FOR APPROVAL **PUBLIC** **OPEN SESSION**

TO: Governing Council

SPONSOR: Professor Scott Mabury, Vice President, Operations and Real Estate Partnerships
CONTACT INFO: 416-978-2031, scott.mabury@utoronto.ca

PRESENTER:
CONTACT INFO: See Sponsor

DATE: May 11, 2023 for May 18, 2023

AGENDA ITEM: 3 (d)

ITEM IDENTIFICATION:

Capital Project: *Report of the Project Planning Committee for Lash Miller Building Expansion* - **Project Scope and Sources of Funding**

JURISDICTIONAL INFORMATION:

Pursuant to section 4.2.3. of the Planning and Budget Committee's terms of Reference, "…the Committee considers reports of project planning committees and recommends to the Academic Board approval in principle of projects (i.e. space plan, site, overall cost and sources of funds)."

Pursuant to section 5.1 of the Academic Board's Terms of Reference, the Board considers reports of project planning committees (i.e. space plan, site, overall cost and sources of funds) with a capital cost as specified in the *Policy on Capital Planning and Capital Projects*.

The *Policy on Capital Planning and Capital Projects* provides that capital projects with costs in excess of $50 million (Approval Level 3) on the St. George campus, will first be considered by the Planning & Budget Committee, which shall recommend approval to Academic Board. Following consideration and by the Academic Board and approval for execution by the Business Board, such proposals are then brought forward to the Executive Committee for endorsement, and then forwarded to the Governing Council for approval. [Section 3(b)(ii)(1)(b) and (d)] The Policy further states that "any financing will be approved by the Business Board". [Section 3(c)].

GOVERNANCE PATH:

A. Project Planning Report, Total Project Cost, and Sources of Funding

1. Planning & Budget [for recommendation] (April 12, 2023)
2. Business Board [for approval, financing] (April 26, 2023)
3. Academic Board [for recommendation] (April 27, 2023)
4. Executive Committee [for endorsement and forwarding] (May 9, 2023)
5. **Governing Council [for approval] (May 18, 2023)**

B. Execution of the Project:

1. Business Board [for approval] (April 26, 2023)

PREVIOUS ACTION TAKEN:

At the January 31, 2020 Capital Project and Space Allocation (CaPS Executive) Committee meeting the project was brought forward to approve the Terms of Reference (TOR) and to formally strike the Project Planning Committee.

On January 22, 2021 CaPS Executive Committee approved consultant fees to engage consultants to the end of Schematic Design for the Lash Miller Building Expansion. Mikkelsen Architects + Cumulus Architects were the selected proponents in September 2022.

On August 18, 2022 CaPS Executive Committee approved full consultant fees increase and fees for construction management pre-construction services.

HIGHLIGHTS:

The Lash Miller Building Expansion envisions an addition of three new storeys and mechanical penthouse atop the existing one storey northeast corner volume at St. George Street and Willcocks Commons to house an important research initiative: the Acceleration Consortium (AC). Located at a highly visible, prominent intersection within the St. George campus, the project will enhance the presence for the Department of Chemistry and showcase the innovative and visionary research taking place within. Opportunity to reconfigure the ground and basement areas directly below the expansion will allow for accessible classrooms while strengthening student life and the through connection to the Willcocks pedestrian zone. Both the research spaces and classrooms are planned to foster a highly flexible, functional, open, and engaging environment.

The Lash Miller building located at 80 St George Street was built in 1963 with a subsequent addition along the lower wing at St. George in 2001. Unique to the northeast portion of the existing faceted concrete volume considered for this expansion are 17 exterior alchemy symbols which will be conserved. The alchemy symbols directly affected by the proposed design will be relocated. The proposed design will open up the northeast corner of the existing volume with glazed panels allowing views to the public realm along with increased daylighting. The new volume atop this existing building will frame the Willcocks Street pedestrian corridor with the upper mechanical penthouse volume set back from Willcocks to mitigate shadow impact. The project seeks to animate the south side of Willcocks Street by allowing intensification of the existing site without overwhelming the existing building and context.

The expansion provides space for an important research initiative integral to Chemistry at UofT. The Acceleration Consortium (AC), founded in Canada but global in reach, is leading a revolutionary shift in materials discovery and technology development by working at the interface of computer science and the discovery of new forms of molecules and materials. The AC combines three emerging technologies: artificial intelligence, robotics and high-throughput computation and experimentation. The approach accelerates materials discovery more than 10x, creating platforms that are able to do in months what it now takes a human researcher decades to do, and represents a tremendous opportunity. The addition will service the AC research initiative with labs, offices and shared meeting spaces within a highly functional and collaborative space. The spaces are designed to be flexible, allowing for adaptability driven by research change and growth. The AC has submitted a major Canada First Research Excellence Fund (CFREF) grant to facilitate their efforts to position Canada as the global hub of accelerated materials discovery. The timely delivery of the Lash Miller Expansion project is critical to moving this forward.

The northeast expansion of Lash Miller is identified as future development Site 9b in the 2011 St. George Campus Master Plan. The proposed massing allowed for a three-floor infill addition above the existing single storey structure. The project is informed by the St. George Campus Secondary Plan policies and Urban Design Guidelines. The University submitted an application to amend the Official Plan for a new Secondary Plan in 2016 with a re-submission in 2018. The Official Plan Amendment 582 was adopted by City Council in July 2022. The block-specific Urban Design Guidelines are anticipated to be brought forward to City Council in Q2 2023. The Draft block-specific Urban Design Guidelines (2018) provide guidance on Vision, Public Realm Strategy and Built Form Strategy to guide the evolution off future development on university-owned lands. The Lash Miller Expansion, located within Block G, is designed to align with the general intent of these Draft Urban Design Guidelines.
A key challenge of this project is the connection and integration of the new and existing spaces on the upper levels. The design solution proposes an atrium separation with skylight to filter in daylight throughout. The atrium creates an internal showcase for visitors to gain insight into the innovative work taking place on the upper floors while maintaining a respectful architectural dialogue between the two buildings and offering users an organizational understanding of the spaces. It addresses the non-alignment in floor level between the existing building and addition at the third and fourth floors due to accommodation of higher floor to floor heights required in the new lab spaces.

On the upper floor levels, the project provides 1,200 nasms for the AC labs and 565 nasms for AC offices, reception and meeting rooms. 101 nasms is accommodated to replace existing second floor Chemistry space with a new faculty lab and office. The existing basement space within the project footprint will be lowered to provide additional space for classrooms and mechanical space. The ground floor accommodates classroom space as well as crush space. The new accessible, covered entrance is located at the northeast corner of the volume opening onto Willcocks Commons. 929 nasms is indicated to replace existing LSM classrooms with three new large, sloped classrooms as well as three new active learning classrooms. Crush space is provided at 284 square metres.

The Lash Miller Expansion project was reviewed at the University's Design Review Committee in December 2022 and is scheduled for subsequent reviews in March 2023 and May 2023. The project was presented to the Community Liaison Committee (CLC) in November 2021 within the context of the draft Secondary Plan and Urban Design Guidelines for Block G. In January 2023, a letter was distributed to the CLC to provide a project update. The Lash Miller Expansion will be presented at the

first CLC meeting with the newly elected Councillor once a date is confirmed. Project consultation with student representatives included Project Planning Committee meetings and breakout consultation sessions during the planning phase. During implementation, student representatives continue to be involved in bi-weekly project meetings. In addition, at the end of Schematic Design informal one-on-one sessions were scheduled to answer any questions and receive valuable feedback on the current design prior to the Design Development stage.

A total of 2,858 nasms is provided within a gross area of 5,817gsm. 4,881gsm is new construction and 936gsm is renovated existing space. The project has completed Schematic Design and is entering into the Design Development phase. A minor variance and Site Plan Application are required for the Lash Miller Expansion. The project submitted a site plan control application to the City in mid-January. Assuming timely review and approvals, the project is scheduled to start Phase 1 demolition and early works construction with Construction Management delivery in July 2023 and Phase 2 construction in November 2023. Occupancy and final commissioning targets September 2025.

<u>Acceleration Consortium</u>

- Research Labs:
  - Synthetic Lab
  - Inorganic Lab
  - Polymers Lab
  - Small Molecules Lab
- Staff Offices
- Hacking Rooms
- Meeting Rooms
- Reception/Waiting
- Kitchen/Lounge

<u>Chemistry</u>

- Faculty Lab
- Faculty Office

<u>Classrooms</u>

- Large Sloped Classrooms
- Active Learning Classrooms

Schedule

The proposed schedule for the project is as follows:

Terms of Reference to CaPS Executive	January 31, 2020
CaPS Executive Approval for Consulting Fees	January 22, 2021
Consultant RFSQ Issued	February 2021
Consultant RFP Issued	June 2022
Consultant Selection and Letter of Award	September 2022
Schematic Design	September 2022 – Dec. 2022

CM Preconstruction Services	September 2022– June 2023
Design Development 100%	January 2023 – April 2023
CaPS Executive Approval for Full Project Cost	Cycle 5 Feb. 2023 – May 2023
Sequential Tendering	June 2023
Construction – Phase 1	July 2023 – October 2023
Construction Documents 100%	April 2023 – August 2023
Construction – Phase 2	November 2023 – August 2025
Occupancy	September 2025
Final Commissioning	September 2025

This schedule assumes all municipal approvals may be achieved within the timelines.

FINANCIAL IMPLICATIONS:

Discussion of overall costs and sources of funds can be found in the *in camera* document for this project.

RECOMMENDATIONS:

Be It Resolved

THAT the project scope of the Lash Miller Building Expansion as identified in the *Report of the Project Planning Committee for the University of Toronto Lash Miller Building Expansion,* dated February 14, 2023, be approved in principle; and,

THAT the project totaling new 2,858 net assignable square metres (nasm) (4,881 gross square metres (gsm)), and 936 gross square metres (gsm) renovated space, be approved in principle, to be funded by the Provost Institutional Funds, Faculty of Arts & Science Operating Reserves, Faculty of Arts and Science Future Major Capital Projects Reserve Fund and Fundraising.

DOCUMENTATION PROVIDED:

- *Report of the Project Planning Committee for University of Toronto Lash Miller Building Expansion,* dated February 14, 2023.

Report of the Project Planning Committee for
University of Toronto
Lash Miller Building Expansion

February 14, 2023

University Planning – University Planning, Design and Construction

I.Executive Summary

The Lash Miller Building Expansion envisions an addition of three new storeys and mechanical penthouse atop the existing one storey northeast corner volume at St. George Street and Willcocks Commons to house an important research initiative: the Acceleration Consortium (AC). Located at a highly visible, prominent intersection within the St. George campus, the project will enhance the presence for the Department of Chemistry and showcase the innovative and visionary research taking place within. Opportunity to reconfigure the ground and basement areas directly below the expansion will allow for accessible classrooms while strengthening student life and the through connection to the Willcocks pedestrian zone. Both the research spaces and classrooms are planned to foster a highly flexible, functional, open, and engaging environment.

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The expansion provides space for an important research initiative integral to Chemistry at UofT. The Acceleration Consortium (AC), founded in Canada but global in reach, is leading a revolutionary shift in materials discovery and technology development by working at the interface of computer science and the discovery of new forms of molecules and materials. The AC combines three emerging technologies: artificial intelligence, robotics and high-throughput computation and experimentation. The approach accelerates materials discovery more than 10x, creating platforms that are able to do in months what it now takes a human researcher decades to do, and represents a tremendous opportunity. The addition will service the AC research initiative with labs, offices and shared meeting spaces within a highly functional and collaborative space. The spaces are designed to be flexible, allowing for adaptability driven by research change and growth. The AC has submitted a major Canada First Research Excellence Fund (CFREF) grant to facilitate their efforts to position Canada as the global hub of accelerated materials discovery. The timely delivery of the Lash Miller Expansion project is critical to moving this forward.

The northeast expansion of Lash Miller is identified as future development Site 9b in the 2011 St. George Campus Master Plan. The proposed massing allowed for a three-floor infill addition above the existing single storey structure. The project is informed by the St. George Campus Secondary Plan policies and Urban Design Guidelines. The University submitted an application to amend the Official Plan for a new Secondary Plan in 2016 with a re-submission in 2018. The Official Plan Amendment 582 was adopted by City Council in July 2022. The block-specific Urban Design Guidelines are anticipated to be brought forward to City Council in Q2 2023. The Draft block-specific Urban Design Guidelines (2018) provide guidance on Vision, Public Realm Strategy and Built Form Strategy to guide the evolution off future

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A key challenge of this project is the connection and integration of the new and existing spaces on the upper levels. The design solution proposes an atrium separation with skylight to filter in daylight throughout. The atrium creates an internal showcase for visitors to gain insight into the innovative work taking place on the upper floors while maintaining a respectful architectural dialogue between the two buildings and offering users an organizational understanding of the spaces. It addresses the non-alignment in floor level between the existing building and addition at the third and fourth floors due to accommodation of higher floor to floor heights required in the new lab spaces.

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(Image by Mikkelsen Architects)

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II.Project Background

a) Membership

Vince Tropepe, (Committee Co-Chair) Professor, Vice-Dean Research, Faculty of Arts and Science
Robert Batey, (Committee Co-Chair) Professor, Chair, Department of Chemistry
Scott Mabury, Vice-President, Operations and Real Estate Partnerships
Alan Aspuru-Guzik, Professor, Department of Chemistry, Department of Computer Science
Aaron Wheeler, Professor, Department of Chemistry
Dwight Seferos, Professor, Department of Chemistry
Grace Flock, Director, Chief Administrative Officer, Department of Chemistry
Zamyla Chan, Associate Director, Platform & Training, Department of Chemistry
Mark Lautens, Professor, Department of Chemistry
Mark Nitz, Professor, Department of Chemistry
Alexa Torelli, graduate student, Department of Chemistry
Teh Ren Hou, undergraduate chemistry student, Department of Chemistry
Christine Allen, Associate Vice President and Vice Provost, Strategic Initiatives
Kim McLean, Chief Administrative Officer, Faculty of Arts & Science
Lucy Chung, Director of Infrastructure Planning, Faculty of Arts & Science
Lisa Neidrauer, Senior Planner, Infrastructure Planning, Faculty of Arts & Science
Steven Bailey, Director, Learning Space Management (LSM)
David Lehto, Chief of University Planning Design & Construction (UPDC)
Costas Catsaros, Director, Project Development, UPDC
Rajko Jakovic, Senior Manager, Project Development, UPDC
Brian Szuberwood, Executive Director, Capital Projects, UPDC
Flavio Bertolo, Acting Director of Utilities and Building Operations, Facilities and Services
Christine Burke, AVP, University Planning, UPDC
Cara Kedzior, Planner, University Planning, UPDC

b) Terms of Reference

1. Make recommendations for a detailed space program, functional plan and project scope for an expansion of the existing Lash Miller Building that will accommodate new research facilities for AC and Chemistry; meeting, interaction and teaching space; and renovations to existing classrooms.
2. Identify the space program as it is related to the department's academic plans; taking into account the impact of approved and proposed program enhancements that are reflected in increasing faculty, student and staff complement.
3. Articulate the role of the expansion in this location as a key institutional strategic initiative.
4. Demonstrate that the proposed space program is consistent with the Council of Ontario Universities (COU) space standards and University of Toronto space standards.
5. Determine a functional layout of the space required.
6. Determine the secondary effects of the project including the impact on the delivery of academic programs and activities in the sector during construction.

7. Identify all equipment and moveable furnishings necessary to the project and their related costs.
8. Identify all data, networking and communication requirements and their related costs.
9. Identify all security, occupational health and safety and accessibility requirements and their related costs.
10. Identify specific sustainability goals and energy targets for this project. Recommendations for goals that meet operational aspirations should also be cost effective and incorporate proven best practices.
11. Address planning directives and project opportunities to enhance future public space development at the Willcocks Common pedestrian corridor.
12. Determine a total project cost (TPC) estimate for the capital project, including costs associated with secondary effects, infrastructure and projected increase to the annual operating cost.
13. Identify all sources of funding for capital operating costs.

c) Background Information

The Department of Chemistry is internationally recognized as the top department in Canada and is composed of an outstanding group of faculty, students and postdoctoral fellows. The department continues to build upon existing research and scholarship strengths, improving collaborative and translational research to address major societal needs in areas such as biomedicine, renewable energy, and sustainability, and to provide its students with the experience and expertise necessary to compete in today's global economy.

Faculty, students and postdocs have grown in number, and overall research productivity has increased considerably over the last decade. In addition, the department has been involved in several initiatives that require novel space allocation. There is a pressing need for new research space to accommodate this continuous growth.

The department is located within the Lash Miller Chemical Laboratories Building. The building was constructed in 1963, and is laid out in an L-shaped configuration with a 6 storey wing along Willcocks Street. A lower wing along St George Street expanded the building, with 2 new storeys of laboratory and office space, and was completed in 2001. The existing northeast corner of the building is a low one storey faceted concrete volume, containing on the ground floor 4 larger lecture halls, smaller classrooms and washrooms. It serves as one of the major entrances to the building. The basement area contains a number of rooms, including a server room and several smaller labs containing equipment.

A new strategic institutional initiative is proposed to anchor a new addition at the northeast corner: space for the new University-Wide and Pan-Canadian Acceleration Consortium (AC). In addition, the project aims to improve the existing lecture hall and classroom space thereby improving student experience as well as the building's connection to the St. George campus

<u>Acceleration Consortium</u>
The Vice Provost of Research's office and the Faculty of Arts & Science has proposed an advanced materials and artificial intelligence initiative, drawing together both internal University stakeholders and researchers from other Canadian institutions. Broadly speaking, this project establishes innovative research

facilities for those working at the interface of computer science and the discovery of new forms of molecules and materials by combining three emerging technologies: artificial intelligence, robotics and high-throughput computation and experimentation.

At the forefront of this initiative is the global transition to clean technology. Chemistry at UofT values that the classic training programs generate highly skilled personnel with expertise that are particularly suited to future academic or research careers in universities or major corporations. We also feel that this educational model works well for continuing the mission of universities, however it limits the career opportunities for the majority of today's students who do not follow the traditional career paths. Specifically, our initiative will merge hypothesis-driven research with laboratory automation and machine learning/AI based research and development.

The Acceleration Consortium (AC) is a consortium that is leading a revolutionary shift in materials discovery and technology development. Founded in Canada but global in reach, the Consortium will work closely with industry, academia, and government to achieve three overarching goals:

- Accelerate the discovery of advanced materials;
- Enable and accelerate the integration of these materials into cutting-edge technologies;
- Develop and integrate and ecosystem of Canadian and International enterprises with this technology; and,
- Position Canada as the global hub of accelerated materials discovery.

Advanced materials are an essential element for addressing some of humanity's biggest challenges, including climate change, renewable energy, clean air, clean water, CO_2 capture, utilization, and sequestration, and better medicines for all. Developing new technologies to solve these pressing challenges depends on the discovery of high-performance, low-cost, and clean materials. However, discovering such materials takes decades using conventional approaches that are simply too slow and too expensive.

The Acceleration Consortium aims to revolutionize materials science by developing a network of Materials Acceleration Platforms (MAPs), which are fully integrated platforms that combine materials science with three cutting-edge, disruptive technologies:

- Robotics;
- Artificial intelligence (AI) and machine learning (ML); and
- Advanced computing (big data).

By putting the vision of the Fourth Industrial Revolution into action, the Acceleration Consortium will enable the development and production of better materials at a fraction of the time and cost. MAPs will accelerate materials discovery more than 10x; what now takes a human researcher decades to do, these platforms will be able to do in months. This fundamental shift represents one of the biggest opportunities of our time for governments, companies, foundations, and society as a whole.

AI and robotics are enabling ongoing global transformation of the IT, transportation and healthcare industries, amongst others. Building upon Canada's leadership role in AI and the success of the Pan-Canadian AI Strategy, the Acceleration Consortium aims to transform the global materials industry. This opportunity intends to position Canada as the global leader of this technological revolution. The envisaged space includes fume hoods and preparative space for AI/robotic assisted synthesis and characterization.

Classroom Space
The existing LSM teaching classrooms at the northeast corner of the Lash Miller building are dated and no longer meet modern standards for instruction. As part of the project, these classrooms will be redesigned and informed by emerging teaching pedagogies.

Massing
The site of the expansion is located at the northeast corner of the existing Lash Miller building, above the existing one storey volume. The site is prominently located at the intersection of St. George and Willcocks streets. It forms part of an important hub for student life, at a key pedestrian crossroad on campus. The 2011 St. George Campus Master Plan envisioned development at this site, identifying a three-storey addition atop the existing first-storey. The proposed massing is in general alignment with the University of Toronto St George Campus Secondary Plan draft Urban Design block-specific guidelines, including built form and public realm considerations. Preliminary meetings with City Planning in December 2022 informed the project team that minor variance and site plan application will be required.

A preliminary feasibility study commissioned by the Department of Chemistry was completed in May 2012. The 2020 Committee examined the 2012 study in light of the new research initiatives intended to occupy the space and arrived at the proposal for a new three-storey addition above the existing single storey structure, aligned with the 2011 St. George Master Plan. A Structural Feasibility Report and Building Code Compliance Report were undertaken to support the proposal prior to consultant selection.

d) Existing Space

Existing space

The Lash Miller Chemical Laboratories Building was constructed in 1963 and is laid out in an L-shaped configuration with a 6 storey wing along Willcocks Street. A lower wing along St George Street expanded the building with 2 new storeys of laboratory and office space, completed in 2001.

The following table displays the distribution of Chemistry space by space category. Chemistry occupies 15,607 NASM of space.

Subcategory	Subcategory Description	Sum of Shared Area	Count of Subcategory
1.0 Classrooms		56	1
2.0 Teaching Labs & Support Space		3,509	35
3.0 Research Labs & Support Space		8,108	188
4.1	Academic Offices	1,012	64
4.2	Research Office/Project Space	138	11
4.3	Graduate Student Office	1,053	52
4.4	Departmental Support Staff Office	452	34

4.5	Office Support Space	749	41
5.1	Library Collection Space	107	1
5.2/5.3 Library Support Space		38	4
5.4	Study Space Under Library Jurisdiction	156	9
11.1	Structured Formal Study Space	121	3
11.2	Informal Study Space	73	2
14.1	Student Office and Support Space	33	4
Grand Total		**15,607**	**449**

The older research wing underwent a major overhaul of its air handling and electrical systems. These renovations were completed in April 2018, and were funded from the University-led Federal Strategic Investment Fund (SIF) grant. The $23M building renovation project endeavors resulted in an enhanced and more stable air handling system with a substantial reduction in energy use.

The northeast corner of the existing Lash Miller Building houses a number of the University's shared classrooms including a series of tiered lecture rooms (LM 158, 159, 161, and 162) as well as two smaller classrooms (LM155, 157). The total seating capacity of these classrooms totals 703 seats and are heavily used by various departments of the University including many Chemistry courses. Given their tiered seating arrangement, these spaces rely on access from the ground level as well as from a lower intermediate basement level.

Occupant profile

This project will serve to provide space to the Acceleration Consortium as well as reimagining existing classrooms on the ground floor.

Acceleration Consortium (AC)

The Consortium is a new initiative that offers a growing pool of outstanding scientific and technical talent, knowledge, and tools to accelerate innovation and technology development. The Consortium generates high-impact research and expertise in the application of AI, ML, robotics, advanced computing (big data), and materials science (including biomaterials), which collectively form the basis of MAPs.

Materials Acceleration Platforms (MAPs) are inspired by the expert report from the global initiative Mission Innovation's Clean Energy Materials Innovation Challenge (IC6), which is co-led by Canada. These smart robotic platforms, or self-driving laboratories, will have the capacity to efficiently and autonomously synthesize materials and diagnose their properties. Crucially, these self-driving laboratories will also be able to learn from the data they collect and use this information to autonomously guide subsequent experiments and new material formulations. MAPs' state-of-the-art modular software and robotics will allow for large scale and cost-effective accelerated discovery of a broad set of advanced materials, from single molecules to complex structures. Examples include materials with applications in:

- Non-toxic batteries and energy storage technologies
- Next-gen biofuels
- Solar Cells

- Energy efficiency technologies
- Low-energy semiconductors
- Sustainable chemicals
- CO_2 capture, use, and utilization (CCUS)
- 3D printing and power electronics
- Pharma and biotech
- Translational research
- Biomaterials
- Nanomaterials and Microfluidics (medical applications)

In today's rapidly evolving world, speed is key; not only in materials discovery and technology deployment, but also in forming effective multi-disciplinary and multi-sectoral collaborations. This initiative is focused on creating high-impact, high-quality projects that deliver effective solutions to society's grand challenges *fast*.

The Consortium will also strengthen and expand its network of leading experts, and will provide open-source access to cutting-edge robotic platforms and software, alongside a strategy to maximize benefits for Canadian society. The participation of industrial members will help determine research priorities, and these companies will have the option to fund directed research projects.

By leading the global AI for materials revolution, the initiative aims to leverage Canada's strengths and expertise, which will act as a magnet for the best researchers in the world to join us in developing this emerging field of autonomous materials discovery. Due to its skilled labour market and investments in artificial intelligence, Canada is uniquely positioned to leverage and grow its talent pool in key disruptive technologies and become the hub of self-driving laboratories for materials discovery. The Consortium will realize these goals by enabling Canadian companies, from small to large, to provide the key robotic and software components for autonomous materials development. AC will become an integral counterpart to a new facility in Mississauga, where the National Research Council (NRC) and National Resources Canada (NRCAN) plan to house federally-funded MAPs, known as the Advanced Materials Research Facility.

These efforts will create a virtuous cycle based on knowledge that fosters talent, develops technologies, attracts investment, and creates jobs, all of which contribute to attracting more talent and accelerating the innovation-fueled economic growth and development. These investments will also accelerate the urgent transition to a clean economy both in Canada and worldwide.

III. Project Description

a) Vision Statement

This project is an opportunity to create an enhanced presence for the Department of Chemistry as a whole, while showcasing the innovative and visionary research taking place within. The addition to the Lash Miller building is situated at an important campus location, and will combine student life, classroom and research functions in a highly visible, open and engaging manner. While maintaining the current street wall setbacks, the new addition will frame and anticipate a revitalized pedestrian zone along Willcocks

Street. The introduction of new apertures at ground level will further animate the south side of Willcocks Street, connect occupants visually to the open space directly west of the project, and create a welcoming, and provide an accessible and inviting entrance.

Within the addition, the new research initiative will incorporate large research groups within a highly functional and collaborative space, making use of core spaces for equipment sharing. The spaces are designed to be flexible, allowing for adaptability driven by research change and growth.

b) Statement of Academic Plan

AC

The vision for the shared facility is that students and faculty generate ideas but are removed from the laborious tasks associated with laboratory work so that they are free to generate more ideas and better ones. To close the loop in the process, machine learning will be used to help students and faculty decide on the next steps of a given project. This is the manner in which we believe Science and Engineering will be conducted in this new decade and beyond.

The space will be as flexible and interactive as possible so that the space can be allocated as new faculty joins or leaves the initiative.

A portion of the research space will be allocated to *shared* MAPs that will involve several UofT researchers. For example, a team of UofT Chemists and Engineers submitted a proposal to merge energy storage and energy conversion. This concept is very complementary in that techniques, equipment, and day to day laboratory activities are very similar, even though the overall goals of the particular projects are different. A major CFREF grant has been submitted to facilitate this effort. The majority of the requested equipment is designed to streamline research in materials and biomaterials discovery. These cell culture hubs would be developed as interconnected suits for specific functions, namely, primary cell culture, transformed cell line culture, etc.

c) Space Requirements, Program and Functional Plan

Space Requirements

Below is a table showing Council of Ontario Universities (COU) calculations for the department of Chemistry. Overall, the department is at 96% of COU standards. However certain categories, notable Academic Offices, far exceed COU generated space, while other categories are short. Allowances have been made for as-found office sizes, noting that offices tended to be larger when the building was constructed. Faculty of Arts and Science Infrastructure Planning will work with the department to explore in detail the inventory and will continue to look for additional space efficiencies to align with the specific needs of the department over time.

Category Code / Description	Input Measure	COU Space Factor	COU Generated	Proposed Space NASMS	P/G (%)
2.0 -Teaching Laboratories & Support Space	8,028	0.6	4,817	3,509	73%
3.1 / 3.2 - Research Laboratories & Support Space	185	45.0	8,325	8,108	97%
4.1 - Academic Offices	41	12.0	492	1,012	141%
4.2 - Research Office / Project Space	68	12.0	816	138	34%
4.3 - Graduate Student Space	272	3.0	816	1,053	129%
4.4 - Department Administration & Support Staff Offices	43	12.0	516	452	81%
4.5 - Office Support Space	2,640	0.25	660	749	114%
COU Generated Space Subtotal			**16,442**	**15,022**	**92%**
5.0 - Library & Study Space			0	**302**	
11.0 - Non-Library Study Space			0	194	
14.0 - Common Use & Student Activity			0	33	
(5.0, 11.0, 14.0) Non COU Generated Space Subtotal			**0**	**585**	
TOTAL SPACE			**16,442**		**96%**

Space Program

The space program proposes a total of 2,858 nasms within the Department of Chemistry. This includes 929 nasms of classroom space and 101 nasms of Chemistry Faculty Lab and Office space to replace existing space. The gross square metres of new construction will be 3,105 gsm, and the gross square metres of renovated space is 2,523 gsm.

	Renovated (gsm)	New Construction (gsm)	Total (gsm)
BASEMENT	207	894	1,101
GROUND FLOOR	277	812	1,089
2ND FLOOR	305	862	1,167
3RD FLOOR	49	861	910
4TH FLOOR	49	861	910
MECH. PENTHOUSE	49	591	640
TOTAL	**936**	**4,881**	**5,817**

Space Program Lash Miller	Quantity	Nasm	Total Nasm	Totals (Nasm)
AC				
Senior Staff Offices	8	11-12*	96	
Staff Office Teams	7	22	153	
Grad Students	1	45	45	
Collective Working Space	1	60	60	
Murphy's Lab Room	1	23	23	
Hacking Rooms (3-5 people)	5	10	52	
Meeting Room (10 seats)	3	20	62	
Kitchen/Lounge	1	55	55	
Mail/Copy/Supplies	1	7	7	
Reception/Waiting	1	12	12	
Server Room	1	13	13	
				578
Research Labs:				
Synthetic Lab	1	200	200	
Inorganic Lab	1	200	200	
Polymers Lab	2	200	400	
Small Molecules lab	2	200	400	
Equipment Storage	1	50	50	
				1,250
				1,828

Chemistry (replaced departmental space)				
Faculty Lab	1	90	90	
Faculty Office	1	11	11	
				101
Subtotal (AC + Chemistry)				**1,929**
Classrooms (LSM)				
Sloped Classroom 1 (200 seats, Ground Floor)	1	283	283	
Active Learning Classroom 1	1	69	69	
Active Learning Classroom 2	1	77	77	
Active Learning Classroom 3	1	81	81	
Sloped Classroom 2 (120 seats, Basement)	1	191	191	
Sloped Classroom 3 (150 seats, Basement)		228	228	
				929
TOTAL				**2,858**

*Offices provide a space program at 11 nasms, but are

AC

The AC space will incorporate office and administrative space for faculty, staff, students and visiting professors. AC envisions “Faculty Groups” which provide lab and office space for separate research groups. The four types of research labs are as follows: Formulation Composite Lab, Inorganic Lab, Polymers Lab, and Small Molecules Lab. Each Research Lab accommodates a minimum of six researchers. All are envisioned to be as transparent as possible to showcase the research within.

Chemistry

The Department of Chemistry will replace existing spaces occupied by the project including a new Faculty Office and Faculty Lab.

Classrooms

The Lash Miller Building Expansion provides a unique opportunity to reimagine the existing classrooms within this building, incorporating new audiovisual technologies, flexible furnishings, and collaborative learning tools. In consultation with the Department of Chemistry, the following upgrades have been identified as integral to ensuring the instructional spaces function effectively in a way that serves both the department and the broader community:

a. Provide audiovisual technology to meet the University's current classroom instructional technology standards, including:
    - Active learning collaborative layout, with Teaching Dock control point, and either laser projection/power retractable projection screens or flat screen monitor display on all four walls.
    - Focused instructional technology at the Teaching front of room to support seminar layout, with Teaching Dock control point, and either laser projection/power retractable projection screens or flat screen monitor display.
    - Focused instructional technology at the Teaching front of room, with Teaching Station control point, dual or triple laser projection/power retractable projection screens.
    - Ample writing surfaces
b. Provide classroom collaborative learning tools, both technologically enhanced and analogue, to support collaborative and active learning activities such as writable and sharable surfaces throughout the classrooms wherever possible.
c. Incorporate flexibility in furnishing and layout, including loose mobile seats with personal tablet, mobile seats with reconfigurable tables, and flexible seating within the lecture halls wherever possible to support a greater level of movement and collaboration within the classroom.
d. In order to achieve the key priorities outlined above, the capacities within these classrooms must reflect current best practices and recommended space factors. Any change to the current layout and configuration will be reviewed against existing utilization data, however these activities will need to be in balance with, and should not compromise, the recommended best practices.
e. Ensure universal access is provided to instructors and students alike.

The recommended changes outlined will provide an upgrade of high-quality teaching and learning spaces within the south-central sector of campus, enhancing the University's classroom inventory overall and elevating the instructional environment within this sector.

Non-Assignable Spaces

Included in the building project are non-assignable elements that are not specifically described in the Space Program, but will be part of the architect's responsibility for design.

Non-assignable spaces include: elevators, corridors, stairs, electrical and telecommunications closets, caretaking closets, mechanical rooms and shafts, etc. These aspects of the building program are not included in the above summary of assigned spaces.

The project includes 284 square metres of Crush Space located outside of the new Sloped and Active Learning Classrooms.

Stairs
Interconnectivity between floors is an important aspect of this project. An atrium staircase between the existing north façade and the new construction will make traveling up and down between floors convenient and accessible. This vertical feature will ensure that each floor is not isolated, and is critical to the success of this addition. The atrium stairs will feel integral to the design, attractive and well lit,

maximizing light while simultaneously maximining space effectiveness. Due to travel distance and added occupant load a new exit stair is required for the project.

Functional Plan

Three floors of new laboratory and associated faculty and administrative space are proposed on top of the existing volume along with a mechanical penthouse. The second floor aligns with the existing floor level and complements the existing laboratory and office function at this level. In order to accommodate floor to floor heights best suited to the new labs, the third and fourth floor will be slightly offset to the existing and bridged by the new elevator and atrium stairway within the addition as well as a few steps at the south connection into the existing Lash Miller building hallway. The atrium separation with skylight filters in daylight to both existing and new spaces including at the mechanical penthouse level.

On the existing ground level, the project opens up the Willcocks Street entrance to create an accessible, welcoming space, introducing natural light at the northeast corner and providing enhanced connection to the exterior at this important intersection. The ground floor accommodates a large, tiered classroom with 200 seats, as well as several smaller active learning classrooms providing 24-39 seats. In order to open up ground floor space, the project will lower the basement area directly below the project footprint to a 4.8m height providing an additional tiered classroom space with 135 seats and the necessary mechanical spaces to directly support the adjacent areas.

Refer to the Appendix for Schematic Design floor plans.

d) Building Considerations

Standards of construction

The Lash Miller addition is located at a prominent campus intersection, and its design will be reflective of this context. The addition will address the public spaces surrounding it, particularly the Willcocks Common to the north and St. George Street to the east. The high tech, cutting edge research performed at AC will be present in the architectural expression of the building. The addition will respond to, and complement the existing Lash Miller Building.

Finishes are planned to be durable and high-performing, and suitable for this type of laboratory environment.

The mechanical penthouse for the expansion will be highly visible, and is designed to be thoughtfully included and integrated in the overall architectural design.

Building Characteristics and Massing

The proposed expansion includes three new floors on top of the existing ground floor volume at the northeast corner of the Lash Miller building. Proposed floor to floor heights and overall massing and heights are described in detail in the Site Considerations: Master Plan and Zoning section of this report.

The scope of expansion has been carefully considered in order to mitigate shadows on Willcocks Common and future Institutional Major Open Space to the north. The mechanical penthouse in particular, is set back from Willcocks in response to the University of Toronto St George Campus Secondary Plan draft Urban Design block-specific guidelines. The mechanical penthouse has increased visibility due to the lower building height of this expansion and its prominent location on campus. The architectural design carefully incorporates this volume into the overall design concept considering these concerns.

Structural

The existing Lash Miller building is a conventional reinforced concrete structure divided into two, separated by an expansion joint. There is a shared basement between the smaller one-storey building and the multiple storey portion and the basement on the smaller side being replaced is shallower. The existing main structural system is comprised of reinforced concrete columns, slabs, and shear walls supported on footings where some of these footings are shared at the expansion joint by two rows of columns (one on each side of the joint). A summary of the structural strategy is as follows. For details refer to the consultant's Engineering Basis of Design Report, December 1, 2022.

From a sustainability perspective, the design team initially considered utilizing a timber framed structure as it has a lower embodied carbon than both concrete and steel. However, it was deemed to be unsuitable by the code consultant due to the need for an 'alternative justification', as the solution would not be code compliant. This presented significant schedule risk to the project. The next alternative was considering a primarily steel structure with composite deck spanning floor system. While steel is an ideal material to handle the long spans, there are multiple downsides as the lightweight structure makes it susceptible to vibrations, and the increased structural depth would not work with the floor-to-floor heights and services zones required for the lab spaces. This structural system could also not be completely exposed from an architectural point of view as the steel would need to be fireproofed. Ultimately, the final material considered for the design was concrete as it meets all the requirements that the other materials could not. It does not require additional fireproofing, it handles vibrations the best of three materials, and it can be exposed from an architectural perspective. To mitigate the embodied carbon impact of concrete the following will be considered: cement replacement and concrete mix designs, minimizing the use of new material, reuse of existing structure where possible, and use of carbon negative concrete CMU block.

The new design adds a substantial number of floors to the existing building. To accommodate this, the existing building would need extensive and complex strengthening works to most structural elements including the foundations. Given the magnitude of the increase in loads it was considered that the provision of a new structure is more effective and permits more flexibility in space planning.

The proposed new structure occupies a footprint of roughly 40 m x 29 m in plan and 3 additional floors of approximately 4.4m floor to floor height as well as a mechanical penthouse. The foundation system is pending geotechnical recommendations from the appointed geotechnical consultant. Based on preliminary

load takedowns, the foundations will likely consist of bored piles to a depth specified by the Geotechnical engineer, with either a raft slab or discrete piles. The substructure consists of reinforced concrete retaining walls forming one storey of basement with a stiffened raft slab on grade. The existing basement with shallower depth will be lowered to have the same depth as the other basement areas. Additionally, the existing exterior basement walls will either be underpinned or partially restrained with secant piles and used as a retaining structure during construction to achieve a deeper basement. The superstructure consists of cast in place concrete columns supporting a suspended ribbed slab system with perimeter and intermediate edge beams to control deflections. It will have a lateral stability system composed of reinforced concrete shear walls. A primary grid of 6.6m x 11m is currently proposed. The superstructure of the new building will not rely on the existing structure. The enhanced vibration analysis will further inform the depth of the horizontal structure.

Elevators

There are four existing elevators at Lash Miller, three of which are passenger and one freight. The existing passenger elevators are not large enough to accommodate a stretcher should it be required. Side by side passenger elevators 134A and 134B located in the west wing tower along with the freight elevator 130A all have a high rate of service calls due to problems with positive air pressure resulting in problems with door locks connecting. Passenger elevator 13E, a hydraulic elevator located in the south wing, is in good condition but only services three floors.

This project will upgrade equipment in the existing freight elevator 130A. In addition, the project provides a new elevator, with proper sizing for accessibility and stretcher accommodation. The new elevator traverses all levels of the addition. At the basement level it connects directly to the building's existing loading area.

Sustainability design and energy conservation

The University of Toronto is committed to reducing its scope 1 and 2 greenhouse gas (GHG) emissions by at least 37% below its 1990 level of 116,959 tonnes eCO_2 by 2030, working towards becoming a net-zero GHG institution. To accomplish this, the University has retired the previous Energy Performance and Modelling Standard (April 1, 2019) and introduced this now-governing Tri-Campus Energy Modelling & Utility Performances Standard. This new standard provides project-specific energy performance and water efficiency targets, necessary at a minimum, to achieve the 2030 goal, while also introducing a streamlined modelling and documentation submission approach.

New construction projects must meet the project-specific energy performance targets established in the Project Charter by the Project Planning Committee. The Standard also identifies utility performance requirements and targets for renovation projects of varying scopes and complexities through a performance pathway for major renovation projects. Please refer to the appended New Construction Project Charter and Major Renovation Charter for the project targets.

Targets will be revisited and adjusted regularly to ensure UofT remains in a leadership position. Projects should anticipate adjustments in 2022 and 2026 for all the key performance indicators included in the

standard. The consultants shall recognize the anticipated regulatory and published UofT Standards that will be in place at time of permit application. They shall inform the UofT Implementation Committee about which performance indices are to be used and provide design solutions compliant with the more stringent of the applicable UofT standards and authority requirements.

The Project Consultant Team must complete and submit an energy performance simulation (model) with associated documentation at each stage of the design process to demonstrate ongoing compliance with these performance targets. At occupancy, the simulation must be updated to reflect the as-constructed building characteristics. All energy performance simulations shall be approved and accepted by the U of T Implementation Committee.

Beyond energy, additional performance levels include:

- 50% reduction in indoor water use over the LEED version 4 baseline;
- 60% reduction in outdoor water use over the LEED version 4 baseline; and
- Complete whole-building air tightness testing following the US Army Corps of Engineers Air Leakage Test Protocol for Building Envelopes and submit air leakage testing report.

To further ensure projects are developing in accordance with these performance requirements, documentation must be completed by the Project Consultant Team and/or the UofT Implementation Committee at each project stage. For each documentation item, the expectations and responsible parties are outlined in the Standard.

In addition to the energy performance, utilities performance and water efficiency targets mandated by the University through this standard other regulatory authorities and certification process will be included within the planning, design and implementation of all projects. The intent of these additional regulatory processes is to ensure that the high performance building required by the energy and water performance targets of this standard is part of a holistic approach to sustainable building practice. The following Certifications and regulations will be mandatory for all New Construction and Renovation projects: LEED Silver minimum (non-certified); Toronto Green Standard V3 Tier 1. The minimum requirements for these certifications and regulations are not to supersede the energy, utilities and water efficiency performance targets of this standard.

Project Planning, Implementation and Consultant teams are to address the embodied energy, embodied carbon and other GHG emissions associated with building materials. Building and Renovation projects will be required to report the embodied emissions of the building's structural and envelope materials using life-cycle assessment (LCA) software in compliance with the Canadian Green Building Council's recommended methodology. (CAGBC Zero Carbon Building Standard, May 2017: Pg. 7). UofT Facilities and Services will provide utility costs to the consultant team for the purposes of life cycle costing.

Refer to the appendix for the current Project Charter agreement.

Project Sustainability Approach

In the Schematic Design Phase, a series of sustainability targets has been collaboratively established in relation to the consumption of resources such as energy, water and materials, ecological impact, waste

diversion, and health and wellbeing of the users. Specific sustainability objectives for the project are summarized in the table below. This table also includes stretch targets that the design team aims to meet which go beyond the project's requirements.

	Target	Stretch Target
Energy & Carbon	Achieve building energy use targets set out in the project charter (yet to be established), using metrics of TEUI, GHGI, H-TEDI & C-TEDI 5% renewable energy, enhanced commissioning	Achieve a EUI of 195 kWh/m2-yr and a GHGI of 12.5 kg CO2/m2-yr* Enhanced monitored based and envelope commissioning 5% renewable energy
Water	Reduce indoor potable water use requirement by 50% (relative to LEED) Reduce landscape water requirement by 60% (relative to LEED)	Use recycled rainwater to reduce landscape water requirement by 100% (relative to LEED) or for toilet flushing Use recycled rainwater to toilet flushing and reduce potable water requirement by 50% (relative to LEED)
Site & Ecological System	Retain the first 17.6 mm of rainfall onsite using LID/GI Reduce microclimate heat island effect, comply with associated LEED and TGS requirements Landscaping with native species to restore natural habitat Bird collision deterrence glazing	Restore Natural Habitat (25% of site area)
Indoor Environmental Quality	Design based on ASHRAE 55 and 62.1 guidelines and criteria Introduce digital occupancy survey for thermal comfort control feedback Incorporate selective health and wellness design principles based on the WELL rating system Introduce nature elements into interior spaces to help relieve occupants' stress and encourage overall mental wellbeing	Achieve Spatial Daylight Autonomy of 300/50% for at least 40% of all regularly occupied spaces Introduce circadian rhythms to all regularly occupied spaces with daylighting and electric lighting
Materials	Divert 75% of total construction and demolition materials from landfill Use of low emitting materials on the building interior	Achieve Spatial Daylight Autonomy of 300/50% for at least 40% of all regularly occupied spaces Introduce circadian rhythms to all regularly occupied spaces with daylighting and electric lighting

Toronto Green Standards	Comply with TGS v3 Tier 1	TGS v3 Tier 2

Accessibility

The existing entrance at Willcocks Commons contains a single step and is not accessible. The new entrance is shifted east towards St George to better allow for circulation. The entrance is set back so as to be covered and will be accessible. A detailed project review by the University's Accessibility department will be arranged during Design Development.

New or redeveloped exterior, and some interior (i.e. service counters, fixed queuing guides, and waiting areas), public space, must comply with Part IV.1, Design of Public Spaces Standards (Accessibility Standards for the Built Environment, Integrated Accessibility Standards of the Integrated Accessibility Standards, O.Reg. 191/11, http://aoda.hrandequity.utoronto.ca/buildings/). This would include approaches to new buildings. Maintenance, environmental mitigation, or environmental restoration excluded from this requirement.

Public space projects affecting exterior paths of travel, recreational trails, outdoor play spaces, or accessible on-street parking must include consultation with the public and persons with disabilities pursuant to aforementioned standards.

For additional information contact the University of Toronto's AODA Office.
http://aoda.hrandequity.utoronto.ca/

Personal safety and security

The building is currently key access. This project will upgrade the building to fob access, at minimum for the main entrances and all new interior spaces. Exterior entrances should use the Honeywell system and generally interior spaces are Salto. All electronic security system installed at UofT will have hard key override for use by police, emergency, maintenance, and custodial staff. Access control system shall allow for interfaces with other systems including, but not limited to, the burglar alarm, intercom, fire and CCTV systems.

All publicly accessible program elements should remain open and accessible during regular operating hours as well as for scheduled after-hour events. The research labs however, will all have controlled access. All spaces must meet University standards for safety and security. A sophisticated access control system will be required to provide building occupants appropriate access to specified building locations as necessary. Security for the laboratories, and for the entries to AC will be required. Secure access design for the Lash Miller Building will be detailed during Design Development in consultation with Campus Police, ITS and Facilities Management and Planning.

Abundant exterior lighting will provide for ease of movement around the exterior of the building at all times of the day.

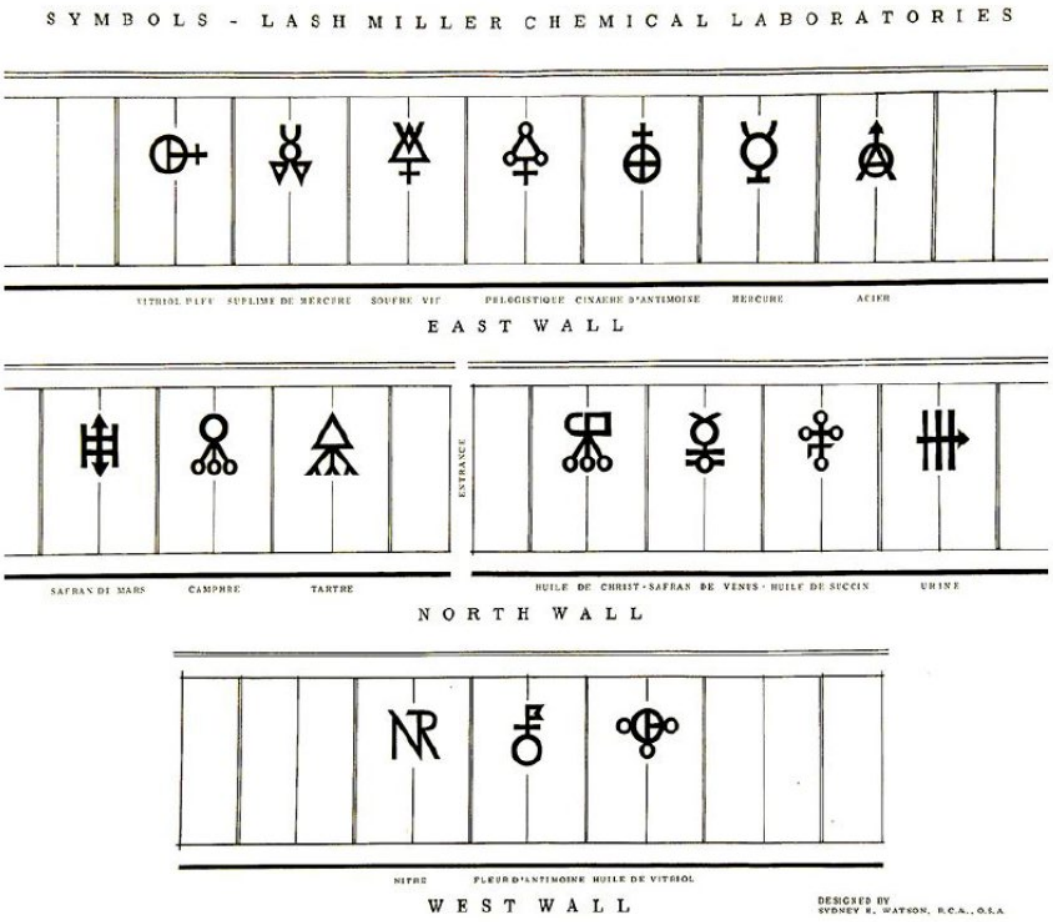
An automatic wet sprinkler/standpipe system will be provided throughout the new Lash Miller extension in accordance with NFPA 13, NFPA 14 and 2012 OBC requirements.

Signage, donor recognition

Exterior and interior signage will be a required element of the detailed project design for building identification and wayfinding purposes. The building design will consider the provision of opportunities for creative donor recognition of various types.

Should there be a requirement for donor recognition, its accommodation must be appropriately integrated within the building.

There exist 17 alchemy symbols on the building's exterior. The alchemy symbols directly affected by the proposed design will be relocated while the rest will be maintained. The symbols are as per the drawing below, however one symbol was moved from the west to its current location on the north façade.



Mechanical/ Electrical and Data

Mechanical

Energy efficiency is a primary goal for the mechanical system design. Strategies aimed at energy reduction include energy recovery and smart, well defined load diversity for plant sizing and operation. Mechanical systems load diversity includes Research Labs, Offices and Process Cooling. Domestic cold and hot water systems will be designed with 66% redundancy. Laboratory systems (i.e., compressed air, vacuum, etc.) will be designed with diversity according to best engineering practices, as outlined in the American Society of Plumbing Engineers (ASPE) guidelines. For complete details refer to the consultant's Engineering Basis of Design Report, December 1, 2022.

Air handling systems

During the 2018 SIF project, the existing Lash Miller Tower individual fume hood exhausts have been converted into common fume hood / general exhaust system. It consists of common plenum on the roof and 3 Strobic type exhaust fans with glycol heat recovery (each 60,000 cfm capacity) and provision to add 2 fans. They are designed to operate 2 of 3 at the time, providing 100% redundancy in the case of failure of one of the fans – based on the current diversity and operation of the labs. Since the completion of SIF, the Davenport and Lash Miller wings are no longer balanced. The expansion project, once integrated into the Lash Miller building, shall be designed so as to not cause air flow disruption in Lash Miller labs.

Research Labs:
A single, dedicated outdoor air systems (DOAS) will deliver 100% outdoor air (OA) to the research labs and associated lab support spaces. The system will be sized based on ventilation rates to satisfy the greater of requirements of ASHRAE 62.1-2016, laboratory air changes rates, and heating and cooling requirements. The AHUs will be provided with active heat recovery via a heat pump and glycol loop connected to the laboratory exhaust system.

The research laboratory spaces will be designed based on air change rates (ACH) depending on the requirements of the research and fume hood design within the laboratory. Depending on the load density and ACH requirements, the laboratory spaces will be provided with FCUs or 2 and/or 4-pipe active chilled beams or provided only with direct supply air via VAV venturi valves with reheat for make-up air and temperature/humidity control. The laboratory fume hood exhaust and general laboratory exhaust will be connected to the laboratory exhaust system via laboratory exhaust VAV venturi valves.

Perimeter heating will be provided for both Research and Classrooms/Administration spaces by local low temperature radiators designed for supply at ~54.5ºC (130°F) and returned at ~43.3 ºC (110°F).

Classrooms/Administration:
Dedicated DOAS units will deliver 100% outdoor air (OA) to the building via a system of active chilled beams or direct displacement ventilation. The systems will be sized based on the greater of ventilation rates to satisfy the requirements of ASHRAE 62.1-2016 and heating and cooling requirements.

Classroom and administration will be ventilated and conditioned with either 2 and/or 4-pipe active chilled beams (ACBs) which operate by supplying primary air from a DOAS through nozzles creating a pressure

differential or ducted fan coil units (FCUs). Ducted FCUs will be utilized in areas subject to infiltration (i.e., lobbies) and high sensible loads, while areas not otherwise subjected to these conditions will be served by ACBs.

Displacement ventilation will be utilised, where feasible, delivering low velocity, conditioned air directly into the occupied zone, improving occupant comfort and displacing stale air through a high-level return path. Return grilles and lined transfer ducts will be used to transfer air to the open circulation spaces (without compromising privacy) to be exhausted through the associated DOAS unit.

Laboratory Exhaust Air Units:
A packaged laboratory exhaust fan systems will be located on the roof. The system will contain three fans manifolded together. On normal operation, two fans will satisfy 100% of the exhaust requirements. The exhaust branch at each level will be connected to the exhaust riser with a sub-duct connection. Where a horizontal run is required between fire compartments, the laboratory exhaust duct will be protected in a horizontal fire rated enclosure or fire wrapped. The laboratory exhaust ductwork will be sized for a maximum velocity of 8.6 m/s (1700 ft/min). To maximize heat recovery potential, an active heat recovery loop with heat pump will be provided between the central laboratory exhaust fans and the lab make-up AHU heating coils.

Miscellaneous Mechanical Systems:
Spaces that require dedicated mechanical cooling, including server and electric rooms, will be provided with a dedicated FCU connected to the building chilled water system for local temperature control. Where practical, based on load and proximity to the exterior of the building, electrical rooms will be cooled by mechanical ventilation using outdoor and recirculation air. Mechanical equipment rooms will be locally ventilated with supply and exhaust fans ducted to the outside via exterior louvers. Heating will be provided by local hydronic unit heaters.

Heating system

The existing heating system consists of high temperature hot water (HTHW) being supplied from central steam plant converted with heat exchangers into hot water (mech room 39) for all perimeter heating, duct reheat coils and glycol heating for all air handling units. For units installed during SIF project the primary heating source for the air handling units and duct mounted reheat coils is a low temperature heating water LTHW from the central steam plant flue gas waste heat recovery system (Sofame). High temperature hot water (HTHW) is the secondary source if the LTHW system does not have sufficient capacity or inoperable. The domestic hot water tank also uses LTHW as a primary source.

The heating for this project will be primarily provided from the existing campus district energy system. The source will be the UofT campus SOFAME LTHW system with steam generated district HTHW as back-up. 2 sets of heat exchangers will be provided for the Lash Miller expansion (HTHW and LTHW).

Two options have been considered for heat recovery provision: air source heat pumps and heat recovery chiller. Air source heat pumps will be utilised to maximise the heat recovery within the building. Buffer tanks will be provided to satisfy the minimum system volume requirements for the heat pump. All heating systems will be designed using LTHW at a temperature of 54° C or less. The system will be sized to

include the following: AHU heating coils, envelope losses, and re-heat coils throughout the building. The design shall include for duplex pumps to provide full redundancy to the distribution system.

Cooling system

The existing cooling at Lash Miller is provided from multiple sources:

1. From BCIT chilled water plant (seasonal chiller plant)– serving Lash Miller Tower AHUs and few Undergraduate wing AHUs. Two heat exchangers separate the BCIT loop from the Lash Miller loop are located in the Lash miller mech room 39. The heat exchangers are sized to provide 400 Tons of cooling each with space for an additional 100Tons of plates to each . The heat exchangers and associated pumps were originally designed for a duty / standby operation. Due to a previous SIF project, the cooling system requires both heat exchangers and pumps to operate simultaneously. The cause of the hydronic in-balance needs to be reviewed and corrected as it the current system requires greater heat exchanger surface area than previously designed for.
2. 75 Ton chiller (2 circuits / 4 compressors chiller) serving process bench cooling and one AHU in the undergraduate wing. Maximum cooling load for each circuit is 30-35 Ton. If one circuit fails or one compressor fails then the second circuit is a back up.
3. 196 Ton chiller (seasonal chiller, 50-60% loaded during peak season) predominantly serves the undergraduate wing units. There is no backup when the chiller fails.
4. 500 Ton chiller (seasonal chiller, 80-90% loaded during peak season, located in room 550) serving the Davenport wing. There is no backup when the chiller fails.

The anticipated peak cooling load is estimated at approximately 1.4 MW (400 tons) at summer design conditions. The cooling plant will primarily be located at rooftop / penthouse level, the building cooling requirements will be services by one of the following options:

- Air source heat pump system comprising of a 4-pipe air source heat pump, capable of concurrent heating and cooling, sized to cater for the required simultaneous load, along with 2-pipe air source heat pumps (cooling in summer, heating in winter) to supply the rest of the cooling demand.
- Air cooled Magnetic Levitation or screw compressor chiller, utilising R513a refrigerant in combination with an indoor heat recovery chiller.
-

Buffer tanks will be provided to satisfy minim system volume requirements for the cooling system. A provision will be made to allow for future campus low temperature DES system connectivity.

Controls

The existing control systems are mix of vintage controls, electric pneumatic, and new DDC such as brand new JCI system at SIF renovated labs in LM Tower.

The new building addition will have a complete direct digital control (DDC) building automation system (BAS), to be designed in accordance with ASHRAE 135. Each research lab will be provided with local lab BAS controls with interface to the main building automation system. Where feasible, based on fume hood exhaust air flow demand, the labs and lab support spaces will be provided with a demand control system (Aircuity or similar) that will control the ventilation of these spaces based on active environment sampling of the air. The systems will be metered and monitored by the BAS to provide energy data by the

system over the life of the building. Integration with the University's Energy Management and Reporting System (EMRS) will be provided.

Plumbing Systems

Domestic Cold and Hot Water, Non-potable, and Tempered Water
Subject to capacity verification, it is assumed at this design stage that domestic cold and hot water will be provided for the new Lash Miller extension via the existing Lash Miller main domestic 100mm (4") cold and 75mm (3") hot water loop located at the basement level. The domestic cold water will be connected to all the plumbing fixtures, emergency safety equipment, and any HVAC equipment requiring make-up water. The domestic hot water will be distributed and circulated to all required plumbing fixtures.

Where non-potable water is required for laboratory sinks, cup sinks (in fume hoods), and laboratory equipment, locale reduced pressure zone (RPZ) backflow preventors will be provided and strategically located as per CSA B64.

Where tempered water is required for local emergency fixtures, local ANSI-approved tempering valves will be provided: ANSI-approved deluge shower facilities will be near spaces using chemicals within the laboratory facility. Showers will be located in accordance with the university's health & safety officer and at regular intervals in accordance with ANSI standards. Eye and face washing equipment will be provided in accordance with ANSI Z358.1, in coordination with the university's health & safety officer and in every space where chemicals are used. These devices will be located at or near sinks and will be positioned so they do not interfere with the normal use of sinks and drain boards. Where eyewash units are placed separate from sinks, a plumbed waste line will be provided from the eyewash bowl. An eye wash will be located at each major sink in laboratories or in combination with each emergency shower.

Compressed Air
An oil-free central compressed air system with a dewpoint of -40ºC will be provided to laboratory benches, fume hoods, and equipment. Capacity will be based on number of outlets (TBD) with 0.5 l/s per outlet, per laboratory simultaneous use. Dual compressors for redundancy and ease of maintenance will be provided with desiccant air dryers. 689 kPa (100 psi) minimum pressure will be distributed. The default setting will be 552 kPa (80 psi) at the laboratory bench nozzle, and 862 kPa (125 psi) operating pressure at the source (TBC by UofT). The compressed air system will be distributed as a loop system which will have two main pipe risers and a shut-off valve at each riser at each floor will be provided. This distribution strategy will reduce pipe sizes. Compressed air system piping will be Type L copper.

Vacuum
A dry vacuum system will be provided to laboratory benches and fume hoods. Capacity will be based on 0.23 l/s at 81 kPa (TBC by UofT). A dual (or triplex) rotary vane vacuum pump will be provided. The vacuum system will operate at 88 kPa (12.8 psi) with the capability of delivering approximately 67.7 kPa (9.8 psi) at the bench nozzle (TBC by UofT). The vacuum system will be distributed as a loop system which will have two main pipe risers and a shut-off valve at each riser at each floor will be provided. The redundant vacuum pump and loop system will ensure 100% system redundancy and simplified maintenance. Vacuum system piping will be Type L copper.

Natural Gas

For natural gas distribution within the laboratory spaces, a connection will be made to the existing building system. Natural gas provision to the life safety generator will require a new, dedicated connection. Capacities for both systems to be determined as the design progresses.

Nitrogen
Subject to capacity verification, it is assumed at this design stage that nitrogen will be provided for the new Lash Miller extension via the existing located at the Lash Miller loading dock to the point of use.

Pure Water (RODI)
Subject to capacity verification, it is assumed at this design stage that RODI water will be provided for the new Lash Miller extension via the existing Lash Miller main RODI loop that runs around the building at each floor level.

Bottle Gasses
Bottle gas provision for laboratory use shall consist of the following: Carbon Dioxide (CO_2), Argon (Ar), Oxygen (O_2), Hydrogen (H), and Helium (He). It is expected that oxygen and hydrogen cylinders will be local to the laboratory space. Carbon Dioxide, Argon and Helium are expected to be stored in a centralised location, piped distribution will be provided to the laboratory spaces.

Sanitary Waste and Vent Drainage
A new sanitary waste & vent system will be provided for the new Lash Miller addition. Subject to capacity verification, it is assumed at this design stage that the new sanitary waste from the new Lash Miller extension will be connected to the existing 150mm (6”) sanitary main located below the existing Lash Miller building.

Laboratory Waste and Vent Drainage
The existing building does not have specialised lab waste or neutralization, waste treatment tanks.

A dedicated waste system will be provided for the laboratory sinks and fume hood cup sinks. Policy and procedure will be to segregate and dispose of any toxic, radioactive, or high concentration wastes through local “in-lab” safety containers without the use of the piped waste system. Hence, an acid dilution waste system will not be provided. Rather, the dedicated waste system will be connected to the conventional waste system as close to the main outflow as possible. Piping material will be fire resistant fusion welded polypropylene. Floor drains will be provided in laboratory areas and at specific equipment locations (i.e., sterilizers, glassware washers, ice machines).

Plumbing Fixtures
Plumbing fixtures will be water conserving and barrier free (ADA compliant). All fixtures will be provided with individual stop valves. Water closets and urinals will be furnished with hard wired sensor-operated flush valves and lavatories will be provided with water savings sensor-operated faucets. Electric water coolers will be ADA complaint and equipped with integral chillers and bottle fillers

<u>Electrical</u>

Normal power
The existing building is fed from two feeders from the 4160V campus loop system. These feeders feed into a HV switchgear that is located in the basement level (Room 040). The HV switchgear feeds two

2500kVA pad mounted transformers which then feeds the building services from a main-tie-main configuration 600V switchgear. This 600V switchgear feeds two 750KVA dry-type transformers, which then feed a 208V switchgear. This 208V switchgear feeds the existing building busducts at 208V. The HV switchgear also feeds a 4160V switchgear in the penthouse of the Davenport wing of the building. This distribution was installed in 2018 with a plan to upgrade to the 13.8kV campus loop in the future. The HV switches are rated for 15kV to allow for the upgrade. The existing 2500kVA pad-mounted transformers also have double taps to allow for a transfer to 13.8kV on the primary.

The Lash Miller expansion will utilize the existing Lash Miller electrical distribution at the 600V level. There are two existing spaces that will have a new 1200A breaker installed to feed the expansion's space electrical distribution at 600V. The anticipated mechanical load is expected to exceed the capacity of the existing 2500kVA transformers. To accommodate the redundancy requirements and the additional power capacity required of the additional mechanical loads, a new transformer will be installed in the electrical room basement and a new switchgear will be installed in the mechanical penthouse. This new transformer will be fed from the existing 15kV switchgear as a separate distribution.

The building power distribution will be at 600/347V and will be distributed via cable feeders in conduits. Step down transformers 600V/120-208V will be provided as required. The expansion's main electrical room will be located on the basement level of the expansion and will contain the main switchgear and distribution boards. The main switchgear will be a double ended, main-tie-main 600V, 1200A switchgear. From the main switchgear, bus ducts will extend up the electrical riser to a primary electrical room on each floor of the expansion space. Each primary satellite electrical room, with minimum 3m x 3m dimensions, shall be vertically stacked; the vertically stacked rooms will make up the electrical risers to serve the upper levels of the building. The 600V distribution panels will allow breaker space for individual distribution to each lab space. The penthouse mechanical loads will be fed from both the 600V switchgear and the new15k-600V transformer.

Emergency power
Emergency power is required to support critical lab equipment. The existing emergency power feeder to Lash Miller originates from the CSP emergency generator and is at maximum capacity. In addition, the generator at CSP has reached the end of its economic life. A new natural gas generator shall be installed to accommodate the new life safety and non-life safety loads for the entire current and future needs of the block bounded by Willcocks, St. George, Huron and Ursula Franklin.

Current demand on the existing transfer switches in the building is 160kW. This does not include the fire pump ATS which is protected by a 250A breaker, operating at 600V. The size of the new generator to feed the building shall therefore take into account existing emergency demand, fire pump size, and anticipated emergency power demands for the expansion. A 20% growth multiplier shall be added to this number for future growth consideration.

The existing Lash Miller emergency distribution shall be disconnected from the McLennan Labs emergency network and connected to the new generator. The connections will be a 60A feed to the Fire Pump Controller and a 225A feed to the existing emergency splitter. A temporary generator/load bank connection box at grade shall also be provided. This temporary generator box shall be connected to the roof emergency distribution board. An interlock between the breakers served from the rooftop generator

and the temporary generator shall be provided to ensure that both the breakers are not turned on at the same time.

Lighting and lighting control
All lighting in the proposed expansion shall be new LED lights with digitally addressable led drivers. One LED luminaire with complete full cut-off shielding will be used to replace the western-most wall pack on the existing façade on Willcocks Street and will be controlled by photocell and by time of day via the master lighting control system. Recessed canopy light fixtures with LED lamps will be installed at the Willcocks Street entrance. The St. George entrance canopy lighting will be existing to remain. A fully computerized low voltage control system will be provided throughout the new expansion. The control system shall accommodate numerous inputs such as ambient light sensing, scheduling, motion sensors, etc. and shall be programmable to the point that each individual fixture or zone shall have a separate address. The level of control will be determined on a space-by-space method to balance cost and complexity with functionality. The basis of design manufacturer for the control system will be Lutron.

Data

With the acceptance of a 70m horizontal cable distance limitation for network cabling, only one LAN Room to service the overall footprint of each room is required. The LAN rooms will be vertically stacked to facilitate an efficient means of running backbone cables across the building. LAN Rooms are currently sized 3m x 3m to accommodate a minimum of 1m front, back and side clearance surrounding IT racks.

The existing Server Room located in the basement of the existing building will be decommissioned. As part of the expansion building, a new Server Room will be required. The new Server Room is recommended to be located at Ground floor or above to mitigate flood concerns, however not considered mandatory to align with the conditions of the building's existing Server Room. Should the new Server Room be located within the basement, the design will account for all necessary leak, flood and moisture mitigation to ensure the room is provided with the appropriate environment. The new Server Room will be apportioned into rack locations, in rows, one rack location for each 3 nasms. Rack locations are to be suitable for standard 19" 4-post racks cabinets, up to 48U high, weighting up to 2000 lbs. Each rack location needs to be accessible from front and back with at least 1.2m (4') clearance. Each rack location should be equipped with a patch panel with eight CAT6A copper connections (UTP, RJ45 connector) and four pairs of OS2 fibres (LC connector) to a designated communication closet. An overhead open, metal telecommunications cable tray should be provided that runs along each row, and between rows, such that there is a continuous cable tray path between all rack locations in the room. A suitable conduit or cable tray path between the nearest telecommunications closet and the in-room cable tray should be provided. Approximately 12 nasm will be required to host 40-60 GPU clusters. The minimum size of the new Server Room will be 3.05m by 3.7m and is currently located within the basement to align with the existing Server Room location.

Individual data/IT requirements for all spaces in the project are listed on room data sheets. Wireless must be present throughout. A wireless site survey is under coordination to provision for the appropriate infrastructure to support the wireless access points (WAP) layout.

Environmental Health and Safety

Projects that include renovations of existing buildings will also be required to address a number of additional issues.

Facilities & Services have Ministry of Environment (MOE) agreements in place. In conjunction with EHS, amendments are to be requested once this project proceeds in Implementation Phase. EHS will perform emissions modelling as required by MOE. Consultants to coordinate information to EHS as required per MOE agreements.

The University of Toronto will investigate and identify designated substances and other site-specific hazardous materials present within the project area as per appropriate regulations and the Ontario Occupational Health and Safety Act.

e) Site Considerations

Site context

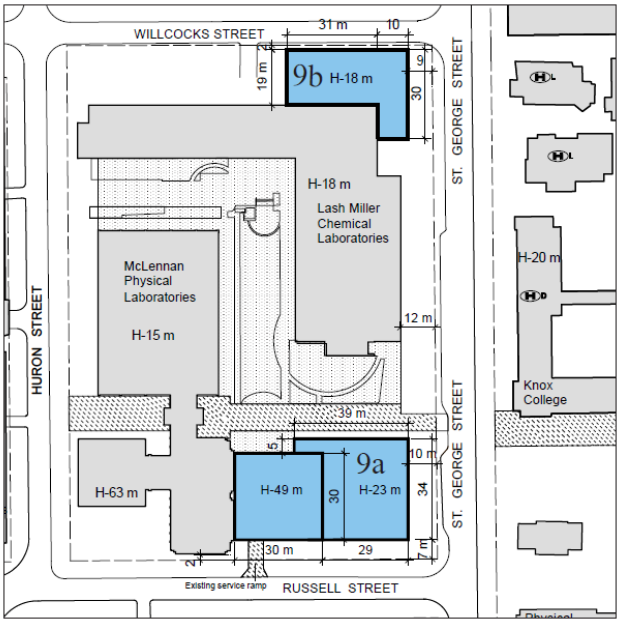
The expansion to Lash Miller will be located above the existing one storey volume of the northeast corner of the Lash Miller Building. Sited prominently at the intersection of St. George Street and Willcocks Street, the expansion of Lash Miller is a highly visible project in the heart of UofT's St. George campus. The project design will carefully consider its unique relationship with, and opportunities presented by, its adjacent siting to Willcocks Common, an informal car-free east west pedestrian zone designed for the university community and the future West Campus Hub and a new proposed Institutional Major Open Space to the north of Willcocks Common.

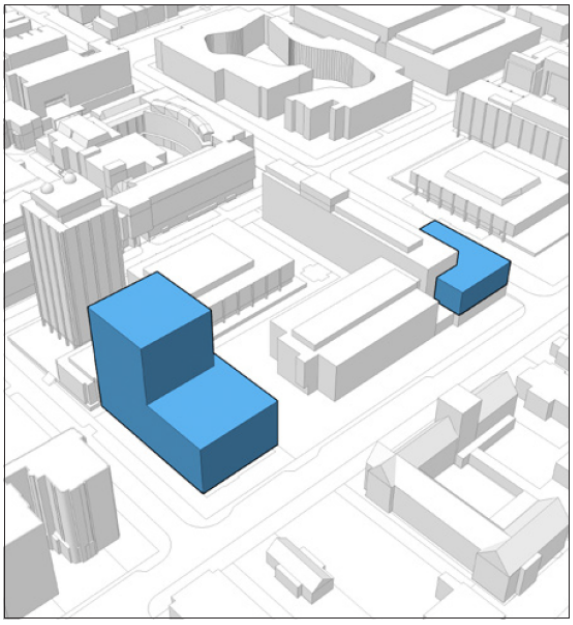
Master Plan and Zoning

The Lash Miller site is zoned Mixed Use (Q, T2.0) as per Zoning By-law 438-86. This allows for a gross floor area two times the lot area and permits Class A laboratories affiliated with the University. By-law 438-86 permitted a maximum height of 23m for the site area.

In 2011, the University approved in principle a new Master Plan for the St. George Campus. The Master Plan was the result of a consultative process with University planners and stakeholders, area residents and City officials. It recognized that modified existing and new infrastructure development would be required to meet the needs of the University of Toronto's Towards 2030 vision document. The Master Plan provided updated planning strategies for the future development of the University and included for the proposed northeast expansion of Lash Miller as Site 9b. The proposed building envelope capacity of Site 9b allowed for a three-floor infill addition above the existing single storey structure.

2011 University of Toronto St. George Master Plan, Site 9b Proposed Massing:





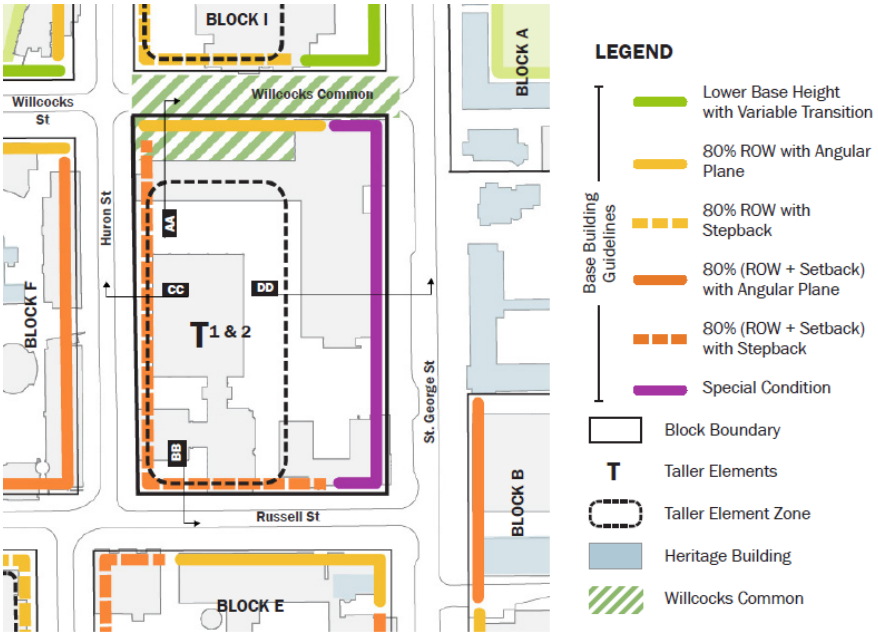
In 2016, an application was made by the University of Toronto to amend the Official Plan for a new Secondary Plan, the 'St George Campus Secondary Plan Area', and a re-submission was made in 2018. The Secondary Plan was adopted by City Council on July 19, 2022, forming Official Plan Amendment 582. The Secondary Plan does not come into force until appeals are resolved by order of the Ontario Lands Tribunal.

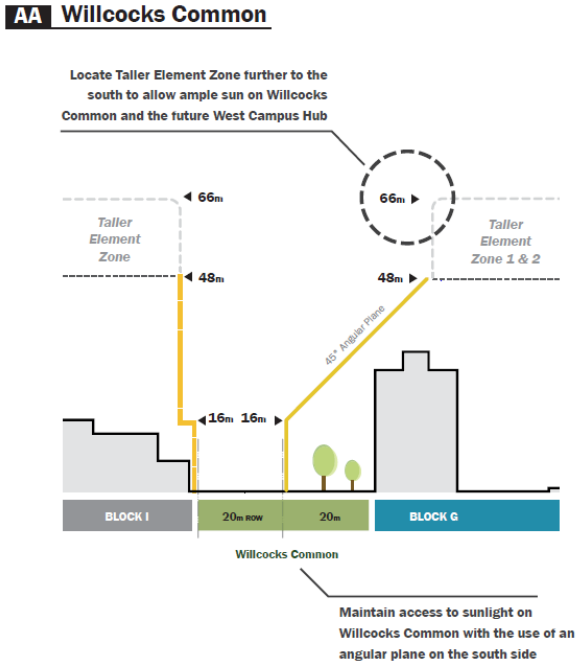
The Secondary Plan policies, together with the Urban Design Guidelines, are to inform the evaluation of current and future development applications in the University of Toronto St. George Campus Secondary Plan Area. City Planning is to develop and bring forward block-specific Urban Design Guidelines for the University of Toronto St. George Campus Secondary Plan Area, as required, for consideration by City Council. These block-specific Urban Design Guidelines will provide more detail and guidance on each block's Vision, Public Realm Strategy, and Built Form Strategy, to inform and guide the evolution of the public realm and future development on the university-owned lands. These are anticipated to be finalized and brought forward to City Council for consideration in Q2 2023.

Lash Miller Building Expansion is located within Block G, as identified in the Draft block-specific Urban Design Guidelines (2018). The Public Realm strategy at this location focuses on integration with Willcocks Commons and activation of the northern building elevation. The 2022 adopted St George Secondary Plan, Official Plan Amendment 582, identifies Willcocks Commons as an Institutional Major Open Space. The 2022 adopted Urban Design Guidelines note that'a hub will be created within the West Campus and St. George Street Character Areas on the block north of Willcocks Common west of St. George Street. Together with a signature building, the new Institutional Major Open Space should act as a hub for activity that expands Willcocks Common, the Huron Street Shared Street design and the St. George Street streetscape to create a flexible and accessible gathering, recreation and event space.' The area directly south of Willcocks Common to the west of the project area is identified as Existing Key Open Space. The Built Form Strategy identified in the Draft block-specific Urban Design guidelines

(2018), provides guidance at this intersection for base heights of 16m in relation to 80% of the Willcocks Street Right of Way, up to 18m towards St George Street, increasing in height to the south via an angular plane to minimize shadowing, and promote access to sunlight. Building heights south along St George Street are anticipated at approximately 24m due to the relationship to St George Street.

2018 University of Toronto Secondary Plan Draft Urban Design Guidelines Built Form Considerations, Block G:





The proposed building addition is designed to align with the general intent of the Draft Urban Design Guidelines.

In accordance with this massing, the mechanical penthouse is set back from Willcocks Street. As this project is located in a prominent location on campus and will have great visibility, architectural excellence is key. In addition, due to the low building height of the expansion, the mechanical penthouse is designed to be well-integrated into the architectural design of the project, considered from at-grade views as well as from taller vantage points from the existing and future taller building context of the West Campus.

Landscape and open space requirements

Restorative hardscaping and soft landscaping are included in the project scope for any areas affected by the construction. Further landscaping design is anticipated with future improvements to the Willcocks Commons pedestrian street therefore landscaping for the Lash Miller Expansion will be only as necessary to restore to the existing condition. The project relocates the Willcocks Commons north entrance towards St. George Street in response to circulation and the new covered entrance will be fully accessible.

The north area of the project is considered Existing Institutional Major Open Space and to the west of the project is Existing Key Open Space. Minimizing the impacts of shadows on these areas, integrating the expansion with Willcocks Common and activating the northern building elevation are identified as key public realm strategies. Enhancing the pedestrian character of St. George Street by maintaining generous pedestrian space along this edge is also a project consideration.

Site access

The site is at the corner of St. George Street and Willcocks Street. Pedestrian access will remain in place, with entries off both streets. There is Green P street parking on St. George and Huron, in addition to paid UofT parking lots at Rotman School of Management, MCEIE, and Graduate House. Drop-off of passengers can be facilitated through the St. George parking lane, which functions as a layby.

Heritage status

The Lash Miller Building is not listed on the City's Heritage Register. Under the review of the University's application for an Official Plan Amendment of the St. George Campus Secondary Plan, the University submitted a Cultural Heritage Resource Assessment (CHRA) prepared by consultants ERA Architects. The CHRA identifies the Lash Miller Building as not meeting I.O. Reg. 9/06: Criteria for Determining Cultural Heritage Value or Interest. The City has further reviewed the Lash Miller Building for its potential heritage value and has confirmed that it is not considered to have heritage value. Within the University, there is a requirement to maintain the Chemistry symbols that are currently on the façade of the building.

Environmental Issues, Regional Conservation, Ministry of Environment, Conservation and Parks (MECP)

Environmental emissions (MECP submission requirements)

Consultant to perform associated ASHRAE and AERMOD modelling (air) and acoustic assessment related to the project and built upon existing models in the current Emissions Summary and Dispersion Modeling (ESDM) report and Acoustic Assessment Report (AAR), to ensure continued regulatory compliance as required per the U of T's current Environmental Activity and Sector Registration (EASR) for the site. All noise emitting sources to comply with acoustic emission regulations and standards. All significant air emission sources to comply with air emission regulations and standards. If the design indicates any non-compliance for air and/or noise emissions, then the consultant shall provide modelled mitigation or design alteration options which will achieve compliant outcomes. The consultants will coordinate Noise, Air and Emission modelling information with the U of T Office of Environmental Health and Safety (EHS) and will provide EHS with both Acoustic and Emission Dispersion modeling information to be reviewed. The final deliverable to this regulatory requirement will be updated model outcomes, model files and acoustic and emission summary tables, signed and stamped by a third-party Licensed Engineering Practitioner (LEP). EHS will update the ESDM, AAR and EASR via the final deliverable, as required by MECP.

The Lash Miller Labs will be designed to meet all operational and physical safety and security requirements identified in the current Canadian Biosafety Guidelines and Standards issued by the Public Health Agency of Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs.

Site servicing; existing and proposed

Lash Miller is currently served by shared loading/servicing facility accessed off Ursula Franklin Street at the McLennan Building. It is expected that this will continue as the servicing location.

f) Campus Infrastructure Considerations

Utilities (electrical capacity, water, gas, steam lines)

Existing Water Servicing
There are two existing water services both connecting to one point at the southwestern portion of the building. An existing 150mm watermain located along Willcocks Street provides one water service connection. Another water service connection is provided from the 150mm watermain located on Huron Street just south of the existing University of Toronto underground service tunnel crossing the street.

Existing Stormwater Infrastructure
The building is serviced by two storm sewer connections, one on St. George Street at the east side and another on Huron Street at the west side. On the east side, a 200mm and 250mm storm pipe from the building connects into a manhole and outlets as a 300mm storm sewer before connecting into the 675mm Reinforced Concrete Pipe (RCP) storm sewer running south along St. George Street. On the west side, a

150mm and 250mm storm pipe from the building connects into a manhole and outlets as a 375mm storm sewer before connecting into the 675mm RCP storm sewer running south along Huron Street.

Existing Sanitary Servicing
There are two existing sanitary connections from the building. On the east side, an existing 250mm sanitary pipe outlets the building to a manhole before connecting to a 750mm x 1125mm Egg Shaped Brick (ESB) combined sewer on St. George Street via a 375mm sanitary pipe. On the west side, an existing 300mm and 325mm sanitary pipe outlets the building to a manhole before connecting to a 600mm x 900mm ESB combined sewer on Huron Street via a 375mm sanitary pipe.

Third-Party Utilities
The existing building is surrounded by several third-party utility assets as identified from the City of Toronto DMOG utility map. On Huron Street, there are two abandoned 200mm University of Toronto hot water pipes, a University of Toronto buried cable, an abandoned 150mm and 75mm gas main, a Bell Canada conduit, a Toronto Hydro Electric Systems Ltd. (THESL) conduit, and two 300mm supply and return mains for steam cold water (chilled water). On St. George Street, there are two Bell Canada conduits, an abandoned 200mm gas main, an active 50mm gas main, and a THESL conduit. Located along the south side of Willcocks Street, there is a Bell Canada conduit.

Most third-party utilities connect into the southwest corner of the building adjacent to Huron Street. Based on the University of Toronto Utility Plans, this includes a 4.16kV loop (THESL), two 300mm supply and return mains for steam cold water (chilled water), and two 150mm Low Temperature Water (LTW) supply and return pipes. There are two University of Toronto underground service tunnels crossing Huron Street and Willcocks Street that contain 50mm and 75mm compressed air lines, central communications lines, and heating lines including 75mm and 150mm steam lines, 37.5mm and 75mm condensate lines, and a 300mm High Temperature Hot Water (HTHW) line.

Proposed Works
It is currently expected that no proposed civil works will be required with the proposed development. The proposed vertical expansion of the northeast wing of the existing building is considered to be a minor addition with no site alterations, Therefore, no site grading and additional stormwater connections are required. It is assumed that the increased sanitary flows due to the expansion will be negligible and can be discharged into the existing sanitary connection without any capacity concerns to the municipal system. It is also expected that the existing water service connection will be sufficient for the proposed expansion.

The following data collection and investigations are currently in process and will contribute to the supplemental data to complete the design: geotechnical investigations, hydrant flow tests and subsurface utility engineering quality level field investigation.

Communications Systems
There is an existing Building Entrance Facility (BEF) which serves the existing building. With the building's current BEF and available fibre strands near capacity, a new BEF for the expansion building will be required. New copper and fibre lines will be provided from Sir Daniel Wilson Residence across from St. George Street to extend UofT's existing wide area network (WAN) services into the new building. The new BEF should be located as close to the building entry point as possible, within vicinity

of the northeast corner of the building. The new BEF room will have a minimum dimension of 3.5m by 3m and house 19’ equipment racks. Pathways from the BEF will route to LAN Rooms and Server Room.

Bicycle parking

The University of Toronto has its own bicycle parking requirement, a site-specific exemption Zoning By-Law 438-86, which requires a minimum 850 spaces on campus.

The St. George campus currently offers over 3,150 spaces. Therefore, the bicycle parking requirement generated by this project will be minimal and based primarily on need.

g) Secondary Effects

During Schematic Design, in consultation with the consultant team, it was determined that the basement directly under the project footprint would be lowered to allow for a 4.8m height. This approach provided opportunities for reconfiguring and replanning the ground floor and basement layouts.

The existing LSM classrooms 155, 157, 158, 159, 161, and 162 will be taken offline during construction as will neighbouring classroom 123 due to close its proximity. The LSM classrooms will be staged throughout construction utilizing exiting space in two proposed locations: Bloor St. W. at Spadina Ave. (both 371 Bloor St and 750 Spadina) and 230 College St . The proposed staging plan is described in the table below:

Need/Duration	Building	Rm #	Seat Capacity	Proposed Staging Plan
Lecture Theatres				
	LM	159	208	371 Bloor W Auditorium
	LM	162	154	Off-campus option JCC Al Green Theatre (under review)
	LM	158	108	Student Commons Room B120
	LM	161	141	371 Bloor W Tiered Room 230
Flat Floor/Seminar Rooms				
	LM	157	42	Student Commons Room 444/450
	LM	155	50	371 Bloor W Room 213
	LM	123	28	Student Commons Room 440

The project will attempt to minimize demolition and removals of existing space, though temporary staging may be required for those rooms that will be severely impacted by noise. The stairwell (201, 301, 401, 501) will be renovated and upgraded.

In the basement, the following existing rooms will be affected by construction:

- 65, 65A, 65K, 66. These rooms are anticipated to be vacant at the time of construction.
- 67 existing Air Conditioning space will require coordination with new mechanical systems.
- 70A and 70B are an existing Laser Lab that will be required to vacate for construction. The re-allocation of other departmental space is under consideration for replacement space.
- 55 and 56 Custodial Areas, 60 Lunch Room and 61 Generator will remain though their usage may be limited during construction.
- 57A First Aid Room, and 58A Women's Washroom will be taken offline during construction and their usage will be replanned as part of the project replacement space.

On the second floor, the following existing rooms are affected:

- 260, 261, 261A, 262, 262A, 263. Room 263 is F&S space which houses a large air handler unit. This project will relocate this unit to a new mechanical penthouse.

On the third floor, the following existing rooms are affected:

- 301A.

On the fourth floor, the following existing rooms are affected:

- 402A. This room operates as a small lab to perform light-sensitive experiments. Relocation of this function is under review.

On the fifth floor, the following existing rooms are affected:

- 528. This room currently houses a new ice machine and a -80 freezer that serves Research Labs. This equipment is to be relocated, accessible to labs located in Lash Miller.

In addition, the windows of the following rooms will be affected:

- 328, 329, 329A, 329B, 330A, 437, 437B, 438A, 439, 527, 527A, 526A, 525A, 524A. The atrium design will incorporate filtered natural light and views into the new space. Windows will be replaced with fire-rated glass.

During construction, some disruption to typical vehicular flow along St George and Huron Streets may periodically occur due to construction deliveries and removals. A construction management plan will be coordinated through the municipal approval process. Construction noise is to be limited to daytime hours with potential impact on rest of the Lash Miller Building and Sidney Smith Hall north of Willcocks. Those rooms in the north wing of Lash Miller will have significant impacts with respect to noise. Access will be coordinated through temporary hoarding, ramping and entrances. Willcocks Street (Commons) is anticipated to be closed for pedestrian use during this time. Fire access during construction with scheduled closures will be coordinated with the University of Toronto and the City.

The new volume may impede on the existing tree canopy at the eastern edge of the project. An arborist report is being finalized and City permissions will be required for any identified impacts.

h) Schedule

Terms of Reference to CaPS Executive	January 31, 2020
CaPS Executive Approval for Consulting Fees	January 22, 2021
Consultant RFSQ Issued	February 2021
Consultant RFP Issued	June 2022
Consultant Selection and Letter of Award	September 2022
Schematic Design	September 2022 – Dec. 2022
CM Preconstruction Services	September 2022– June 2023
Design Development 100%	January 2023 – April 2023
CaPS Executive Approval for Full Project Cost	Cycle 5 Feb. 2023 – May 2023
Sequential Tendering	June 2023
Construction – Phase 1	July 2023 – October 2023
Construction Documents 100%	April 2023 – August 2023
Construction – Phase 2	November 2023 – August 2025
Occupancy	September 2025
Final Commissioning	September 2025

I. Resource Implications

a) Total Project Cost Estimate

Refer to Appendix for the Total Project Cost Estimate.

b) Operating Costs

Operating costs for the Lash Miller Building #073 are assigned per gsm. Operating costs developed per gsm are comprised of campus operating expenses, caretaking expenses and utilities expenses. Costs are reviewed each year and updated accordingly based on market conditions. Operating costs of $210/gsm are currently projected for a fiscal year 2024-2025 occupancy. The unit rate per gsm is applied uniformly across the entire building.

c) Funding Sources

The project will be funded by the Provost Institutional Funds, Faculty of Arts & Science Operating Reserves, Faculty of Arts and Science Future Major Capital Projects Reserve Fund and Fundraising.

APPENDICES:

1. Floor Plans, Schematic Design Phase
2. Views, Schematic Design Phase
3. Existing Floor Plans
4. Space Utilization and Requirement Analysis Room Specification Sheets (on request)
5. Project Charter
6. Background Document: Lash Miller Chemistry Expansion Feasibility Study 2012
7. Total Project Cost Estimate (on request to limited distribution)