

AGENDA

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OPEN SESSION

1. MINUTES OF PREVIOUS MEETING – FEBRUARY 26, 2020 (OPEN SESSION)
2. CHAIR'S COMMENTS AND UPDATE
3. BUSINESS ARISING
4. PROPOSAL TO ESTABLISH THE CANADIAN CENTRE FOR ELECTRON MICROSCOPY (CCEM)
 - a. [Canadian Centre for Electron Microscopy \(CCEM\) \(APPROVAL\)](#)
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 - a. [Capital Plan \(APPROVAL\)](#)
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March 10, 2020

TO: University Planning Committee
FROM: Dr. Karen Mossman, Acting Vice-President, Research
RE: **Canadian Centre for Electron Microscopy (CCEM)**

Karen Mossman

The Committee on Research Institutes and Centres has reviewed the attached Proposal for the Canadian Centre for Electron Microscopy (CCEM) as per the policies and guidelines, and has been unanimously approved.

Please include this as an agenda item for the next University Planning Committee Meeting on Wednesday, March 18, 2020. Dr. Mossman will be available to attend the University Planning Committee meeting to discuss the proposed Institute in further detail.

KM:jt

Attach.

cc: Acting Provost and Vice-President (Academic)
Dean and Vice-President, Health Sciences
Vice-Provost and Dean of Graduate Studies
Dean of Engineering
Dean of Science
Dean of Social Sciences
University Secretariat and Freedom of Information and Protection of Privacy Officer

February 18, 2020

The Committee on Research Centres and Institutes

Re: the Canadian Centre for Electron Microscopy

Dear Fellow Committee Members:

Attached please find a proposal to establish the Canadian Centre for Electron Microscopy (CCEM) as a Senate-approved Centre.

The CCEM is an established Centre at McMaster University, originally housed within the Brockhouse Institute for Materials Research (BIMR). It provides world-class electron microscopy capabilities and expertise to Canadian researchers and industry working in a broad range of fields.

The Centre was established in 2008 through funding from the Canada Foundation for Innovation (CFI) and the Ontario Innovation Trust (OIT). A highly successful Centre serving researchers across Canada, the CCEM has since been awarded significant levels of research funding, including that provided through the CFI Major Science Initiatives (MSI) program. This designation as an MSI-funded facility is a result of the success of the centre's support for research and its effective management and governance practices.

The CCEM supports research that advances society, using best practices and cutting-edge technologies. It supports collaborative work and thinking across Faculties and disciplines, and supports partnerships with governments, institutions and the private sector. This high-profile Centre fits the criteria of being a Senate-approved Centre and we now seek such designation in recognition of these strengths. Given the cross-disciplinary nature of the research supported by the CCEM, the Centre will report to the Vice-President Research, in accordance with McMaster's Guidelines for the Governance and Review of Research Institutes, Centres and Groups.

Sincerely,



Karen Mossman,
Acting Vice-President, Research

Encl.

Overview

Official Name of Research Centre

Canadian Centre for Electron Microscopy

Dr. Nabil Bassim, Associate Professor,

Submitted by

Department of Materials Science and Engineering

CCEM is a user facility, and as such, does not have official membership, outside of the Scientific Director, Deputy Director, and Director of User Operations. Faculty members are welcome to use the facility on a per-hour basis. Several faculty members serve on the User Group Executive Committee.

Name	Position & Expertise
Nabil Bassim	Scientific Director, Focused Ion Beam and Transmission Electron Microscopy
Drew Higgins	Deputy Director, Catalysis and In Situ Microscopy Methods
Gianluigi Botton	Founding Director, Transmission Electron Microscopy and EELS Spectroscopy
Leyla Soleymani	User Group Executive Committee, Bio-Nano Devices, In situ Microscopy
John Bradley	User Group Executive Committee, Photonic Devices

McMaster users of the CCEM who have current active projects include faculty members and their teams from the following departments:

Faculty	Department
Engineering	Electrical & Computing Engineering
	Materials Science & Engineering
	Engineering Physics
	Mechanical Engineering
	Chemical Engineering
	Civil Engineering
Health Sciences	Biochemistry & Biomedical Science
	Medicine
	Pathology & Molecular Medicine
Science	Chemistry & Chemical Biology
	Biology
	Geography & Earth Sciences
	Physics & Astronomy
Social Sciences	Anthropology

In addition, users of the CCEM who have current active projects include faculty members and their teams from the following academic Institutions:

Brock University	Concordia University	Dalhousie University
Lakehead University	Universite du Quebec a Trois-Riviere	University of Ottawa
Laval University	University of Acadia	University of Saskatchewan
McGill University	University Alberta	University of Toronto
Polytechnique Montreal	University of British Columbia	University of Victoria
Queens University	University of Calgary	University of Waterloo
Royal Military College	University of Guelph	University of Windsor
Ryerson University	University of Manitoba	Western University
Simon Fraser University	University of Montreal	Wilfrid Laurier University
Trent University	University of New Brunswick	York University
Université de Sherbrooke	University of Ontario Inst of Technology	

And from outside of Canada: (among others)

Institut Pascal	University of Connecticut	University of Missouri
University of Buffalo	Kansas State University	Uppsala University
Universite de Grenoble	Temple University	Penn State University
Vanderbilt University	Massachusetts Institute of Technology	Trinity College Dublin

Space Needs	Sq. Ft	New space required?	Yes	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>
	7,629	Location?	ABB B161A, B161C-W ABB B169A, B & C ABB B150, & 328	Confirmed	<input checked="" type="checkbox"/>	Proposed
		Space cost allocation covered by lead Faculty?	Yes	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>

As the CCEM will report to the VPR, per the Budget Model Faculty coverage of space costs is not required

Plans for Organizational Review	Frequency of Internal:	An annual report will be provided to the Governing Board.
	Frequency of External:	A full review will be completed every 5 years or sooner at the request of the Governing Board
		The CCEM receives MSI funding, which requires an annual report, a mid-term review (undertaken in 2019) and a renewal report in 2022.

Please provide names below and check box to verify that approval has been obtained:

Department Chair/ Area Director	n/a	Check box	<input type="checkbox"/>
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Faculty Dean or Director of Administration	n/a	
Vice-President Research (Acting)	Dr. Karen Mossman	<input checked="" type="checkbox"/>

Proposal

Background

The Canadian Centre for Electron Microscopy (CCEM) provides world-class electron microscopy capabilities and expertise to Canadian researchers and industry working in a broad range of fields.

The CCEM was established in 2008 through funding from the Canada Foundation for Innovation (CFI) and the Ontario Innovation Trust, which together provided over \$14M in funding for research infrastructure. The proposal was supported by 22 universities across Canada, 12 Government laboratories (NRC, NRCan and Environment Canada), and several international institutions. A series of awards from the federal and provincial governments along with funding from McMaster University has since that time provided an additional \$39M in infrastructure funding.

In addition to awards for establishment of research infrastructure, the CCEM was awarded over \$6M in funding for operation and maintenance from the CFI Major Science Initiatives (MSI) program in the 2014 and 2017 MSI competitions. Following completion of the mid-term review in the fall of 2019, the CCEM was awarded an additional \$2M in CFI MSI funding. CFI has unique requirements for governance structures of facilities supported by MSI funding and the CCEM has evolved to meet those requirements. The additional funding awarded to the CCEM is a result of the

success of the centre and CFI's approval of its research activities, resulting outcomes, and effective management and governance practices.

The CCEM supports research through training and provision of infrastructure. This infrastructure includes 4 transmission electron microscopes (TEMs). 2 of these microscopes have aberration-correction electron optics (Titan High Base, Titan Low Base), which allow the microscopes to resolve atom resolution images, with accompanying spectroscopy that can obtain chemical identification and bonding information from single atomic columns. One of the aberration-corrected instruments is configured to have high energy and spatial resolution with a wide pole-piece gap, which permits the performance of dynamic experiments inside the microscope (i.e. observing chemical reactions, melting, or the electrical biasing of an electronic device). The other two microscopes perform lower resolution but very critical measurements. These include an instrument that can acquire very rapid chemical mapping from nanoscale materials (Talos 200FX), and another teaching microscope (Talos 120C) that performs many of the main tasks critical for standard materials imaging, including electron diffraction, chemical identification and size analysis. A 5th TEM is planned for installation in 2021 (Nion HERMES), which will be one of the worlds highest energy resolution spectroscopy instruments, coupled with cryogenic capabilities, enabling the study of quantum states of materials.

The CCEM also possesses a suite of scanning electron microscopes (J6610, J7000F, and Magellan 200) capable of imaging the surface of materials at high resolution and performing electron-based x-ray analysis and electron backscattered diffraction measurements to obtain crystal orientation information. This surface analysis is complemented by an Auger electron microscope, which obtains information from the top 2-3 nm of a material, enabling high resolution studies of nanomaterials and corrosion.

In order to perform nanoscale 3-D analysis and to prepare site-specific samples for TEM and Atom probe (see below) analysis, the CCEM also possesses a pair of focused ion beam (FIB) microscopes. One instrument (NVision400) uses a gallium source and is the primary feeder for all of the TEMs at the CCEM. The other employs a plasma xenon source and is capable of milling away large volumes of materials, exposing mesoscale materials features. The plasma FIB is the only one available in Canada to a large user base.

Finally, the CCEM possesses the only atom-probe tomography system in Canada, which is capable of constructing 3-D information about materials on an atom-by-atom basis. This is useful for studying nanomaterials, defects, grain boundaries and interfaces in materials, which are critically important for their bulk properties.

In order to operate all of this instrumentation, the CCEM has a staff of 11 (9 full-time and 2 part time). These are highly skilled personnel, with six having Ph.Ds and two having Master's degrees, and technicians having at least 2 years' training. One of the staff members acts as the manager of the entire operation on a day-to-day basis, including troubleshooting, managing some access and training certification, and technical details of the centre. 5 of the staff holding Ph.Ds have training in the advanced operation of high-end characterization equipment, and also undertake elaborate scientific research projects in collaboration with CCEM users. The technical staff is usually responsible for a specific instrument or a pair of instruments in order to support the CCEM User base. One technician is responsible for maintaining ageing equipment and facilities. One staff member is in charge of user and customer outreach, including organizing and planning workshops associated with the CCEM (see below).

The CCEM currently relies on ROADS for MSI management, the Vice-President Research Office for account management, and an external bookkeeper for the financial operation.

Objectives and Proposed Activities

The CCEM has the following objectives critical to its sustainability and flourishing as a nationally-and internationally-recognized scientific user facility:

- ❑ Elevate national and international status of the CCEM as a world-class facility for electron microscopy
- ❑ Provide state-of-the-art equipment and exceptional user support to enable research advances and technology development
- ❑ Ensure benefits to Canadians by providing unparalleled HQP training and support for technology transfer

In order to pursue these objectives, we acquire, maintain and develop world-class instrumentation that reflects the cutting edge of electron microscopy-based research. These include the aforementioned microscopes that are currently in-house, as well as a planned \$11M renovation and upgrade of the existing facilities. The renovations that are forthcoming are (as of this writing) in the form of the Nion microscope, a replacement microscope for the Titan HB (coming in 2022), and the recent upgrades to the 2 Talos microscopes.

The plan in the very near future (Q1 FY20-21) is to further professionalize the administration of the CCEM to incorporate professional management and governance through the addition of the position of Executive Director (ED). The ED position will be funded through the CFI MSI program (part of the additional allocation towards the centre). The ED will be responsible for Board Relations, national and international strategic planning, budgeting, grant writing, pursuit of funding opportunities and outreach administration. Furthermore, the CCEM plans to hire a full time financial manager (also funded by CFI) to help with budgets, purchases, human resources tasks and billing.

Our training and outreach program (satisfying objective 3) is quite elaborate. The CCEM hosts at least three workshops per year at McMaster, with attendance by 100-150 users. In November 2019 speakers from Canada and the United States presented their work on the use of SEM, energy dispersive X-ray spectroscopy, secondary electron imaging, backscattered electron imaging, transmission kikuchi diffraction, electron backscattered diffraction, SEM with electron energy loss spectroscopy, and computer simulations. The workshop included basic theory of SEM signal generation and applications on a broad range of materials such as mineral, metals, and Canadian artwork.

The CCEM also participates regularly in off-site training and workshops, including among others the Microscopical Society of Canada's (MSC) workshop sessions, the FIB-SEM User Group meeting (hosted every three years at McMaster). The CCEM will host an international conference (IUMAS), coincident with the MSC annual conference in Banff in 2021.

The CCEM hosts the CCEM Summer School on Electron Microscopy, a tradition spanning 13 years. This weeklong course brings the best and brightest students from around the world, as well as the world's most prestigious instructors, to deliver a short course on transmission electron microscopy. Our goal is to provide students advice in solving characterization problems with the help of experts. The course includes lectures given by invited experts in the use of the techniques from various international research labs and provides students with hands-on training. This exposure allows the CCEM to maintain its status as a center of excellence in microscopy in the world.

The CCEM provides a series of successive training sessions to students at McMaster and from outside McMaster in order to use the microscopes independently. It trains over 400 users per year, with work associated with many different academic disciplines. Online training modules are also provided.

From an academic perspective, the CCEM supports training within the Department of Materials Science for the Capstone design class, the graduate Electron Microscopy of Materials (MATLS 724), and in the department of Chemistry and Chemical Biology, with training sessions for basic electron microscopy. In these sessions, there are full laboratories offered, employing the microscopes to advance the training of McMaster students.

Rationale for Establishment of the Centre

The CCEM is an established Centre at McMaster University. It has developed into a truly national facility of international reputation with both large capital investments and significant funding from CFI to support operations and maintenance. Given the success and growth of the CCEM, it was in 2019 separated from the BIMR and established as an independent Centre with its own financial and governance structures.

The CCEM has allowed McMaster to build a critical mass of researchers and has facilitated interdisciplinary research and cross-sectoral collaboration, increasing the visibility of research at McMaster. For example, the CCEM has supported collaborative research undertaken with researchers at the Massachusetts Institute of Technology, IBM-Zurich, IBM-US, Hewlett-Packard, Cambridge University and Strasbourg. It enabled researchers working in collaboration from U. Pierre Marie-Curie, U. Paris-Diderot, CNRS Lyon and McMaster to uncover how nanomaterials used in cancer phototherapies degrade inside living tissues and how these materials could be protected from degradation using Au.

The CCEM has facilitated linkages between research and education and been critical to the training of highly qualified personnel. The success of research supported by the CCEM has increased McMaster's ability to secure research funding both for infrastructure and operations. With these significant outcomes, this high-profile Centre fits the criteria of being a Senate-approved Centre and we now seek such designation in recognition of these strengths.

Alignment with McMaster's Strategic Research Plan:

Research supported by the CCEM is in keeping with the core values outlined in McMaster's Strategic Research Plan (SRP). The CCEM supports research that advances society, using best practices and cutting-edge technologies. It supports collaborative work and thinking across Faculties and disciplines, and supports partnerships with governments, institutions and the private sector. The CCEM is seen as a valuable resource to industry and in fact each year provides industry with over 50 technical reports, demonstrating the impact of the technology to the user community. The CCEM extends the boundaries of knowledge through research, providing exceptional training opportunities for research personnel.

This proposal builds directly on our institutional research strengths and interdisciplinary capacity, as well as significant investments already made in infrastructure and people. The CCEM supports a wide range of research activity across disciplines. Key areas of research supported are biomedical devices, quantum materials, and additive manufacturing. The CCEM has helped established interactions with industries and academic institutions working in the area of additive manufacturing, one of the cornerstones of advanced manufacturing. Advanced Materials and Manufacturing has been a strategic priority at McMaster for more than three decades and a priority outlined in our SRP as a focus for future directions. The CCEM supports new approaches to manufacturing and the development of new materials, the importance of which is outlined in the SRP. It supports fundamental research as well as knowledge transfer and commercialization, SRP priorities which will also support McMaster's success in meeting the metrics of SMA3. McMaster's SRP speaks to the importance of building partnerships, including partnership with other sectors, in order to solve complex problems, spur economic growth and create a more skilled workforce, all areas in which the CCEM excels.

The focus of the CCEM is aligned with that of the Brockhouse Institute for Materials Research (BIMR) - the first interdisciplinary materials research institute in North America - the McMaster Manufacturing Research Institute, the Centre for Automotive Materials and Corrosion, the Biointerfaces Institute, and the Centre for Emerging Device Technologies. Together, these facilities have developed internationally competitive research programs ranging from soft materials and biointerfaces, to materials processing, corrosion, and steels.

Alignment with the Strategic Mandate Agreement

Critical to meeting the metrics in SMA3 are: supporting McMaster's researchers, scholars and students to encourage and promote research excellence and advance interdisciplinary research; improving McMaster's share of Tri-Agency funding; maintaining and enhancing research partnerships including partnership with and funding from other sectors; and engaging in knowledge mobilization and tech transfer. Examples of how the CCEM will advance some of these priorities are as follows:

The CCEM has enabled a number of industry users from various sectors to solve relevant problems. It has supported the automotive sector (Stackpole, General Motors), the aerospace industry (Trilocus Aerospace, Collins Aerospace), the steel industry (Stelco, US Steel, Evraz), the semiconductor industry (Techinsights, ON Semiconductor, Ranovus, 3SP Technologies SAS), the nuclear industry (Kinectrics, Canadian Nuclear Laboratories) and the pharmaceutical industry (Dalton Pharmaceuticals). In the aerospace sector, the CCEM has helped determine premature failures of gas turbines for Trilocus Aerospace which led to the company being able to repair the failed parts. The CCEM has also studied novel aluminum alloys for the development of aircraft braking systems. In the semiconductor industry, the CCEM provides first-class failure analysis and reverse engineering services. The CCEM has also been a key contributor to the development of novel pharmaceuticals by providing analysis services to Dalton Pharmaceuticals, for a project that involved TEM imaging and chemical mapping.

The CCEM, the McMaster Steel Research Centre and Stelco Inc., have collaboratively developed a new Zinc coating process for steel. This allows production of thinner gauge sections leading to a significant weight reduction and outstanding, cost-effective corrosion protection. The parts are being used in the automotive industry and lead to increased life span and quality of the steel coating and the overall durability of the automotive body. Furthermore, the associated weight reduction leads to lighter cars with lower CO2 emissions, helping our fight against climate change.

With support of the CCEM, General Motors is working on a radically new separator between anode and cathode, preventing diffusion of some of the Mn ions negatively affecting the nature of the anode, leading to capacity loss and safety issues for batteries and range of electric vehicles. This detailed work, carried out at the CCEM with PFIB and advanced SEM, has led to an improvement of a factor of 2x of the lifetime of commercial batteries. This research enables keeping the R&D base associated with electric car technology with high Canadian participation.

Vision

The vision of the CCEM is to be one of the leading electron microscopy facilities in the world for the quality of the scientific research and to be the go-to provider of electron microscopy services to Canadian and international researchers and industry working on a broad range of materials research. Our mission includes playing a leading role in promoting interactions amongst researchers in various fields nationally and internationally and providing unparalleled training in electron microscopy.

Organizational Structure

The following robust organizational structure has met the requirements of CFI, which provides operation and maintenance funding for the Centre.

Scientific Director:

The Scientific Director will be appointed for a 5 year term. The Scientific Director of the CCEM reports directly to McMaster's Vice-President, Research, or designate, on matters concerning CCEM staff appointments. The Scientific

Director of the CCEM reports directly to the CCEM Governing Board on matters concerning strategic planning, operational management, risk management, and financial management of the CCEM.

Dr. Bassim has been Acting Scientific Director of the CCEM since May 2019. Following the recommendation of the Governing Board, and a selection committee representing the stakeholders and chaired by the Acting Associate Vice-President Research, Dr. Bassim was recommended as Scientific Director by the Senate. Approval by McMaster's Board of Governors is pending.

Nabil Bassim is Associate Professor in the Department of Materials Science and Engineering. He received his Ph.D. from the University of Florida in 2002 with research centered on the fundamentals of low-temperature growth of oxide and nitride thin films for electronic applications. He had a postdoctoral appointment at the U.S. Naval Research Laboratory (NRL) followed by a term at the National Institute of Standards and Technology in the USA, before returning to NRL as a staff Materials Research Engineer. In 2016, he joined the Department of Materials Science and Engineering at McMaster University and quickly established one of the larger and most productive research teams in the department. His research is primarily focused on developing novel electron and ion microscopy techniques and applying them to a wide variety of materials systems, including structural materials, nanomaterials, 2-dimensional materials, and related image processing integrating machine learning and AI. He is widely recognized as an international leader in Focused Ion Beam microscopy and has delivered several dozen invited talks on FIB and microscopy. With nearly 100 publications and 3 patents, his work is widely known in the microscopy and materials communities. He is a councillor of the Microscopical Society of Canada and was the Chair of the Microscopy and Microanalysis meeting in 2018 (the largest microscopy meeting in the world). He received the prestigious Woody Award for outstanding service to the Profession from the Materials Research Society in 2015. He currently serves as the Acting Scientific Director of the Canadian Centre for Electron Microscopy (CCEM), Canada's premier microscopy facility.

Governing Board:

The CCEM is overseen by a Governing Board (GB). The Governing Board has overall responsibility for the governance and management of the CCEM. The Governing Board fulfills its mandate by providing direction and oversight to the CCEM with regard to strategic planning, risk management, and financial monitoring. Members of the GB were selected to ensure expertise in the following areas: Facilities Management; Materials; Strategic Planning and Leadership; Stakeholder Engagement; Risk Management & Audit; Financial Management; Director/Manager Experience; Board & Committee Experience. A skills matrix was developed to ensure appropriate expertise in each of these areas.

There will be at least two (2) meetings per year of the Governing Board per year.

The Governing Board will be composed of a minimum of eight (8) and a maximum of eleven (11) individuals with a right to cast votes (not including ex officio members) (the "Members"). The precise number of Members of the CCEM Governing Board from time to time will be determined by a resolution passed at a meeting of the Governing Board.

To ensure that the needs of researchers across Canada are represented, the Chair is appointed by the Governing Board and will have a two-year term. Two standing members will be the designate of the Deans of the Faculties of Engineering and Science at McMaster University for a two-year renewable term. A minimum of six Rotating members will be appointed for a one-year or two-year renewable term. The two ex officio members will be the Associate Vice-President, Research and the Scientific Director of the CCEM.

The GB is in place and meets the unique governance requirements of a CFI-MSI funded research facility serving the national and international community. Membership of the Governing Board is as follows:

- Gianni Parise, Associate Dean Research and External Relations, Faculty of Science, McMaster (standing)
- John Preston, Associate Dean Research and External Affairs, Faculty of Engineering, McMaster (standing)
- Neil Branda, Professor, Simon Fraser University and Scientific Director, 4D Labs

- Patricia Hawkins, Manager, Strategic Partnerships and Innovation Services, Xerox Research Centre of Canada
- Guillermo Ordorica-Garcia, Director General, Nanotechnology Research Centre, National Research Council of Canada
- Sara Iverson, Professor, Dalhousie University and Scientific Director, Ocean Tracking Network
- Keana Scott, Research Scientist, Group Lead, Materials Characterization, National Institute of Standards and Technology, USA
- Anja Geitman, Dean and Professor, Faculty of Agriculture and Environmental Sciences, McGill
- Andrew Knights, Acting Associate Vice-President, Research, McMaster (ex officio)
- Nabil Bassim, Acting Scientific Director, CCEM (ex officio)
- Bob Walker (Chair of Governing Board), (Ret.), Former CEO of Canadian Nuclear Laboratories, Ottawa

Scientific Advisory Committee

A Scientific Advisory Committee (SAC) will provide advice to the Governing Board with regard to the operations of the facility, scientific or scholarly priorities and direction for the CCEM. Specifically, the Scientific Advisory Committee will make recommendations to the CCEM Governing Board with regard to improving operations, raising awareness of the CCEM and monitoring scientific output, as well as strategic planning activities, reports pertaining to the use of the facility and the research that the facility has enabled, the productivity of the centre and possible upgrades to existing instrumentation and the acquisition of new instrumentation.

There will be at least two (2) meetings per year of the Scientific Advisory Committee.

The Scientific Advisory Committee will be composed of a minimum of five (5) individuals with a right to cast votes (not including ex officio members). The precise number of members of the CCEM Scientific Advisory Committee from time to time will be determined by a resolution passed at a meeting of the CCEM Governing Board. A minimum of four Rotating members will be appointed by the Members, in consultation with and with approval of the Governing Board, for a three-year renewable term. The Scientific Director of the CCEM will be an ex officio member.

Current members of the Scientific Advisory Committee are:

- Eric Stach, Brookhaven National Laboratory (Chair)
- Quentin Ramasse, SuperSTEM Facility, UK
- Guozhen Zhu, University of Alberta
- Keana Scott, National Institute of Standards and Technology, US
- Tom Zega, University of Arizona
- Nabil Bassim, McMaster University, Acting Scientific Director, CCEM (ex officio)
- Leanna Fong, ROADS, McMaster University (Secretary; ex officio)

Planning and Operations Committee

The Planning and Operations Committee will ensure that the CCEM has the resources required to operate effectively and efficiently. The Planning and Operations Committee fulfills its mandate by: monitoring and making recommendations to the CCEM Governing Board regarding the CCEM's financial performance indicators; ensuring that the CCEM financial activities are aligned with best practices; securing financial support for the CCEM from government, university and other resources; communicating with University and municipal government offices regarding space requirements (including construction/ renovation needs) and necessary environmental conditions; identifying and proposing risk management strategies (including financial and personnel); making recommendations to the CCEM Governing Board regarding long-term financial planning (considering revenues from grants, university support and user fees); and coordinating additional support for CCEM leadership (including teaching relief for the CCEM leadership for major grant applications, communications support from the CCEM Communications Director, financial and logistics support for special events such as workshops, mini-conferences, international conferences led by the CCEM, and the summer schools).

The Planning and Operations Committee will be composed of a minimum of seven (7) individuals with a right to cast votes (not including ex officio members). The precise number of members of the CCEM Planning and Operations Committee from time to time will be determined by a resolution passed at a meeting of the CCEM Governing Board.

The following individuals will be standing members of the Planning and Operations Committee by virtue of their office: The Scientific Director of the CCEM; The Deputy Director of the CCEM; The Director of User Operations of the CCEM; The Associate Dean, Research and External Affairs, Faculty of Engineering, McMaster University; and the Associate Dean, Research and External Relations, Faculty of Science, McMaster University; A minimum of two Rotating members will be appointed by the existing Members for a three-year renewable term. The Manager of the CCEM will be an ex officio member. The Chair is selected by majority of votes present at the Planning and Operations Committee meeting. The appointment is communicated to the CCEM Governing Board for approval. The Chair is appointed for a three-year renewable term.

Current members of the Planning and Operations Committee are as follows:

- Nabil Bassim, Acting Scientific Director, Planning and Operations Committee Chair
- Drew Higgins, ENG, McMaster University, CCEM Deputy Director
- Mohsen Mohammadi, University of New Brunswick, CCEM Director of User Operations
- John Preston, Associate Dean Research and External Affairs, Faculty of Engineering
- Gianni Parise, Associate Dean Research and External Relations, Faculty of Science
- Sherisse Webb, Director, ROADS
- Andreas Korinek, CCEM Facility Manager (ex officio)
- Dave Reinhart, Director, McMaster Research Finance

There will be at least two (2) meetings per year of the Planning and Operations Committee.

Users Group Executive

All users of the facility are members of the “Users Group”. The Users Group Executive is composed of individuals from the Users Group and provide insight and feedback to the CCEM Governing Board on user needs, user access levels, training quality, outreach events and workshop.

The Users Group Executive will be composed of a minimum of five (5) individuals with a right to cast votes (not including ex officio members). The Users Group Executive of the CCEM fulfills its mandate by making suggestions to the CCEM Governing Board regarding CCEM operations from the user’s perspective, including workshop topics, training topics, instrumentation (not available in the CCEM) of interest to users, and areas of improvements in infrastructure; and providing feedback to the CCEM Governing Board on access, training quality, Standard Operating Procedures, and operational issues (access times and tools operation windows) for improvement to the CCEM user experience

There will be at least three (3) meetings per year of the Users Group Executive.

The Users Group Executive will reflect the diversity of the user base and be composed as follows:

- The Chair, who is selected by majority of votes present at the Users Group Executive meeting. The appointment is communicated to the CCEM Governing Board for approval. The Chair is appointed for a three-year renewable term.
- A minimum of four (4) Rotating Members are selected from their peers for a three-year renewable term by a majority of votes present at the Users Group meeting and will include at least one (1) student member.
- The Director of User Operations of the CCEM will be a standing member of the Users Group Executive by virtue of his or her office.

Current members of the Users Group Executive are as follows:

- Nabil Bassim, Acting Scientific Director, CCEM

- Jonathan Bradley, McMaster
- Babak Shalchi Amirkhiz, CanMet
- Samantha Stambula, CCEM
- Chris Thomsen, student representative
- Dakota Binkley, student representative
- Mohsen Mohammadi, Director of User Operations (DUO), CCEM, Professor (University of New Brunswick) and Director, Marine Additive Manufacturing Centre of Excellence (MAMCE)
- Samuel Norris, Johns Hopkins University, Materials Characterization and Processing
- Leyla Soleymani, McMaster University

Organizational Review

Annual Review:

The GB monitors the activity of the CCEM every year and the Scientific Director will report to the GB on, at minimum, an annual basis. The GB reports annually to the VPR. Authority for all matters concerning CCEM staff appointments rests with the VPR. As required by CFI policy for CFI MSI-funded Centres, the authority for all matters regarding the direction and operation of the CCEM rests with the Governing Board.

Five-year Review:

The CCEM will be reviewed at least every 5 years by a Centre Review Board (CRB). The composition of the CRB will be determined by the GB and will comprise 3 high caliber scholars who will be arms' length from the Centre. The CRB will assess the performance of the Centre's Scientific Director and its research program. The CRB will be furnished with documents describing the University's policy on Research Institutes and will be asked whether performance is compatible with expectations described in the policy. The CRB is expected to use accepted measures of performance such as publication numbers and impact to assess the Institute's contributions in comparison with those of (a) the Centre during the preceding 5 years and (b) the performance of centres of similar size in the same field of research. The recommendations of the CRB will include the renewal of the Scientific Director, and whether the Centre's performance is consistent with that of a Centre at McMaster University.

The report of the CRB will be submitted in confidence to the VPR, who will share the report or major recommendations with either the current Scientific Director, or the successor to the current Director, so that the leadership of the CCEM benefits from the perspective of the CRB.

Explanation of revenues and expenses

Revenue:

Carry-Forward: The CCEM is an existing Centre within the VPR envelope. It is currently projecting a surplus for this year, resulting in a carry-forward of \$472,144 as it enters F21.

The Vice-President Research is providing \$150K/year for F21 through 25.

User Fees: The CCEM anticipates user fees will generate \$1.3M for Fiscal 21. While the user base is increasing, this will take some time as many users will need to reconfigure their expected experiments as a result of changes in fees and capabilities while a new microscope (Nion) comes online. With the increasing user base and changes in fees, etc. we are projecting an increase in user fee revenue of approximately 5% per year. Ultimately expanded access to tools and adjustment to user fees based on updated and new instrumentation will help the CCEM realize increased user fees over the coming years.

MSI funding: The CCEM received its first round of CFI MSI funding in support of expenses beginning in 2014. Following the first 3 year award, the CCEM was successful in securing funding for an additional five years, with each year a significant increase over the previous award. Based on the success of the 2019 mid-term review, CFI increased their contributions and in fact provided funding for an additional year. For the final three years of this award, CFI will provide an average of \$1.18M/year, a significant increase over the first three years, which provided on average \$490K/year.

The reviewers of the mid-term report highlighted that the CCEM was a vibrant, functional centre with a varied user base and that it had an excellent impact on industry. They also noted the highly skilled technical expertise and excellent outreach and training programs. Given the significantly increased support from the CFI MSI program, we are confident that continued funding will be provided through the next MSI competition. Should levels of funding from the MSI program decrease however, we will seek funding from other sources. If necessary, we will review our staffing levels and maintain the positions that are most critical to maintaining the facility for our use base.

The Faculty of Engineering has committed \$125K/year through F23. The Faculty will consider providing \$125K/year for each of F24 and 25 if those funds are needed. The Faculty anticipates however that, with the increasing infrastructure in the CCEM, user fees will at that time have increased beyond the current conservative projection, eliminating the need for that support.

CFI/ORF-RI or McMaster Funding – The CM12 was in urgent need of replacement. A new item was purchased in F20, with plans to recoup the costs from CFI/ORF-RI applications currently under review. Should those proposals not be successful, the required \$610K has been secured via commitments from the University Fund, VPR and Faculties.

Operational Expenses:

Personnel:

As mentioned, the CCEM has a staff of 11 (9 full-time and 2 part time). These are highly skilled personnel, with six having Ph.Ds and two having Master's degrees, and technicians having at least 2 years' training. Five of the staff holding Ph.Ds have training in the advanced operation of high-end characterization equipment, and also undertake elaborate scientific research projects in collaboration with CCEM users.

One staff member is the manager, overseeing operations on a day-to-day basis.

Technical staff are responsible for a specific instrument or a pair of instruments in order to support the CCEM User base. One technician is responsible for maintaining ageing equipment and facilities.

One staff member is in charge of user and customer outreach, including organizing and planning workshops associated with the CCEM.

As part of the CFI MSI mid-term review, funding for three new positions was requested. CFI reviewers stated that each of these positions was critical and awarded funds to cover these costs. We expect to have two of these positions in place early in F21. The CCEM will hire an Executive Director, who will be responsible for Board Relations, national and international strategic planning, budgeting, grant writing, pursuit of funding opportunities and outreach administration. A full-time financial manager will be hired to assist with budgets, purchases, human resources tasks and billing and a new technical position to support CCEM instrumentation will be established at the end of F21

Personnel costs assume 2% increase per year. Costs in the budget include fringe benefits.

Materials and Supplies:

Costs of supplies include gases for all instruments, including the sample preparation tools (i.e. nitrogen, oxygen, argon and occasional use of SF6 replacement when venting the FEG vessels of the Titans), liquid nitrogen for cold traps of Titans, 2010F, CM12 and for the Si(Li) EDS detectors (on the 2010F, Titan1, CM12), chemicals for cleaning and sample preparation (Ethanol, Methanol, Acetone), FIB, SEMs, TEMs consumables not charged to researchers (such as O-rings replacements, thermionic filaments for the SEM 6610LV, CM12), cutting wheels, cutting wires for the wire saw and for the spark erosion, pump oil, Ag paste, Cu tape, sputtering targets for coating SEM imaging (such as Au, Pt, W, Cr) etc. Since some diffraction work needs to be carried out on negatives (for imaging and simple diffraction a digital camera is used), chemicals for negative development are occasionally used for the dark room and need to be available for users. Users are charged for the cost of each negative used.

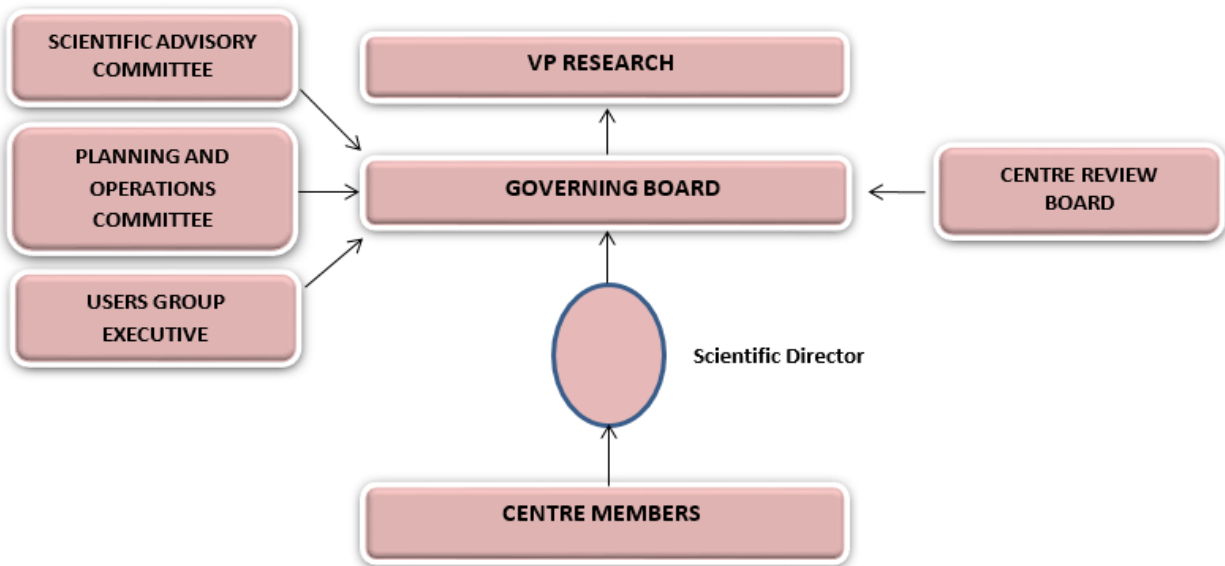
Equipment Costs:

CM12 Purchase: The CM12 is a 35 year old microscope that is used to obtain, for example, diffraction information, examine nanoparticle sizes, and measure a material's microstructure. It is also used to train new users so they can graduate to higher-end instruments, and to train undergraduates in Materials Science & Engineering and Chemistry & Chemical Biology. Unfortunately, due to its age, the CM12 was on the verge of failure and could not be repaired. A replacement to the CM12 (new Talos 120C) was therefore purchased in F20.

Service Contracts: Costs for service contracts will support the JSM-7000F, JSM-6610, LEAP Atom Probe, nVision F, PFIB, Titans, Magellan, Nion, and Talos 200 and 120 instrumentation.

Costs for Travel and Meeting Expenses are included, as is the cost of General Repairs. Many of the CCEM instruments are supported through service contracts. To serve the research community and reduce downtime on instrumentation, a small amount of funding is set aside each year to cover general repairs that fall outside of service contracts.

Appendix A - Organizational Chart



Appendix B – Budget and Sources of Funds

	F21	F22	F23	F24	F25			
OPENING BALANCE/CARRY FORWARD	\$ 472,144	\$ 515,998	\$ 348,592	\$ 137,584	\$ 55,656			
REVENUE	Insert year	Insert year	Insert year	Insert year	Insert year	Total	\$ Secured	\$ Anticipated
CCEM carry-forward from F20	\$ 472,144					\$ 472,144	\$ 472,144	
VPR Contribution	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 750,000	\$ 750,000	
User Fees	\$ 1,300,000	\$ 1,353,403	\$ 1,426,073	\$ 1,497,377	\$ 1,572,246	\$ 7,149,099		\$ 7,149,099
Research-CFI-MSI Funding (Proj#20005260)	\$ 1,222,000	\$ 1,172,000	\$ 1,147,000	\$ 1,200,000	\$ 1,200,000	\$ 5,941,000	\$ 3,541,000	\$ 2,400,000
McMaster-Engineering contribution (Proj#20007	\$ 125,000	\$ 125,000	\$ 125,000	\$ 125,000	\$ 125,000	\$ 625,000	\$ 375,000	\$ 250,000
McMaster-University Fund, Faculty & VPR contributions to CM12 equipment	\$ 610,000					\$ 610,000	\$ 610,000	
TOTAL REVENUE	\$ 3,879,144	\$ 2,800,403	\$ 2,848,073	\$ 2,972,377	\$ 3,047,246	\$ 15,547,243	\$ 5,748,144	\$ 9,799,099
EXPENSES	F21	F22	F23	F24	F25	Total	\$ Secured	\$ Anticipated
Operating Expenses:								
Personnel costs including fringe						\$ -		
PostDoc Fellow	\$ 154,239	\$ 155,699	\$ 158,360	\$ 161,527	\$ 164,758	\$ 794,583		
Support Salaries	\$ 995,767	\$ 1,143,251	\$ 1,165,558	\$ 1,142,217	\$ 1,171,327	\$ 5,618,120		
Office Supplies:						\$ -		
Materials and Supplies	\$ 50,760	\$ 50,760	\$ 50,760	\$ 50,760	\$ 50,760	\$ 253,800		
Bank Charges	\$ 1,500	\$ 1,500	\$ 1,500	\$ 1,500	\$ 1,500	\$ 7,500		
Equipment						\$ -		
CM12 purchase	\$ 610,000					\$ 610,000		
Service Contracts	\$ 1,407,659	\$ 1,473,378	\$ 1,539,683	\$ 1,555,079	\$ 1,570,630	\$ 7,546,429		
Travel:						\$ -		
Travel	\$ 67,060	\$ 67,060	\$ 67,060	\$ 67,060	\$ 67,060	\$ 335,300		
Meeting expenses:						\$ -		
Meeting expenses	\$ 16,532	\$ 16,532	\$ 16,532	\$ 16,532	\$ 16,532	\$ 82,660		
Communications:						\$ -		
Communication expense	\$ 1,782	\$ 1,782	\$ 1,782	\$ 1,782	\$ 1,782	\$ 8,910		
Renovations:						\$ -		
General Repairs	\$ 57,847	\$ 57,847	\$ 57,847	\$ 57,847	\$ 57,847	\$ 289,235		
Ongoing costs for space:						\$ -		
No change to current CCEM space. Per the budget model, as CCEM reports to the VPR, space is not charged directly.						\$ -		
TOTAL EXPENSES	\$ 3,363,146	\$ 2,967,809	\$ 3,059,081	\$ 3,054,304	\$ 3,102,196	\$ 15,546,536		
IN-YEAR (Surplus/ Deficit)	\$ 515,998	-\$ 167,406	-\$ 211,008	-\$ 81,928	-\$ 54,950	\$ 706		



Facility Services

2020/2021 Capital Plan Update

BRIGHTER WORLD

FACILITY SERVICES



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1 INTRODUCTION

1.1 *Scope of the Capital Plan*

McMaster University's 2020/2021 Capital Plan is a planning document that supports the University's strategy Forward with Integrity (2011) and the Strategic Mandate Agreement (2014-17 and 2017-20) and will evolve as the President develops his strategic priorities over the coming year. The intended purpose of this Capital Plan is to guide the growth of physical assets at McMaster University and it includes planning through fiscal year 2025/2026. The Capital Plan encompasses all buildings under the purview of McMaster, both on and off the main campus.

The Capital Plan is a Board-approved document helping to guide the University's priority setting and planning of capital projects over a period of time. It is intended to be responsive to the University's strategic vision both at present and in future. As a result, the Capital Plan is viewed as a dynamic document that is subject to change in order to align itself with the shifting priorities and opportunities of the University. According to the capital planning process, this plan is updated annually. Additionally, the plan is supported by detailed documents that elaborate on various concepts and initiatives related to infrastructure such as academic and enrolment plans, research priorities, the Campus Master Plan, the Campus Capacity Study, the Asset Management Plan, the Campus Accessibility Action Plan and the Energy Management Plan.

1.2 *What is a Capital Plan?*

The Capital Plan represents McMaster University's existing approved priorities and a number of additional projects (funded, partially funded, or unfunded) for capital investment. It will set forth a framework to guide the growth of physical assets such as buildings and land and infrastructure. The IT Strategy 2019-21, which sets the strategy for information systems, is a separate document.

The Capital Plan provides an overview of the capital needs, issues and projects in various stages of development. Additionally, the plan summarizes the status of current and planned capital activities that are directly related to various planning processes. Furthermore, the Capital Plan encompasses other capital projects' activities related to the current condition of the University's building infrastructure, energy management capital projects and building accessibility capital investments.

Table 1 illustrates the relationship of the Capital Plan within the hierarchy of key capital plans and other documents prepared for the University.

Table 1

Level of Planning/Reporting	Key Capital Plans and Reports at McMaster University	Audience	Review
Strategic: University's overall philosophy and approach to managing capital; highest level of planning; fundamental decisions and actions directed to achieving institutional goals	McMaster Capital Plan	Public	Annual
	Campus Master Plan	Public	Every 5 - 10 years
	Asset Management Plan	Public	Annual
	Energy Management Plan	Public	Annual
	Campus Accessibility Action Plan	Public	Annual
	Campus Capacity Study	Public	2011
Portfolio Governance: Updates/funding status of capital projects for Board; delineate McMaster's management, oversight and monitor capital projects approved/under construction	McMaster Capital Plan	Public	Annual
	Capital Funding and Expenditure Report	Planning and Resource Committee	Every meeting
Project Management: Identify strategic and specific capital requirements along with plans and strategies intended to resolve the most urgent and highest priority needs	Key Technical/Management Documents (Asset Reports)		
	Asset Management Plan	Public	Annual

2 BACKGROUND AND THE CURRENT STATE OF CAPITAL INFRASTRUCTURE

2.1 *The First 30 Years in Hamilton*

In 1930, the University moved from Toronto to Hamilton, the forty-first academic session opening on the present site. The University's lands and new buildings were secured through gifts from graduates, members of the churches of the Baptist Convention of Ontario and Quebec and citizens of Hamilton.

2.2 Buildings Procured 1960 – 2019

For detailed information about the development of McMaster facilities during this period, refer to “McMaster University, Facility Services, Planning and Infrastructure Development History: 1960 – 2019” posted at <https://facilities.mcmaster.ca/app/uploads/2019/05/2019-04-16-History.pdf>.

In the past 60 years McMaster has not only acquired infrastructure through new build construction and renovation/addition projects but has also procured the use of various existing off-campus buildings. For example:

- McMaster's family practice teaching unit, established in the early 1970's at Henderson Hospital, was relocated in the early 1990's to the south mountain as the Stonechurch Family Health Centre.
- McMaster Innovation Park (procured for use in 2004).
- 100 Main St West (David Braley Health Science Centre opened in 2015)
- 88 Forsyth Avenue (purchased in 2015).
- 47 Whitton Road (acquired in May 2015 and used for research purposes).
- 182 Sterling Street (purchased in 2015).
- One James North (leased from 2015).
- 96 Forsyth Avenue North (purchased in 2017).
- Existing houses bound by Forsyth Avenue South, Traymore Avenue, Dalewood Avenue and Main Street West (purchased in 2017).
- 106 Forsyth Avenue North (purchased in 2018).
- 132 Mayfair Crescent (purchased in 2019).
- 8 Mayfair Crescent (purchased in 2019).

Furthermore, McMaster has expanded to house remote campuses in space procured or leased in municipalities other than Hamilton:

- The Waterloo Regional campus was established by McMaster at the University of Waterloo in 2007 and focuses on Health and Medical Sciences.
- In 2012, McMaster opened Educational Services space in St. Catharine's at Brock University's Cairns Family Health and Bioscience Research Complex.
- In 2010, McMaster built the Ron Joyce Centre in Burlington.
- The Welland McMaster Family Health Team has been in operation since 2011.

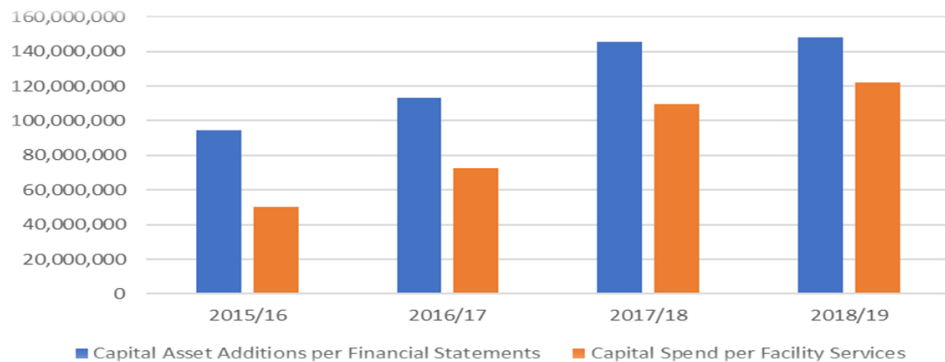
2.2.1 Summary

Since 1960, McMaster has added a total of 41 buildings on campus to its existing infrastructure through new construction. These buildings total 4,952,836 gross square feet of added infrastructure, during the past 60 years. McMaster has also invested in several renovation/addition projects to existing infrastructure since 1960. During this time, McMaster has completed major renovations/additions, totaling 1,029,656 SF, on 21 campus buildings. Renovations and additions were often completed in order to update technological, electrical and utility infrastructure as well as add usable space. These construction projects have been supplemented with infrastructure growth off

campus, particularly in the last decade, through the procurement of buildings and property.

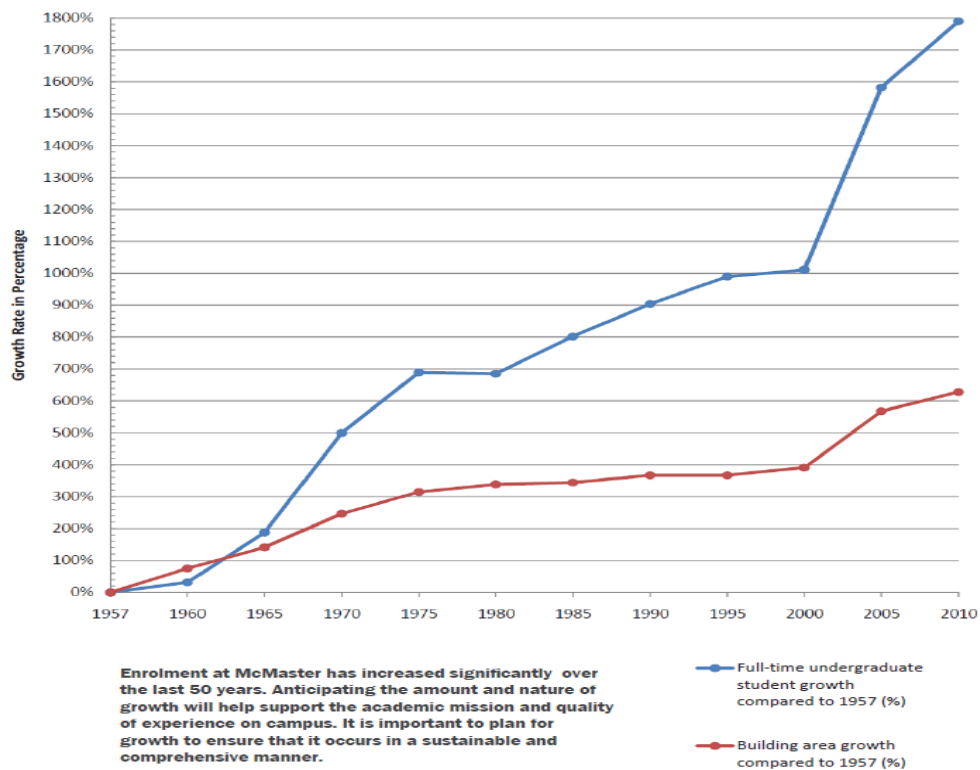
Facility Services has undertaken significant growth in projects over the last 4 years with the capital spend on new building expansion and renovation; this is depicted in the chart below compared to capital asset additions per our audited financial statements.

Chart 1 – Capital Spending



In addition to the above the following Chart 2 below indicates the growth in student population and the comparative amount of new space added to McMaster.

Chart 2 - 50 Years of Growth in Space and Undergraduate Enrolment



2.3 Existing Usage, Ownership and Condition of McMaster's Physical Assets

McMaster University was home to a total enrolment of 33,147 students (undergraduate and graduate¹). The University employs more than 10,000 staff and 1,011 full-time instructional faculty. Concerning the critical space categories, space is dispersed as indicated in Table 2, current as of November 1, 2016 and reported to the Council of Ontario Universities (COU) Committee on Space Standards and Reporting to inform the triennial "2016-17 Inventory of Physical Facilities of Ontario Universities."

Table 2: 2016 Space by Category

Category	Area (net assignable square feet (NASF))	Area (net assignable square metres (NASM))
1 Classrooms	284,372	26,419
2 Class Labs	194,515	18,071
3 Research Labs	620,712	57,666
4 Office Academics	644,898	59,913
5.1 Library Stacks	104,937	9,749
5.3 Library Support	10,419	968
5.4 Library Study	49,439	4,593
6 Athletics	185,602	17,243
9 Maintenance Shop	36,619	3,402
10 Office Administration	195,139	18,129
7,8,12,13,14,15 Central Services	257,925	23,962
Total	2,584,577	240,115

McMaster's most recent Campus Capacity Study (2011) cites critical needs for administrative office and related space, graduate student offices, assembly facilities and service space. A similar study is being considered to update this information.

McMaster has 55 buildings on the main campus, including 13 residences, a nuclear reactor, a stadium complex and a hospital. McMaster owns or otherwise operates out of several more buildings throughout Hamilton and the province, such as the Ron Joyce Centre in Burlington and the David Braley Health Sciences Centre in downtown Hamilton. The main campus itself sits on 296 acres of land with approximately 6,293,464 gross square feet of building area. Appendix E includes a list of McMaster properties.

¹ McMaster Fast Facts

Chart 3 and Chart 4 shows the breakdown of McMaster's building age and area (facilities as listed in Appendix D).

Chart 3: Number of Bldgs based on Age

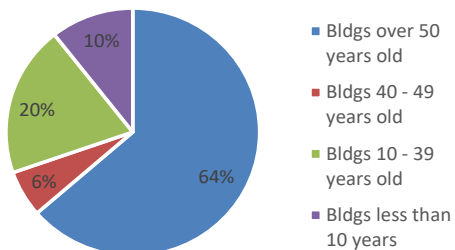


Chart 4: Bldg Gross Area based on Age

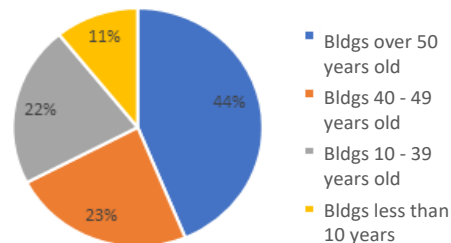
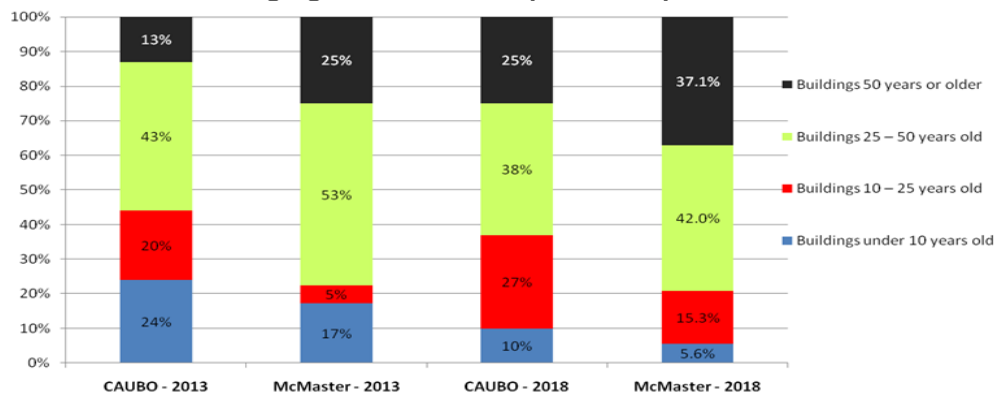


Chart 5 shows building age (as a percentage of total building area) at Canadian campuses compared to that at McMaster.

Chart 5: Building Age: Canadian Campuses compared with McMaster



* This chart includes existing buildings only. Potential new development is not included.

The Deferred Maintenance backlog was identified in 2012 as a high-risk item. Facility Services developed an Asset Management Plan which is updated on an annual basis.

Currently the University funds deferred maintenance from the operating budget. The asset management base was increased by \$2 million in each of 2013/14, 2014/2015, 2015/16 and 2016/17; i.e., until the allocation reached an annual base increase of \$8 million per year. This allocation continued for years 2017/18 and 2018/19. In 2019/2020 McMaster allocated \$600,000 for DM requirements at MUMC, however, after reviewing the DM requirements of MUMC, the annual allocation was increased by another \$700,000 for a total of \$1.1 million per year. In 2020/21, an additional \$1.0 million was approved on a continued basis, dedicated initially to the tunnels, buried utilities and

other failing infrastructure upgrades. The total budget for deferred maintenance for 2020/21 is \$14.09 million, which includes the \$9.7 million base allocation, along with \$3.39 million from the Ministry of Colleges and Universities for deferred maintenance needs and \$1 million in additional operating funding within Facilities Services. The 2020/21 approved project list for deferred maintenance items is attached as Appendix F.

The Council of Ontario Universities (COU) Space Management Committee's Triennial Report was published in June, 2018 as the Inventory of Physical Facilities of Ontario Universities 2016-17 and shows that McMaster's current interior classroom space totals 284,382 net assignable square feet. It also shows that overall, the institution has increased its inventory of classroom space from having approximately 84% of the space it needs (2013) to 85% (2016) according to COU standards (for more details see Section 5.1.). This report will be updated in 2020.

2.3.1 Computerized Maintenance Management System

PeopleSoft's Maintenance and Asset Management modules are used to maintain McMaster University's facilities and grounds. These modules integrate with McMaster's Finance landscape (Asset Management, Project Costing, Expenses, Procurement and Payables and General Ledger). Proper maintenance of an organization's asset infrastructure is key to ensuring safety, complying with regulations and achieving the financial and operational targets that are established by the leadership team. This software enables the organization to create work orders, schedule resources and track costs associated with asset maintenance and repair. In addition, McMaster employees can create an online self-service request to report or request maintenance, repairs, renovations, cleaning, moves and other service activities. When required, a work order is generated from the service request and associated costs can be billed back to the requestor. Business process mapping of the work order process has begun in 2019 to ensure the most efficient process is in place.

2.4 Land Assets, Physical Growth Opportunities

The McMaster University Campus Master Plan was originally prepared in 2002 and updated in 2008 and again in 2017. The 2017 process included the sourcing of campus user input by way of on-campus visioning stations, online polling and meetings with stakeholders in a working committee that included students, staff and faculty.

The Campus Master Plan provides an overall physical framework for campus growth and renewal. The Plan outlines a vision for the campus and recommends that this be updated every five to ten years. Specifically, it establishes a framework for future development that extends the structure of the campus' historic core to its periphery while respecting the surrounding built and open space context. Although it does not advocate for growth, it identifies area for potential new development, with supporting open space amenities and infrastructure initiatives. The current capacity available for new development is estimated to be 3,000,000 gross square feet of floor area on the Main Campus. As outlined in the Campus Master Plan, physical capacity on McMaster's main campus has been largely determined by its physical structure, which contains a well-established hierarchy of streets and natural features. This clear structure has

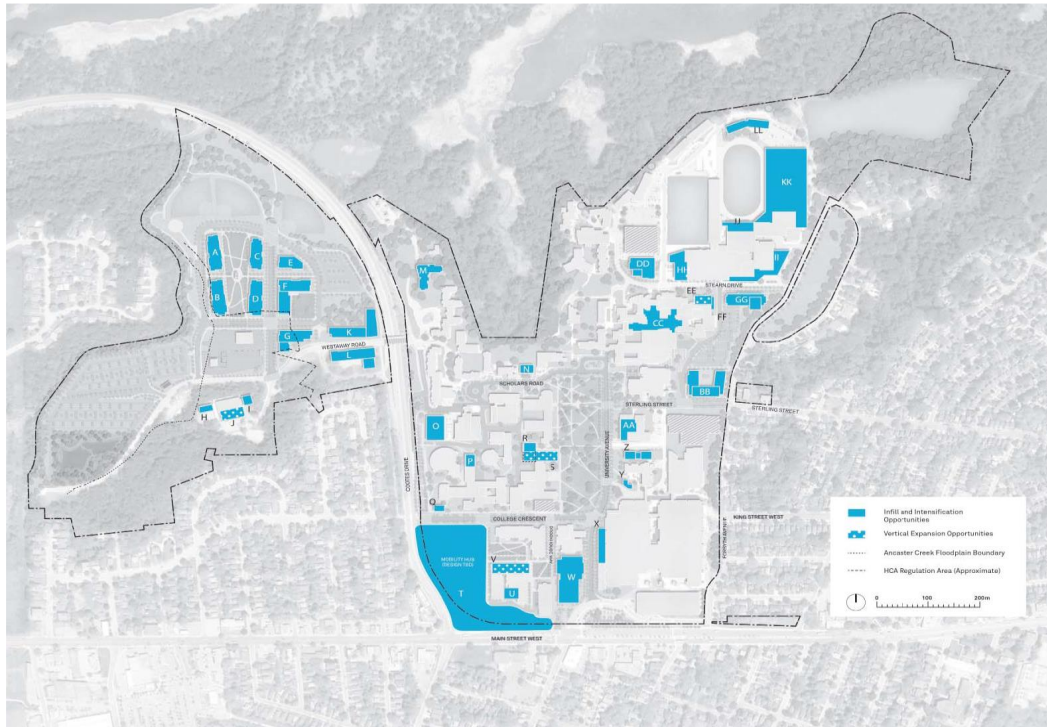
provided a strong setting and logic for development and infrastructure investments to continue to evolve in an integrated manner. The Campus Master Plan is intended to be flexible, to accommodate the changing needs of various departments and Faculties and to enhance learning by providing the physical environment in which to gain knowledge, live and work.

An important component of the implementation of the vision outlined in the Campus Master Plan was the identification of several potential development sites that could support incremental growth throughout the University campus. However, it is understood that some of these sites may not be developed and that McMaster may need to consider further off-campus development in appropriate locations.

The identified development sites are primarily within the Core Campus, North Campus and West Campus.

- Within the Core Campus, there are several opportunities to introduce new buildings and/or building additions: north of Bates Residence beside the President's Residence, Forsyth Avenue frontages and a significant gateway/landmark development site at the location of existing building to be removed, T-13. Parking Lot 'I' at Cootes Drive and Main Street was being planned for development of a transit hub with the LRT development however the University is still looking at options even after the cancellation of the LRT.
- Even with years of substantial building activity in the North Campus (the David Braley Athletic Centre, Stadium and Les Prince Hall), there remains development potential in the area. The Peter George Centre for Living and Learning opened in 2019 at the location of previously demolished buildings T28, T29 and T18. The McMaster Athletics and Recreation Complex Facility Assessment and Master Plan Study, October 2016, identified a number of potential additions that are either under consideration for future development or otherwise are already at the initial construction stage, i.e., the Student Activity and Fitness Expansion (SAFE) project.
- West Campus has substantial potential to accommodate new buildings, subject to more detailed investigations. There is current interest in developing the West Campus as a potential living laboratory. The development of a strategy for this area of campus, and connecting it to the Campus Master Plan, is ongoing.

Figure 1: Potential Development Sites



Off campus, McMaster has acquired the land adjacent to the Ron Joyce Centre in Burlington, which would allow for more construction in an expansion of that campus. In downtown Hamilton, McMaster has built the David Braley Health Sciences Centre; the north parcel of that building site includes an existing parking lot facing King Street West and Bay Street South, which remains vacant and could be developed (Hamilton Integrated Research Centre proposed for this site that would house some of McMaster's growing research programs in Health Sciences and other collaborative areas with a building size estimated similar to current DBHSC). Also, McMaster's property at Lower Lions Club Road, currently used in part by the Faculty of Science, could see limited future development to further that Faculty's efforts.

McMaster has recently acquired seven existing houses in the Westdale neighbourhood; 88 Forsyth Avenue North has been transformed into the new Home of the Bertrand Russell Archives and Research Centre. The Faculty of Engineering is using 47 Whitton Road as a "Smart House", i.e., as a space to monitor elderly health in a typical home; 182 Sterling Street is now being used by Student Affairs for recipients of the Wilson Leadership Scholar Award; both 106 and 96 Forsyth are managed by the University (Housing and Conference Services and the President's Office) for small meetings. In 2019, McMaster purchased 132 Mayfair Avenue (under construction) and 8 Mayfair Avenue, both of which will be managed by Housing and Conference Services.

McMaster also owns land and a grouping of houses bound by Main Street West, Traymore Avenue, Dalewood Avenue and Forsyth Avenue South. This is a prime development location, immediately adjacent to the main campus. The University has received Board approval to build an undergraduate student residence at this location as part of a P3 partnership. It is anticipated that this building will be open in 2023 pending planning approvals.

McMaster also received Board approval to build a Graduate student residence on the south-west corner of King Street West and Bay Street South in downtown Hamilton; this is also part of a P3 partnership. The University anticipates construction to begin in the fall of 2020 and completion in the summer of 2023.

2.5 Accessibility

2.5.1 McMaster University Accessibility Plan 2012-2025

In September 2012, the McMaster Accessibility Council (MAC) published the McMaster University Accessibility Plan 2012-2025 in order to comply with the evolving Accessibility for Ontarians with Disabilities Act (AODA). This plan reflects a commitment by the University to engage in incremental initiatives in accordance with the AODA and the expectation that the University will be free of attitudinal, physical and social barriers by the year 2025.

2.5.2 Campus Accessibility Action Plan (CAAP)

The Campus Accessibility Action Plan (CAAP) Phase 2 (2018-2023) is a multi-year plan to address the identified accessibility issues on campus buildings. The Plan is posted at: <https://facilities.mcmaster.ca/app/uploads/2018/10/Campus-Accessibility-Plan-2018-2013-V5-20Apr2018.pdf>. Funding for the plan is provided by an operating allocation.

2.6 Building Sustainability

The 2020/21 Energy Management Plan identifies and recommends 11 potential energy-saving projects. More information about Sustainability, included the LEED and Energy Management is included in the Energy Management Plan posted on the Facility Services website and Section 5.3, Energy Management Projects and Sustainability.

2.6.1 LEED®

McMaster currently has fifteen LEED® certified, or anticipated to be certified, projects. New buildings and major additions at McMaster are to be constructed according to McMaster's Sustainable Building Policy, which in turn references the LEED® Rating System. The LEED Rating system has recently undergone some revisions, which will need to be reflected in an updated Sustainable Building Policy moving forward.

Table 3: LEED® Certified Projects

Building	Construction Date / Renovation Date	Gross Area (S.F.)	Attained/ Anticipated LEED® Certification Level
New Construction			
Les Prince Hall	2006	106,016	LEED® Certified
David Braley Athletic Centre	2007	140,479	LEED® Certified
Engineering Technology Building	2009	125,600	LEED® Gold
Ron Joyce Centre (Burlington)	2010	105,745	LEED® Gold
CANMET Materials Technology Laboratory (MIP)	2010	145,000	LEED® Platinum
Halton McMaster Family Health Centre – Burlington	2014	10,647	LEED® Gold
David Braley Health Sciences Centre – Downtown Hamilton	2014	192,081	LEED® Gold
L. R. Wilson Hall	2015	177,927	LEED® Gold
Peter George Centre for Living and Learning (PGCLL)	2019	335,167	LEED® Silver*
Total New Construction		1,338,662	
Renovation/Addition			
C.E. Burke Science Building	2005	196,401	LEED® Silver
Nuclear Research Building	2011	23,605	LEED® Gold
Ivor Wynne Centre	2012	20,010	LEED® Silver
McMaster Automotive Resource Centre (MARC)	2013	85,000	LEED® Silver*
Gerald Hatch Centre for Engineering Experiential Learning	2017	28,007	LEED® Silver*
ABB Addition	2018	63,173	LEED® Silver*
Total Renovation/Addition		416,196	
TOTAL New & Reno Construction		1,754,858	gross square feet

* denotes anticipated certification level

2.6.2 Trends of Energy Consumption

See link below to the Energy Management Plan:

<https://facilities.mcmaster.ca/app/uploads/2019/08/Energy-Management-Plan-April-29-2019-EC.pdf>

2.7 Environmental Compliance

McMaster University retained the services of an external environmental consultant in late 2012 to survey all campus buildings in terms of their compliance with the Ontario Ministry of Environment (MOE) air and noise emission regulations. A multi-year Environmental Compliance Action Plan (ECAP) was developed in the fall of 2013.

The approved Phase 1 of the plan authorized spending of \$400,000 per year for 5 years (2014/15 to 2018/19) from the deferred maintenance funds to achieve compliance for all buildings on campus except the E.T. Clarke building. While this was ongoing, in 2017, as part of the co-gen project Environmental Compliance Approval (ECA) process, the MOE asked McMaster to apply for a campus-wide ECA. This changed the mitigation requirements and a re-audit of all campus buildings was undertaken again in 2017. A campus wide ECA application was made in June 2017 and McMaster received a conditional ECA in November of 2017. The ECA require McMaster to replace the non-compliant cooling towers at E. T. Clarke building and achieve compliance before 2028.

Phase 2 of the ECAP is for 2019/20 – 2027/28. Facility services engaged mechanical, structural and an environmental consultant to prepare a feasibility report for replacing the cooling towers. The consultant report estimates \$15.19 million in 5 phases for replacing the ten existing cooling towers, roof replacement, additional structural reinforcements and the acoustical sound barrier. This will be funded from the deferred maintenance funds of years 2020/21 to 2027/28 (8 years).

3 RESEARCH PRIORITIES GUIDING FUTURE CAPITAL DEVELOPMENT

McMaster University continues to submit applications to the Canada Foundation for Innovation's (CFI) competitions and to the Province of Ontario seeking funding for new construction and renovation projects to support McMaster's innovative and transformative research and technology development activities.

During the last year McMaster has been awarded more than \$5.8M from the CFI John Evans Leaders Fund (JELF) and the Ontario Research Fund-Research Infrastructure programs to provide McMaster researchers with the infrastructure they require to achieve advances in a variety of strategic research areas. Three of the ten awarded projects include minor renovations which are expected to be completed in 2020. Electrical upgrades to the Central Animal Facility, the installation of new fume hoods in the Life Sciences Building, and security upgrades to L.R. Wilson Hall will

contribute to our understanding healthy aging, sustainable aquatic systems, and the use of artificial intelligence to support democracy and human rights.

McMaster also recently received funding from the CFI Major Science Initiatives (MSI) program in support of the Canadian Centre for Electron Microscopy (CCEM) and the Canadian Research Data Centre Network (CRDCN). The CCEM has been recognized by the CFI as a national facility and, as such, was awarded over \$6M in funding through the 2014 and 2017 competitions for operation and maintenance of the more than \$50M in state-of-the-art infrastructure that it houses. CFI MSI funding to the CCEM was recently increased by \$2M following a successful mid-term review of the current award. The additional funding will assist with the operation and maintenance of \$11M in new infrastructure to be installed in the CCEM following renovations of approximately \$1M. The anticipated completion date for the project is 2021.

The CRDCN was also recognized by the CFI as a national facility with an award of almost \$6M in 2017. Like the CCEM, the CRDCN succeeded in securing more than \$2M in additional CFI MSI funding following favorable review of its mid-term review report. The additional funding will assist with operation and maintenance of the high-performance computing infrastructure which constitutes the \$10M “Canadian Research Data Centre Network Transition to High Performance Computing: Liberating Data for Research and Policy” project. In 2017 the multi-institutional infrastructure project was awarded \$2.8M from CFI and \$2.6M from various provincial governments across Canada. The project includes minor security upgrades to L.R. Wilson Hall and has an anticipated completion date of 2023.

4 PLANNING AND GROWTH ASSUMPTIONS

4.1 *Enrolment Growth*

McMaster has experienced rapid growth in recent years in part due to population increases in the Greater Toronto Area and Hamilton Region. This institutional growth has been further accelerated because of the rising prominence of many of the University's diverse academic offerings, particularly in the fields of Health Sciences and Engineering. With continued enrolment growth expected and the ongoing development of new academic programs, McMaster is ideally positioned to become one of North America's most prominent universities.

International student enrolment has been steadily increasing. In 2006, 1,714 international students made up 7.8% of the McMaster student population. In 2019, 4,075 international students made up 13.5% of the McMaster student population.

4.2 *Technological Development*

The McMaster IT Strategic Plan 2019-2021 was published in January 2019. The Plan is focused on the Strategic Pillars of a Connected McMaster community, a Seamless Foundation and Transformative Information Technologies and Services. This new IT strategy addresses classroom and technology needs for the future.

4.3 *Efficient Space Management*

In order to actively and responsibly plan for future growth, McMaster is presently reviewing its current space management practices. The McMaster University Space Management Policy was last approved in 1987 and will be reviewed in 2020. Space processes such as maintenance of the space inventory database, control of scheduling, maintenance of facilities, new project approval, evaluation of space requests, etc., will be reviewed through this policy revision.

The University has a need for more and better classroom space. For this type of space, McMaster's I/G (Inventory of Space / Generated, or needed space based on COU standards) is 85%. In 2014, a Classroom Design Subcommittee was struck, co-chaired by the AVP Facilities and the AVP Leadership and Learning, to study and analyze the current utilization of classroom spaces. This activity has resulted in a Reconfiguration Plan which calls for the upgrading of existing classrooms and which also lays out a strategic approach to designing new, needed, teaching and learning space.

In early 2019, the Board of Governor's approved a \$2 million annual allocation for 5 years to renovate classrooms on campus. Classrooms have been prioritized based on data from a survey completed in 2018 of faculty and students along with health, safety and legislative requirements. Funding will be used to replace seating, upgrade lighting, flooring, electrical, accessibility and audio visual in classrooms identified. To date, classrooms in Togo Salmon Hall have been renovated, along with planned renovations in Chester New Hall in the summer of 2020.

4.4 *Student Residences*

In May of 2017, The Government of Ontario released an update to the June 16, 2006 Growth Plan for the Greater Golden Horseshoe, under the terms of the provincial Places to Grow Act, 2005. A core objective of the Growth Plan policies is accommodating and directing new population and employment growth to built-up areas through intensification. Directing growth in this manner is intended to create complete communities that offer options for living, working, shopping and playing; providing greater choice in housing types; and curbing development sprawl.

McMaster's objective is to guarantee all first-year entrants a space in residence if they so desire. Currently, admission is given using an incoming average percent cut-off. This cut-off percentage changes from year to year based on factors including number of applicants, existing capacity and department cut-off percentages.

Since 2012, configurations to campus residences – such as changing bunk and loft rooms to double rooms – have impacted total capacity. McMaster has thirteen different residence buildings on campus, with a variety of room types and lifestyle themes for a total capacity across all buildings of 4,298 students living on campus. Given enrolment growth as noted above, more capacity is needed. To this end, new residence buildings (approved by Board) are being planned which includes the following:

- A new Main Street Undergraduate student residence bordering Main Street West, Traymore Avenue, Forsyth Avenue and Dalewood Avenue and is now moving through the approval stages with the City of Hamilton. This new residence will include 1,373 beds and is part of a P3 partnership.
- A new 30-storey Graduate Student Residence also working in partnership with a P3 developer and an integrated McMaster parking garage, will be located on the south-west corner of King Street West and Bay Street South in downtown Hamilton. This new residence will be home to 630 graduate students.

Research shows that students who stay in residence develop stronger relationships and support networks, leading to a more positive overall student experience. McMaster is one of only two universities in Ontario that cannot guarantee residence to all first-year students, for lack of space.

5 PROJECTS AND INITIATIVES TO SUPPORT THE CAPITAL PLAN

5.1 *Addressing Research, Program and Enrolment Growth*

Space at McMaster is tracked relative to its need. McMaster's inventory vs. generated (I/G) ratio represents the amount of net assignable space that McMaster has versus how much is ideal based on standards set by the Council of Ontario Universities. The construction of new buildings and additions, the fluctuation in the number of students and professors and consideration of different needs for different types of spaces, are some of the factors that impact this ratio.

The Council of Ontario Universities (COU) published the results of the most recently prepared triennial report on space, i.e., from 2016. Facilities Services compared these results to those from 2013 and will complete the survey again this year. Once this survey has been completed and analyzed, we will update comparisons of McMaster to our peer institutions.

McMaster's I/G for classroom space and athletics and recreation space kept relatively stable compared to the 2013 triennial report, at 85.3% and 68.6% respectively. In these cases, student population growth kept close pace with net building floor area growth.

For library space, McMaster's I/G is 78.6%. This was a decrease over the previous report, resulting from a change in COU standards that required study space to be split into library and (a new separate category) non-library space.

As noted in part in the Campus Capacity Study, the most critical space needs at McMaster were for administrative offices, graduate student offices, assembly facilities, service space, classrooms, research space, recreation space and quiet study space. The new Peter George Centre for Living and Learning (PGCLL) is anticipated to address the need for new large classrooms. A new addition has recently been completed on the A. N. Bourns Science Building (ABB) as part of a Strategic Innovation Fund (SIF) project. Another project is underway to increase athletics and recreation

space. This project is building additions to the David Braley Athletics Centre and the Ivor Wynne Centre

5.1.1 Projections of Growth in Research

Recent trends (five years of McMaster's financial statements as reported to the Canadian Association of University Business Officers (CAUBO)) indicate a sponsored research income of approximately \$205 - \$220 million per year, not including intake for affiliated hospitals.

5.1.2 Ongoing Projects and Initiatives

The following summarizes the ongoing major capital projects at McMaster. These are also summarized in Appendix A.

- Peter George Centre for Living and Learning
 - In recognition of the strong need at McMaster for more classroom, exam-writing, residence, administrative and daycare space, this project recently received substantial completion at the previous location of temporary buildings #T28, #T29 and #T18, including 335,000 gross square feet at a total cost of \$122 million.
- Athletics and Recreation – Pulse and Student Space Expansion
 - In March 2017 students voted in a referendum to have a significant expansion and improvement of campus activity and athletic recreation space, including adding nearly 100,000 square feet of fitness studios, study areas, multi-faith prayer space and meeting facilities. The plan calls for the expansion of the Pulse fitness area, providing all students with Pulse memberships, a small grocery store and rooms for events and meetings. The expanded facilities will contribute to a revitalization of the north end of campus, which is also the site of the Peter George Living and Learning Centre.
- DSB Expansion (at Innis Library) – The McLean Centre for Collaborative Discovery
 - To address the need for new administrative and academic space at the DeGroote School of Business, this \$89.7 million, 160,000 sq. ft. project will allow for additional floor levels to be built north of the existing DSB building.
- Research Capital Commercialization Project
 - McMaster is investing \$50 million into the renovation of the warehouse at 200 Longwood at MIP. This space will be sublet by McMaster to research intensive companies in the next phase of commercialization of research. This space will allow for a continued commitment to research by the University.

- Graduate Student Residence Partnership and Parking Structure (P3)
 - In partnership with Knightstone Capital, a new Graduate Residence will support student recruitment and retention and will also further enhance the student experience at McMaster. A total of 630 new graduate student beds and 265 parking spaces will be housed in a 30-storey building located in downtown Hamilton. This project's integrated parking structure has been designed to meet the needs of the building and provide public parking in the downtown core.
- McMaster Main Street Residence (P3)
 - The University, in partnership with Knightstone Capital, continues to work with stakeholders as plans progress for a proposed undergraduate student residence on Main Street West. The proposal is for a mixed-use student residence building on a site owned by the University, on Main Street between Forsyth and Dalewood. The current plan envisions a two-phased project housing approximately 1,373 students.
- Global Hub / International Affairs / One-Stop Shop (Student Affairs)
 - This major renovation was originally planned for select spaces at Gilmour Hall, Togo Salmon Hall and Kenneth Taylor Hall. Current plans have a portion of the group located in one of the two shell floors in the new McLean Centre for Collaborative Discovery. The project is to include front-facing student service space, back-of-house office space and consolidation of existing functions.
- Existing Building Infrastructure Asset Management and Renewal
 - See the Asset Management Plan, posted on the Facility Services website, for details.
- Energy Management Projects and Sustainability
 - Projects included with listing of other projects in Appendix 'A' In addition, the Energy Management Plan is updated yearly.
- Campus Accessibility Action Plan (CAAP)
 - The approved Campus Accessibility Action Plan (CAAP) now invests \$337,000 annually for accessibility-related improvements to McMaster buildings. The CAAP Phase 1 ran from 2012-2013 through to 2016-2017. Phase 2 of CAAP (2018-2023) is underway.
- Environmental Compliance
 - The Cogeneration project completed at the E.T. Clarke Centre required an Environmental Compliance Approval (ECA) and the Ministry of the Environment asked McMaster to submit a campus wide ECA application. Some of the major noncompliance noise sources such as cooling towers will be mitigated as part of a multi-year plan. McMaster is implementing a 9 year phased plan given that most of the non-compliant sources are at the end of their service life and are identified

for replacement as part of the deferred maintenance/Asset Management Plan.

5.1.3 *Planned Projects and Initiatives*

5.1.3.1 *Major Projects (see Appendix B and Appendix C)*

Appendix B provides a summary of potential future capital projects for the University in several categories of prioritization. These projects are at various stages of planning/development and available funding. Appendix C summarizes the funding for capital projects over a planning horizon until 2027. The following projects can be found within the Appendix B. All projects will flow through appropriate governance as the projects evolve.

A - High Priority Projects - Partially Funded

- Bates Residence – Retrofit
 - This \$44 million, multi-year, multi-phase project calls for major upgrades to nearly all building systems at Bates Residence and includes interior finish replacements and suite re-arrangements (currently funded at \$24M).
- Greenhouse (Construction and Demolition)
 - This \$14.4 million project involves demolishing the existing Greenhouse and relocating it to land between Life Sciences and Divinity College. This project will now be combined with some interior renovations in LSB.
- JHE Interior Renovation
 - The Faculty of Engineering has initiated the planning of upgrades to JHE in a series of steps over the coming years. This includes some much-needed upgrades to washrooms, which will be funded with some deferred maintenance funding as much as feasible. Upgrades to corridors and the addition of collaborative spaces are part of the long-term project, estimated project cost of \$5 million.
- JHE Tower – The PIVOT
 - The Faculty of Engineering is reimagining the curriculum, beginning with Level 1, and working through all levels to increase integration, experiential learning, PBL, innovation, etc. Space to support this transition is needed; with an estimated project cost of \$50 million.

B - High Priority Projects Unfunded

- Peak Shaver Installation and Boiler
 - This project is expected to include a \$10M investment (approximate) in electric boilers, funded through savings from peak shavers, installed and operated by an external company. The peak shavers' electrical

output is synchronized with the electrical grid. The peak shaver generators would only be operated at times when the IESO is experiencing the potential of a coincidental peak demand. With the operation of the peak shavers, this would reduce McMaster's typical 9-11MW electrical demand down to approximately 6 MW, resulting in a reduction of GA costs by 30%. This savings stream will provide payback to central bank to purchase and install 2 Boilers that would replace the current 1962 boiler that is at the end of its useful life. Facilities is exploring both gas and battery-powered generators.

- Lot K Parking Structure
 - This \$12 million project will build a parking structure on the current Lot K parking footprint. The University is in need of additional off central campus parking spaces. The University currently leases land at Ward Ave and this lease is set to expire in Fiscal 2024 with no option to renew.
- Life Science Building Deep Renovation
 - Revitalization of the buildings envelope, systems and infrastructure. The proposed \$59.5 million deep retrofit will solve existing building envelope deficiencies of barrier leaks, thermal bridging, and roof leaks. Student study space and an identifiable entrance is lacking within the current configuration. With a growing enrolment for the programs, additional space is needed to increase capacity and must be located within close proximity to required services. Overall this project would offer a platform for future development and growth of life sciences research and education. It would also bring an aging building in line with current industry standards for both research and operations.
- Fit Out of Floors 7&8 DSB Expansion
 - The University has made the decision to shell in floors 7 and 8 of the DSB Expansion project for future growth at a cost of \$5.6 million (total for both floors). One of these floors will be occupied by the One Stop Shop hub (already approved) and the other is under discussion.
- Athletics & Recreation – Aquatic Centre/Pool Replacement
 - This phase includes the demolition and re-construction of the pool, to be known potentially as the Bay Area Community Pool and Aquatic Centre at McMaster University (BACPAC@MAC). Further, this phase includes a new student gym and major retrofits. A total of 23,190SF of new/renovated space is included in this project. This project is outlined in the Athletics and Recreation Business Case (November 3, 2017); project estimated cost of \$56 million.
- Hamilton Integrated Research Centre - downtown
 - To be constructed on the parking lot adjacent to the DBHSC building on Bay Street, downtown Hamilton. This research centre, intended to be similar to The Francis Crick Institute in Paris, France, would house some of McMaster's growing research programs in Health Sciences

and other collaborative areas. Building size estimated similar to DBHSC with parking requirements met through the Graduate Student Residence on King Street; estimated cost of \$100 million. This project replaces the previous STEM building on previous capital lists.

- Central Animal Facility (CAF) Renovation
 - The Central Animal Facility (CAF), located in the MUMC building, is in need of a complete renovation in order to meet accreditation requirements by the Canadian Council on Animal Care. The facility has undergone minor renovations in the past several years, including an overhaul of the ventilation system, but a more extensive complete renovation is now an urgent need. An external consultant has been engaged and the current estimate is a \$20M investment in order to meet the current requirements; estimated total project cost of \$36 million.
- Arts Quad Renovation
 - L. R. Wilson Hall (phase 1), allowed for the migration of teaching and learning spaces from the Arts Quad to this new building. Phase 2 – Arts Quad Renovation is to allocate \$63 million toward critically needed design and construction renovation improvements in the teaching and learning spaces within the existing Arts Quad.
- Land Acquisition – Downtown (adjacent to GSR)
 - 0.76 acres of land adjacent to the Graduate Student Residence property downtown is available through Knightstone Capital for a partnership opportunity. In the interim, the land is being sub-leased to the City for parking, and this could continue for the foreseeable future; land cost \$8 million.

C - Medium Priority Projects unfunded

- Thode Library – High Density Shelving
 - This is a multi-phase project to thoroughly renovate and expand library space on campus.
- Housing and Conference Services Exterior Spaces plan (multi year plan)
 - Housing has a multi-year plan to upgrade and install landscape/hardscape in the residence areas around campus. This plan will likely be a 20+ year plan, with funding set aside each year to accomplish small projects.

D - Low Priority Projects unfunded

Please see the following chart, projects listed here will only be elevated if funding becomes available or circumstances change that change the priority:

Transit Hub - Academic and Commercial Building (Phase 2)	\$34,900,000
Transit Hub - Academic Classroom (Phase 3)	\$56,250,000
Athletics and Recreation - Phase 3 Expansion	\$37,900,000
Arts Quad Cover	\$47,500,000
Thode Library Phase 2: Major Renovations	\$6,000,000
Mills Library Phase 1 Research Collections	\$4,000,000
Mills Library Phase 2: Library Entrance, Washrooms	\$2,500,000
Mills Library Phase 3: Staff Spaces, General Learning and Collections Reno #1	\$4,500,000
Mills Library Phase 4: Staff Spaces, General Learning and Collections Reno #2	\$4,000,000
MAC Forest (Ancaster) - proposed teaching and research building	\$4,000,000
IAHS Expansion with Mohawk	\$20,000,000

E - McMaster Innovation Park Projects

McMaster Innovation Park also has several capital projects under various stages of development/planning. These projects are highlighted in the MIP strategy presentation annually to the McMaster Board of Governor's and Planning and Resources Committee.

Hotel	\$23,000,000
ETC#1 (Gowlings)	\$35,000,000
44 Frid Street (Hamilton Spectator)	\$30,000,000
Glass Warehouse	\$110,000,000
Park Complete Build-out	TBD

5.2 *Design Principles and Standards*

All projects will be executed in accordance with appropriate campus planning principles, design standards, code compliance and functional requirements; and all major projects are to adhere to McMaster policy on sustainable buildings.

The overall planning policies for the McMaster Campus follow from the twelve principles as detailed in Section 3.4, Westdale Campus Master Plan. They are intended to guide the University's growth and renewal over time. They are supplemented by area-specific policies for the campus found elsewhere in the Campus Master Plan.

In all cases, the policies are intended to reflect the intent of the University's Environmental Policies, including its Sustainable Building Policy, the City of Hamilton's Official Plan and Zoning By-law, the principles of Hamilton's Vision 2020 document and the planning and environmental policies of the Hamilton Conservation Authority and Royal Botanical Gardens.

Also, the space standards from the McMaster Space Management Policy (1987) need to be reviewed and revised, to more appropriate and up-to-date minimum standards, based on current minimum space standards outlined by the Council of Ontario Universities and the analysis of McMaster's current spatial data to reflect how space is actually being used on campus.

6 CONCLUSIONS AND RECOMMENDATIONS

McMaster has recently successfully completed a great deal of new construction, addition/renovation projects and has acquired new space by lease arrangements. As identified by the Campus Master Plan areas for development still exist on the Main Campus, and these locations need to be the focus of future growth. McMaster's many currently ongoing addition/renovation projects and plans for new residence buildings and new teaching facilities, will help support existing needs and any new growth over the next few years.

In regards to existing infrastructure asset management, it should be noted that out of the 66 buildings, 46 buildings (70%) and 67% of our total gross building area are over 40 years old. With a total deferred maintenance backlog for all buildings and infrastructure including Residences and MUMC of \$713.87 million, and \$419.77 million for all buildings and infrastructure excluding Residences and MUMC, funding for deferred maintenance remains a high priority. McMaster University is currently funding deferred maintenance for the academic portfolio at \$9.4 million and MUMC at \$1.3 million/year (includes a loan payment), for a total allocation of \$10.7 million/year, an investment that will only maintain control of the top priority deferred maintenance items in the short term.

In the interest of sustainability, energy conservation and cost savings, McMaster has implemented several energy management programs.

7 EXECUTIVE SUMMARY

This 2020/2021 Capital Plan is an update of Version 4, published by McMaster University Facility Services in May 2019.

The amount of classroom space on campus is close to 86% of what is needed by COU standards. Full-Time Student Enrolment and the subsequent critical demands for space, is increasing. As such, McMaster University needs to identify and take advantage of existing opportunities for physical growth. McMaster needs to seek out off-campus expansion opportunities and to take advantage of the area available for development on the main campus. It will also be essential to increase efficiencies in planning for the utilization of existing space.

Over its rich history, McMaster has accumulated a wealth of physical assets. The challenge today is to manage this inventory of aging buildings and infrastructure as best suits anticipated needs. To this effect, McMaster University has increased the deferred maintenance funding for the academic portfolio and is allocated to spend \$14.09 million (including funds from the Ministry of Colleges and Universities) in 2020/21. This investment will maintain control of the top priority deferred maintenance items in the short term.

In addition, McMaster needs to further embrace sustainable construction and energy management practices. Accessibility needs to be increased for compliance with today's standards, including new installations of barrier-free ramps, washrooms, fire alarm strobe lights, water fountains, etc.

Numerous documents and reports have been produced to inform McMaster's efforts. Chief among them are McMaster President and Vice-Chancellor Patrick Deane's 2011 letter, "Forward with Integrity" (FWI), his 2012 letter, "Forward with Integrity: The Emerging Landscape" and the follow up document "Forward with Integrity: Next Phase" issued in October 2015. The Strategic Mandate Agreements (2014-17 and 2018-20) have also been prominent in outlining priorities and principles which help shape the University's development. Also, McMaster has joined the world's health-promoting universities and colleges in signing the Okanagan Charter, dedicated to advancing human and societal health and wellbeing.

Appendix A: 2019/20 Governance Approved Capital Projects

Active Projects at December 2019 (greater than \$2M)*		Funding Source
Innovation Hub - The Clinic	3,100,000	Donor/Equity
Athletic and Rec - Pulse and Student Space Expansion	64,000,000	Equity/Student
DSB Expansion (at Innis Library)	89,730,000	Donor/Equity
Classroom Reconfiguration Plan	12,000,000	Equity
Research Capital Commercialization Project	50,000,000	Equity
Residence Renewal	18,000,000	Equity
Energy Management Projects and Sustainability	27,830,778	Gov't/Equity
Peter George Centre for Living and Learning	122,320,000	Equity
Advanced Manufacturing Centre	9,060,000	Equity
ABB - SIF (Renovation, addition, DM)	56,220,000	Gov't/Equity
Existing Building Infrastructure Asset Management and Renewal	80,000,000	Equity
Deferred Maintenance Projects	50,200,000	Gov't/Equity
Environmental Compliance	2,800,000	Equity
Campus Accessibility Action Plan (CAAP)	2,359,000	Equity
CFI 2017 (University contribution)	4,664,976	Equity
One Stop Shop/International Affairs	9,000,000	Equity
CFI Research Future Matching Funds	5,403,044	Equity
Graduate Student Residence Downtown	30,600,000	P3
Main Street Student Residence (Traymore)	12,900,000	P3
LRT Transit Hub and Parking Garage	8,980,000	P3/Equity
ABB 5 th Floor (Engineering and Science)	2,815,000	Equity
Parking and Security Relocation	2,300,000	Equity
CFI 2014 and 2015 (University contribution)	1,280,538	Equity
Mayfair Properties	5,600,000	Equity
Forge expansion at MIP parking garage	1,800,000	Gov't/Equity
Fraunhofer Center IZI at MIP - BEAM	17,400,000	Gov't/Equity
SANS for Nanostructured Materials (Gaulin CFI)	8,920,669	Gov't/Equity
L.R. Wilson Hall and Parking	66,054,595	Donor/Gov't/Equity
McMaster Health Campus	84,644,854	Donor/Gov't/Equity

*Note: the above includes any projects that will remain open/active during May 1, 2020 to April 30, 2021 with a budget greater than \$2M. In addition, the highlighted projects are substantially complete.

Appendix B: 2020/21 Subject to Approval Capital Projects

Summary Table:

	PVP Approved: High Priority and Partially Funded:	
1	Bates Retrofit (Partially Funded \$24,000,000)	44,000,000
2	Greenhouse new Construction and Demolition (Partially Funded \$5,000,000)	14,400,000
3	JHE Interior Renovation (Fully funded)	5,000,000
4	JHE Tower – The PIVOT (Partially Funded \$15,000,000)	50,000,000
	Contemplated:	
	High Priority Unfunded:	
5	Peak Shaver Installation and Boiler	10,000,000
6	Lot K Parking Structure	12,000,000
7	Life Science Building Deep Renovation	59,500,000
8	Fit Out of Floors 7&8 DSB Expansion (BHSC Expansion, Other – TBD)	5,674,200
9	Athletics & Recreation – Aquatic Centre/Pool Replacement	56,000,000
10	Hamilton Integrated Research Centre – downtown (replacement for STEM)	100,000,000
11	Central Animal Facility (CAF) Renovation	36,000,000
12	Arts Quad Renovation	63,000,000
13	Land Acquisition – Downtown (adjacent to GSR)	8,000,000
	Medium Priority Unfunded:	
14	Thode Library - High Density Shelving	2,000,000
15	Housing and Conference Services Exterior Spaces plan (multi-year plan)	20,000,000
	Low Priority Unfunded:	
16	Transit Hub - Academic and Commercial Building (Phase 2)	34,900,000
17	Transit Hub - Academic Classroom (Phase 3)	56,250,000
18	Athletics and Recreation - Phase 3 Expansion	37,900,000
19	Arts Quad Cover	47,500,000
20	Thode Library Phase 2: Major Renovations	6,000,000
21	Mills Library Phase 1 Research Collections	4,000,000
22	Mills Library Phase 2: Library Entrance, Washrooms	2,500,000
23	Mills Library Phase 3: Staff Spaces, General Learning and Collections Reno #1	4,500,000
24	Mills Library Phase 4: Staff Spaces, General Learning and Collections Reno #2	4,000,000
25	MAC Forest (Ancaster) - proposed teaching and research building	4,000,000
26	IAHS Expansion with Mohawk	20,000,000
	MIP Funded Projects:	
	Hotel	23,000,000
	ETC#1 (Gowlings)	35,000,000
	44 Frid Street (Hamilton Spectator)	30,000,000
	Glass Warehouse	109,795,372
	Park Complete Build-out	TBD

Appendix C: Capital Budget – Summary (Refer to Section 5)

Projects	Pre 2018	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Grand Total
Active - Ongoing												(850,512,286)
Innovation Hub - The Clinic			(108,037)	(1,500,000)	(1,491,963)							(3,100,000)
Athletic and Rec - Pulse and Student Space Expansion (SAFE)		(1,590,299)	(1,471,901)	(20,828,099)	(30,109,701)	(10,000,000)						(64,000,000)
DSB Expansion (at Innis Library)				(2,000,000)	(29,725,779)	(35,153,026)	(22,851,195)					(89,730,000)
Classroom Reconfiguration Plan	(1,520,000)	(541,594)	(3,000,000)	(2,000,000)	(2,000,000)	(2,938,406)						(12,000,000)
Research Capital Commercialization Project		(20,495)	(4,270,225)	(35,729,775)	(9,979,505)							(50,000,000)
Residence Renewal		(974,578)	(4,534,497)	(490,925)	(2,000,000)	(2,000,000)	(2,000,000)	(2,000,000)	(2,000,000)	(2,000,000)		(18,000,000)
Energy Management Projects and Sustainability	(12,546,727)	(6,631,224)	(1,963,073)	(6,689,754)								(27,830,778)
Peter George Center for Living and Learning	(7,116,042)	(28,686,137)	(54,289,582)	(24,124,281)	(8,103,958)							(122,320,000)
Advanced Manufacturing Centre			(68,911)	(8,991,089)								(9,060,000)
ABB - SIF (Renovation, addition, DM)	(3,270,694)	(30,530,655)	(20,362,353)	(2,056,298)								(56,220,000)
Existing Building Infrastructure Asset Management and Renewal (annual)		(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(8,000,000)	(80,000,000)
Deferred Maintenance Projects (annual)		(4,200,000)	(5,250,000)	(5,020,000)	(5,020,000)	(5,020,000)	(5,020,000)	(5,020,000)	(5,020,000)	(5,020,000)	(5,020,000)	(49,610,000)
Environmental Compliance		(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)	(400,000)		(3,600,000)
Campus Accessibility Action Plan (CAAP)		(334,000)	(334,000)	(337,000)	(337,000)	(337,000)	(337,000)	(337,000)	(337,000)	(337,000)		(3,027,000)
CFI 2017 (University contribution)				(4,664,976)								(4,664,976)
One Stop Shop/International Affairs				(500,000)	(6,000,000)	(2,500,000)						(9,000,000)
CFI Research Future Matching Funds						(5,036,666)						(5,036,666)
Graduate Student Residence Downtown (P3)		(277,549)		(500,000)	(13,642,004)	(16,180,447)						(30,600,000)
McMaster Main Street Student Residence (P3)	(6,434,360)	(7,770,304)	(1,645,336)		2,950,000							(12,900,000)
LRT Transit Hub and Parking Garage						(5,926,460)	(3,053,540)					(8,980,000)
ABB 5th Floor (Engineering and Science)				(500,000)	(2,315,000)							(2,815,000)
Parking and Security Relocation					(2,300,000)							(2,300,000)
CFI 2014 and 2015 (University contribution)		(187,000)	(1,093,538)									(1,280,538)
Mayfair Properties				(5,600,000)								(5,600,000)
Forge expansion at MIP parking garage - PVP Approved			(1,817,210)									(1,817,210)
Fraunhofer Center IZI at MIP	(4,099,366)	(10,314,730)	(1,765,941)	(1,219,963)								(17,400,000)
SANS for Nanostructured Materials (Gaulin CFI)	(6,383,952)	(2,548,589)	11,872									(8,920,669)
L.R. Wilson Hall and Parking	(64,371,074)	(1,395,122)	(288,399)									(66,054,595)
McMaster Health Campus	(81,387,375)	(2,402,593)	(162,959)	(691,927)								(84,644,854)
PVP Approved: High Priority and Partially Funded:												(113,400,000)
Bates Retrofit - PVP Approved							(4,000,000)	(20,000,000)	(20,000,000)			(44,000,000)
Greenhouse new Construction and Demolition - HPF				(500,000)	(7,000,000)	(6,900,000)						(14,400,000)
JHE Interior Renovation					(2,500,000)	(2,500,000)						(5,000,000)
JHE Tower - The PIVOT						(5,000,000)	(20,000,000)	(20,000,000)	(5,000,000)			(50,000,000)
High Priority Unfunded:												(350,184,440)
PeakShavers and Boilers					(5,000,000)	(5,000,000)						(10,000,000)
Lot K Parking Structure					(12,000,000)							(12,000,000)
Life Science Building Deep Renovation						(6,500,000)	(23,500,000)	(23,500,000)	(6,000,000)			(59,500,000)
Fit Out Floors 7&8 - DSB Expansion (BHSC Expansion, Other - TBD)					(5,674,200)							(5,674,200)
Athletics & Recreation - Aquatic Centre						(5,601,024)	(22,404,096)	(22,404,096)	(5,601,024)			(56,010,240)
Hamilton Integrated Research Centre - downtown						(2,000,000)	(32,000,000)	(42,000,000)	(17,000,000)	(7,000,000)		(100,000,000)
Central Animal Facility Renovation				(4,000,000)		(16,000,000)	(16,000,000)					(36,000,000)
Arts Quad Renovations - HPU						(3,000,000)	(31,500,000)	(28,500,000)				(63,000,000)
Land Acquisition - Downtown (adjacent to GSR)					(8,000,000)							(8,000,000)
Medium Priority Unfunded:												(9,000,000)
Thode Library - High Density Shelving					(2,000,000)							(2,000,000)
H&CS Exterior Spaces Plan (Multi year to 2041 \$20M)					(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(1,000,000)	(7,000,000)
Low Priority Unfunded:												(221,550,000)
LRT - Ph 2 - Academic Commercial Building - LPU						(4,900,000)	(25,000,000)	(5,000,000)				(34,900,000)
LRT - Ph 3- Academic Classroom - LPU							(11,250,000)	(45,000,000)				(56,250,000)
Athletics and Recreation - Phase 3 Expansion - LPU						(2,900,000)	(4,000,000)	(11,500,000)	(11,500,000)	(8,000,000)		(37,900,000)
Arts Quad Cover - LPU					(500,000)	(20,000,000)	(16,000,000)	(11,000,000)				(47,500,000)
Thode Library Phase 2 Major Renovations - LPU					(3,500,000)	(2,500,000)						(6,000,000)
Mills Library Phase 1 (Sherman) - LPU					(4,000,000)							(4,000,000)
Mills Library Phase 2 Entry, Washroom, CAV Renovations - LPU						(2,500,000)						(2,500,000)
Mills Library Phase 3 Staff, Learning, Collections Area Renovations 1 - LPU						(2,000,000)	(2,500,000)					(4,500,000)
Mills Library Phase 4 Staff, Learning, Collections Area Renovations 2 - LPU							(2,000,000)	(2,000,000)				(4,000,000)
MAC Forest Research Building - LPU					(200,000)	(2,500,000)	(1,300,000)					(4,000,000)
IAHS Expansion with Mohawk						(5,000,000)	(10,000,000)	(5,000,000)				(20,000,000)

Appendix D: Schedule of Facilities

Building Code	Building Name	Building Section	Construction / Renovation / Acquisition Date	Current Total Building Gross Area (Square Feet)	Current Total Building Gross Area (Square Metres)
1	University Hall		1929	48,652.83	4,520.00
		Addition	1991		
2	Hamilton Hall		1929	51,865.81	4,818.49
4	Refectory		1929	23,365.44	2,170.72
		Addition	1965		
5	Edwards Hall		1929	25,025.44	2,324.94
6	Wallingford Hall		1929	23,461.70	2,179.66
7	Alumni House (Formerly President's Residence)		1929	6,523.90	606.09
8	Alumni Memorial Building		1949	14,062.10	1,306.41
		Addition	2003		
9	Nuclear Research Building		1950	61,117.00	5,677.96
		Addition	1957		
		Addition	2001		
		Addition	2011		
10	Mills Memorial Library/Alvin A. Lee Building		1950	230,069.00	21,374.11
		Addition	1962		
		Addition	1968		
		Addition	1990		
11	Burke Science Building		1953	196,401.35	18,246.28
		Addition	1958		
		Addition	1961		
		Addition	1963		
12	E. T. Clarke Centre		1954	53,465.93	4,967.15
		Addition	1958		
		Addition	1965		
		Addition	1968		
		Addition	1996		
15	Nuclear Reactor		1957	28,780.8	2,673.8
			1958		
16	John Hodgins Engineering Building	Addition	2017	278,377	25862.06
		Addition	1989		
		Addition	2001		
		Addition	2016		
17	Divinity College		1959	38,148.20	3,544.08
18	Moulton Hall		1959	58,692.50	5,452.71
19	Whidden Hall		1959	69,989.40	6,502.23

20	Gilmour Hall		1959	90,127.80	8,373.15
22	General Sciences Building		1962	59,583.20	5,535.46
23	Chester New Hall		1964	87,870.01	8,163.39
24	Ivor Wynne Centre		1964	246,954	22,942.77
		Addition	1972		
		Addition	2011		
25	Arthur N. Bourns Building		1968	352,648.00	32,762.07
		Addition	2003		
		Addition	2006		
		Addition	2019		
26	Matthews Hall		1964	61,808.30	5,742.18
27	McKay Hall		1964	66,824.30	6,208.18
28	Commons Building		1965	56,448.90	5,244.27
		Addition	1968		
29	Togo Salmon Hall		1965	146,039.68	13,567.53
		Addition	2000		
		Addition	2015		
30	Biology Greenhouse		1967	8,377.60	778.30
31	Campus Services Building		1968	51,935.60	4,824.98
32	Tandem Accelerator Building		1966	36,493.00	3,390.31
		Addition	2002		
		Addition	2011		
33	Applied Dynamics Laboratory		1967	21,480.00	1,995.56
34	Psychology Building		1970	102,691.5	9,540.3
		Addition	2013		
35	Woodstock Hall		1968	64,341.30	5,977.50
36	Brandon Hall		1968	118,354.70	10,995.51
37	Health Sciences Centre ¹		1970	981,238	91,159
		Addition	2005		
38	Kenneth Taylor Hall		1971	126,990.70	11,797.82
39	Life Sciences Building		1970	106,851.52	9,926.83
40	Bates Residence		1971	164,055.40	15,241.25
		Addition	1972		
42	H. G. Thode Library		1976	87,793.70	8,156.30
43	Communications Research Laboratory		1983	28,862	2,681.36
		Addition	1989		
44	Health Sciences Parking Garage		1986	N/A	N/A
45	Hedden Hall		1989	104,279.10	9,687.85
46	DeGroote School of Business		1990	74,422.44	6,914.07
		Addition	1999		
		Addition	2001		
48	Institute for Applied Health Sciences ¹		2000	118,652	11,023.13
49	Information Technology Building		1955	123,725.60	11,494.48
		Addition	1959		
		Addition	2001		
50	Mary E. Keyes Residence		2002	146,195.20	13,581.98
51	McMaster University Student Centre		2002	146,830.69	13,641.01
			2016		
52	Michael G. Degroote Centre for Learning and Discovery		2004	304,365.61	28,276.49
		Addition	2005		
		Addition	2017		
53	Les Prince Hall		2006	106,016.20	9,849.23

54	David Braley Athletic Centre		2007	140,478.85	13,050.91
55	Ron V. Joyce Stadium		2008	56,941.95	5,290.08
56	Engineering Technology Building		2009	138,682	12,883.97
57	Ron Joyce Centre (Burlington)		2010	103,591.87	9,624.00
58	MIP - MARC		2013	85,000	7,896.75
59	MIP – Atrium Building		2009	140,751	13,076.19
73	St. Paul's Anglican Church (Hamilton) – Leased Space		2013	5,808	539.5
74	L.R Wilson Hall		2016	177,927.00	20,438.20
82	88 Forsyth Avenue North		2015	4754	441.66
83	David Braley Health Sciences Centre		2015	232,843.00	21,631.82
85	One James North – Leased Space ¹		2015	52,991	4,923.02
86	47 Whitton Road		2015	3,587	333.24
87	182 Sterling Street		2015	3,937.00	365.76
89	Peter George Centre for Living and Learning (PGCLL)		2019	335,165.00	31,137.85
90	Halton McMaster Family Health Centre/JBH		2013	31,107.70	2,890.00
91	Canadian Martyrs – Licensed Space		2016	4,172	387.59
92	Cairns Research Complex- (Brock University)		2012	10,176	954.49
94	96 Forsyth Avenue North		2017	5,944.78	552.29
95	106 Forsyth Avenue North		2018	5012	465.63
96	132 Mayfair Crescent		2019	2,900	269.42
97	8 Mayfair Crescent		2019	4,600	427.35
T13	Preliminary Laboratory		1967	23,066.60	2,142.96
TB26	Temporary Building, Multi-use (Formerly Scourge Building)		1989	2,112.00	196.21
T31	Stone Church Family Health Care Centre		N/A	15,726.01	1,460.99
T32	Temporary Portables (Offices)		2013	6,031.56	560.35
T33	Temporary Portables (McMaster Children's Centre)		2013	7,805.02	725.11
T34	Temporary Classroom/Offices		2019	5,000.00	464.51
200	Integrated Health Building (Waterloo)		2010	59,816.34	5,557.12
Grand Total:				7,066,182.13	656,469.79

Note 1: McMaster space in shared building

Appendix E: Schedule of Properties

Of McMaster's on-campus buildings, the following have unique ownership arrangements:

- Divinity College – owned by College of Divinity.
- Health Sciences Centre – owned by McMaster and leased to Hamilton Health Sciences (HHS then leases approximately 38% of the building back to the Faculty of Health Sciences).
- Institute for Applied Health Sciences – owned jointly by McMaster and Mohawk.
- McMaster University Student Centre – operated by McMaster Students Union under the direction of a management committee.
- David Braley Athletic Centre – owned by McMaster and operated by Athletics and Recreation; construction paid for from external sources, operating expenses paid for by McMaster and the students.

Additionally, off campus, the University owns or leases the following:

- 4350 South Service Road, Burlington – Ron Joyce Centre (east side)
- 4350 South Service Road, Burlington – Farmland (west side)
- 200 Longwood Rd South, Hamilton – McMaster Automotive Resource Centre (MARC) Warehouse (MIP)
- 175 Longwood Rd South, Hamilton – The Atrium Building at McMaster Innovation Park (MIP), aka The Atrium@MIP (Various Suites)
- 155 Chatham Street, Hamilton – (MIP) (undeveloped)
- 270 Longwood Road South, Hamilton – BEAM (Fraunhofer)
- 565 Sanatorium Road, Hamilton – Chedoke Hospital (leased space)
- 25 Charlton Avenue East, Hamilton, Suites: 300, 303, and 702 – Family Medicine
- 30 Birge Street, Hamilton – David Braley Research Institute (leased space)
- 237 Barton Street East, Hamilton – Hamilton General Hospital (leased space)
- 699 Concession Street, Hamilton – Juravinski Cancer Centre (leased space)
- 100 West 5th Street, Hamilton – Juravinski Centre for Integrated Healthcare (leased space)
- 711 Concession Street, Hamilton – Juravinski Hospital (leased space)
- 1475 Upper Ottawa St, Hamilton – Stonechurch Family Health Centre
- 2757 King Street East, Hamilton – St. Joseph's Community Health Services (leased space)
- 50 Charlton Avenue East, Hamilton – St. Joseph's Healthcare (leased space)
- 1140 King Street West, Hamilton – St. Paul's Anglican Church in Westdale (leased space)

- 10B Victoria Street, Kitchener – McMaster Michael G. DeGroote School of Medicine in the Integrated Health Building, Waterloo Regional Campus, Education Services, Faculty of Health Sciences
- 304 Victoria Avenue, Hamilton – Victoria Medical Center (leased space)
- 25 Main Street West – (leased space)
- 88 Forsyth Avenue North, Hamilton

- 100 Main Street West, Hamilton – David Braley Health Sciences Centre (south side)
- 100 Main Street West, Hamilton – Parking (north side)
- One James North, Hamilton –
- (previously known as The Downtown Centre, i.e., DTC) (leased space at Lloyd D. Jackson Square):
 - The Centre for Continuing Education (CCE),
 - Finance,
 - University Advancement (UA),
 - Institutional Research and Analysis (IRA)
- 47 Whitton Road, Hamilton
- 182 Sterling Street, Hamilton
- Existing houses bound by Forsyth Avenue South, Traymore Avenue, Dalewood Avenue, and Main Street West
- 1221 Lakeshore Road, Burlington – Halton McMaster Family Health Centre at Joseph Brant Hospital
- 1355 Main Street West, Hamilton – Canadian Martyrs (licensed space)
- Brock University, Level 200 @ 500 Glenridge Ave., St. Catharines – (leased space, Education Services)
- 96 Forsyth Avenue North, Hamilton
- 106 Forsyth Avenue North, Hamilton
- 110 King Street West, Hamilton – (leased space)
- 199 James Street North, Unit 2, Hamilton – (leased space, Sociology)
- 1205 Rymal Road East, Hamilton – (leased space, Faculty of Health Sciences)
- 142 Queenston Street, St. Catharines – (leased space)
- 16-24 Ontario Street, St. Catharines – (leased space, Medical Clinic)
- 180 James Street South, Hamilton – (leased space)
- 249 Caroline St S, Unit A, Hamilton – (leased space, School of Nursing)
- 293 Wellington Street North, Hamilton - (leased space, Family Medicine - Surgery), Suites: 110, 111
- 3155 Harvester Rd., Burlington – (leased space, Family Medicine), Suites: 207, 208, 209
- 495 Woodward Avenue, Hamilton – (leased space)
- 1960 Main Street West, Ancaster – (leased space)
- 555 Prince Charles Drive North, Suite 201, Welland – (leased space)
- 700 Bay Street, Suite 2303, Toronto – (leased space)
- 701 Main St. West, Suite 101, Hamilton - Family Medicine – Maternity Centre (leased space)
- 162 Ward Avenue, Hamilton - Parking lot (leased lot)
- Lot 56, of Hamilton Plan 1475 – (MIP)
- 245 James Street North, Hamilton – (leased space)
- 200 Victoria Street, Toronto, unit 1506 (leased space)

- Property on the north side of Lower Lions Club Road, east of Louise Drive, Ancaster – (undeveloped 115 acres)
- 120 Forsyth Avenue North, Hamilton – (The Oval at Mayfair Crescent: 5.5 acres)
- Grant Boulevard at Barrie Street, Hamilton – (undeveloped)
- 1190 Main Street West, Hamilton – (between Forsyth Avenue South and Dalewood Avenue) (undeveloped)
- 1480 Sandhill Drive, Ancaster – (leased space) Suites: 9A
- 777 Bay Street, Toronto – Capital Hill Group (leased space)
- 459 Hume Street, Collingwood – Collingwood General and Marine Hospital (leased space)
- Osler Drive, south side, east of University Plaza (undeveloped)
- Osler Drive, north side, east of University Plaza (undeveloped)
- 132 Mayfair Crescent, Hamilton
- 8 Mayfair Crescent, Hamilton

Appendix F: 2020/21 Approved Project List for Deferred Maintenance Items

Bldg #	Building Name	Scope	Estimate (\$)
Structure			
4	Refectory	Structural repairs under loading dock	
Sub-Total			\$75,000
Exterior Enclosure			
24	Ivor Wynne Centre	Replace windows on 2nd floor south offices	
7	Alumni House	Replace windows	
15	Nuclear Reactor	Replace roof and exterior wall restoration	
10	Mills Library	Replace screens in the Sherman Centre Basement	
12	E.T. Clarke	Roof replacement below cooling tower cells 7 & 8	
Sub-Total			\$1,525,000
Conveyance and Interior Finishes			
10	Mills Library	Elevator upgrade	
2	Hamilton Hall	Flooring replacement	
29	Togo Salmon Hall	Lobby area and classroom B129 renovations	
42	Thode Library	Basement and Second floor ceiling	
16	John Hodgins Engineering	South Washrooms renovation	
16	John Hodgins Engineering	Common washrooms and corridor upgrades	
Sub-Total			\$1,550,000
Mechanical			
22	General Sciences Building	HVAC upgrades and additional noise mitigation	
28	Commons Building	HVAC upgrades	
16	John Hodgins Engineering	Replace AHU 1, 2, 3 and 5	
10	Mills Library	Replace re-heat coils on 4th floor	
20	Gilmour Hall	Replace all supply and return fans in the basement mechanical room	
39	Life Sciences Building	Replace RO water system	
24	Ivor Wynne Centre	26.67% of the ICIP funding application to upgrade the HVAC in Burrigge Gym	
48	Institute of Applied Health Sciences	Deferred maintenance work, cost shared with Mohawk	
Sub-Total			\$3,944,730
Electrical			
28	Commons Building	Replace high voltage sub-station	
16	John Hodgins Engineering	Replace sub-station, MCC and 2 distribution switchboards	
39	Life Sciences Building	Replace 600V main breaker and low voltage switchboard	
Sub-Total			\$2,000,000
Fire Safety			
24	Ivor Wynne Centre	Fire alarm Upgrade	
48	Institute of Applied Health Sciences	Fire damper fusible links replacement (Cost is shared with Mohawk College)	
4	Refectory	Fire alarm panel upgrade	
Sub-Total			\$650,000
Environmental Compliance Action Plan - Phase 2			
12	E.T. Clarke	First phase of the cooling tower replacement	
Sub-Total			\$1,345,270
Infrastructure			
Campus Tunnels		Repairs to tunnels and replacement of buried cables and utilities - Phase 1	
Campus Mall drainage		Add drainage and connect to existing sewer system	
Sub-Total			\$1,700,000
McMaster University Medical Centre (MUMC)			
37	MUMC	Facility contribution to pay for the outstanding central bank loan	\$200,000
37	MUMC	Infrastructure projects at MUMC	\$1,100,000
Sub-Total			\$1,300,000
Total			\$14,090,000