UBCO ICI - PART A (SECTIONS 1 - 10)

DD REPORT

13 April 2021

UBC PROPERTIES TRUST

HCMA KIERANTIMBERLAKE ecora studio

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INTRODUCTION

Location + Site Description

The UBC Okanagan Campus's (UBCO) proposed Interdisciplinary Collaboration and Innovation (ICI) building will be a new academic facility located on Campus Plan Site 20 on the east side of Alumni Avenue. The site is located at the southeast portion of campus, south of the Engineering, Management and Education (EME) building and north of a parking area (Lot J).

Across Alumni Avenue to the west is full-size sports field with foot paths north of the field connecting to the campus administration building and the athletic precinct beyond. The main path to the north of the field is the Knowledge Lane Green Connector which runs east west on the campus and is intended to draw both people and the Okanagan landscape across the Campus extending through the ICI site framing axial views.

The Campus Plan envisions a compact campus core through strategic infill development that is sensitive to context. This site forms the southern edge of the campus center with its academic buildings. The site's proximity to the campus center facilities the intent for collaboration and interdisciplinary research. There is an intent to add a sports field flanked by student residences to the south of the ICI building.

There is a stand of mature Pine trees at the west edge of site along Alumni Avenue and a ravine forming the east edge of the site with another stand of Pine trees. At the bottom of the ravine to the north is the main holding pond with a secondary over flow holding pond/natural depression to directly east.

Currently there is service road running north-south through the otherwise natural ICI site to service the EME exterior work area and potential EME high head bay addition. The ICI site development takes into account relocation of the service road required to serve both the ICI and EME buildings with a service road directly off of Alumni between the two buildings.

Campus Plan

PROJECT DESCRIPTION

The ICI building is a proposed new interdisciplinary/transdisciplinary research and academic building with a mandate to advance UBCO as a partner in Okanagan regional development. The proposed project is 13,564 gross square meters and will provide the physical environment and visibility to enable genuine collaboration and learning leading to novel solutions and approaches to real world challenges and opportunities. It will include indigenous programs, health, data, high value agriculture and social economic regional development. With a meaningful response to the Okanagan campus and landscape as a starting point, the project will aspire to cultivate the partnership between UBCO and the Syilx Okanagan Nation.

The vision of the ICI building integrates five overarching principles – Indigeneity, Interdisciplinary and Community Engagement, Flexibility, Wellbeing, and Sustainability.

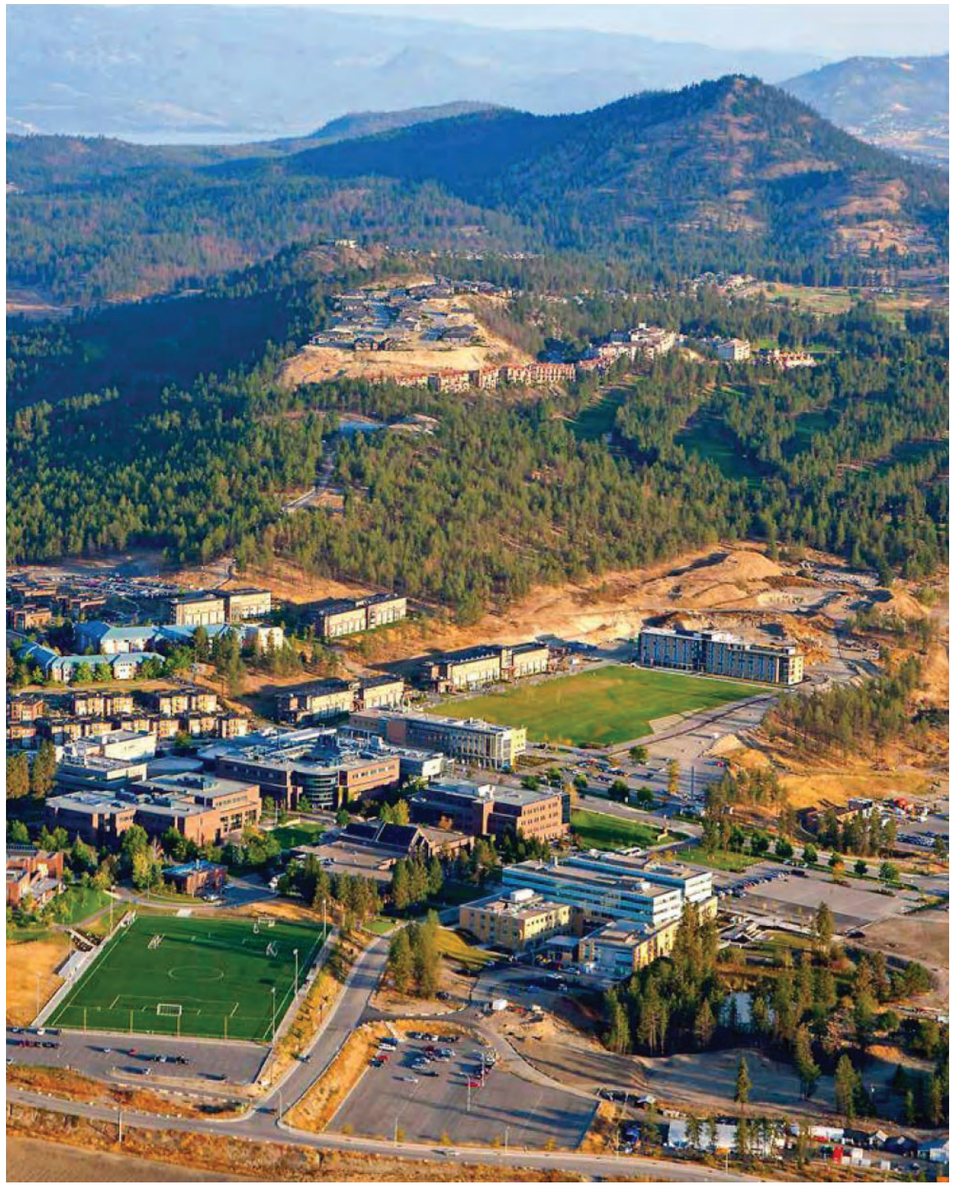
Indigeneity incorporates a process with the Syilx Nation including the eventual naming of the building. The housing of Indigenous programs, provision of space for Indigenous partners, and incorporating Indigenous and land-based ways of knowing across research and learning programs will be integral to the project. There will be a circular gathering place with capacity to support smudging and interaction with Indigenous community members and elders. A thoughtful relationship to the land and vistas beyond, natural light and materials are paramount to the project. The design team began by researching the history of the Okanagan and what this place has meant and continues to mean for the Syilx nation and the Okanagan Nation Alliance more generally.

Interdisciplinarity and community engagement will be integral from the sense of arrival and invitation through the site to within the building wherein flow from social and communal spaces of the building intermix with research and teaching. The intent is for multiple perspectives and synergies across disciplines, professions, and communities to flourish.

Flexibility is critical in that many of the programs and people in the ICI building will be new to the campus and are likely to change over time. To that end, some modularity is included and adaptability for evolving needs along with current needs is conceived of in the program and systems layouts.

Wellbeing as part of the Okanagan 2040 strategic plan component, “thriving campus communities” includes an emphasis on encouraging personal and cultural behavior that promotes healthy choices and physical activity. While always remaining accessible, the approach to the site and to the building promotes exploration and socialization and welcoming of the broader campus population.

Sustainability is also part of the Okanagan 2040 strategic plan component, “thriving campus communities”. LEED Gold certification in conjunction with reduced operational and embodied carbon are driving the systems approaches. The project team is currently reviewing strategies to meet aspirational sustainability goals.

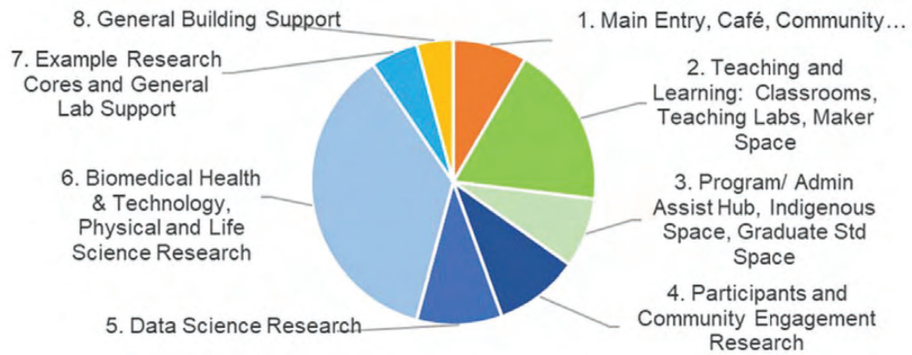


PROGRAM SUMMARY

The following diagram represents the program elements and theoretical distribution of the Functional Program. It represents the various stakeholders and users of the future ICI Building. The program is based on alignment with UBC's strategic plan, relevance to the region and potential for significant social impact, current research strength of UBCO faculty, potential for indigenization and Indigenous engagement, and potential for translating the knowledge generated by research into unique interdisciplinary academic programs.

The program includes general teaching spaces, teaching labs, maker space, research labs with support spaces, and offices. In addition, there are various community and engagement spaces, including an Indigenous gathering space, café, lecture theatre, collegium, multipurpose gathering, and social opportunities between the program areas.

While it is assumed that the program may change or evolve over time, the current program topic areas include a Salishan language teaching lab, Climate and High Value Agriculture, Health, Data, and Social and Economic Regional Development (SERD).



	Collaboration	Classrooms	Teaching Labs	Offices	Dry Labs	Wet Labs	Building Support	Total NSM	BSGM
Component 1: Entry, Cafe, Community Engagement									
	694.0	-	-	-	-	-	-	694.0	1,145
Component 2: Classrooms, Teaching Labs, Maker Space									
	32.0	743.6	742.6	-	-	-	-	1,518.2	2,505
Component 3: Program / Administrative Assistants Hub, Indigenous Space, Graduate Students Space									
	355.7	-	-	295.8	-	-	-	651.1	1,075
Component 4: Participants and Community Engagement Research Labs and Offices									
	93.5	-	-	541.4	155.7	-	-	790.6	1,304
Component 5: Dara Science Research Labs and Offices									
	133.5	-	-527.4	137.2	-	-	-	798.1	1,317
Component 6: Biomedical Health & Technology, Physical and Life Science Research									
	125.0	-	-	842.1	177.8	1,840.1	-	2,985.0	4,925
Component 7: Example Research Cores and General Lab Support									
	-	-	-	59.0	-	383.6	-	442.6	730
Component 8: General Building Support, Service Entry, Custodial, Facilities Management, End-of-Trip									
	-	-	-	-	-	-	340.5	340.5	562
Total	1,433.7	743.6	742.6	2,265.7	470.7	2,223.7	340.5	8,220.5	**13,564**

SUSTAINABILITY

The ICI project is striving to exemplify the principles of sustainable design and demonstrate leadership in response to climate change. The Design Brief sets out clear building performance goals to align with current policy and climate commitments, with a clear emphasis on planning for the future. Project progress in response to each performance goal is documented in this section. Design strategies and considerations in response to each goal is included where progress at this early stage permits.

APPROACH AND PROCESS

The UBCO Whole Systems Infrastructure Plan sets a clear path and vision for a net positive carbon campus by 2050, further supported by the UBC Green Building and Climate Action Plans. Accordingly, our design approach is rooted in the principles of sustainability, and emphasizes a contextual, place-based response that reflects the community needs as well as the local climate and site conditions. The design brief sets clear performance targets across a range of areas and requires Gold certification under LEED v4 BD+C. Emphasis on energy and low carbon construction for both operations and embodied impacts is a priority along with an approach that is sensitive to the local ecosystems prioritizes health.

Our design approach seeks co-benefits, drawing on all disciplines throughout the process to optimize decision making informed by analysis. Design strategies emphasize a passive approach first at both the building and site scale, seeking to eliminate or reduce demands first, followed by optimizing active systems for efficiency.

The project team is following the UBC Integrated Design Process for Major Capital Projects and has completed Steps 1, 2, 3A and 3B.

The first Sustainability workshop was held 02 November 2020, and the agenda included a review of project sustainability goals the project performance targets, followed brainstorming of potential design strategies related to energy and water. In advance of initiating the General Sustainability Workshop (3B), small team working sessions were held on 21 January, 26 February and 8 March with various disciplines to develop early systems strategies in response to the initial massing and program. From these sessions, a further working session was convened to frame an approach for informing refined energy performance targets in collaboration with UBC.

Workshop 3B, General Sustainability Workshop (technical) was convened 17 March 2021. Strategies related to the passive and active systems of the building were discussed and are summarized below.

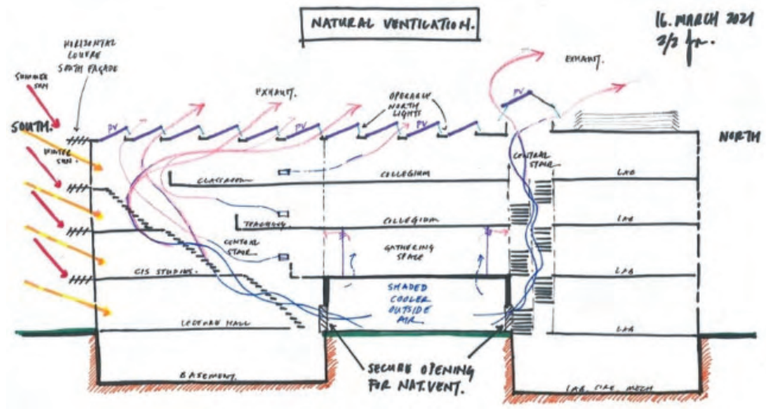
PROJECT TARGETS

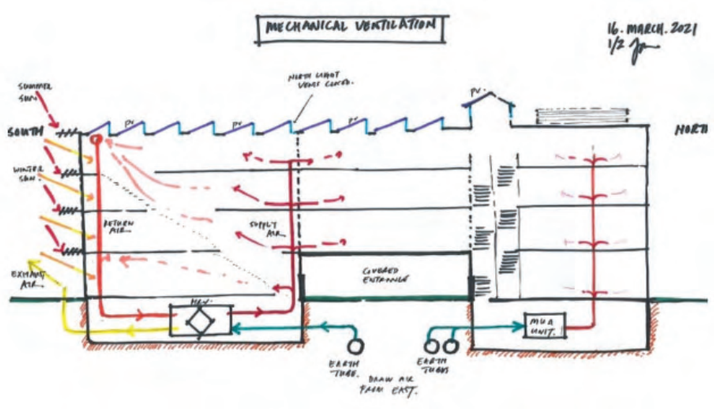
Energy

The project Design Brief set energy performance goals as follows:

a) Thermal Energy Demand Intensity (TEDI): 18 kWh/m2
b) Total Energy Utilization Intensity (TEUI): 179 kWh/m2
c) Greenhouse Gas Intensity (GHGI): 4.1 kg CO2e/m2

The ICI Design Brief sets out specific building performance goals to align with current policy and climate commitments, with a clear emphasis on planning for the future. Project progress in response is currently on-track to meet each goal. Major design strategy development to date has been focused on operational energy and emissions performance for short medium- and long-term climate conditions, embodied carbon impacts, site water management, and a guiding approach for health and wellness. Energy performance targets remain a challenge relative to the lab program, and the design team is working to refine these together with the UBC team. The Preliminary Energy Model Report completed at the end of SD confirms the design strategies reflect strong performance with TEDI, TEUI and GHGI within the range of aspirational, but realistic targets. More engagement with UBC and refinement will be required to establish final targets relative to the program. The preliminary model report estimates 18 Optimize Energy points in the LEED v4 rating system, the maximum available as evaluated according to the traditional energy cost savings metric and the new carbon savings metric. The project total LEED score is currently estimated at 70 points, ten points beyond the minimum 60 to earn Gold.





Source: Sketches of possible passive ventilation strategies

demand so careful consideration and balance between envelope efficiency and ventilation loss is key. The project is planning for whole building air tightness testing per the BCBC Energy Step Code and UBC Technical Guidelines.

The GHGI will be dependent on the fuel source for the project. The Whole Systems Infrastructure Plan outlines the long-term vision of the campus to be carbon neutral by 2050.

Opportunities and Next Steps

Based on experience with similar projects, and on other benchmarked performance data, the team have proposed a process to revise the targets in collaboration with the UBC. We expect targets to be refined in the coming weeks based on preliminary energy modeling included in this SD Report, and inform the Energy Modeling workshop accordingly.
The second workshop raised some concerns with existing natural ventilation strategies in core buildings on UBCO campus buildings, so the team is following up on these concerns to determine how they can be addressed, and any natural ventilation strategies proposed are successfully implemented.

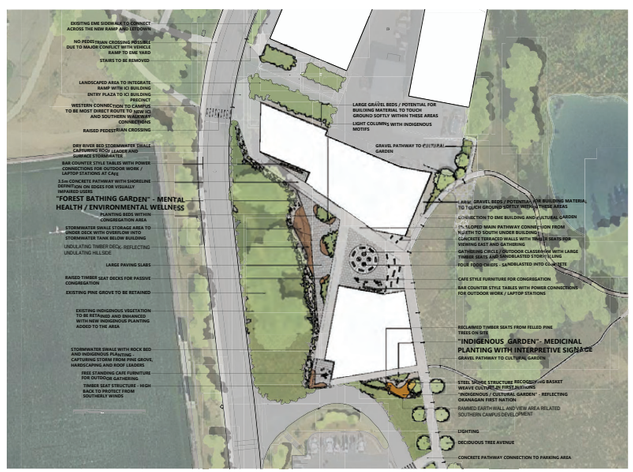
SUSTAINABILITY

Water

The project will demonstrate a 50% reduction of outdoor water use, 35% reduction of indoor water use, and comply with the UBC Okanagan Integrated Rainwater Management Plan. The project will meet the IRMP's minimum on-site retention storage of 50mm for all new catchment areas.

The project site soil is dominated by clay, limiting the ability to infiltrate rainwater on the site. Excavating the soil that currently exists on site for the foundation and then infilling around the foundation with a more porous ground medium, more water can be infiltrated. The project is currently proposing to direct some site water to a pond within the courtyard space between the two podiums, while the rest of the water would be directed to bioswales on the eastern edge and to a subsurface infiltration location.

Rainfall modelling accounting for future climate conditions, shared by UBC, confirms that the main campus pond and Pond 2 immediately adjacent to the ICI site will not be able to accommodate rainfall from the ICI site during a 1 in 100 year storm. ICI project is planning to capture all site water for infiltration or re-use. Re-use strategies will be explored once the volume of water that can be accommodated via infiltration can be confirmed.



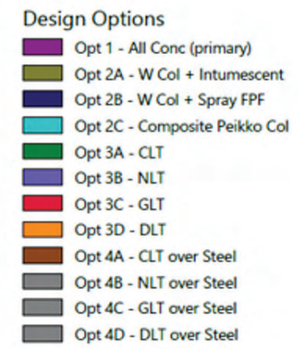
Materials and Resources

The design will account for the targets and priorities set in the design brief including strategies to support a zero-waste ready building (e.g. recycling spaces, access and loading), diverting at least 75% of construction waste from the landfill, and selecting materials with a reduced environmental footprint.

As the outline specification is developed, consideration of materials that do not contain known substances harmful to human and environmental health are being evaluated, in part to align with the goals of UBC's Green Building Action Plan which sets a target to eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human health by 2035. While the list of UBC identified substances is not yet available, the team will collaborate with the UBC stakeholder group to propose a list or standard to guide decision making.

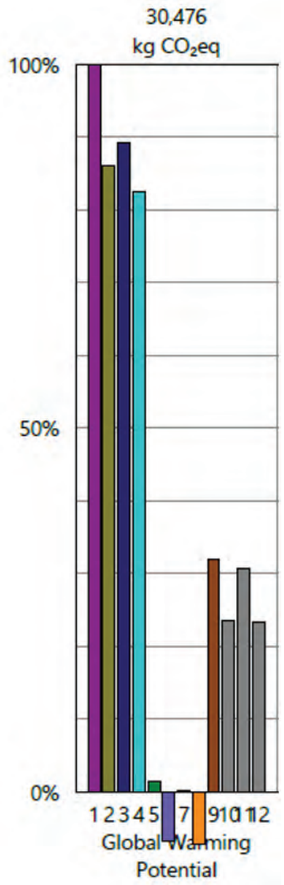
Life Cycle Assessment

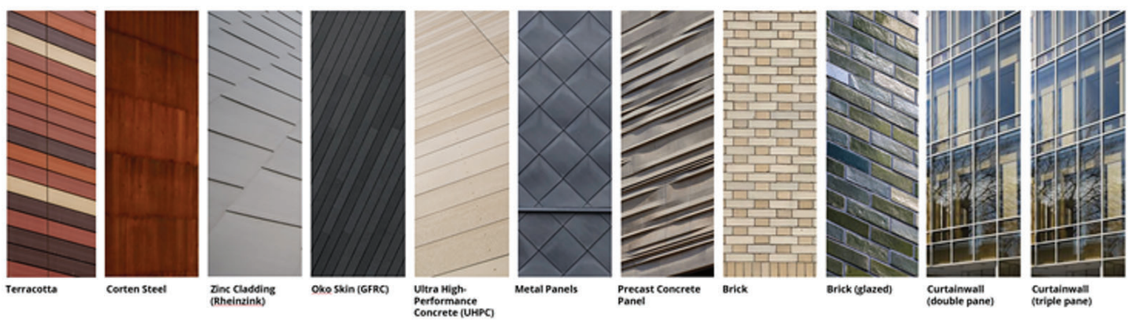
At this early stage of design, emphasis is on addressing embodied emissions as structural options and envelope assemblies are being evaluated. At minimum, the project will demonstrate a 10% savings of embodied energy compared to a baseline and comply with the requirements of the Life Cycle Assessment credit in LEED v4. Life Cycle Assessment has been initiated to best inform design decision making through the process. Both Whole Building LCA and discrete materials studies are being conducted, with a focus on structural systems and envelope options. Preliminary results of studies of a single structural bay currently indicate that a hybrid structural system is the most favourable system that is also capable of achieving the design requirements of the project. An all-steel system demonstrated an approximately 15% reduction in embodied carbon from a concrete baseline, while the hybrid steel-timber system was under 60% less CO2 equivalent emissions.



Mass timber options were studied but are not considered suitable for the project given the required floor-to-floor height clearances as well as the acoustic and vibration considerations. These studies also took into account some finishing material as required for fire rating of the different assemblies.

A preliminary Whole Building LCA will be completed a few weeks after the completion of this SD phase. Material studies will be conducted as the project progress, including more detailed analysis of envelope assembly options, and the Whole Building LCA will be repeated at the end of each subsequent design phase as options are refined.





Source: Envelope cladding options currently being considered for LCA analysis

Health and Wellbeing

Contributions to health and wellbeing are central to the design principles established. Social and contemplative spaces are reflected in the early concepts as part the site and early space programing. Collaboration spaces and opportunities for physical activity will be prioritized as design is refined. Natural ventilation is a consideration as part of the building systems strategies where applicable, and access to daylight is a priority to contribute both to high quality space and to limit demand for electric lighting.

Material considerations for both landscape and building structure prioritize natural options to benefit health as well as reduce the impact of embodied carbon. Acoustics and infectious disease control will be addressed as program and building systems are refined.

Quality

Operational considerations are included as part of design decision making. The UBCO Facilities and Operations team provided invaluable advice as part of the first Sustainability Workshop, providing experience and feedback on a range of systems and strategies. Currently, the team is engaging with the UBC to refine the lab program requirements and advise on assumptions for future program and operational needs. This engagement is critical as we refine performance targets.

The building envelope consultant was engaged as part of the first Sustainability Workshop. As design progresses, we will draw on this expertise to help optimize envelope assemblies for both quality and performance, including addressing thermal bridging, air tightness and overall performance.

Climate Adaptation

To respond to the design brief requirements to address future climate conditions, a Climate Adaptation Data Memo was prepared by reLoad Sustainable Design on 19 January 2021. The memo summarizes published data sets on climate change predictions to inform the design approach for temperature change and cooling capacities to ensure thermal comfort and to avoid expensive retrofit costs in the future. The memo lists the most relevant published information on climate change predictions for Kelowna pertaining to temperatures. The summary includes a suggested methodology for working with the data as part of the design process for UBCO-ICI to meet the UBC Climate Ready Requirements and create a climate adaptive design that is “2050 Ready”. Also included are key climate indicators and predicted temperature changes for the 2020s, 2050s and the 2080s, suggested cooling design temperatures to use for system sizing to create a “2050 Ready” facility, information on adjusted weather files to use for energy modeling and comfort studies for UBCOICI and a summary of climate file peaks and diurnal temperature variations.

The analysis and guidance provided in the memo is informing early design decision making, and systems considerations as part of the early design process. The methodology outlined in the memo will inform the upcoming Preliminary Energy and Water Workshop and inform the refined energy targets.

Green Building Certification

The design guidelines require LEED certification under LEED v4 BD+C, New Construction. The UBC LEED v4 Implementation Guide is to be applied where relevant to the Okanagan campus.

The team is using the LEED rating system strategically to evaluate performance as design progresses where applicable. The preliminary scorecard shows a minimum of 64 points, to earn Gold certification, a conservative estimate given early stages of the project. The project will pursue LEED v4.1 compliance paths where it is advantageous or aligned with performance goals.

Other Considerations

As part of the November 2020 Sustainability Workshop, a desire to demonstrate leadership in ultra low carbon design was expressed. As design progresses, we will evaluate the potential to pursue the CaGBC Zero Carbon Building – Design certification (ZCB – Design). Pursuing the program may require proposing alternative energy targets to the CaGBC to account for the intensity of the lab use. If successful, the project could contribute new knowledge and support advancement of low carbon design for this building typology. As energy targets are clarified, the team will evaluate potential to pursue ZCB – Design further.

LEED v4 BD+C
PROJECT SCORECARD

PROJECT NAME: UBCO ICI
DATE: Apr-21 **CERTIFICATION LEVEL:** GOLD

HCMA

Y	?	N			
1			Credit	Integrative Process	1

5	9		Location and Transportation		16
-	-	-	Credit	LEED for Neighborhood Development Location	16
	1		Credit	Sensitive Land Protection	1
	1		Credit	High Priority Site	2
2	3		Credit	Surrounding Density and Diverse Uses	5
2	2		Credit	Access to Quality Transit	5
1			Credit	Bicycle Facilities	1
	1		Credit	Reduced Parking Footprint	1
	1		Credit	Green Vehicles	1

6			Sustainable Sites		10
Y			Prereq	Construction Activity Pollution Prevention	Required
1			Credit	Site Assessment	1
	2		Credit	Site Development - Protect or Restore Habitat	2
	1		Credit	Open Space	1
2	1		Credit	Rainwater Management	3
2			Credit	Heat Island Reduction	2
1			Credit	Light Pollution Reduction	1

4	6	1	Water Efficiency		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
2			Credit	Outdoor Water Use Reduction	2
2	3	1	Credit	Indoor Water Use Reduction	6
	2		Credit	Cooling Tower Water Use	2
	1		Credit	Water Metering	1

27	6		Energy and Atmosphere		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
6			Credit	Enhanced Commissioning	6
18			Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
1	1		Credit	Demand Response	2
	3		Credit	Renewable Energy Production	3
1			Credit	Enhanced Refrigerant Management	1
	2		Credit	Green Power and Carbon Offsets	2

9	2		Materials and Resources		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
3			Credit	Building Life-Cycle Impact Reduction	5
1	1		Credit	Building Product Disclosure - Environmental Product Declarations	2
2			Credit	Building Product Disclosure - Sourcing of Raw Materials	2
1	1		Credit	Building Product Disclosure - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2

9	7		Indoor Environmental Quality		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
2			Credit	Enhanced Indoor Air Quality Strategies	2
2	1		Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
1	1		Credit	Indoor Air Quality Assessment	2
	1		Credit	Thermal Comfort	1
1	1		Credit	Interior Lighting	2
2	1		Credit	Daylight	3
	1		Credit	Quality Views	1
	1		Credit	Acoustic Performance	1

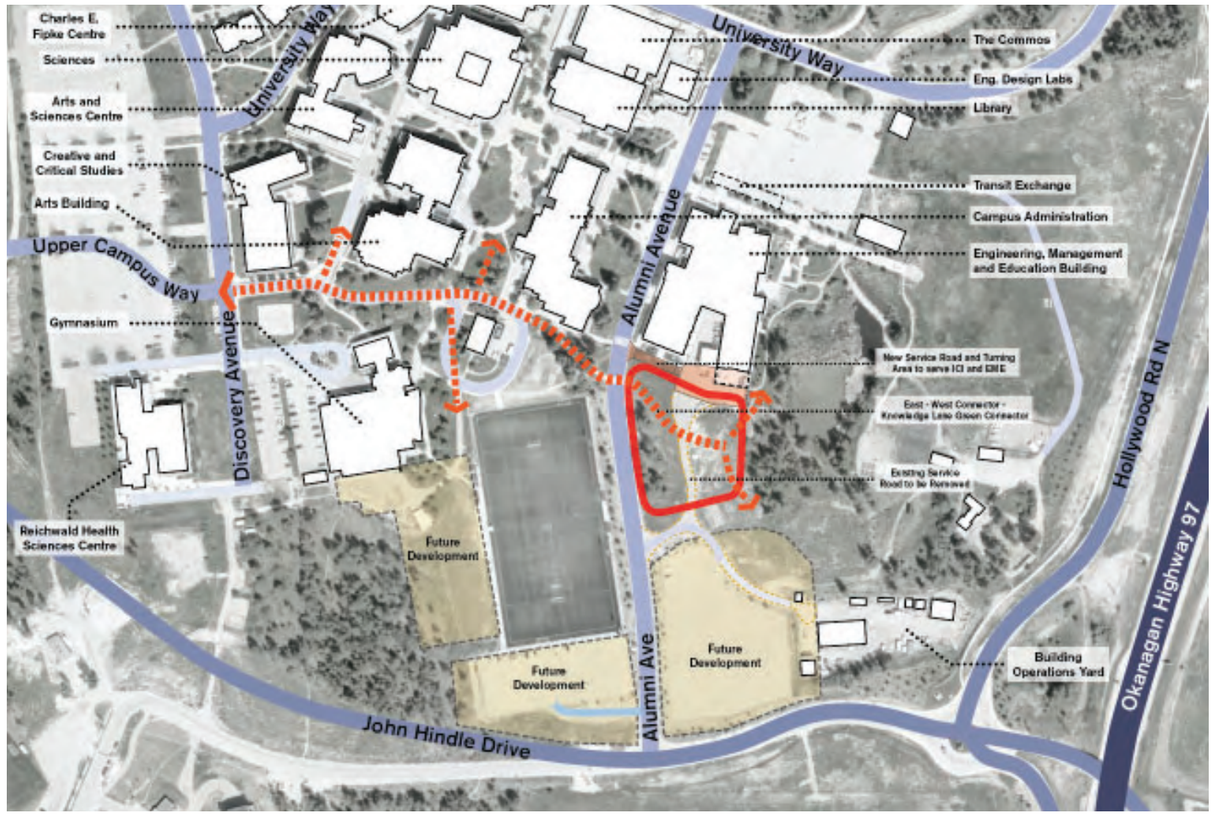
6			Innovation and Design		6
1			Credit	Innovation in Design: TBD	1
1			Credit	Innovation in Design: TBD	1
1			Credit	Innovation in Design: TBD	1
1			Credit	Innovation in Design: TBD	1
1			Credit	Innovation in Design: TBD	1
1			Credit	LEED Accredited Professional	1

3	1		Regional Priority		4
1			Credit	Regional Priority Credit 1: Light Pollution Reduction (1)	1
1			Credit	Regional Priority Credit 2: Optimize Energy Performance (10)	1
1			Credit	Regional Priority Credit 3: MR Building Life Cycle Impact Reduction (3)	1
	1		Credit	Regional Priority Credit 4: TBD.	1

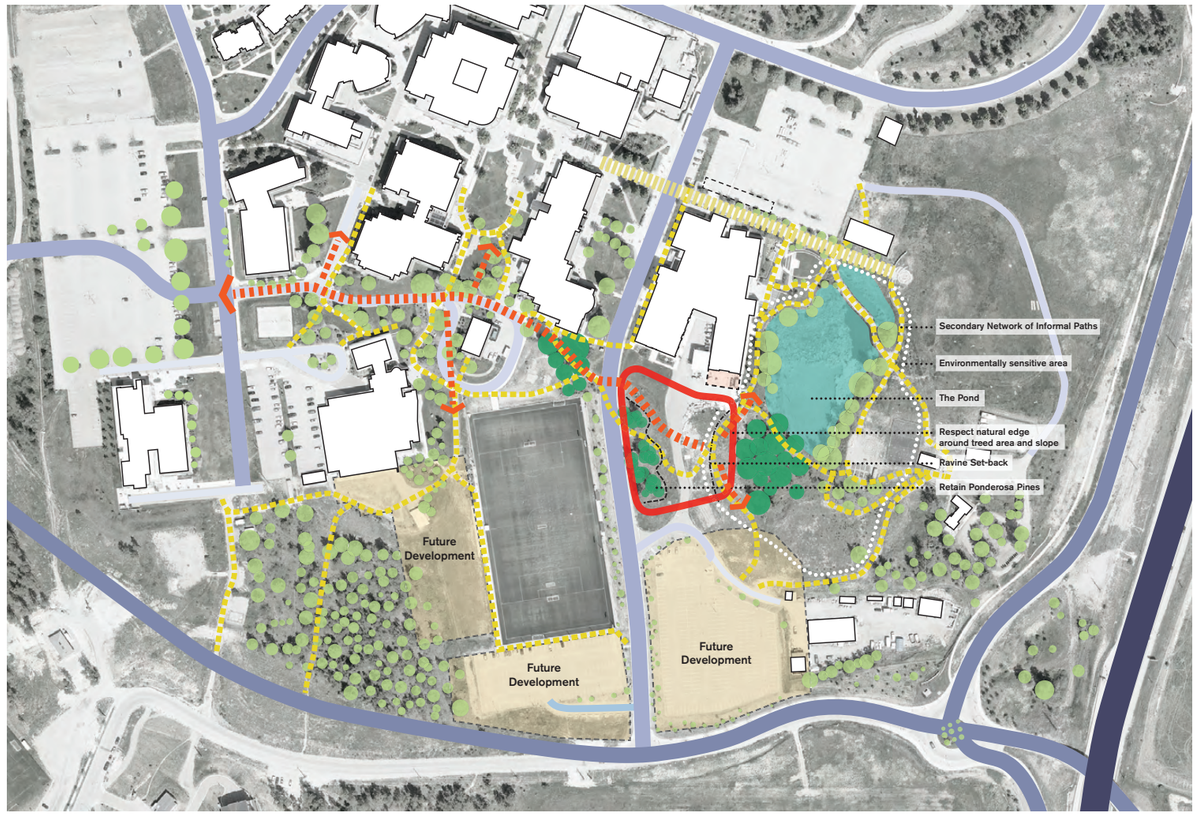
Y	?	N		
70	31	1	TOTAL SCORE	Possible Points: 110

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

CONTEXT PLANS



Formal Circulation + East-West Connector + Service Access



Informal Circulation + East-West Connector + Tree Stands + Water

DESIGN POLICY COMPLIANCE

Campus planning goals / Design Rationale

Touching the ground lightly

The overall site and massing strategy developed around the premise of preserving the natural landscape of the site and beyond. There is a signifi cant stand of Ponderosa pine trees to the west varying in height from 7 to 14 meters tall. To the east there is ravine with Ponderosa pines with a required 5m setback from the highwater mark. The west trees and the ravine form an hourglass usable area with previously noted restrictions to the north and south. The intent is that key interactive areas of the program, in two piers at grade, connect minimally with the topography and invite people into the site under an inviting soffit , into the piers, and under the building through to the paths, ponds, and views to the east. Connecting the building users to the existing and surrounding biodiversity a key driver.

Welcoming streetscape along Alumni and sense of arrival

The ICI building will be the last academic building at the south end of Alumni Avenue. The 4 storey ICI massing reaches out to Alumni just south the EME and north of the pine tree stand. The presence of that massing above the north pier relates to the EME building while signifying the pedestrian arrival entry to site from the north. From the south, the massing can be seen from the south-campus entry along with the stand of pine treeing emerging to the west upon approach to the building. Pedestrians are guided into the site along the trees from both north and south with the main entry being at the middle of the site. The building massing narrows at the middle of the site to maximize light into the entry area and allow for views to the natural landscape to the east. Soffit and landscape lighting will also enforce the welcoming and compelling entry to the central area in the evening.

Connecting Knowledge Lane greenway and framing axial views

The Knowledge Lane Green Connector runs west to east and crosses Alumni between the EME and ICI sites. The views directly east from the west side of Alumni where the greenway currently terminates are obscured by the EME back of house works yard and the EME high head room future extension. The intent is to draw/guide pedestrians from the greenway path across Alumni towards the north pier pedestrian landing with massing above and towards the central entry landscape. Vistas to the eastern landscape are bright and framed generously between the north and south piers. From the social heart of the building on each level, the views to the east are optimized.

CONTEXT ELEVATIONS

Campus planning goals / Design Rationale

Campus ‘gateway’ and defining the eastern edge of campus

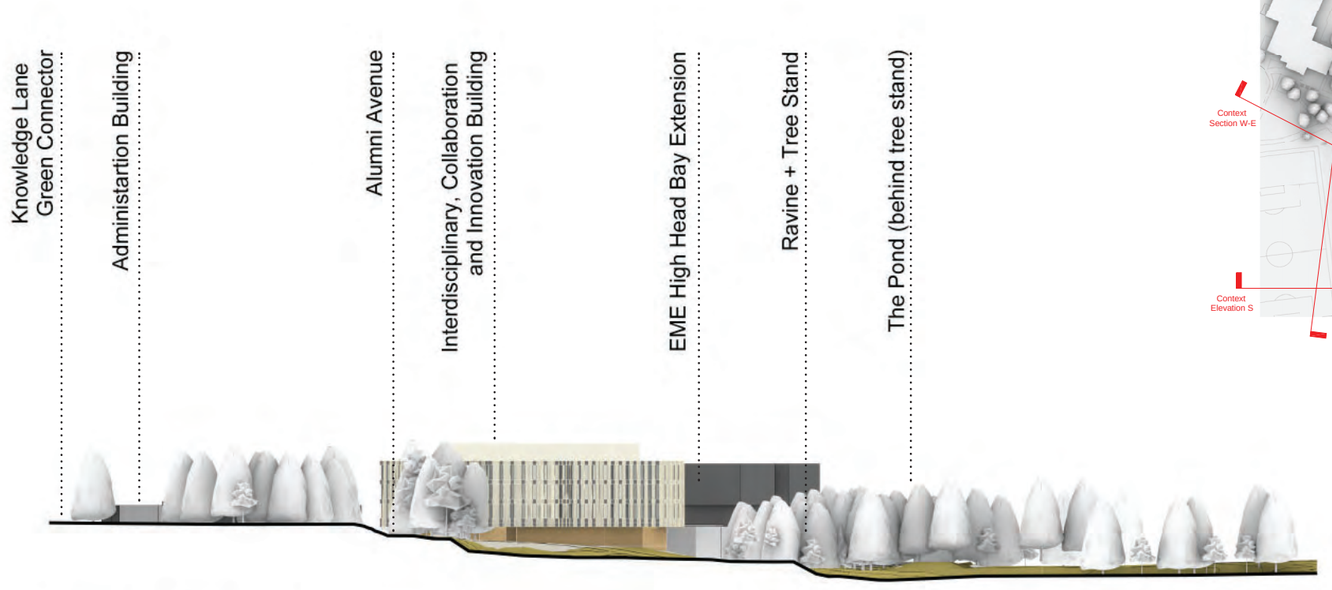
The building massing is 3 stories atop the ground level piers for a total of 4 stories and a basement. Being the last academic building on Alumni, the rhythm of the academic street wall intentionally starts to break down. Although the north wing and facade relate to the EME building, the massing steps back from Alumni south of the north wing and is faceted on the east and west to reflect the site and surrounding landscape and vistas.

What might be called a ‘gateway’ or campus arrival from the South is apparent from John Hindle Drive and as far away as the Kelowna airport. The slenderness of the South elevation allows for a glimpse of the pine trees at the west of the site and for a future relationship to a more residential development and sports field to the South.

The eastern frontage articulation generated by the ravine shape will be visible when viewed from afar.

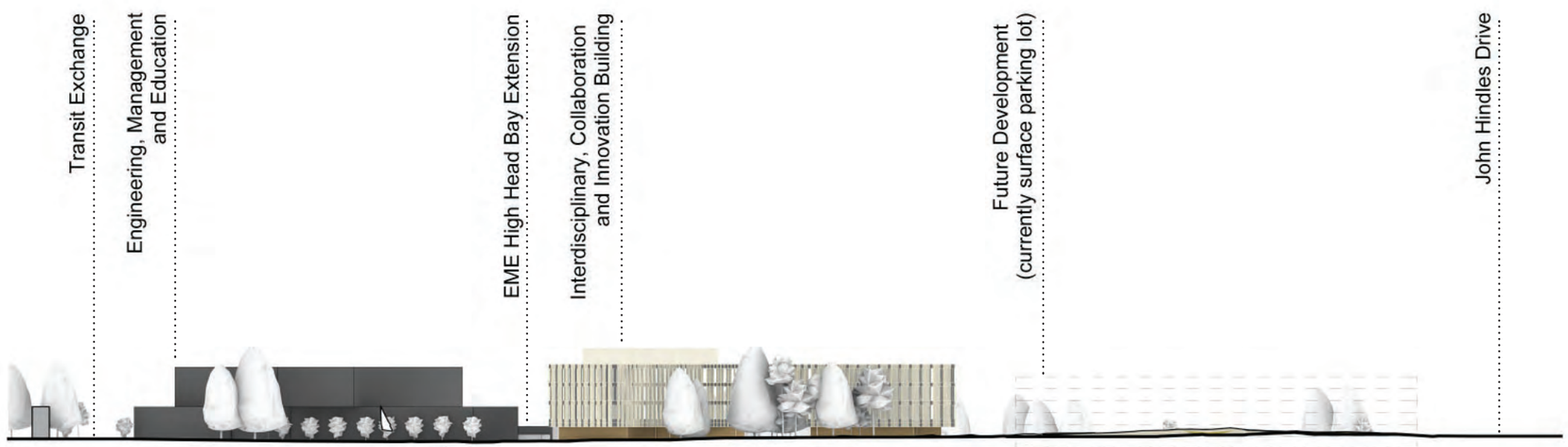
Shared service road and end of trip facilities

Given the ICI site constraints on all sides including an airport height restriction, it was key to the project to re-locate the existing service road in between ICI and EME rather than accommodating the existing service road in a north south orientation. In the development of the new service road, turning and loading requirements were taken into consideration along with the footprint of the future EME high-headroom expansion. The ICI end of trip facilities are placed to the north of the north pier for ease of bike access at this service location.



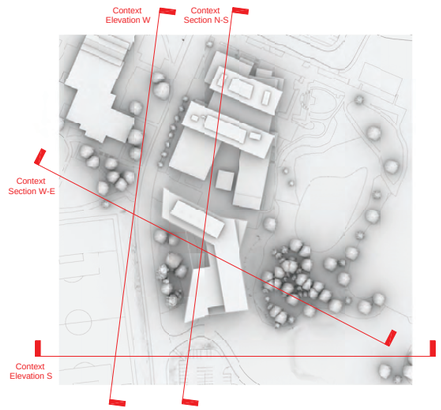
Context South Elevation

0 5 10m

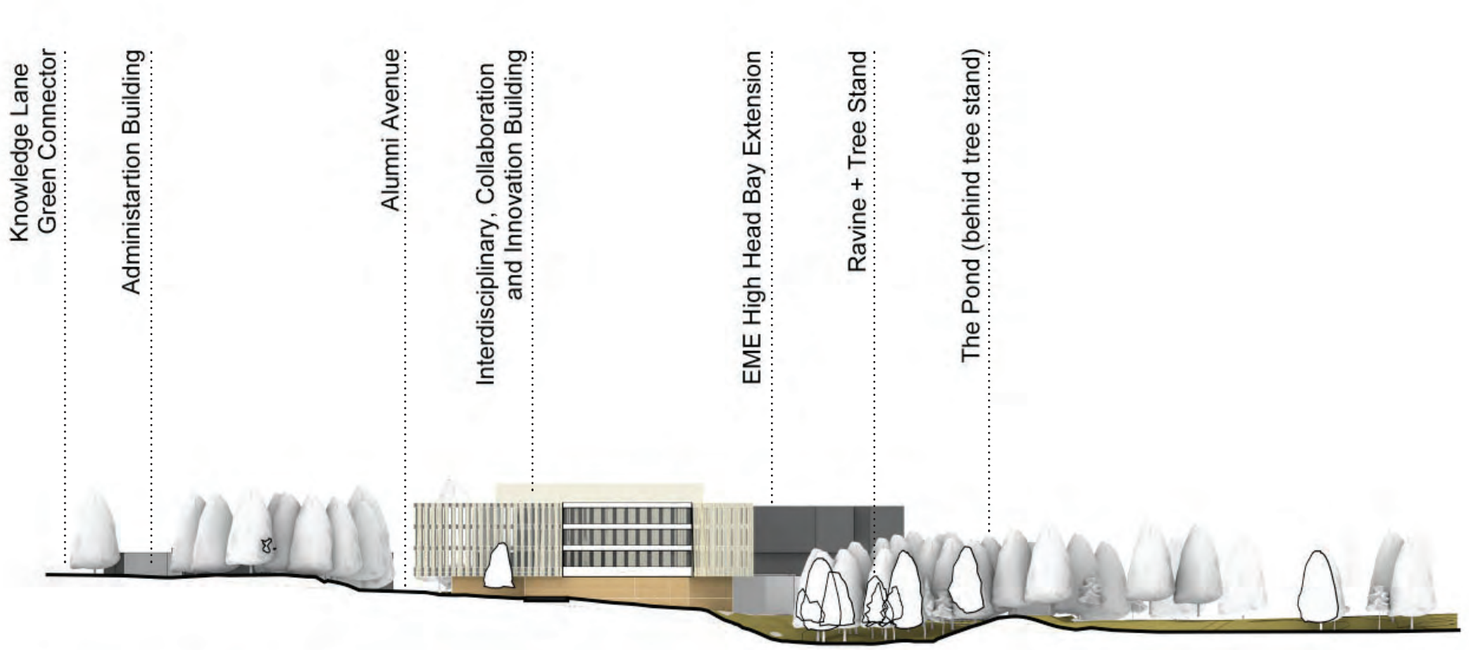


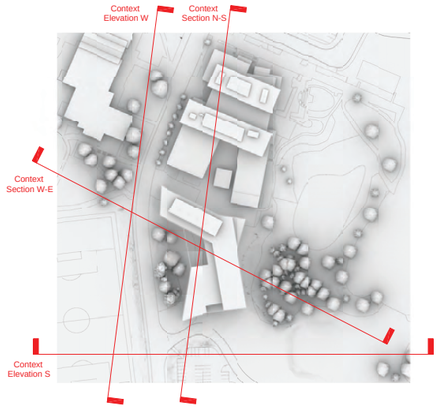
Context West Elevation - Through Alumni Avenue

0 5 10m



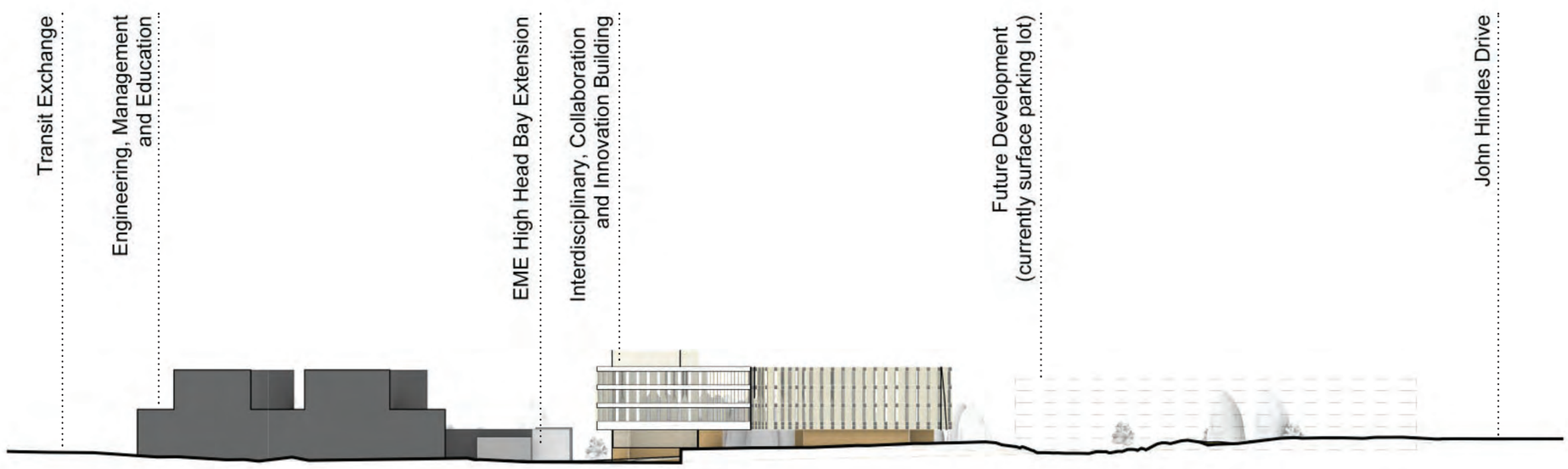
CONTEXT SECTIONS





Context W-E Section - Through Building Entrance

0 5 10m



Context N-S Section - Through Building Entrance

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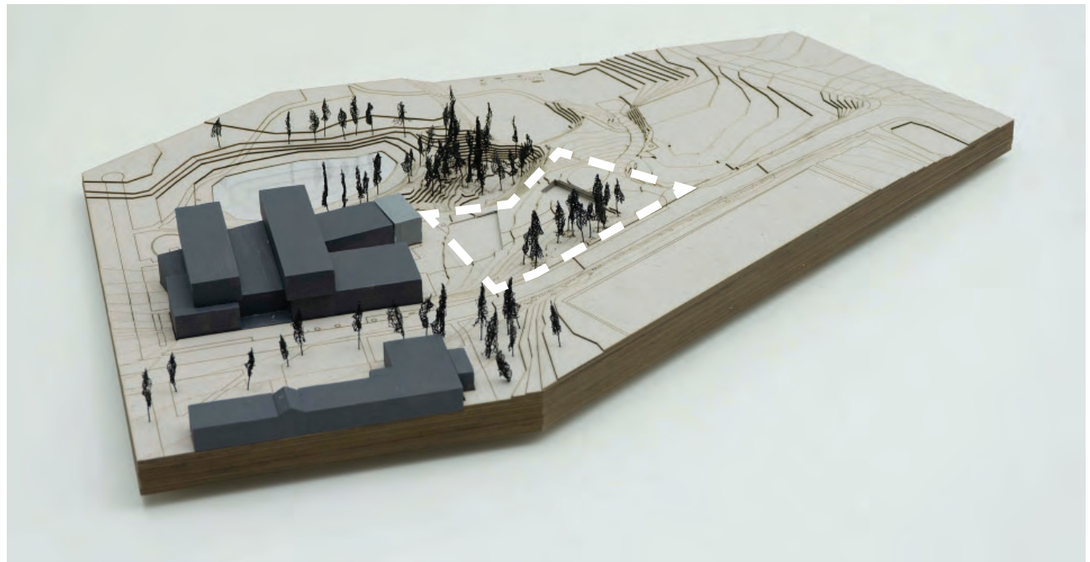
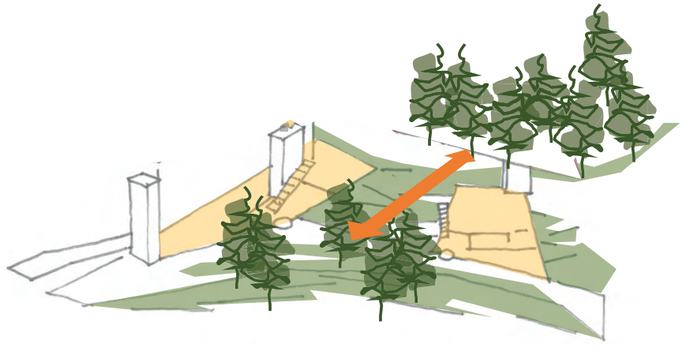
EXISTING SITE PHOTOS

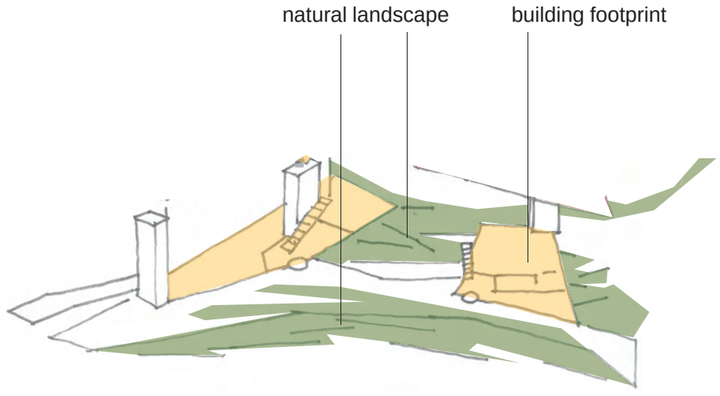


EXISTING SITE PHOTOS

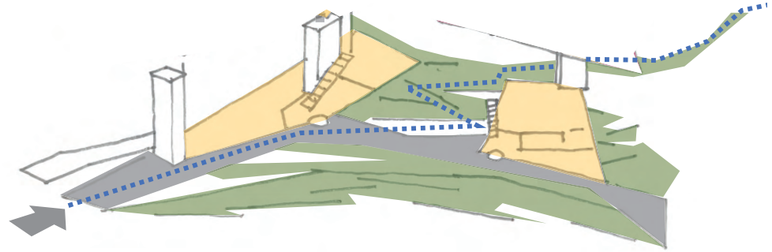
SITE ANALYSIS + DESIGN RATIONALE



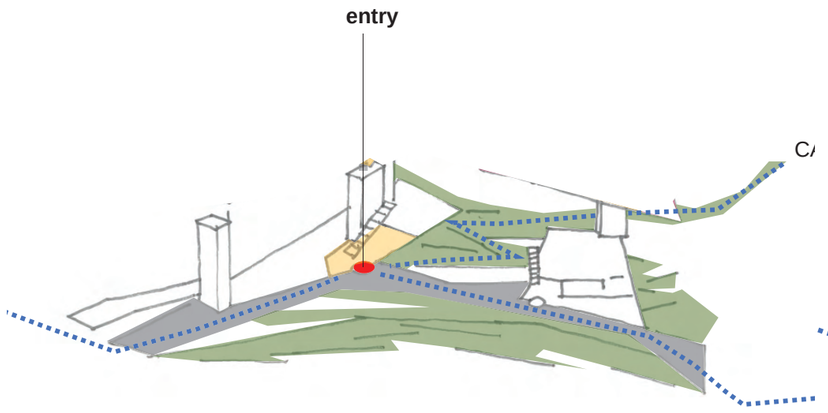
Tree stand linkages



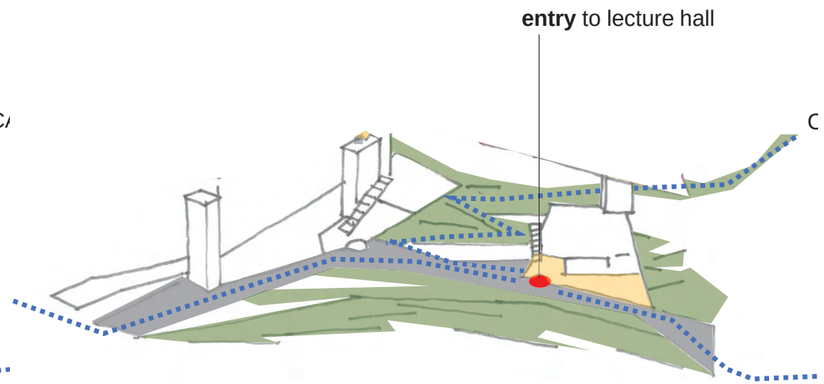
Landform Linkages



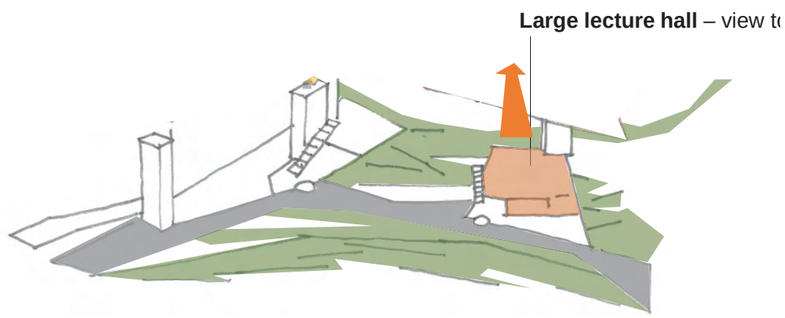
Passage Through + Under



4. Arrival

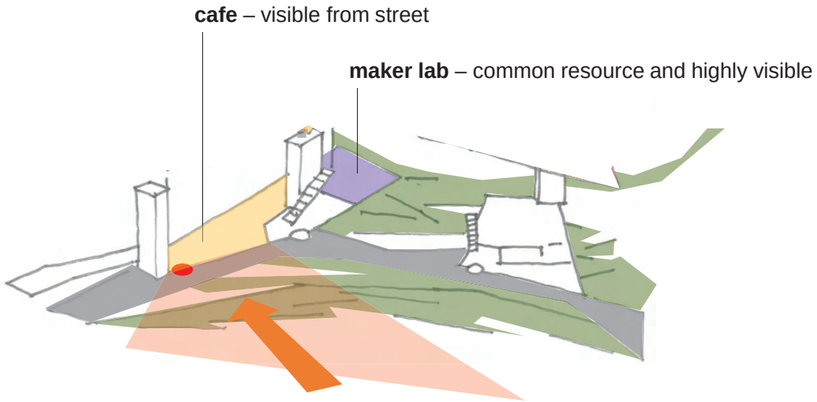


5. Arrival to Lecture Hall

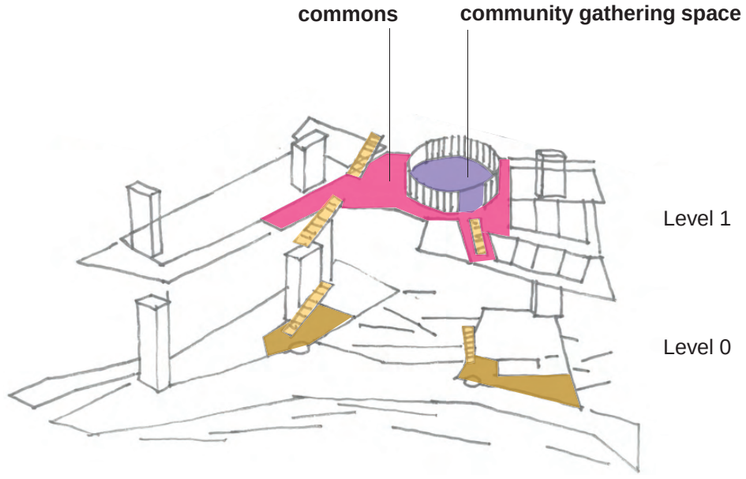


5. Learning Spaces - Lecture Hall

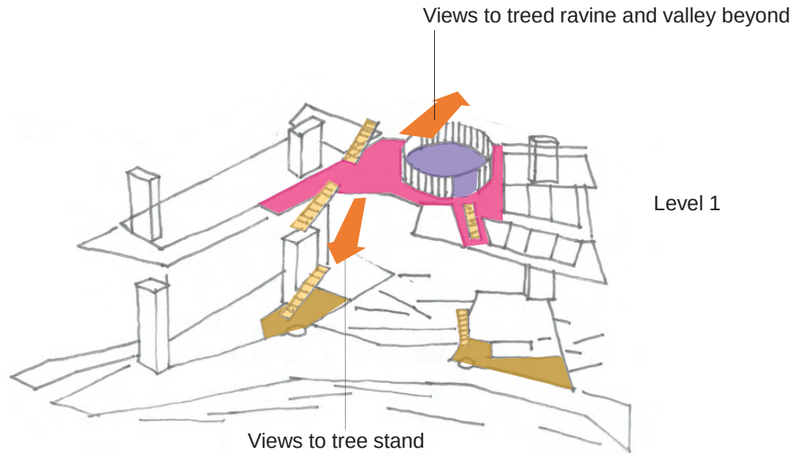
SITE ANALYSIS + DESIGN RATIONALE



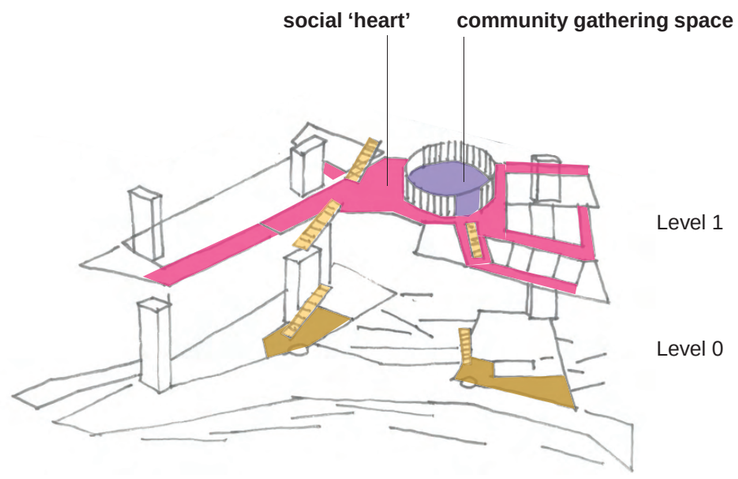
Social Spaces - Café + Maker Labs



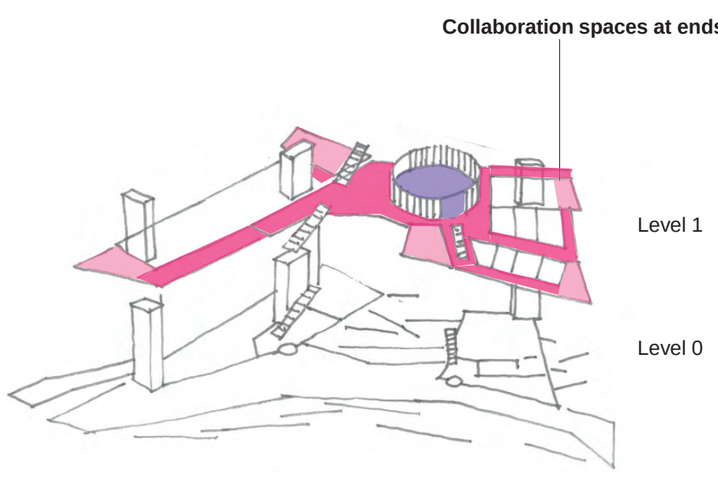
Linkages from Entry to Social Heart



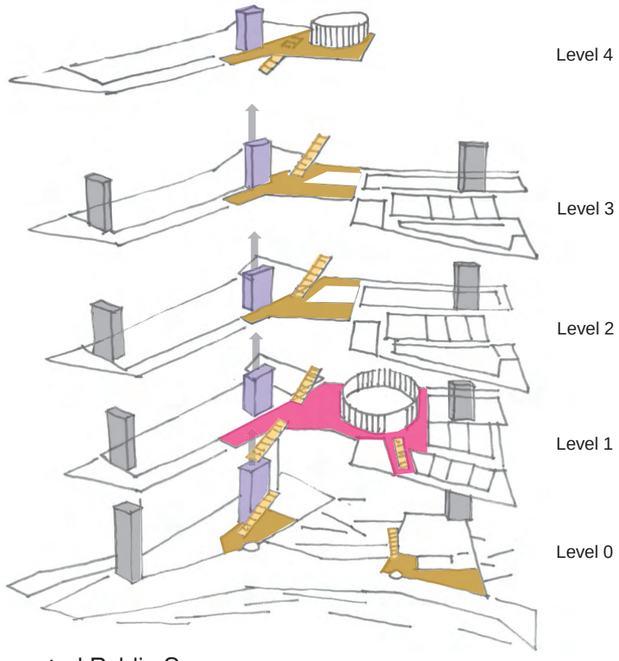
Views from Commons



Distribution to Edges

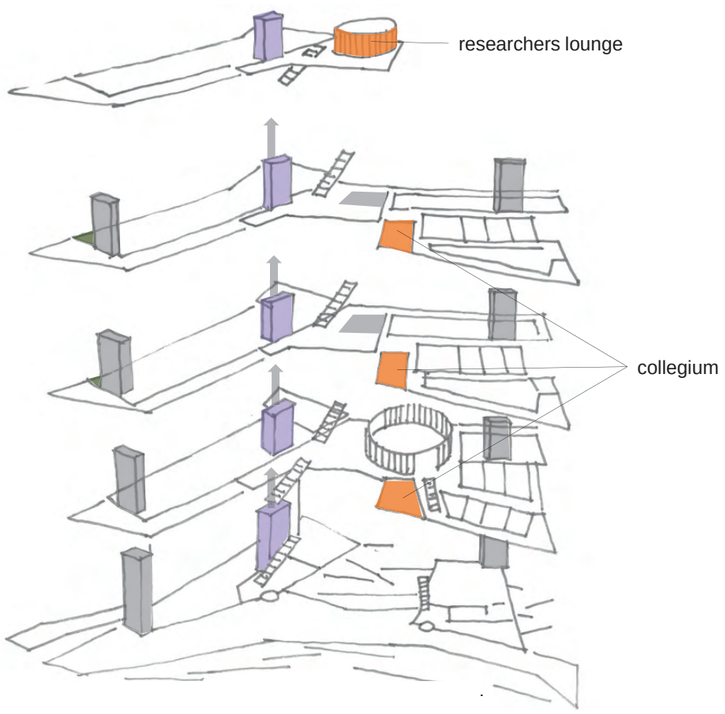


Collaboration Zones

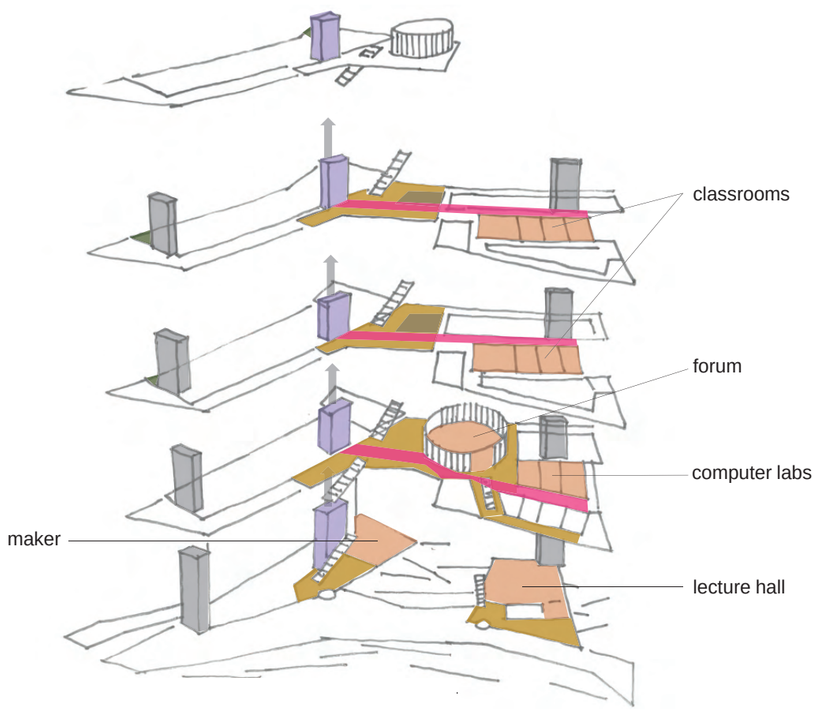


Inter-connected Public Spaces

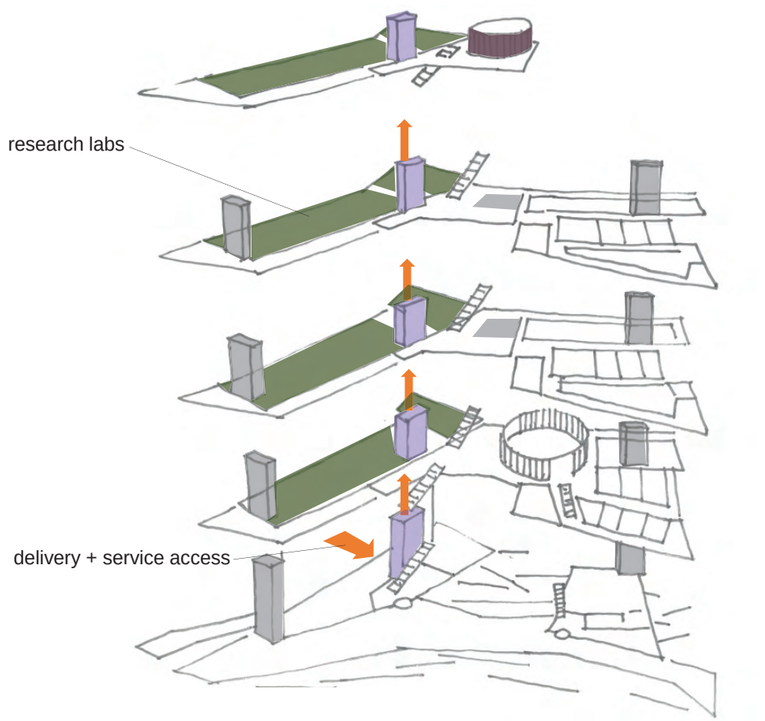
SITE ANALYSIS + DESIGN RATIONALE



Distribution of Graduate Social Spaces - Dispersed Model

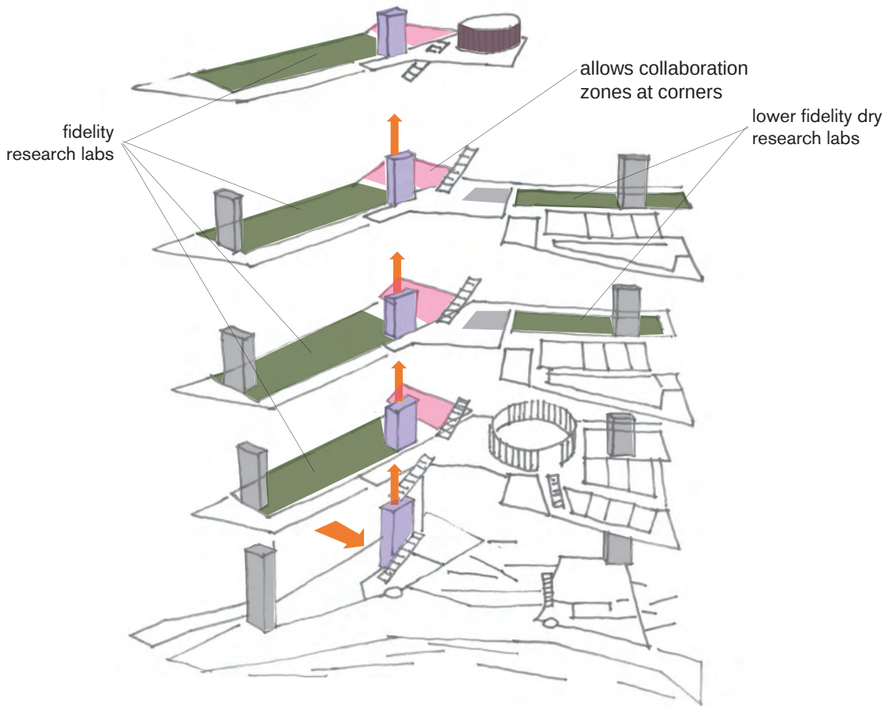


Distribution of Teaching Spaces - Dispersed Model

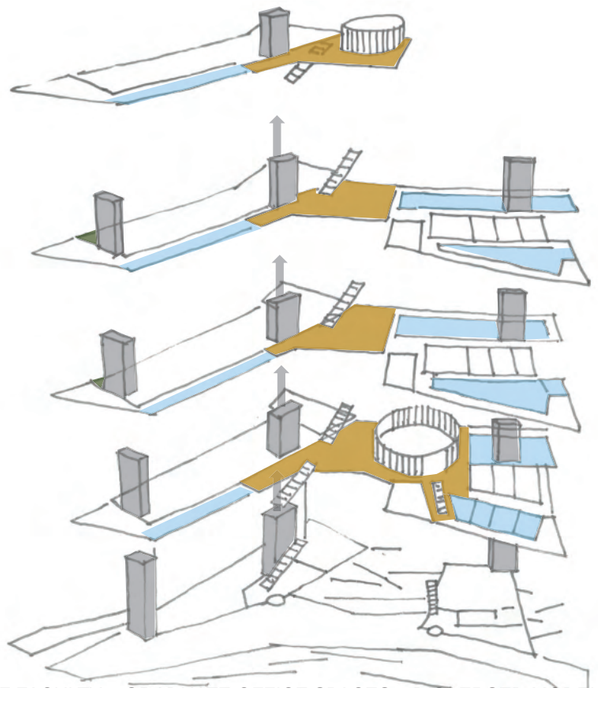


Distribution of Primary Labs - Stacked Model

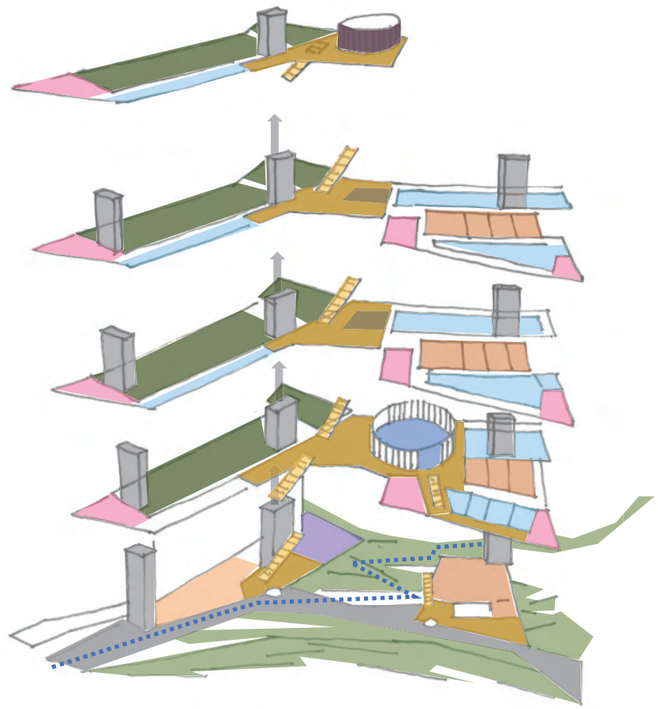
SITE ANALYSIS + DESIGN RATIONALE



Distribution of Primary Labs - Dispersed Model



Distribution of Faculty + Graduate Office Spaces - Dispersed Model



dispursed distribution of Program