LAKE COUNTRY GEOGRAPHICAL INDICATION

February 2021

Technical Documentation

Documentation in support of a formal application to the BC Wine Authority for the creation of a new Geographical Indication named Lake Country a sub-division of the Okanagan Valley Geographical Indication.

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Cover photo: O’Rourke’s Peak vineyards located on slopes composed of mixed glacial sediments along the eastern shore of Okanagan Lake looking toward the southwest.

Lake Country Geographical Indication

TECHNICAL DOCUMENTATION

EXECUTIVE SUMMARY

The concept of the Lake Country geographical indication (GI) encompasses the west-facing slopes and benches overlooking Okanagan Lake in the central Okanagan Valley. The proposed GI covers an area of just under 2,500 ha along approximately 20 km of the eastern shoreline of the lake. The GI includes the adjacent slopes up to a maximum elevation of 650 m to capture the full extent of the arable land on these mountain slopes and the rather favourable climate conditions that exist on these landforms. The placement of the boundaries of the proposed GI are based primarily on natural features of the landscape.

Surficial materials, also called surficial geology, are the loose materials that overlie bedrock. Glacial deposits form the bulk of the surficial geologic materials. Lower elevations along the lakeshore are mantled in fine-textured glaciolacustrine (ancient lake bottom) materials. These form the parent materials for several soil types characterized by silty and clayey texture, high moisture holding capacity and alkaline pH. The most common of these soils belong to the Glenmore soil series. At higher elevations are gravelly till materials deposited directly beneath glaciers during the last ice age some 20,000 to 12,000 years ago. These deposits are widespread in the GI and form the parent materials for several soil types that generally have sandy surface horizons with stony subsoils with low to moderate moisture holding capacity and neutral pH. The most common of these soils belong to the Harland soil series.

There are no long-term weather stations within the area of the proposed GI but several short-term stations located in vineyards in the northern portion of the GI provide an estimate of climate conditions. The predominantly western aspect, gently sloped topography, and close proximity to Okanagan Lake create ideal climatic conditions for production of premium wines. The GI has a relatively long, cool growing season well suited to growing a suite of noble cultivars. The excellent cold air drainage and temperature-moderating influence of the lake create a relatively low risk of frost and winter cold damage to vines.

The GI is best known for producing fine Pinot noir and rich aromatic white wines. There are currently approximately 100 ha of vineyards in the area of the proposed GI. Although two-thirds of the vineyard area is planted with white wine cultivars, Pinot noir is the most widely planted cultivar and accounts for approximately 27% of the total vineyard area. There are also small amounts of Gamay noir, Merlot and Zweigelt. The main white wine cultivars grown are Pinot gris, Riesling, Chardonnay, Gewurztraminer and Auxerrois, which together account for more than half of the vineyard area.

BACKGROUND

This work was initiated in response to the release of a set of recommendations prepared by industry representatives to the BC Wine Authority and the BC Ministry of Agriculture (Appellation Task Force 2015). Following an initial on-line meeting in April 2020, Scott Smith was retained by O'Rourke's Peak Cellars on behalf of a group of neighbouring wineries to help define the extent of a Geographical Indication (GI) within the regional municipality of Lake Country in the central Okanagan Valley. During the summer of 2020, soil and geological surface materials were examined in several locations and climate information was compiled. The result is this technical report which describes the physical, climatic and viticultural characteristics, as well as the placement and rationale for the boundary, of this proposed Lake Country GI.

The authors would like to thank the following individuals and wineries for providing access and to their vineyards for field studies: Tim Parsons, O'Rourke's Peak Cellars; Roger Wong, Intrigue Wines; Curtis Krouzel & Sheri-Lee Turner Krouzel, Matt Fortuna and Alex Hasbach, 50th Parallel Winery; Manny Zuppiger, Arrowleaf Cellars; Jordan Leboe, Gray Monk Estate Winery; Jeff Harder and Anwar Sarder, Ex Nihilo Vineyards; and Pete Wilkins, Sebastian Farms. Thanks are also extended to Sandra Oldfield, Elysian Projects, for her coordination support.

The intent of this report is to provide the required technical documentation for the formal application to the BC Wine Authority for GI status.

GEOGRAPHIC EXTENT AND BOUNDARY

The Concept

The primary concept of the Lake Country GI encompasses the west-facing slopes and benches overlooking Okanagan Lake in the central Okanagan Valley (Figure 1). The proposed GI covers an area of approximately 2,500 ha along approximately 20 km along the eastern shoreline of Okanagan Lake.

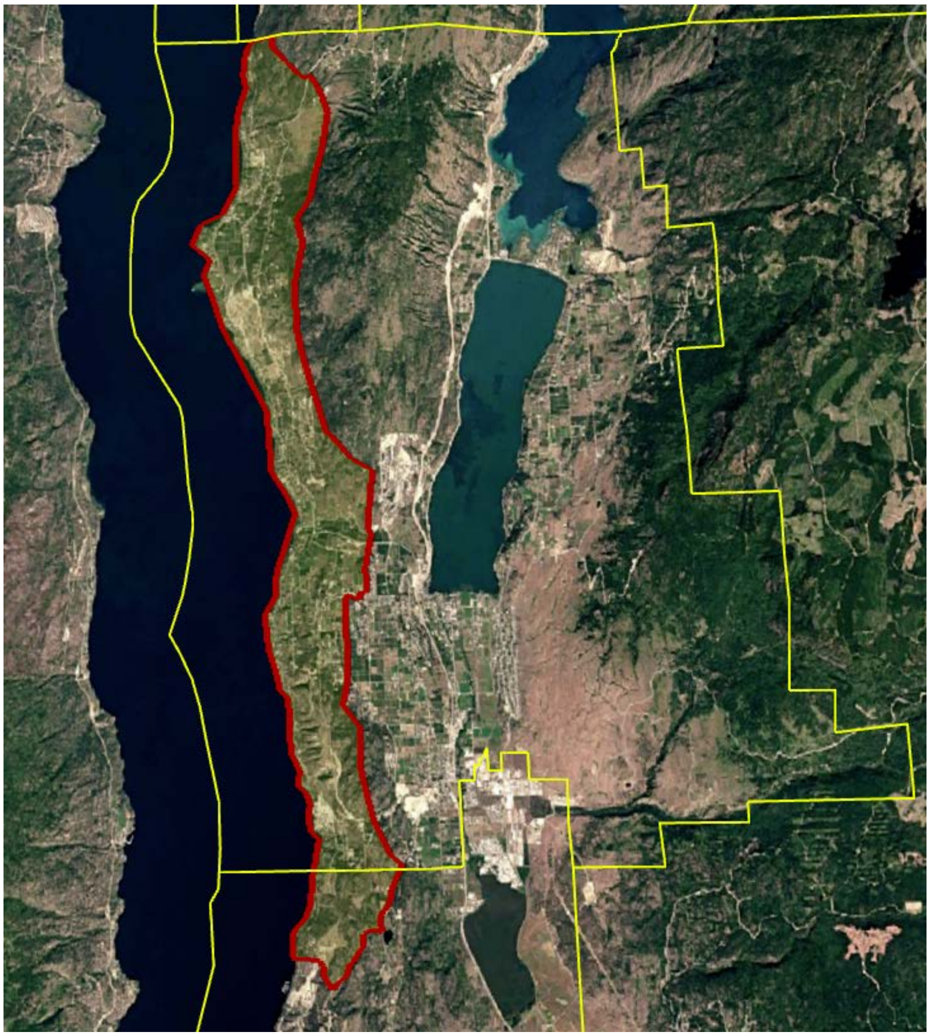

Figure 1. Overview of the boundary configuration for the proposed GI shown in red. Lake Country municipal boundary is shown in yellow

The west-facing slopes of Carr's Landing and Okanagan Centre (two former communities now incorporated into the Municipality of Lake Country) each have a long history of tree fruit production, in particular cherries and peaches, the latter having climatic requirements somewhat similar to hardier *Vitis vinifera* cultivars. As such, it is not surprising that these slopes have seen significant investments in winery and vineyard developments over the last decade. This GI captures the full extent of these arable mountain slopes and the rather favourable climate conditions that exist on these landforms immediately above Okanagan Lake.

As with the delineation of other GIs in the Okanagan Valley, we have used for the most part, natural landscape features that relate to viticulture to place boundaries. For Lake Country, we used several natural features as well a few road rights-of-way that relate to natural landscape breaks to help define the extent of the GI. The upper elevation boundary in the northern portion of the GI beneath Ellison Ridge and Spion Kop Mountain is largely set based on the extent of land suitable for agriculture and the estimated upper climatic limit for successful production of *V. vinifera* cultivars. The lower boundary of the GI follows the eastern shoreline of Okanagan Lake.

An additional guiding principle of GI boundary placement is to try to avoid cutting across or dividing individual agricultural property lots. The boundary as proposed adheres to this principle as far as we are aware, particularly along the cultivated crest of land above Winfield. The details of the boundary placement and the ground features used to place the boundary are described in more detail below.

The formal approved boundaries will be depicted on a detailed map linked to Section 56 of the Wines of Marked Quality Regulation and available through the BC Wine Authority website.

Boundary Description and Rationalization

The Northern Extent

The northern extent of the boundary (Figure 2) initiates at the intersection of the Okanagan Lake shoreline with the Lake Country municipal border just north of Juniper Cove Rd (marker 1).

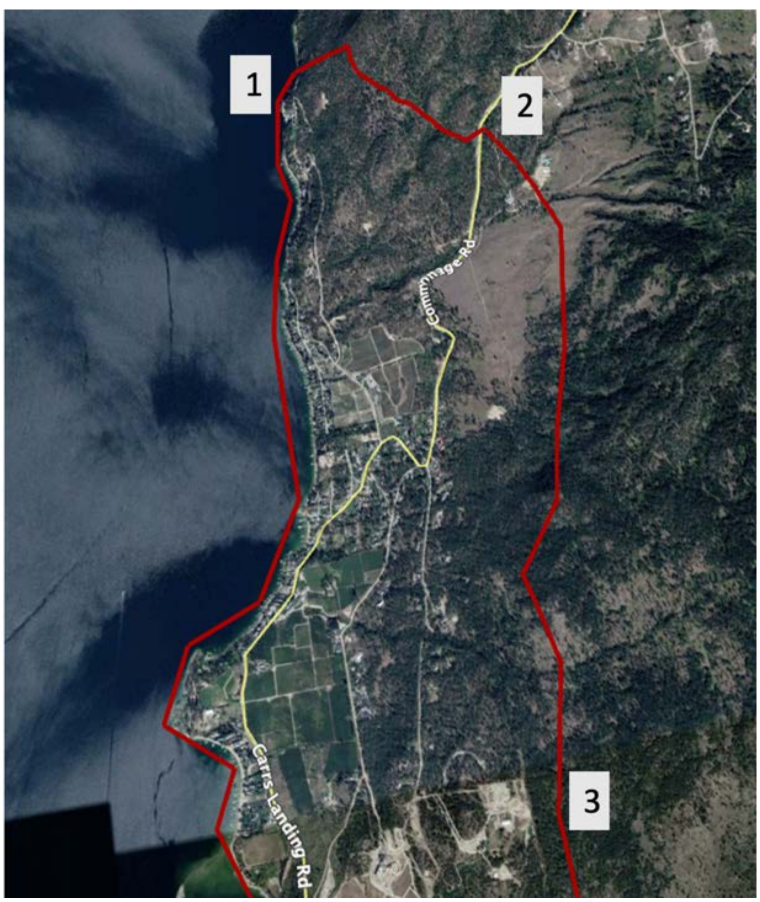

Figure 2. The northern extent of the GI in the Carr's Landing area of Lake Country. The numbered markers are described in the text.

The GI boundary climbs up the slope following the Municipal boundary to an elevation of approximately 600 m then contours across the slope to intersect with Commonage Rd and the pastures of Sunnywold Ranch (marker 2). The upper boundary lies on the slopes beneath Ellison Ridge (the ridge that runs between Okanagan Lake and Wood Lake) at an elevation of approximately 600 m, or up to ~650 m, above which the terrain is generally too steep for cultivation and is currently estimated to be unsuited for viticulture (marker 3).

The boundary continues southward running along the contour beneath Ellison Ridge and Spion Kop Mountain (Figure 3, marker 4) until immediately west of 'The Lakes' residential development (marker 5). At this point the boundary runs downhill following a property boundary to intersect Okanagan Centre Rd E approximately 150 m west of the Oceola Rd traffic circle (marker 6). This point represents the crest (height) of land and the top of the west-facing slopes in this portion of the GI.

Figure 3. The boundary from O'Rourke's Peak Cellars vineyards to Okanagan Centre Rd E.

The Southern Extent

The GI concept is to encompass the west-facing slopes above Okanagan Lake. Elevation changes across the agricultural landscape above Winfield are subtle in places. For the most part the GI boundary follows the hydrologic divide between markers 6 and 7 with the exception of where the divide crosses agricultural parcels (Figure 4).

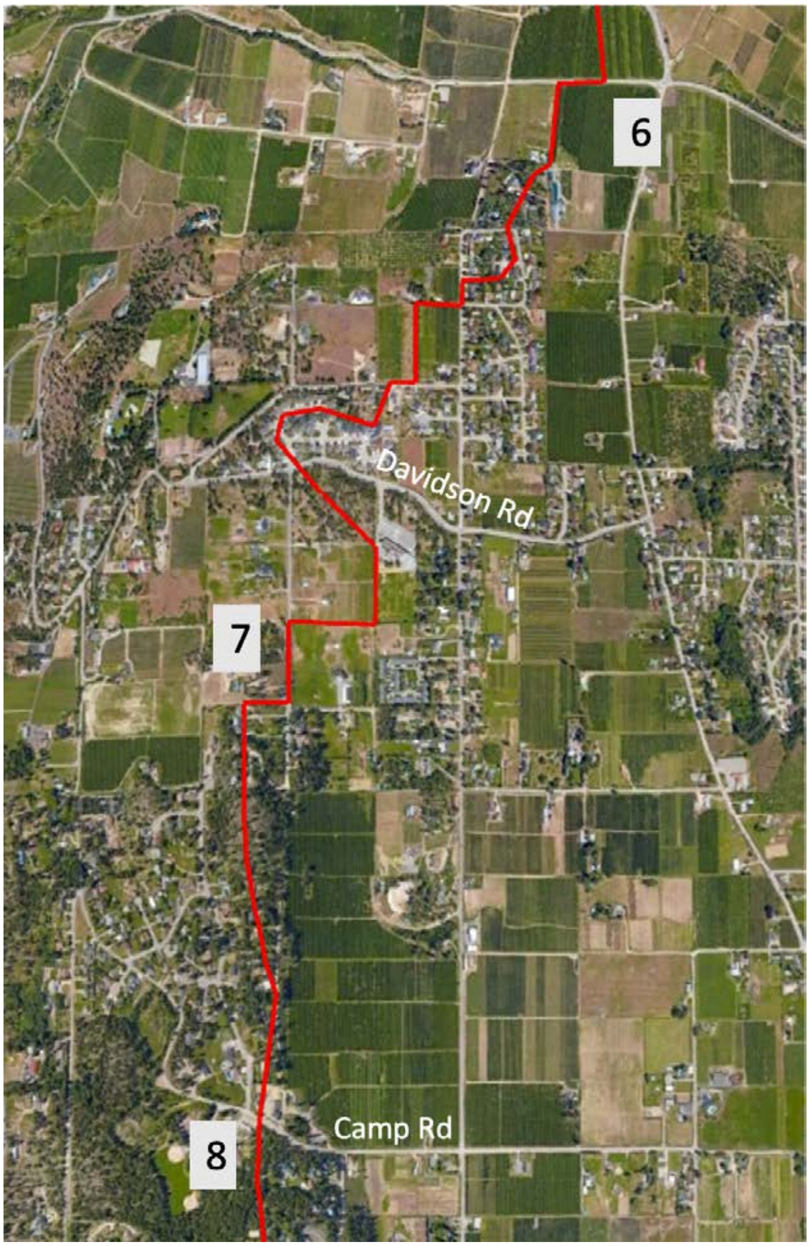

Figure 4. The boundary as it crosses the agricultural land above Winfield. The boundary follows the hydrologic divide except where it crosses agricultural parcels. In these cases, if the majority of the land area in the parcel falls west of the divide, the GI boundary is placed so as to include the entire parcel within the GI. If not, the parcel is excluded from the GI.

At marker 7 the hydrologic divide follows a well define ridge above Cemetary Road, crossing several residential properties as far south as Camp Rd.

From Camp Rd at marker 8, the boundary follows the ridge crest along the rocky upland to eventually cross Okanagan Centre Rd W. at marker 9 on Figure 5a. After crossing Okanagan Centre Rd W., the boundary follows along the tops of several small ridges and hilltops until dropping down to the junction of McKinley Beach Dr. and Hilltown Rd at marker 10 on Figure 5b and finally along the northern border of the McKinley Beach residential development down to the lakeshore. The final segment, to close the loop on the GI, extends along the Okanagan Lake shoreline northward 20 km to the intersection of the shoreline with the Lake Country municipal boundary.

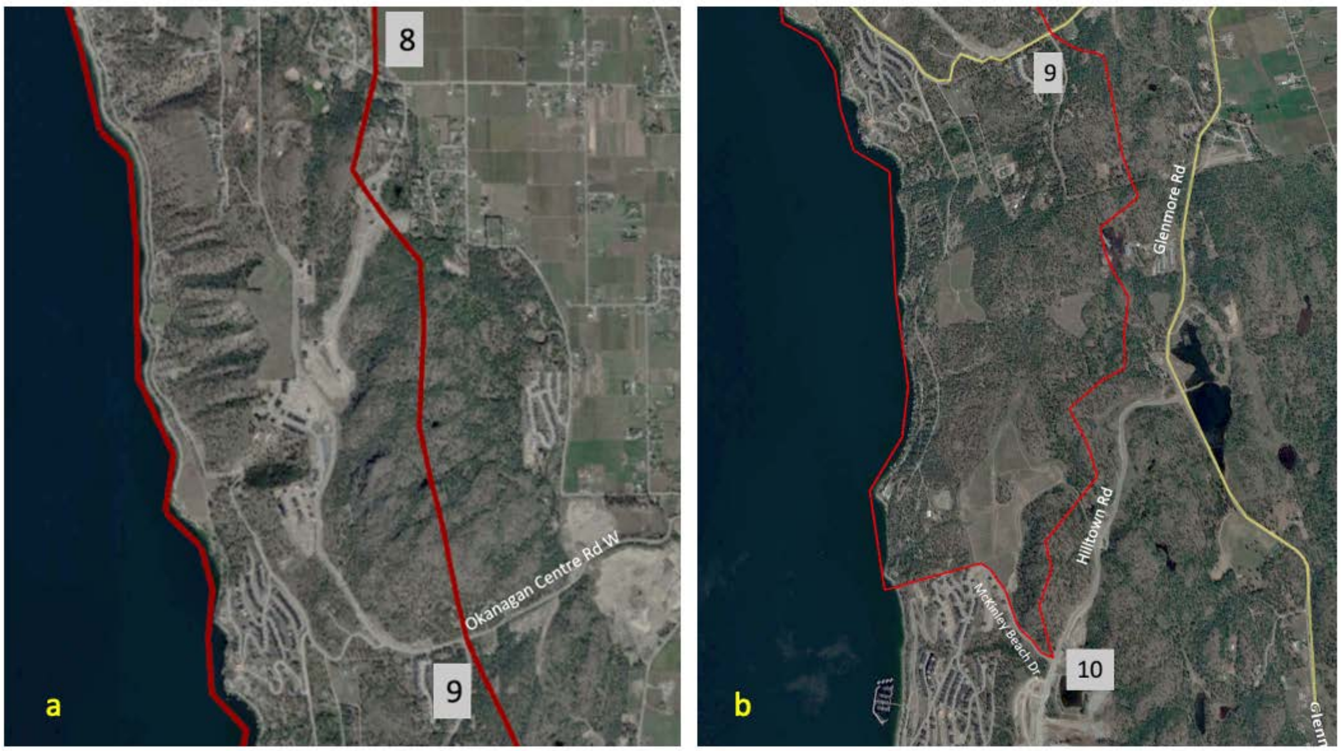

Figure 5. The southern-most extent of the GI boundary. The boundary follows the height of land along the rocky upland between markers 8 and 9 (a). After crossing Okanagan Centre Rd W., the boundary follows along the tops of several small ridges and hilltops until dropping down to the junction of McKinley Beach Dr. and Hilltown Rd at marker 10 (b).

SURFICIAL GEOLOGY AND LANDFORMS

Surficial Geology

Surficial materials, also called surficial geology, are the loose materials that overlie bedrock. They are the parent materials for soils and form the slopes, terraces, and benches that characterize the GI.

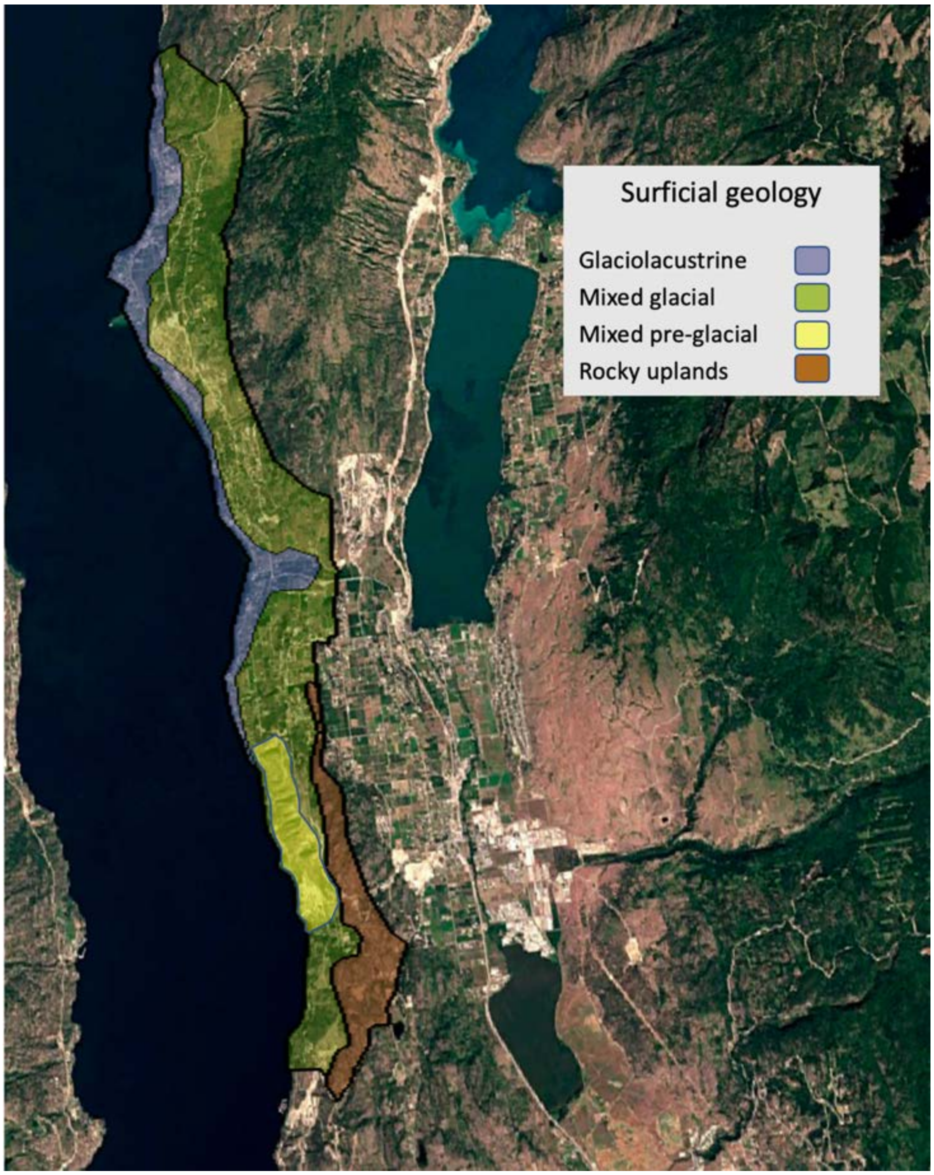

Figure 4. Generalized surficial geology map of the Lake Country GI. Adapted from earlier published regional mapping.

The surficial geology of the area was first mapped and described by Hugh Nasmith (1962) as part of a field study of the Late Glacial history of the Okanagan Valley. This was followed up regional mapping by Bob Fulton (1972). More recently, a surficial geology map of the Kelowna area was published by the Geological Survey of Canada at a scale of 1:50 000 (Paradis 2009). This map covers the southern portion of the proposed GI. These published studies provide a good overview of the materials and landforms in the area (Figure 4).

The Okanagan Valley has been subject to multiple glaciations during the Pleistocene epoch (2.6 million to 10,000 years ago). The bedrock surface shape and the surficial geological materials seen today are the result of these glaciations that at times had over 2 km of ice covering the landscape. Advancing ice scoured the uplands, while melt waters deposited sorted material in the valley bottoms as the ice receded. Wind, water, and gravity continue to shape the land surface today.

Deglaciation occurred on the interior plateau of BC most recently around 12 000 years ago. Large masses of ice melted in place as they were cut off from ice receding into the mountains to the east and west. Valley ice remained in the bottom of the Okanagan Valley after the surrounding plateau was relatively ice free. Meltwater collected in the valley bottom to form what geologists have termed 'Glacial Lake Penticton' (Fulton 1969).

Figure 5. Vineyards on the west-facing slopes along Okanagan Lake in the vicinity of Carr's Landing (a). Much of the sloping terrain is covered by stony till which can be many meters thick (b) or can lie shallow on bedrock (c). Sebastian Farms Pow Road vineyard is situated on south-facing slopes above Okanagan Centre Road in the central portion of the GI (d, foreground). Vineyards are also situated further south on slopes immediately above Okanagan Centre townsite (d, background).

During the late stages of deglaciation, lower elevations of the valley were flooded when meltwater accumulated behind and around stagnant valley ice as the result of a blockage to outflow in the vicinity of McIntyre Bluff in the south Okanagan. This flooding generated the formation of Glacial Lake Penticton. Lake levels and elevations fluctuated over the thousand years or so the lake existed. This large, impounded body of water had a maximum surface elevation approximately 150 m above the present level (344 m) of Okanagan Lake. At its greatest extent, Glacial Lake Penticton stretched from OK Falls to north of Vernon. In deeper lake waters, layers of fine sand, silt and clay accumulated as fine sediments fell out of suspension. These glaciolacustrine sediments now support vineyards below about 425 m elevation along the lower slopes of the GI (Figure 4, Figure 5a). Above this elevation are deposits of stony till (Figure 5b), many covered by 50 cm or more of wind-blown (eolian) sand. Due to land leveling and sculpting activities in vineyard establishment, this surface eolian material is often mixed into or missing entirely from the surface of modern soil profiles. In some locations, even on lower slopes, bedrock is present close to the surface (Figure 5c). These variable conditions, together with areas of glaciofluvial gravels on mid and upper slopes, form what is shown as mixed glacial materials on Figure 4.

One unique geological feature of the GI is the occurrence on the slopes above Okanagan Centre of much older sediments that pre-date the last glaciation (Figure 6). These sediments, first described by Fulton and Smith (1978) consist of pre-glacial gravels, a till deposit related to a glaciation some 70,000 to 50,000 years ago and a soil that developed in eolian sands during the inter-glacial (i.e. between glaciations) period some 50,000 to 25,000 years ago. Recent work by Lesseman et al. (2013) provides actual dates for these deposits and confirms that indeed the slopes in this area of Okanagan Centre are composed of very old pre-glacial and inter-glacial sediments.

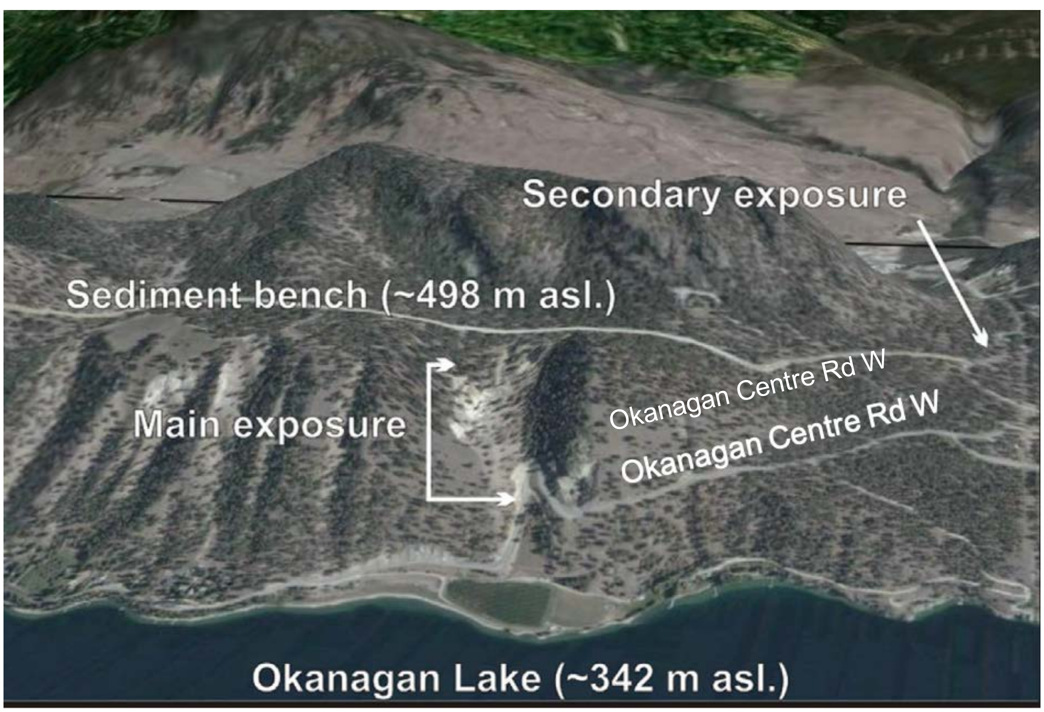

Figure 6. Oblique Google Earth image of the west-facing slopes above Okanagan Centre showing the geological exposure revealing pre-glacial and inter-glacial sediments. These sediments have enabled geologists to better understand events that occurred before the last glaciation in the southern interior. Such exposures are quite rare in the region. Adapted from Lesseman et al. (2013).

SOIL DEVELOPMENT AND SOIL PROPERTIES

In the report *Soils of the Okanagan and Similkameen Valleys*, Wittneben (1986) mapped a half dozen or so common soil series on the landscapes within the extent of the Lake Country GI. Soil series are soil mapping units defined by the nature of the soil profile and the type of surficial material within which the soil has formed. Unconsolidated surficial geologic deposits act as what are termed “soil parent materials”. Parent materials weather over time to form soil horizons, layers of soil with differing colours and properties such as amount of organic matter and water holding capacity. Almost all the soils utilized for viticulture are formed from glacial sediments of one sort or another. Soil textures vary from clayey to gravelly. The soils formed over thousands of years under an open pine forest. Soils formed under forest vegetation belong to the Brunisol taxonomic order according to the Canadian System of Soil Classification (Soil Classification Working Group 1998).

The concept of ‘soil series’ is a package of information that is often labeled by the geographic location where a particular soil was first described. A soil series is defined by several factors including: its taxonomic class, drainage condition, parent geological material, and soil texture (proportion of sand, silt and clay). So, for example the Glenmore soil series was first described in the Glenmore Valley of Kelowna during the first soil survey in the Okanagan Valley in the 1940’s (Kelly and Spilsbury 1949). The Glenmore soil series is defined as an Orthic Gray Luvisol that is moderately well drained and formed on glaciolacustrine sediments with a texture of stone-free clay loam or silty clay loam. All of this information is encapsulated in using just the name Glenmore.

The most common soils used for wine grape production in the GI are presented in Table 1. The soil series are organized according to the nature of the surficial geological sediments that make up the parent materials for soil formation. These have been organized into four groups.

The first group of soils are those formed on glaciolacustrine parent materials. These sediments are fine-textured, meaning they are composed primarily of silt and clay and are generally stone-free. Soils composed entirely of these fine-textured parent materials are classed as Glenmore soils (Figure 7a). The Glenmore soil is composed entirely of glaciolacustrine silts and clays and has a distribution limited to the escarpments along the lowest elevations in the GI. Associated with Glenmore are the Greata, soils in which sands or gravels cap the glaciolacustrine sediments at variable depth. The Maynard soils are composed of raw, unweathered parent material that often becomes saline due to irrigation (Figure 8). This soil series is undesirable for viticulture but fortunately, has limited occurrence. All of these glaciolacustrine soils are limited to the lowest elevations along Okanagan Lake. Their high moisture holding capacity has implications for the amounts and timing of irrigation and plant vigour. These soils are highly alkaline (high pH) which can lead for nutrient imbalances. In comparison, the coarse-textured glaciofluvial soils which occur at higher elevations, have neutral pH and much less water holding capacity.

Table 1. Summary of the properties of the most common soils found within the Lake Country GI. Soil series names according to Wittneben (1986).

Soil Series Name	Geological Material	Profile Characteristics	Distribution and Agricultural Use
		Soils formed on glaciolacustrine parent materials	
Greata	Glaciofluvial over glaciolacustrine	50 cm of gravelly sandy loam over silt or clay loam	Sporatic occurrence at low elevation along lakeshore. Used for viticulture.
Glenmore	Glaciolacustrine	Well developed topsoil underlain by clay loam, silty clay loam, few stones	Very common soil at low elevation along the lakeshore. Used extensively for viticulture
Maynard	Glaciolacustrine	Stratified silts, sands	Found at low elevation on occasional escarpment faces. Often saline and generally too steep for most agriculture
		Soils formed on morainal (till) parent materials	
Harrland	Windblown sand over till	10 to 30 cm of sandy loam or loamy sand overlying gravelly sandy loam	Widespread occurrence on upper slopes >100 m elevation above lake level. Used extensively for viticulture.
Peachland	Glaciofluvial over till	Gravelly silt loam overlying gravelly sandy loam	Sporadic occurance in the southern portion of the GI.
		Soils formed on glaciofluvial materials	
Gammil	Glaciofuvial	Thin (<25 cm) sandy surface horizon overlying gravelly loamy sand.	Occasionally used for viticulture in the GI. Somewhat droughty and often stony when cultivated
Paradise	Glaciofuvial	Thick (25 to 60 cm) sandy surface overlying gravelly loamy sand	Common in southern portion of the GI, seldom used for viticulture
Parkill	Glaciofluvial	Sand and loamy sand>100 cm deep	Common in southern portion of the GI, suitable for irrigated viticulture
		Shallow soils formed over bedrock	
Posthill	Colluvial over bedrock	10 to 100 cm of gravelly sandy loam over bedrock outcrops.	These soils are generally, non-arable, being confined to the rocky uplands in the southern portion of the GI

The second set of soils are those formed on glacial till, the material laid down directly beneath active glaciers. The till is usually composed of stones of varying size set within a matrix of sandy loam texture. In the Lake Country region, the till materials are mostly covered with sediments deposited later. The most common soil in the GI is the Harrland soil series. The soil formed through the weathering of parent material composed of wind-blown (eolian) sediments that were deposited over the till during deglaciation and early post-glacial periods. The eolian layer of sediment is largely stone-free and quite different from the texture of the stony till beneath it (Figure 7b). The Harrland soil is used extensively for viticulture on the mid to upper slopes across the GI.

Figure 7. Soil profiles for the Glenmore (a) and Harrland (b) soil series. The Glenmore soil is formed in clay-rich glaciolacustrine material. Shown between the solid white lines is a characteristic dark brown horizon enriched with clay. The dark topsoil of the Harrland soil (lower boundary shown by the dashed line) is formed in eolian sand overlying gravelly sandy loam till.

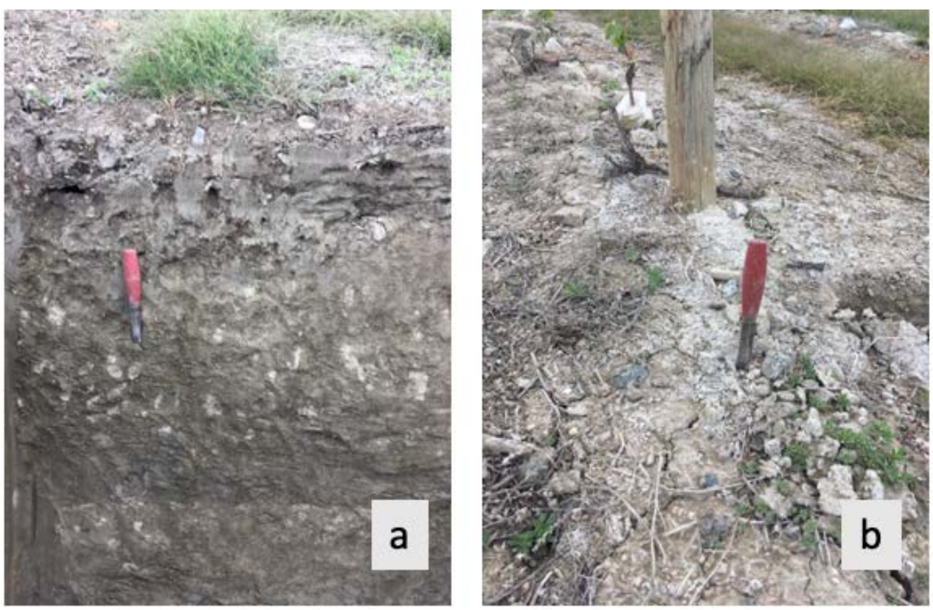

Figure 8. The Maynard soil. The white flecks in (a) are nodules of calcium carbonate (lime). The white surface crust shown in (b) is composed of salts that accumulate on the soil surface through cycles of wetting (irrigation) and drying (evaporation).

The third group of soils listed in Table 1 are those formed on glaciofluvial materials. These always have very gravelly subsoils with surface cover of sandy or loamy sand of various thickness (Gammil, Parkhill, Paradise). The Gammil soil is commonly used for viticulture. This soil series is characterized by a thin cover <25 cm thick of sandy material over gravel. Gammil soils and the similar Paradise soil, which has a slightly thicker surface cover of sandy loam (typically 25 to 60 cm), underlie much of the area. The Parkhill soil may have up to 100 cm of sand overlying the gravelly subsoil. There are several vineyards in the southern portion of the GI located on Parkhill soil.

Finally, the rocky uplands in the southernmost portion of the GI have a thin cover of loose sediment over bedrock. These surface sediments often occur on steep pitches of bedrock and are considered to be colluvium, that is, material that is largely derived from the bedrock surface and has moved downslope under the influence of gravity. In other instances, the soil may be simply a remanent thin cover of till over the bedrock. In both cases, these shallow soils belong to the Posthill soil series which are generally considered non-arable.

CLIMATE

There are no long-term weather stations located within the area of the proposed GI. The closest station is situated at Kelowna airport only 10 km from the southern end of the GI but located in a landscape position (valley floor) that does not represent the landscape or climate condition of the GI. Several short-term climate stations from within vineyards in the northern portion of the GI have been used to characterize the climate in this report.

Aspect (slope direction) and slope angle are important modifiers of regional climate. The combinations of slope, elevation, and landscape position create the range of meso-climates (localized climates) within the GI.

The predominant slope direction is westward, although local topographic conditions alter this to provide an array of slope directions ranging from south to northwest. The sloped topography allows for drainage of cold air from vineyards, preventing cold-air pooling and lowering the incidence of vine damage by frosts and winter freeze events. The second influence on meso-climate is elevation. Sites located at higher elevation are slightly cooler during the growing season, as measured by growing degree days (GDD), than those at lower elevation (Table 2). Additionally, the proximity to Okanagan Lake can affect temperature. Sites closer to the lake generally have more moderated temperatures, resulting slightly longer growing seasons as measured by the frost-free period.

Table 2. Growing season temperature records from three weather stations located in the northern portion of the GI. Data provided by Tim Parsons, O'Rourke's Peak Cellars.

Location	Elevation (m)	Year	GDD*	Date of Frost		Frost-Free Period	Min T
				Last in Spring	First in Fall	(days)	(℃)
O'Rouke's Peak Carr's Landing Vineyard	410	2019	1445	19-Mar	10-Oct	205	—
		2020	1430	13-Apr	24-Oct	194	-18
O'Rouke's Peak Carr's Landing Vineyard	445	2019	1410	19-Mar	09-Oct	204	-15
		2020	1376	13-Apr	24-Oct	194	-16
O'Rouke's Peak Goldie Rd Vineyard	465	2019	1275	02-Apr	09-Oct	190	—
		2020	1245	14-Apr	22-Oct	191	-19

* Growing degree-day total base 10℃ calculated between April 1 and Oct 31 each year.

The first two sites listed in Table 2 are located within sloping, west-facing vineyards in Carr's Landing and are remarkably warm for their latitude at just over 50° N. Long-term records from climate stations elsewhere in the valley indicate that 2019 and 2020 were close to the ten-year average in terms of growing season temperature, however how accurately these GDD values compare to long-term Environment Canada weather stations is uncertain. The third and coolest site in terms of GDD is the O'Rourke's Peak Cellars vineyard on Goldie Rd. This is the result of both higher elevation and landscape position further away from the lake. The site is quite level, sitting on the divide between Okanagan Lake and Wood Lake. Level and depressional landform positions often lack good air drainage.

Growing season length as measured by the frost-free period can vary considerably from year to year. In 2020 all sites experienced similar frost-free periods due to a widespread frost event that affected the entire region. However, in 2019 the Goldie Rd site had frost later in the spring which resulted in a frost-free period a full two weeks shorter than the lakeside vineyards.

There was only slight difference in minimum recorded temperatures at the three sites, the minimum temperatures were all recorded on the same days each year, an indication that the same extreme cold events impacted all sites.

Weather stations at two Kelowna lakeshore area vineyards that are located adjacent to Okanagan Lake at similar elevation but on northwest-facing slopes have similar length of growing season at over 200 days but are slightly cooler illustrating the important role that aspect can play in vineyard temperatures.

Viticultural Characterization

The GI's predominantly western aspect, gently sloped topography, and close proximity to Okanagan Lake create ideal climatic conditions for production of premium wines. Situated near the northern end of Okanagan Valley, the GI has a relatively long, cool growing season well suited to growing a suite of noble cultivars. The excellent cold air drainage and temperature-moderating influence of the lake create a relatively low risk of frost and winter cold damage to vines.

The GI is best known for producing fine Pinot noir and rich aromatic white wines. There are currently approximately 100 ha of vineyards in the area of the proposed GI. Although two-thirds of the vineyard area is planted with white wine cultivars, Pinot noir is the most widely planted cultivar and accounts for approximately 27% of the total vineyard area (Table 4). There are also small amounts of Gamay noir, Merlot and Zweigelt. The main white wine cultivars grown are Pinot gris, Riesling, Chardonnay, Gewurztraminer and Auxerrois, which together account for more than half of the vineyard area. Lesser-grown white wine cultivars include Bacchus, Gruner Veltliner, Kerner and Siegerrebe. The remainder of the area (3.5%) includes small plantings of the white cultivars Erhenfelser and Vidal and the red cultivars Dunklefelder and Rotberger.

The wide variation in soil texture and stone content among sites within the GI requires careful management of irrigation and nutrients, tailored to soil conditions. Sites having sandy or stony soils, such as those formed on glaciofluvial or till materials (Table 1) require more frequent irrigation and nutrient applications but allow for easier manipulation of vine vigor to achieve a balance of vigor and fruit yield, and optimum cluster exposure. Sites having soil with a high silt or clay content, such as those formed on glaciolacustrine materials, require less frequent irrigation to achieve a desired level of vigor.

Table 4. Principal cultivars (≥ 1 % of vineyard area) grown in the proposed Lake Country GI, expressed as percentage of the reporting growing area. Data provided by BC Wine Authority.

Red Wine Cultivars	% of area	**White Wine Cultivars**	% of area
Pinot Noir	26.6	Pinot Gris	23.2
Gamay Noir	2.1	Riesling	12.0
Merlot	1.3	Chardonnay	11.6
Zweigelt	1.1	Gewurztraminer	5.5
		Auxerrois	4.7
		Bacchus	3.2
		Gruner Veltliner	2.1
		Kerner	2.0
		Siegerrebe	1.0
Total	31.2	Total	65.2

References

BC Wine Appellation Task Group (2015). Wine Industry Turning Point: Recommended Changes to the British Columbia Wines of Marked Quality Regulations. Report submitted to the BC Wine Authority and BC Minister of Agriculture. 42pp.

Lesemann, J-E., T.A. Brennand, O.B. Lian and P. Sanborn. 2013. A refined understanding of the paleoenvironmental history recorded at the Okanagan Centre section, an MIS4 stratotype, south-central British Columbia, Canada. Journal of Quaternary Science 28: 729-747.
DOI: 10.1002/jqs.2665

Fulton R.J. 1969. Glacial lake history, southern Interior Plateau, British Columbia. Geological Survey of Canada, paper 69–37.

Fulton R.J. 1972. Bedrock topography of the North Okanagan Valley and stratigraphy of the unconsolidated valley fill; Part B, stratigraphy of unconsolidated fill and Quaternary development of North Okanagan Valley. Geological Survey of Canada Paper 72–8: 9–17.

Fulton R.J. and Smith G.W. 1978. Late Pleistocene stratigraphy of southcentral British Columbia. Canadian Journal of Earth Sciences 15:971–980.

Kelly, C.C and R.H. Spilsbury 1949. Soil Survey of the Okanagan and Similkameen Valleys, British Columbia. Report No.3. British Columbia Department of Agriculture, Kelowna, BC

Nasmith H. 1962. Late Glacial History and Surficial Deposits of the Okanagan Valley, British Columbia. British Columbia Department of Mines and Petroleum Resources, Victoria, BC. 46 pp. plus plates and maps.

Paradis, S.J. 2009. Surficial geology, Kelowna, British Columbia. Geological Survey of Canada, Open File 6146, scale 1:50,000.

Soil Classification Working Group 1998. The Canadian System of Soil Classification 3rd ed. Agric. And Agri-Food Canada. Publ. 1646 (revised) 187 pp.

Wittneben U. 1986. Soils of the Okanagan and Similkameen Valleys, Technical Report 18. BC Ministry of Environment. Victoria, BC. 229pp. plus maps