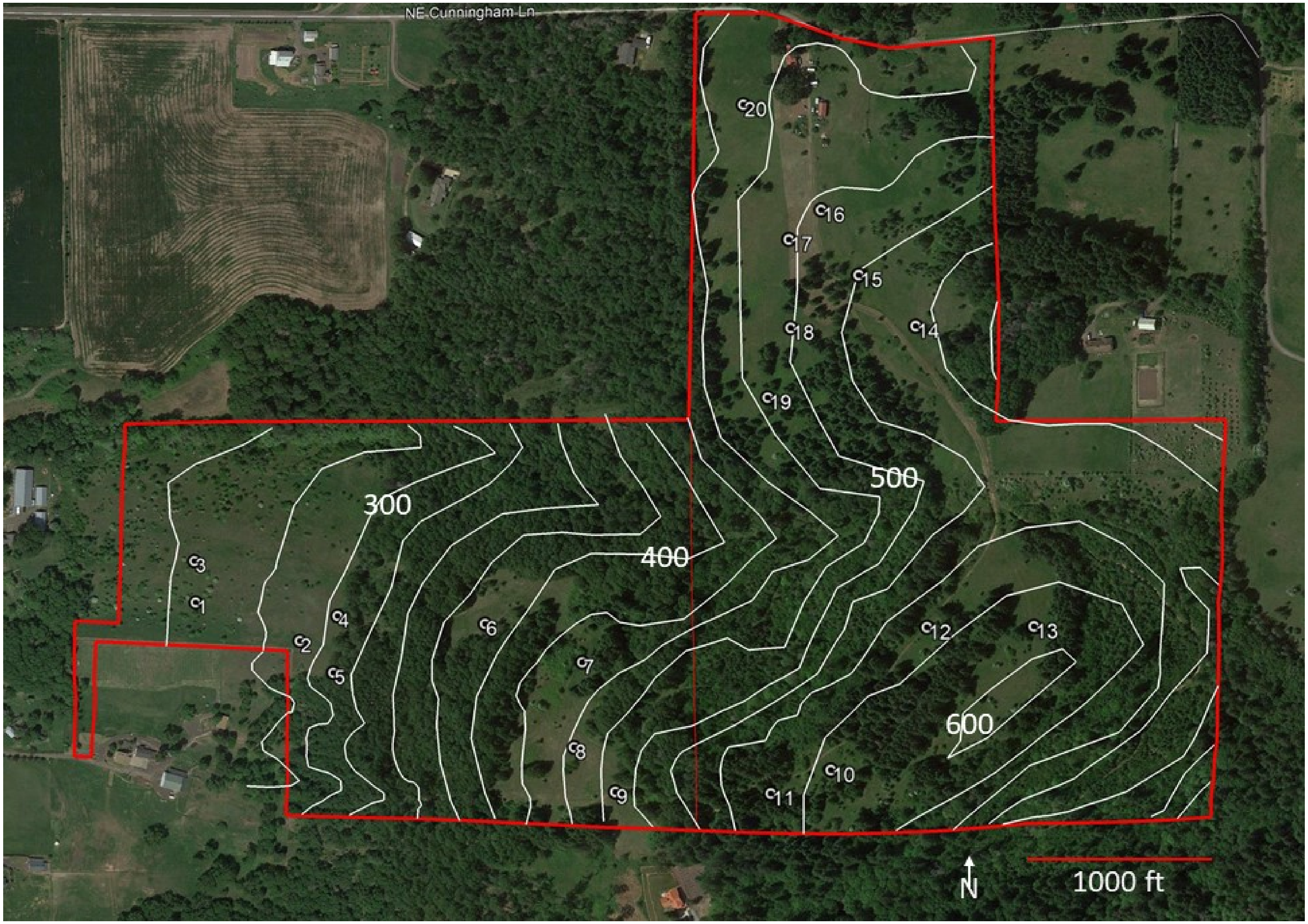

Figure 2. Topographic map of the tract (25 foot contour interval)

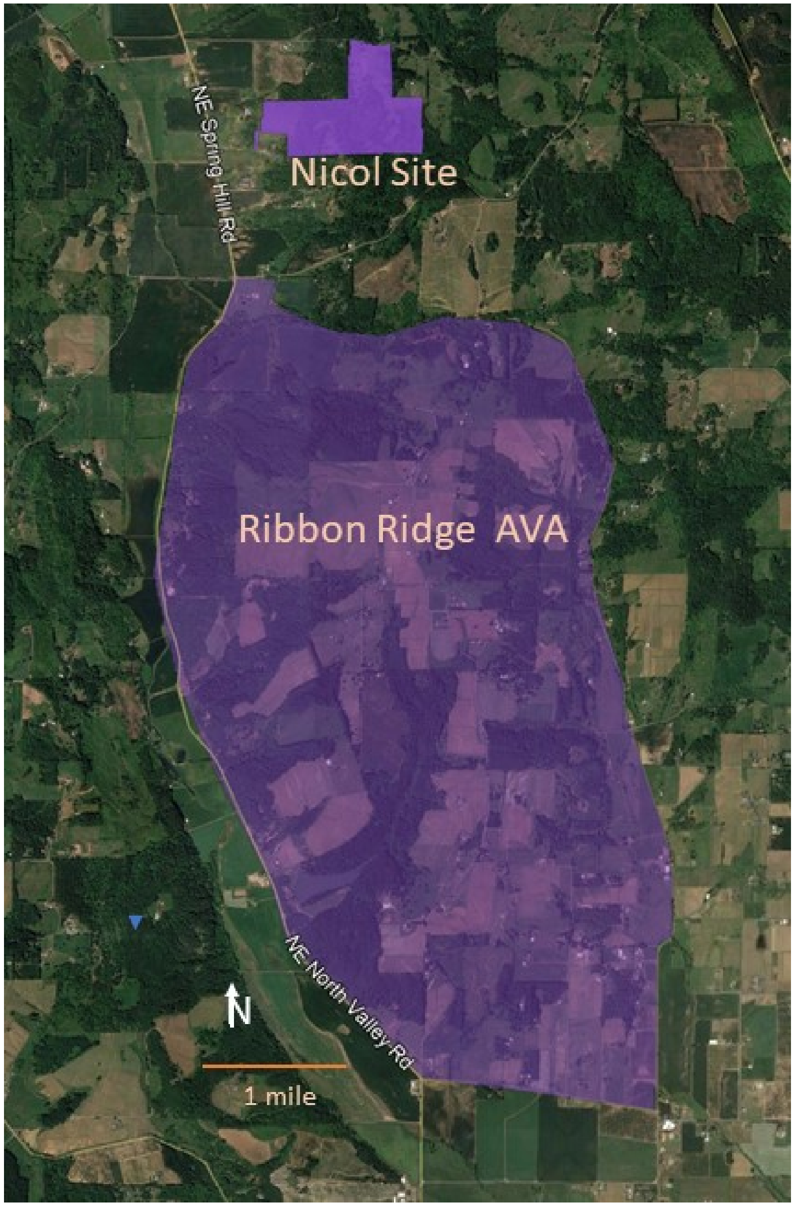

Figure 3. Vicinity of Nicol site and its proximity to Ribbon Ridge.

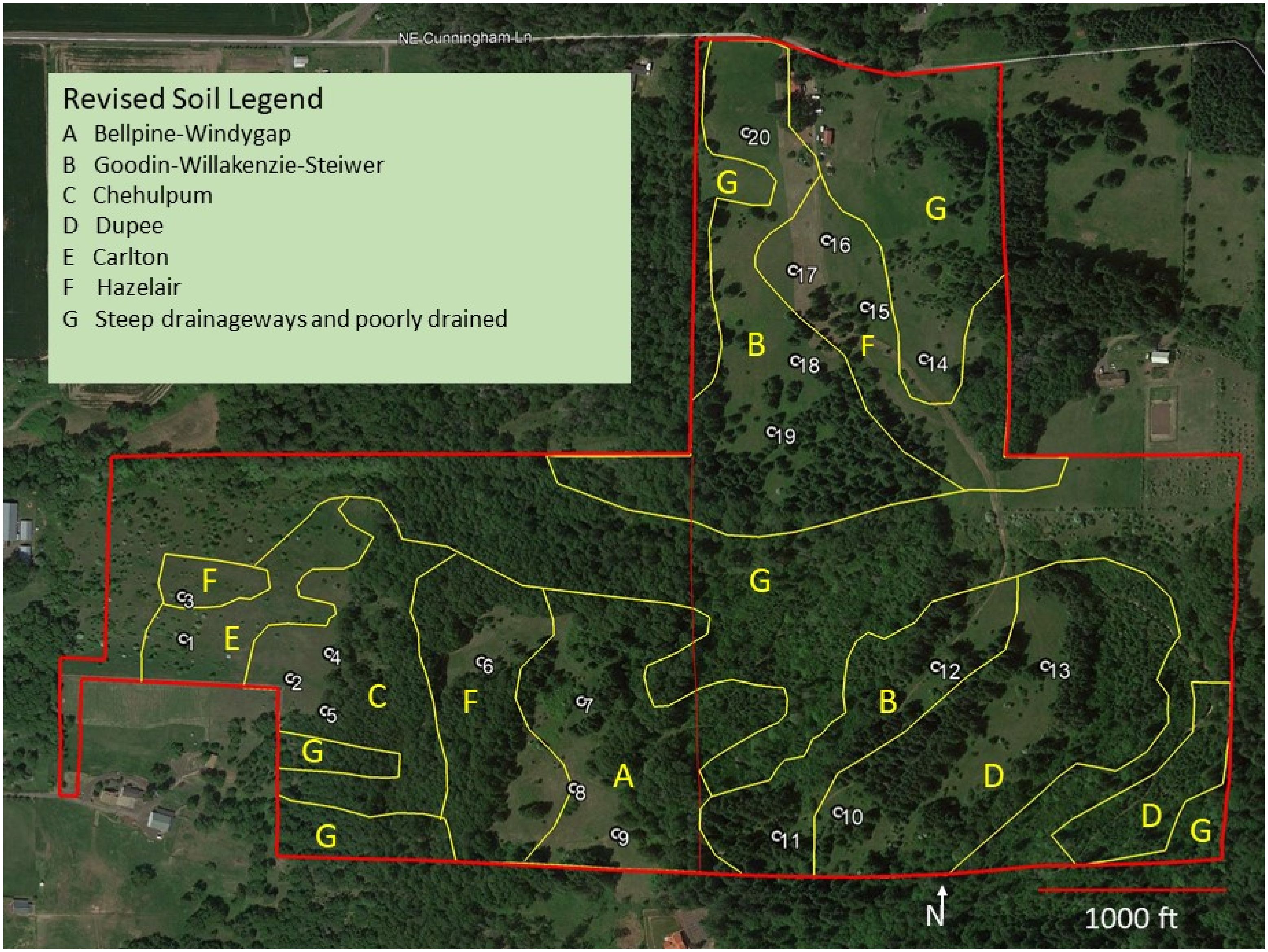

Figure 4. Red Hill Soils revised soil of Nicols site.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 20-317-003

CLIENT NO:

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

SUBMITTED BY: ANDY GALLAGHER

GROWER: NICOL

DATE OF REPORT: 11/16/20

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	Organic Matter * % Rating	Organic Matter ** ENR lbs/A	Phosphorus P1 (Weak Bray) **** * ppm	Phosphorus $NaHCO_3$-P (OlsenMethod) **** * ppm	Potassium K ***** * ppm	Magnesium Mg *** * ppm	Calcium Ca *** * ppm	Sodium Na *** * ppm	pH Soil pH	pH Buffer Index	Hydrogen H meq/100g	Cation Exchange Capacity C.E.C. meq/100g	Percent Cation Saturation (Computed) K %	Mg %	Ca %	H %	Na %
8B	58986	4.3H	115	2VL	4**	337H	316M	1816L	35VL	5.6	6.4	3.9	16.6	5.2	15.7	54.7	23.5	0.9
16B	58987	3.3M	95	4VL	8**	94L	1156VH	3037L	58VL	5.5	6.2	8.8	34.0	0.7	28.0	44.6	26.0	0.7
19B	58988	2.9M	89	1VL	4**	149L	549H	1957L	31VL	5.5	6.4	5.2	20.0	1.9	22.6	48.8	26.0	0.7

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		Particle Size Analysis SAND %	SILT %	CLAY %	SOIL TEXTURE
8B	1VL	7L	0.6L	8M	29VH	1.0M	0.1VL	L	0.1VL						
16B	1VL	7L	0.3VL	2L	17H	0.6L	0.1VL	L	0.1VL						
19B	1VL	6L	0.1VL	3M	14M	1.0M	0.1VL	L	0.1VL						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE | BUILDING K-9 | PORTLAND, OREGON 97223 | (503) 968-9225 | FAX (503) 598-7702

REPORT NUMBER: 20-317-007

CLIENT NO:

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

SUBMITTED BY: ANDY GALLAGHER

GROWER: NICOL

DATE OF REPORT: 11/16/20

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8A	59004	2.1L	71	1VL	4**	140M	337M	1757L	22VL	5.6	6.5	3.7	15.7	2.3	17.7	55.9	23.5	0.6
16A	59005	4.4H	119	1VL	5**	180L	789H	2396L	32VL	5.4	6.4	7.6	26.6	1.7	24.4	44.9	28.5	0.5
19A	59006	4.7H	124	1VL	4**	318M	423H	1498L	17VL	5.4	6.3	4.7	16.6	4.9	21.0	45.1	28.5	0.4

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		PARTICLE SIZE ANALYSIS SAND %	SILT %	CLAY %	SOIL TEXTURE
8A	1VL	6L	0.2VL	4M	13M	0.8L	0.2VL	L	0.1VL						
16A	1VL	6L	0.5VL	4M	27VH	0.9M	0.2VL	L	0.1VL						
19A	1VL	6L	0.6L	5M	28VH	1.1M	0.1VL	L	0.1VL						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
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This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 20-317-007 **CLIENT:** 4249

SUBMITTED BY: ANDY GALLAGHER

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

GROWER: NICOL

DATE OF REPORT: 11/16/20

SOIL FERTILITY GUIDELINES

RATE: lb/acre **PAGE:** 1

Sample ID	Lab Number	Crop	SOIL AMENDMENTS				Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B
			Dolomite	Lime	Gypsum	Elemental Sulfur										
8A	59004	WINEGRAPES		4000			30	300	150		20	10				2.0
16A	59005	WINEGRAPES		5000			20	300	180		20	10				2.0
19A	59006	WINEGRAPES		6000			20	300			20	10				2.0

COMMENTS

LIME REQUIREMENT: Liming may be necessary if buffer index is less than 6.9. Guidelines are based upon common agricultural lime (100-score) per six-inch depth to raise SOIL pH to about 6.5.
NITROGEN: Use local conditions and experience with variety to determine rates and timing. Allow for nitrate levels in your water source also (ppm NO3 X 0.61 = lb N/ac-ft water). Monitor tissue-N.
FERTIGATION: Light frequent applications of fertilizer through the irrigation water will provide the most efficient uptake of nutrients. Limit applications to active growth periods.
MICRONUTRIENTS: Where levels are low, apply according to label instructions, or refer to a tissue analysis to determine necessity. Maintain organic matter and pH at a satisfactory level.

NOTES:

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