UBC Okanagan Greenhouse Proposal

The purpose of this proposal is to gain approval for the placement of fill on ALR to accommodate the construction of a Greenhouse for the University of British Columbia (UBC) Okanagan Campus. Although a greenhouse is a permitted use within the ALR, in pre-application conversations the ALC has advised that in this instance it would be considered a non-farm use as it is intended for the propagation and growth of research plants.

Greenhouse Proposal

There is presently an unmet need for greenhouse space at the UBC Okanagan campus. This need is buttressed by the circumstance that existing facilities in other parts of the BC Interior and in the Lower Mainland cannot effectively and efficiently serve the university's greenhouse research needs. Lack of adequate greenhouse space on campus has resulted in loss of research and researcher interest to out-of-province and country institutions.

The university's greenhouse-related research teams are nonetheless some of the most productive on campus, and research conducted in the Greenhouse will be directly applicable to major agricultural industries in the Okanagan Valley and province, including the fruit and wine industries. The research will also expand knowledge of and develop mitigation strategies for the changing conditions in the Okanagan Valley due to climate change, such as the expanding growing range of cherry crops. Please refer to the attached letter from UBC Okanagan's lead Greenhouse researchers, Dr. Susan Murch and Dr. John Klironomos, outlining the relevance and importance of the research enabled by a campus greenhouse facility in supporting the Okanagan's and province's agricultural industries.

The Greenhouse proposal includes a 475 sq. m. (5,113 sq. ft.) greenhouse building, with a fenced outdoor growing area of 256 sq. m. (2,756 sq. ft.). (Refer to Drawing A-2 – Site Plan). Additional outdoor growing activities will access a discrete area of the adjacent undisturbed native lands. Access to the Greenhouse will be provided from the main UBC Okanagan campus via an extension of a driveway from the Upper Campus Health Building (formerly the Mountain Weather Office) at 1238 Discovery Avenue. The proposed outdoor growing, access and loading areas will be unpaved gravel surface. Services for the Greenhouse will be extended from the main campus along the north side of the proposed driveway access extension, including sanitary sewer. As such, no septic field is proposed. (Refer to Drawing C-101 – Civil Site Plan). Both the driveway access and services extension will cross the Glenmore Ellison Irrigation District's (GEID) land parcel that separates the university's main campus from its agricultural land holdings to the west, and discussions are presently underway with the GEID to secure an access easement across this intervening parcel. The proposed Greenhouse design anticipates two possible future glasshouse additions, which could enable a further indoor growing area of 731 sq. m. (7,868 sq. ft.); however, neither will be developed at this time.

The Greenhouse will be used uniquely for propagation and growth of research plants, and will not include any uses that would not be consistent with normal agricultural operations. Research plants will be monitored and measured with standard techniques and protocols, with all research analyses to take place in existing laboratories on the main UBC Okanagan campus, outside the ALR. The Greenhouse will not be used for classroom, lecture or teaching laboratory, and no scheduled classes or teaching activities will take place at the Greenhouse facility.

Proposed Location

Several sites were assessed for the Greenhouse, including areas on the main campus lands. However, the subject site on the university's west campus lands was identified as the most suitable location for the Greenhouse. In addition to being in close and convenient proximity for the university's researchers, the proposed siting provides a complementary land use on the university's agricultural lands and adjacent to its actively farmed lands. The proposed siting enables the university to minimize related impacts (e.g. light overspill, agricultural impact) on the campus's existing academic and residential facilities, and enables opportunity for outdoor growing activity generally, and in native soils and landscape specifically. The site's unobstructed westward orientation allows for full sun exposure, and its adjacency to the main campus enables analysis activities to occur back in the campus's research labs.

The proposed footprint and siting of the Greenhouse will have minimal impact on the agricultural function of the ALR lands on which it is developed. The site is located at the southeast corner of the land parcel on a sloped area of undisturbed natural woodland, and is located outside of the area on the parcel used for agricultural purposes (i.e., alfalfa cultivation). The proposed access and loading area for the Greenhouse is unpaved and limited in size, and no long-term parking is provided on site. Personal vehicle parking is accommodated at the main campus, and it is expected researchers will access the Greenhouse on foot. Finally, the Greenhouse siting is generally in line with the site's sloped condition to minimize disturbance and the cut/fill needed to level the site.

Proposal dimensions

Total fill placement area (to one decimal place).
The total fill/cut area is 0.2 ha, with a total fill area of 0.1 ha.

Maximum depth of material to be placed as fill.
The maximum depth of the material to be placed as fill could be 3m, along the western edge of the greenhouse building, but is generally expected to be closer to 2.0-2.5m.

Volume of material to be placed as fill
The total volume of material to be cut is 671 Cu. M. and to be filled is 411.75 Cu M. with a net cut of 259.05 Cu. M. The project geotechnical report identifies the subsurface soils as both sand-gravel mixtures suitable for reuse and sand-silt mixtures not practical for reuse. If the soil encountered within the cut portion is feasible for reuse it will be used for the fill component, with the excess soils removed from the site. If the cut portion is not feasible for reuse then structural fill will be imported to the site. The existing top soil will be kept and reused on site for landscape rehabilitation and use at the greenhouse.

Estimated duration of the project.

While the project is expected to take approx. 6-8 months for construction, the Greenhouse is anticipated to serve the university for as long as the building can safely endure.

Has a Professional Agrologist reviewed the project and provided a written report? If yes, please attach the Professional Agrologist report in the "Upload Attachments" section.
No, through pre-application conversations with the ALC it was advised that an Agrologist review would not required due to the limited size and nature of the proposal.

What alternative measures have you considered or attempted before proposing to place fill?
The proposed location for the Greenhouse within the sloped area along the parcel's eastern boundary was selected in order to minimize impact on agricultural. However, due to the slope, earthwork and fill are required in order to level the site. The extent of levelling and site disruption is minimized through orienting the greenhouse in line with the existing slope.

Describe the type of fill proposed to be placed.

As noted above, where the site's existing soils have been cut and are suitable for reuse, they will be used for fill on site. Should they not be suitable for reuse, structural fill will be imported to the site. Any structural fill used on site will be clean and free of contaminants, and sourced from a reputable soils company. In accordance with the project's geotechnical study, the following has been specified for required structural fill for the project:

- well-graded 75 mm minus pit run gravel containing less than 8% fines by weight e.g., MMCD Platinum Edition Volume II (2009) Article 31 05 17 (2.3) – Pit Run Gravel, or
- crushed aggregate sand and gravel containing less than 5% fines by weight such as e.g., MMCD Platinum Edition Volume II (2009) Article 31 05 17 (2.9) – Crushed Granular Sub-Base.

Briefly describe the origin and quality of fill. Has the fill been assessed by a qualified professional to verify its agricultural suitability? If yes, please attach the assessment report in the "Upload Attachments" section. Only clean fill can be placed within the Agricultural Land Reserve. Material must be of good agricultural quality and free of contaminants. If the Commission has any reservations regarding the suitability of the fill material, they may request an additional assessment.

As noted above, wherever possible the site's existing soils will be reused on site if they are found to be of a suitable composition. If any structural fill is required to be imported to the site, it will clean and free of contaminants, and sourced from a reputable soils company.

Describe the type of equipment to be used for the placement of fill. If applicable, describe any processing to take place on the parcel(s) and the equipment to be used. Outline in detail all processing including the type of equipment used for each process. Processing Examples: Crushing, screening, stock piles, etc. Equipment Examples: pulverizers, crushers, screeners, excavators, etc.

Please find below a description of how fill will be managed on site:

- As silty subgrade soils will be sensitive to disturbance from weather and construction traffic, disturbances can be managed by excavating with a smooth-edge bucket as the excavator retreats from the excavation area, then placing a layer of compacted structural fill at least 150mm thick over the foundation subgrade as a working surface.
- Granular fill can be laced using an end-dump method and spread with lightweight tracked equipment
- Construction traffic should not travel directly on the unprotected subgrade and should generally avoid travelling across the proposed building footprint. Depending on the contractor's methods, thickened haul roads may be required to preserve the subgrade integrity.

What steps will be taken to reduce potential negative impacts on surrounding agricultural lands? Describe impact reducing measures such as project phasing, providing landscape screening, fencing, buffering, etc.

The site for the proposed greenhouse is located outside of the actively farmed lands on the subject parcel, and the limit of disturbance has been limited to the extent of the building and grading footprint, as illustrated on Drawing C-102 – Civil Site Plan. All access for construction will be from the east via the main campus and the adjacent driveway access for the Upper Campus Health Building on Discovery Avenue. The proposed building is oriented along existing contours to minimize the need for levelling, and the site will be graded to eliminate the need for structural retaining. The site's topsoil will be retained and reused on site, and the adjacent landscape rehabilitated.

Describe all proposed reclamation measures. If a reclamation plan from a qualified professional is available, please summarize the reclamation and attach the full plan in the "Upload Attachments" section. Describe in detail all proposed reclamation activities. Example. Project phasing, stock piling topsoil, seeding of stock piles, contouring, weed control, dust suppression, site drainage, etc.

The site's topsoil will be stockpiled and reused on site in support of the adjacent landscape rehabilitation. Disturbed areas will be minimized through construction, and reseeded with a locally appropriate, native seed mix. A temporary water management / site drainage plan will be implemented during construction with sediment controls (i.e., swales, interceptor ditches) to prevent erosion and sediment-laden water draining to off-site locations and westwards toward the farmed lands. Appropriate dust control measures will also be undertaken to prevent construction dust impacting adjacent farm lands and other property.

Further Information Regarding Parcel under Application

Legal Description
LOT 1, SECTION 10, TOWNSHIP 23 OSOYOOS DIVISION YALE DISTRICT, PLAN EPP60261

Parcel ID (PID)
030-009-723

Area
Parcel Area: 37.0 ha (91.5676 acres)
Project Site Area:

- Proposed Greenhouse Footprint 475 sq. m. (5,113 sq. ft.);
- Proposed Future Glasshouse Additions 731 sq. m. (7,868 sq. ft.);
- Proposed Outdoor Yard, Loading and Access 421 sq. m. (4,532 sq. ft.);
- Total Proposed and Future Area 1,627 sq. m. (17,513 sq. ft.)*

*Note the two potential future glasshouse additions shown on the Site Plan (Drawing Package, Page A-2) are not presently proposed to be developed at this time, and would come forward under separate future application.

Parcel Purchase Date: 2010*
*Note: Provided as attachments are two titles for the property. The first title dated 2014-11-17 shows the purchase date of 2010-06-30 and a legal description of Lot 2, Section 10, Township 23, ODYD, Plan 1637. The property was subsequently subdivided in 2016 as a result of land dedication required for the extension of John Hindle Drive through the original UBC-owned parcel. Consequently, the current title dated 2018-07-16 shows an Application Received Date of 2016-11-28 and a revised Legal Description of Lot 1, Section 10, Township 23, ODYD, Plan EPP60261.

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

September 10, 2018

To the attention of the Agricultural Land Commission,

The UBC Okanagan campus (UBCO) is embedded in a supportive agricultural and rural community in the Okanagan Valley that empowers the research community to make an impact. UBCO's research pillars are founded in our respectful, inclusive and engaged approach to our research and to the communities in which we work. We are committed to making an impact that reflects our intrinsic attachment to our natural environment; our place in the Okanagan Valley connects us to the land and to environmental issues and agricultural industries that are relevant to our region. Our research strengths in the areas of environmental sustainability and high value agriculture have important applications to our region. The proposed greenhouse facility will directly support the research programs of 12 researchers at UBCO that have spent their careers contributing to healthy environments. These researchers lead some of the most productive research teams on campus; in 2014-15, they held 25 external grants worth $3.45M and produced 45 peer-reviewed publications.

The greenhouse-related projects led by this group of researchers have direct applications in the Okanagan and interior BC food and agro-forestry sectors. The attendant socio-economic benefits of having this cluster of scientists working at UBCO and living in the Okanagan Valley cannot be overstated. The greenhouse facility at UBCO will enable the researchers to develop critical new knowledge for local and provincial agricultural and economic benefit.

Our regional partners, including organizations such as AAFC-Summerland Research & Development Center (SRDC) and FNLRO- Kalamalka Forestry Centre (KFC), have expressed a desire for more interactions with UBCO, along with a need for access to improved, research-quality greenhouse space in the Okanagan, and they support such a facility at UBCO. SRDC has also noted the importance of such a facility in its potential to provide secure back-up capabilities for its greenhouse research contents in the event of emergency, and KFC is interested in long term research collaborations with UBCO involving forest pathology and genetics, both of which require research-quality greenhouse space.

The Dean of the Faculty of Land and Food Systems at the UBC Point Grey campus, Dr. Rickey Yada, has also expressed strong support for this initiative to foster research relationships across both campuses, particularly in the area of viticulture and wine research. In addition, because greenhouse growth space is limited on the Point Grey campus, he envisions using the new greenhouse facility to achieve a new competitive niche for BC food and nutraceutical products.

Greenhouse uses. The proposed research greenhouse will be used uniquely for propagation and growth of research plants and there will be no uses that would not be consistent with normal agricultural operations. Research plants will be monitored and measured with standard techniques and protocols, with all research analyses to take place in existing laboratories on the main campus. The greenhouse will not be used as a classroom, lecture or teaching laboratory setting and no regularly scheduled classes or teaching activities will take place inside the greenhouse.

Supporting research with direct applications to the agricultural industry in the Okanagan Valley. The research conducted in the greenhouse will lead to long term agricultural benefits and

will be directly applicable to major British Columbia agricultural industries, including the fruit and wine industries. The research will also expand our knowledge of and develop mitigation strategies for the changing conditions in the Okanagan Valley due to climate change, such as the expanding growing range of cherry crops. We anticipate local, regional and global benefits stemming from the research projects that will be dependent on the greenhouse including; (a) higher productivity of crops, (b) sustainable new crop development, (c) conservation of endangered species, (d) strategies for management of pests (insect and microbial pests) and development of natural insecticides, (e) sustainable agricultural best practices for wine and craft brewery (hops) industries, (f) water conservation, and (g) climate change resiliency.

Importantly, these projects address issues that are particularly relevant to the Okanagan Valley region – such as adaptation to climate change, water issues, fruit and vegetable production, the wine industry, and crops with increasing economic impact such as cannabis and hops. UBCO researchers have a solid history of collaboration with local, national and international industry partners, spanning projects on wine (Quail's Gate, Summerhill, Burrowing Owl, Tinhorn Creek, NK]Mip, Blackhills and others), hops (Northwest Horticulture, Skagit Horticulture), haskap production (Agro Forestry Systems, Haskap Farms), cannabis production (Aphria, Tweed, Anandia, AgriMed and other US-based companies) and the lavender industry (Lavender Growers Association), among others. Representative examples of projects that are dependent on controlled growth and experimental conditions with scopes that can be realized in the new greenhouse are listed here:

Food security - Approximately ½ of BC's food is imported from other regions of Canada or other nations. The agricultural land is limited and the Okanagan represents a rich agricultural resource but not all crops can grow sustainably on the land. Research projects in the new greenhouse will test new crops for the Okanagan and for BC generally to determine which crops can be grown most efficiently. Current agricultural operations in the region grow about 100 crops but sustainable growing methods are needed.

Both apple and cherry orchards as well as vineyards require rootstocks that are disease resistant, rapidly growing and can withstand water restrictions and temperature fluctuations. Currently, the demand for apple rootstocks is at least 1 million per year and projected to increase by 10%, over the next 10 years. Elite rootstocks are available internationally but not currently available in BC. Research done in the new greenhouse facility will develop and test these elite new rootstocks to efficiently transfer the knowledge to BC producers.

The explosion of craft brewing and microbreweries has driven a high demand for specialty varieties of hops that add specific flavours but hop varieties are also susceptible to disease. Washington state currently has a quarantine restriction on transport of plants due to a virulent powdery mildew outbreak. Research in the new greenhouse facility will develop methods of growing elite certified disease-free hops for transplant to agricultural operations across the province and will breed new varieties of hops to bring new flavours to beer.

Haskap is a relatively new crop to the Okanagan valley and could provide a rich source of vitamins and nutrients to improve food security but detailed research is needed to determine disease susceptibility, the nutritional benefits for humans and the potential market for products.

Adaptation to climate change – Over the next 50 years, it will become increasingly important for Okanagan agricultural land to be used sustainably and with responsible use of water and other natural resources. This will require an understanding of the soil fertility, stability and nutrient availability and the impacts of changing climates. Researchers working at UBCO will use these criteria to create innovation for the agricultural industries in the valley.

Some of the current projects in this area look at how soil biology affects the ability of cherry growers to expand into regions that are now climatically suitable for cherry production. We have found that addition of organic amendments to soils improves their nutrient status and water-holding capacity for cherries. Greenhouse studies have also indicated that these amendments can suppress infections by plant parasitic nematodes.

Research with applications in forestry have looked at the establishment of conifer seedlings after wildfire or timber harvest which may become more difficult as the climate changes. Studies are underway to look at the nutrient status of newly germinated pine seedlings, as germinating seedlings are heavily dependent on nitrogen for growth and development. The greenhouse part of this work will study the mechanisms by which fungi trigger nutrient uptake or loss by the seedlings.

Fruit production in BC - Crop loss due to fungal pathogens is a serious problem in the fruit industry, and there is increasing consumer demand to reduce the usage of chemical fungicides. Studies are underway to look at how fungal pathogens break down to complex carbohydrates forming plant/fruit cell walls, which is the first step in establishing an infection. Understanding these processes at the molecular level is necessary to inform plant breeding strategies and devise alternative ways to elicit plant defensive responses.

The new greenhouse facility will also allow for the creation of an “Okanagan New Crop Incubator (ONCI)” that will develop new varieties of traditional crops and new crops that are ideally suited to the microclimates and ecosystems of the Okanagan and British Columbia. The Okanagan is a unique environment with seven sensitive ecosystems that are rare in the province and not suitable for growing all crops. Most crops are optimized for growth and productivity in other regions and may not be the ideal planting material for the Okanagan. A key program for the greenhouse will be research to understand the needs of Okanagan agriculture and to breed, select and grow new varieties that are specifically developed for this region.

Extraction of new, useful chemicals from plants - Each piece of a leaf contains an estimated 35,000 distinct chemicals, most of which are completely unknown. The new greenhouse facility will be used to grow a wide variety of different plant types, the tissues will be harvested and transported to the main campus for analysis. Research projects already underway on the campus include investigations of (a) a new source of rubber, (b) natural insecticides, (c) natural cosmetic ingredients, (d) anti-inflammatory compounds for topical ointments, (e) new types of anti-anxiety and other medications.

Development of novel biomaterials - Trees will be grown in the greenhouse as a source of natural latex that exudes from cut surfaces. Latex will be collected and transported to the laboratories on campus for analysis. Latex is a cloudy white emulsion of rubber particles, protein, and secondary metabolites that coagulates upon exposure to air and is produced by many plant species. We are investigating latex produced by breadfruit trees as a viable source of natural rubber as an

alternative to the rubber tree (*Hevea brasiliensis*). Rubber trees are susceptible to disease and there is limited genetic diversity after centuries of clonal production in large plantations. Additionally, some people have severe allergic reactions to latex from rubber trees and safer alternatives are needed. To date, methods have been established for rubber and protein isolation from breadfruit latex but further research is needed to determine the potential of the product.

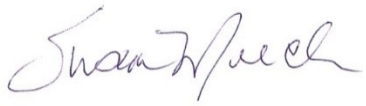
Analysis of a range of issues surrounding cannabis, including identification of plant viruses, production, harvesting, processing, safety, and quality – The closest botanical relative to hops is cannabis. Many of the technologies developed for hops, for disease detection and resistance are immediately applicable to cannabis production systems.

Research is currently underway to explore and analyze/assess a range of issues surrounding cannabis compounds, viruses, production, harvesting, processing, safety and quality. For example, one project is looking at the sustainability of cannabis production systems using the microbiome of the plants and their controlled growth environment to decrease chemical inputs. We are also developing novel biological amendments to satisfy requirements for organic certification. Finally, our researchers are working with producers to understand the chemical differences between "strains" and to determine whether varieties sold by different producers under different names are actually different.

Greenhouse Design, Energy and Waste Management Demonstration Opportunities. In addition to the plant and soil research activities it provides, the greenhouse itself can also present an opportunity to demonstrate state-of-the-art greenhouse design and construction, along with innovative and value-added waste utilization, carbon capture and energy production and utilization systems in greenhouse applications that may be replicable in greenhouse and other industrial, commercial and/or institutional applications.

On behalf of the Greenhouse User Group, we hope that this information has provided the context and evidence for the importance of this greenhouse in supporting the agricultural industry in the Okanagan Valley and British Columbia.

Sincerely,



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