# EAST KELOWNA SLOPES GEOGRAPHICAL INDICATION

May 2020

## Technical Documentation

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

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Cover photo: Vineyards located on lower elevation slopes on glaciolacustrine materials, looking northwest toward Okanagan Lake.

# East Kelowna Slopes Geographical Indication

TECHNICAL DOCUMENTATION

## EXECUTIVE SUMMARY

The primary concept of the East Kelowna Slopes GI encompasses the mixed glaciofluvial and fluvial slopes and benches overlooking Mission Creek in the South East Kelowna area of the central Okanagan Valley. The proposed GI covers an area of approximately 2,500 ha. Much of the GI is defined by the escarpment overlooking Mission Creek and its floodplain between the mouth of Mission Creek and Bellevue Creek. The slopes and terraces above the escarpment host an extensive landscape of agricultural land growing a mix of tree fruits and grapevines .

The surficial materials in the landscape today are the result of the most recent glaciation when over 2 km of ice covered the landscape. Most of the higher elevations in the GI are covered by hummocky coarse sands and gravels – sediments deposited in association with ice and glacial meltwaters during early stages of deglaciation in the valley bottom. During the late stages of deglaciation, lower elevations of the valley were inundated when meltwater accumulated behind and around valley ice, resulting in the formation of Glacial Lake Penticton. This large impounded body of water had a surface approximately 150m above the present level of Okanagan Lake. In deeper lake waters, layers of sand, silt and clay accumulated as finer sediments fell out of suspension. These glaciolacustrine sediments support vineyards between at elevations below 450m in the GI.

Soils formed on hummocky glaciofluvial parent materials have gravelly subsoils with surface cover of sandy or loamy sand of various thickness A single soil series (Rutland) has widespread and continuous distribution on the level glaciofluvial terrace and fluvial fan surfaces in the northern portion of the GI. The wide variation in soil texture and stone content among sites requires careful management of irrigation and nutrients, tailored to soil conditions.

Many vineyard sites in the GI are gently sloped, mostly to the northwest, which promotes cold air drainage and enhances the GDD and the FFP at those sites. Level and depressional landform positions often lack good air drainage. Sites with good air drainage have a lower incidence of vine damage by frosts and winter freeze events. The combinations of slope, elevation, and landscape position create a range of mesoclimates within the sub-GI. The climate in the GI can be described as cool (1200 to 1400 GDD) and having an average FFP of between 170 to 200 days.

The climate and growing season length of the GI make it well suited to growing cool-climate cultivars for production of premium wines. Although 70% of the acreage is planted with white wine cultivars, Pinot noir is the most widely planted cultivar and accounts for 80% of the vineyard area planted with red wine cultivars. The main white wine cultivars grown are Gewurztraminer, Riesling, Chardonnay and Pinot Gris. These produce crisp and full-bodied white wines with abundant flavor and aroma. The GI is also known for producing premium sparkling wine.

# BACKGROUND

This work was initiated in response to the release of a set of recommendations prepared by industry representative to the BC Wine Authority and the BC Ministry of Agriculture (Appellation Task Force 2015). Following an initial meeting in April 2019 hosted by Summerhill Winery and chaired by Ezra Cipes, Scott Smith was retained by Tantalus Vineyards on behalf of a group of neighboring wineries to help define the extent of one or more Geographical Indication(s) (GI) in the southern area of Kelowna in the central Okanagan Valley. The result is this technical (biophysical) report which describes and defines the nature of a proposed East Kelowna GI.

This technical document describes the extent and rationale for a East Kelowna GI boundary. It follows the concept originally put forward by Andy Gebert of St. Hubertus Estate Winery but does not extend into the domain of the proposed South Kelowna Slopes GI along the shore of Okanagan Lake which will proceed with a separate application and designation.

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 East Kelowna Slopes GI encompasses the mixed glaciofluvial and fluvial slopes and benches overlooking Mission Creek in the South East Kelowna area of the central Okanagan Valley. The proposed GI covers an area of approximately 2,500 ha (Figure 1).

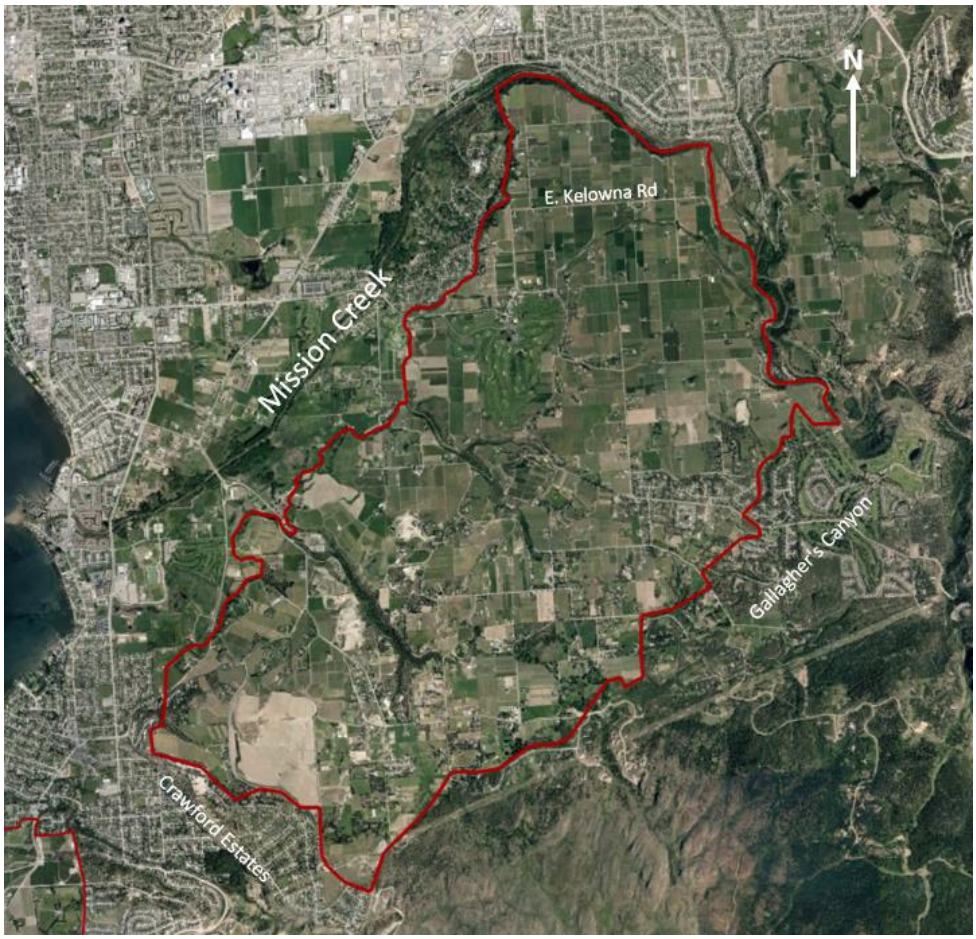


Figure 1. Overview of the boundary configuration for the proposed GI.

As with the delineation of other GIs in the Okanagan Valley, we have used wherever possible natural features to place boundaries. For East Kelowna Slopes, we used several different natural features as well as the extent of arable land to define the GI. The upper boundary was largely set based on the extent of land suitable or potentially suitable for agriculture and for the most part this coincides with the upper boundary of the Agricultural Land Reserve. The elevation of the upper boundary runs between 500 and 550 m elevation depending on local topography and bedrock exposure. The lower boundary for the most part follows a series of predominant escarpments that define the edge of the lower Mission Creek valley. The southwest corner of the GI is defined by

the edge of the uppermost escarpment overlooking Bellevue Creek and the Crawford residential area.

One of the additional guiding principles of boundary placement is to try to avoid cutting across or dividing individual property lots. The boundary as proposed adheres to this principle as far as we are aware. The details of the boundary placement and the ground features used are described in more detail below.

## Boundary Rationalization

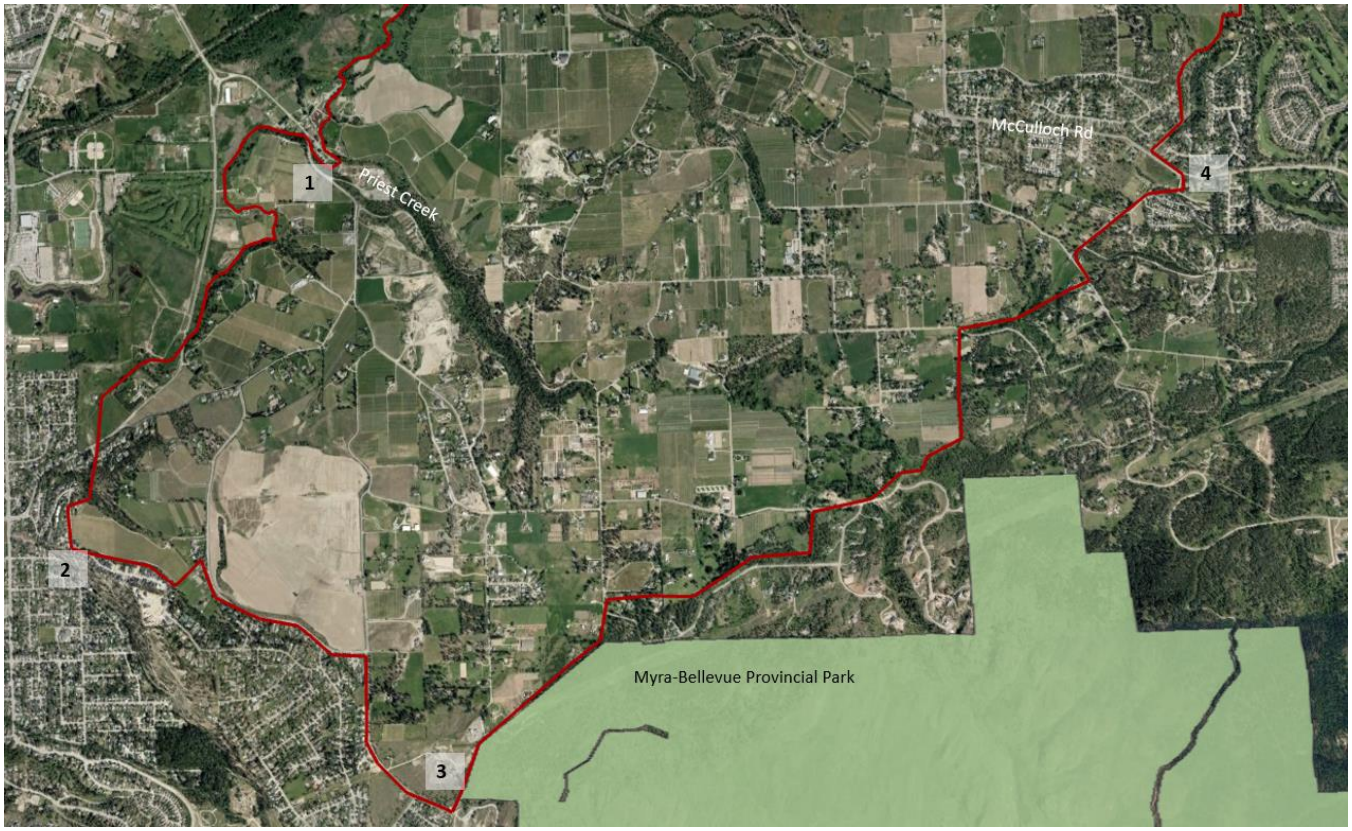


Figure 2. The boundary configuration (red line) for the western portion of the GI. Numbered markers refer to landmarks discussed in the text of this section of the report.

Much of the GI is defined by the escarpment overlooking Mission Creek and the lowlands between the mouth of Mission Creek and Bellevue Creek. The slopes and terraces above the escarpment host an extensive landscape of agricultural land which comprises the extent of the East Kelowna Slopes GI (Figure 2).

Beginning at the lower portion of Priest Creek (Figure 2, marker 1) the boundary follows along a low escarpment, across Swamp and Dehart Roads then climbs to the top of the ridge overlooking Bellevue Creek and the residential developments of Crawford (marker 2). From there the boundary

follows the top of the escarpment where it intersects with Crawford Rd and then along Stewart Rd to the boundary of Myra-Bellevue Provincial Park (marker 3). This marks the beginning of the upper elevation boundary. This follows the break in slope between the agricultural land and the footslopes of the main valley wall at an elevation of between 500 m and 550 m until it eventually intersects with McCulloch Rd at marker 4. For the most part, this is a natural slope break that also corresponds to the upper extent of the Agriculture Land Reserve in the region.

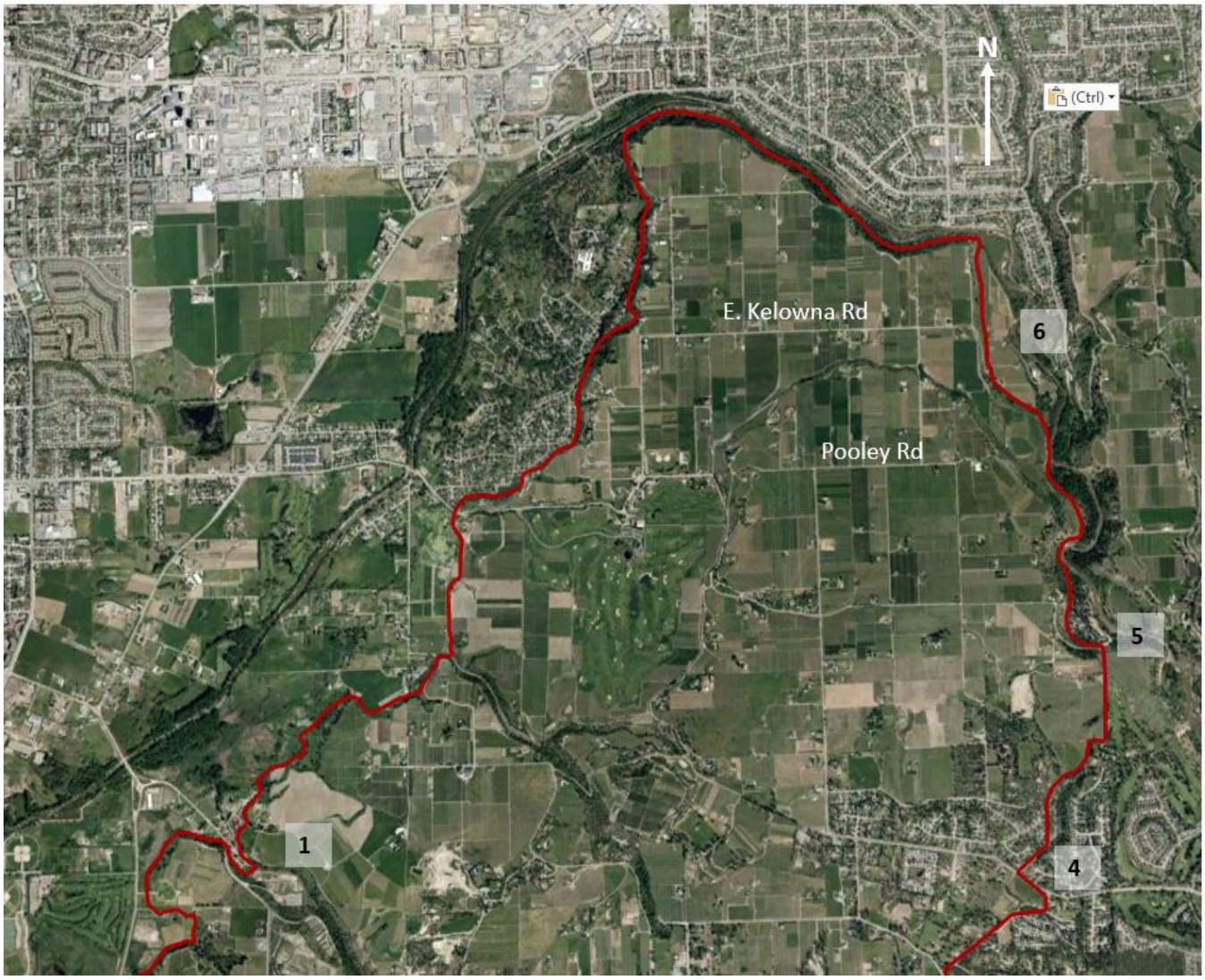


Figure 3. The boundary placement in the northern portion of the GI. For the most part, the boundary follows the escarpment overlooking Mission Creek.

From its intersection with McCulloch Rd (Figure 3, marker 4), the boundary runs northward along the edge of the Gallagher's Canyon Golf Resort until it intersects with the top of the escarpment overlooking Mission Creek (marker 5). The boundary runs along the base of the escarpment for more than 10 km eventually looping back to lower Priest Creek at marker 1. There is no land suitable for viticulture below this escarpment. There is a lower terrace of Mission Creek at the eastern end of E. Kelowna Rd that is below the main escarpment (marker 6) that is excluded due

to its position on the floodplain of the creek. Similarly, some agricultural land lies below the escarpment between Gulley Rd and Priest Creek but is subject to a high water table and thus unsuited for viticulture and not included.

# SURFICIAL GEOLOGY AND LANDFORMS

## Surficial Geology

Surficial materials, also called surficial geology, are the loose materials on top of bedrock. They are the parent materials for soils and form the slopes, terraces, benches and fans that underly the GI. The surficial geology of the area was first mapped and described as part of a regional study of the late glacial history of the Okanagan Valley by Nasmith (1962). Surficial materials were mapped for regional planning at a 1:20 000 scale for and the city of Kelowna (Iverson et al. 2004, Iverson and Uunilla 2008). 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). These studies form a good overview of the materials and landforms in the area (Figure 4).

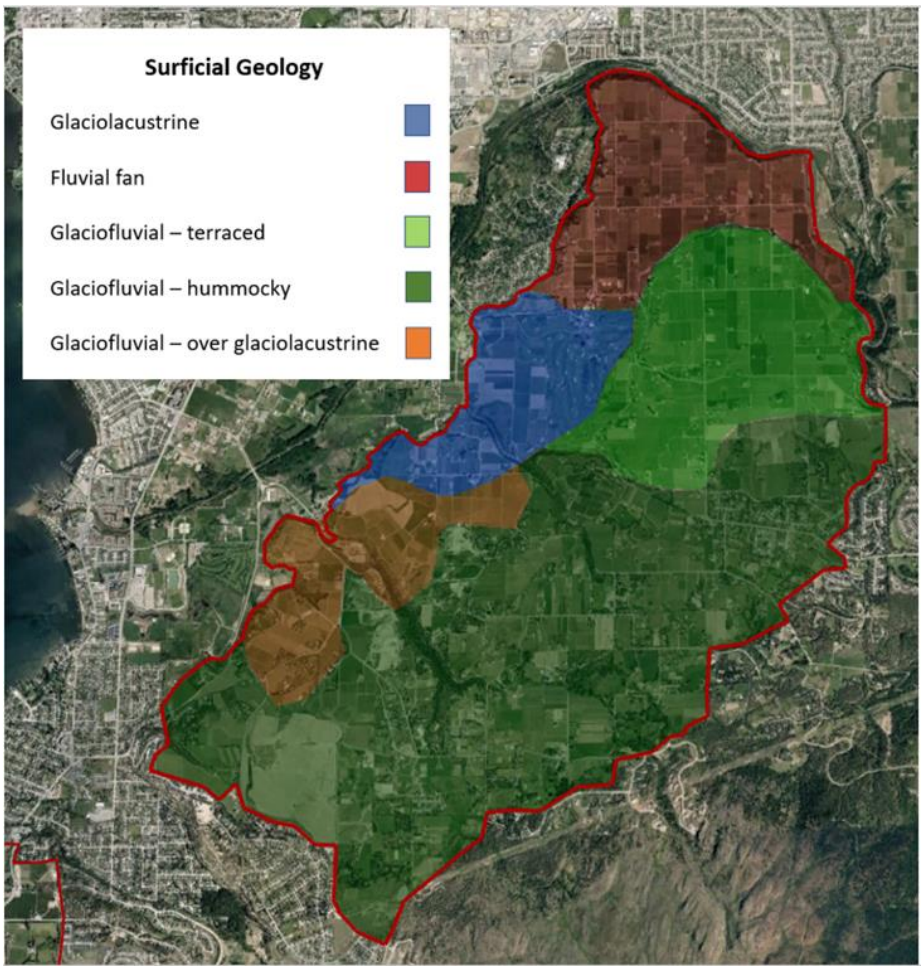


Figure 4. Generalized surficial geology map of the South Kelowna Slopes GI. Adapted from earlier published regional mapping.

The Okanagan Valley has been subject to multiple glaciations over the Pleistocene epoch (2.6 million to 10,000 years ago). The surficial materials in the landscape today are the result of the most recent glaciation when over 2 km of ice covered the landscape. Ice scoured the uplands, melt waters deposited sorted material in the valley bottoms as the ice receded. Wind, water, and gravity continue to shape surficial materials today.

Deglaciation occurred by down wasting in the interior plateau of BC 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. The surficial geology of most of the GI is dominated by coarse-textured glaciofluvial sediments. Most of the higher elevations are covered by hummocky coarse sands and gravels – sediments deposited in association with ice and glacial meltwaters during early stages of deglaciation in the valley bottom. The surface is irregular, with many localized ridges and depressions (pits) related to ice contact, ice movements and related meltwater (Figure 5a). In several areas within the GI, these sediments have been excavated as aggregate sources for the City of Kelowna. To the north of these hummocky sediments there is a large and relatively smoother terrace bisected by Pooley and Rose Roads composed of similar materials. This terrace represents a fan or delta built when Mission and Bellevue creek flowed into a much higher lake level. (light green map unit, Figure 4)


Figure 5. Vineyards growing on a hummocky glaciofluvial landform at higher (490 m) elevation (a); An exposure of stone-free, grayish glaciolacustrine silt and clay along KLO Road just above Mission Creek bridge (b); Vineyards growing on gently sloping glaciolacustrine deposits at the lowest elevation (400 m) in the GI (c); side view of the fluvial fan above Mission Creek showing the long, continuous, flat surface (arrow) that is typical of this type of landform (d).

During the late stages of deglaciation, lower elevations of the valley were inundated when meltwater accumulated behind and around valley ice, resulting in the formation of Glacial Lake Penticton. This large impounded body of water had a surface approximately 150m above the present level of Okanagan Lake and extended south to OK Falls. In deeper lake waters, layers of sand, silt and clay accumulated as finer sediments fell out of suspension (Figure 5b). These glaciolacustrine sediments support vineyards below 450 m elevations (Figure 5c). At lower elevations there is an area where glaciofluvial gravels have been deposited over the glaciolacustrine materials, most prevalently along the base of Casorso and Dehart Roads (light brown, Figure 4). The thickness of the gravels over the silts and clays varies significantly generating a heterogenous cover of soils that today support a range of horticultural production. Somewhat later, an ancestral Mission Creek loaded with coarse gravelly sediment, and flowing at a base level about 50 m higher than the modern-day Mission Creek, generated the fluvial fan that underlies the landscape along E. Kelowna Road (Figure 5d). This landform is classed as a fluvial fan which exhibits a very slight slope toward the lake that represents the gradient of this former system (reddish colour, Figure 4). The soils on this material are uniformly cobbly in nature. This resulted in gullies and scarp slopes cut into the thick glacial materials, leaving the large bench or terrace area of South East Kelowna well above modern lake and river levels Wind deposited, stone free eolian silt and sand form a discontinuous surface layer on gentle slopes and terraces. These geologic materials form the parent materials for the soils that exist in the GI. Parent materials determine the water holding capacity of the vineyard soils and so are important setting vineyard irrigation management.

## Landforms

The surface form or condition of the geological deposits create landforms. Landforms in turn are often associated with specific materials. Figure 6 shows the landscape of the GI classified into landform units based on topography and relative slope positions.

The bulk of the area is simply classed as sloping (yellow) but certain geological materials such as the fluvial fan at the northern end of the GI and the glaciofluvial terrace above it are nearly ‘flat’ surfaces (gray) with slopes <5% gradient. These two nearly level surfaces are often referred to as ‘benches’ and are the dominant landforms in the northern portion of the GI. All of the lowland areas outside of the GI on the modern Mission Creek floodplain are also classed as ‘flat’ (gray). The landscape of the hummocky glaciofluvial deposits is dotted with very localized ridges and valleys (red and blue). The narrow gully systems of the larger creeks in the GI are also classed as valleys (blue).

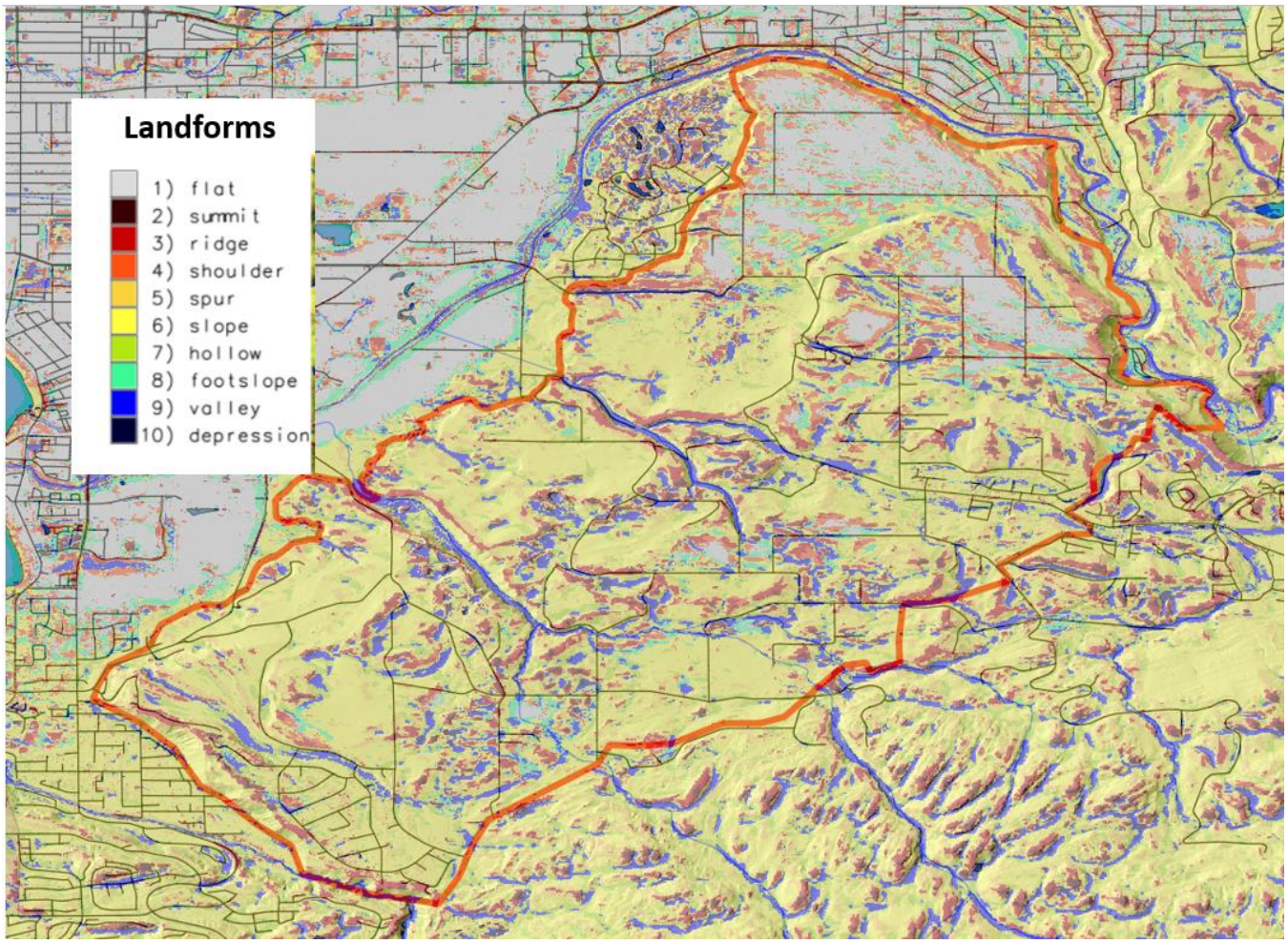


Figure 6. Landform classes based on computer-based terrain classification. The map was generated using 5 m LIDAR elevation data and classified using the method of Jasiewicz and Stepinski (2013) into landform types referred to as 'geomorphons'. Orange line is the boundary of the East Kelowna GI

## 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 East Kelowna Slopes 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 cobbly. The soils formed over thousands of years under an open pine forest at mid to higher elevations in the GI or under shrubby grasslands at the lowest elevations. Soils formed under forest vegetation belong to the Brunisolic taxonomic order according to the Canadian System of Soil Classification while those formed under grasslands belong to the Chernozemic order (Soil Classification Working Group 1998).

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 three groups. Most common are soils formed on hummocky glaciofluvial parent materials, these always have gravelly subsoils with surface cover of sandy or loamy sand of various thickness (Gammil, Parkhill, Paradise and Trout Creek). The Gammil soil is commonly used for viticulture where vineyards are located at higher elevations within the GI. This soil series is characterized by a thin cover <25 cm thick of sandy material over gravel (Figure 7a). 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 classed as hummocky glaciofluvial surficial geology based on soil survey mapping (Wettneben 1986).

The second group consists of a single soil (Rutland) which has widespread and continuous distribution on the level glaciofluvial terrace and fluvial fan surfaces (Figure 7b). The Rutland soil is also common on similar landforms in the south Okanagan and as such is one of the most widely used soils for viticulture in the valley despite the large volume of stones found in this soil. Rounded stones can make up to 60% of the volume of these soils in many cases. Such a high volume of stones greatly reduces the soils ability to hold moisture and so these soils require careful monitoring when under irrigation management.

Table 1. Common soil series and their characteristics found underlying the vineyards of the South East Kelowna Slopes GI.

| Soil Series Name | Location | Profile Characteristics | Viticultural Use |
|---|---|---|---|
| | | ***Soils formed on hummocky glaciofluvial parent materials*** | |
| Gammil | Widespread occurrence | Sandy surface horizon overlying gravelly loamy sand at <25 cm depth | Commonly used for viticulture in the GI. Somewhat droughty and often stony when cultivated, but suitable for irrigation |
| Paradise | Sporadic occurrence | Sandy surface horizon overlying gravelly loamy sand at 25 to 60 cm depth | While less common, use is similar to Gammil soil. |
| Parkill | Common occurrence | Largely stone-free sands and loamy sands | Very droughty, limited use in the GI. |
| Trout Creek | Sporadic occurrence | Loamy sands over gravel at >60 cm depth | Limited distribution but well suited to irrigation. |
| | | ***Soils formed on fluvial fan and glaciofluvial terraces*** | |
| Rutland | Level surfaces of fans and terraces | Soil is composed primarily of cobbles and gravels with thin surface veneer of sandy loam | Although difficult to work, Rutland soils are used throughout the Okanagan valley for viticulture. |
| | | ***Soils formed on glaciolacustrine parent materials*** | |
| Glenmore | Lower elevations | Clay loam, silty clay loam, few stones | High moisture retention, soft when wet. |
| Greata | Sporadic occurrence, often discontinuous coverage | Sandy gravel overlying clayey subsoil | Well suited for irrigated viticulture |
| Kalamoir | Lower elevations | Fine sands overlying loamy to clayey subsoil | Discontinuous distribution but well suited to viticulture |
| Knox Mountain | Lower elevation | 10 to 50 cm of sandy loam overlying silty clay loam | Well suited and commonly used. |

The third group of soils are less common than the glaciofluvial soils but are important to production. These are soils formed on glaciolacustrine sediments . 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. 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, Knox Mountain and Kalamoir soils in which sands or gravels cap the glaciolacustrine sediments at variable depth. As glaciolacustrine soils have sporadic occurrence in the GI, they have limited use for viticulture in the GI, but their high moisture holding capacity at depth has implications for the amounts and timing of irrigation on these soils compared to the coarse-textured glaciofluvial soils which have less water holding capacity.


Figure 7. Two soils formed in parent materials of glaciofluvial and fluvial origin. The Paradise soil series is gravelly with a thin veneer (<25 cm) of sandy loam cover as denoted by the dashed line (a). The Rutland soil is similarly gravelly except that the volume of stones and the size of the stones are larger. The Paradise is a soil formed under Pine forest and exhibits a leached grayish surface horizon while the Rutland soil exhibits a dark-coloured surface horizon typical of soils formed under grassland.

## CLIMATE

Aspect (slope direction) and slope angle are important modifiers of regional climate. In general, the predominant slope direction within the GI is northwest, although local topographic conditions alter this to provide an array of slope directions for most vineyards. The second influence on growing conditions is elevation. Sites located at higher elevation are slightly cooler than those a lower elevation, hence the warmest growing sites in the GI are those at low elevation with slope directions facing more westward rather than northwest. Proximity to Okanagan Lake (Figure 8) affects temperature, as generally sites closer to the lake will have moderated temperatures, slightly cooler in the summer and warmer in the winter and shoulder seasons.


Figure 8. Distances to Okanagan Lake from winery locations within the East Kelowna Slopes GI.

There are no long-term weather stations within the extent of the GI. Table 2 lists average summer temperatures (June, July and, August) and the frost-free period (FFP) for the five winery locations plotted on Figure 8 as modelled by ClimateBC. These temperatures are extrapolated spatially from long-term weather stations in the region, so represent an approximation of temperature conditions in the vineyards. The modelled summer temperatures are largely a function of elevation, and the frost-free period is a function of both elevation and distance to the lake.

Table 2. Topographic and climate factors derived for winery vineyards. Climate values are extrapolated from model outputs from ClimateBC based on the historical period 1981-2010.

| Site location | Elev | Distance to Lake | Ave summer T | FFP |
|---|---|---|---|---|
| | m | km | °C | days |
| Camelot | 450-455 | 6.4 | 19.5 | 172 |
| Kitsch | 400-425 | 4.5 | 19.8 | 175 |
| Spearhead | 470-490 | 4.2 | 19.2 | 168 |
| Sperling | 375-430 | 2.6 | 20.0 | 179 |
| Tantalus | 375-430 | 2.0 | 19.8 | 177 |

Only one vineyard temperature record from within the GI was available for this report. Data were recorded for the year 2018, which was close to an average year in terms of growing season temperatures in the Okanagan Valley. The weather station is located in the Quail's Gate's Fipke vineyard at 435 m elevation. From the recorded temperature data, two climate indices were calculated: growing degree days base 10 (GDD) which is a measure of effective growing season heat; and frost free period (FFP) which is the length of the growing season from the last frost in the spring until the first frost in the fall. The GDD total was 1340, and the FFP was 194 days at the Fipke site (Table 3). Weather stations at two Sebastian Farms sites (Simes and Cedar Creek) in the adjacent South Kelowna Slopes GI are located at similar elevation but closer to the lake than Fipke, and both recorded frost free periods of well over 200 days. The difference may be a function of proximity to the lake or simply local topographic conditions at the Fipke site. While these single year records give us some insight to local growing conditions, they do not provide enough information to truly define the climate condition for an area. Nevertheless, climate in the GI can be described as cool (1200 to 1400 GDD) and having an average FFP for the Okanagan Valley (170 to 200 days).

The combinations of slope, elevation, and landscape position create a range of mesoclimates within the sub-GI. Many vineyard sites in the GI are gently sloped, mostly to the northwest, which promotes cold air drainage and enhances the GDD and the FFP at those sites. Level and depressional landform positions often lack good air drainage. Sites with good air drainage have a lower incidence of vine damage by frosts and winter freeze events.

Table 3. Comparison of three vineyard weather station records for 2018.

| Vineyard | Elevation (m) | 2018 | |
|---|---|---|---|
| | | GDD | FFP (days) |
| Simes (SF22) | 455 | 1280 | >210 |
| Cedar Creek (SF29) | 400 | 1376 | 220 |
| Fipke (Quail's Gate) | 435 | 1340 | 194 |

## Viticultural Characterization

The climate and growing season length of the GI make it well suited to growing cool-climate cultivars for production of premium wines. Although 70% of the acreage is planted with white wine cultivars, Pinot noir is the most widely planted cultivar and accounts for 80% of the vineyard area planted with red wine cultivars (Table 4). The main white wine cultivars grown are Gewurztraminer, Riesling, Chardonnay and Pinot Gris, which account for 84% of the vineyard area planted with white wine cultivars. These produce crisp and full-bodied white wines with abundant flavor and aroma. The GI is also known for producing premium sparkling wine.

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 fluvial fan materials (Table 1) require frequent irrigation and nutrient applications but allow for easier manipulation of vine vigor to achieve a balance of vigor with 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 (≥ 2 % of vineyard area) grown in the proposed East Kelowna Slopes GI, expressed as percentage of the reporting growing area. Data provided by BC Wine Authority.

| Cultivar | Percent of vineyard area |
|---|---|
| Pinot Noir | 23.7 |
| Pinotage | 2.3 |
| Pinot Meunier | 2.0 |
| Gewurztraminer | 19.8 |
| Riesling | 14.6 |
| Chardonnay | 13.2 |
| Pinot Gris | 11.3 |
| Ehrenfelser | 3.8 |
| Sovereign Opal | 3.3 |

## 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

Iverson, K., C. Cadrin, D. S. Filatow, and C. Erwin. 2004. Sensitive Ecosystems Inventory: Central Okanagan, 2000 – 2001. Volume 2: Terrestrial Ecosystem Mapping, Surface Erosion and Slope Stability, and Expanded Legend. Unpub. report prepared for the Regional District of the Central Okanagan.

Iverson, K., and P. Uunilla. 2008. Sensitive Ecosystems Inventory: Kelowna. Volume 2: Terrestrial Ecosystem, Terrain, Terrain Stability and Soil Erosion Potential Mapping, and Expanded Legend. Unpub. report prepared for the Ministry of Environment and Allan Brooks Nature Centre.

Jasiewicz, J. and T. Stepinski. 2013. Geomorphons: a pattern recognition approach to classification and mapping of landforms. Geomorphology 182:147-156.

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