



**FOR CONFIRMATION**

**PUBLIC**

**CLOSED SESSION**

**TO:** Executive Committee

**SPONSOR:** Professor Scott Mabury, Vice President, University Operations  
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**PRESENTER:** See sponsor

**CONTACT INFO:**

**DATE:** December 2, 2013 for February 12, 2014

**AGENDA ITEM:** 4b

**ITEM IDENTIFICATION:**

Capital Project: Project Planning Report for the University of Toronto Mississauga Phase 4 of the Renovation of Biology Undergraduate Teaching Laboratories.

**JURISDICTIONAL INFORMATION:**

Under the *Policy on Capital Planning and Capital Projects*, proposals for capital projects with a project budget over \$3 million and up to \$10 million (Approval Level 2) are placed on the consent agenda of the Academic Board to be considered for approval and are subsequently confirmed by the Executive Committee. The Business Board is responsible for approving execution of such projects.

**GOVERNANCE PATH:**

A. Project Planning Report:

1. Campus Affairs Committee [For Recommendation] (November 11, 2013)
2. Campus Council [For Recommendation] (December 9, 2013)
3. Academic Board [For Approval] (January 30, 2014)
4. **Executive Committee [For Confirmation] (February 12, 2014)**

B. Execution of the Project:

1. Business Board [For Approval] (January 27, 2014)

## **PREVIOUS ACTION TAKEN:**

The Project Planning Report and the project scope of Phase 1 of the UTM Teaching Laboratories Renovation was approved in principle by the Governing Council on December 15, 2011.

The Campus Council, at its meeting of December 9, 2013 considered and recommended this proposal for approval.

## **HIGHLIGHTS:**

The Department of Biology envisions its students receiving a first-class, contemporary education that reflects the modern field of biology. To achieve this vision, students need access to state-of-the-art laboratories equipped with technology and equipment that will enable the latest pedagogical approaches to biology education. An external review of the Department of Biology done in November 2010 and pointed out the need for significant attention to be paid to the upgrading of the teaching laboratories; issues related to both the quality and capacity of the existing laboratories.

In June 2011, the Ontario government announced capital funding estimated at \$17.5 million for the Renovation of Undergraduate Teaching Laboratories at the University of Toronto Mississauga (UTM). This funding has enabled UTM to undertake a multi-year renewal program of its teaching laboratories.

This proposed project will renovate the second level of the William G. Davis Building, Block D recently vacated by the Chemical and Physical Sciences Department, creating two large teaching labs, one preparation room and a technician's office that will accommodate all first year biology classes.

In recent years the Department of Biology has expanded significantly and is one of the largest disciplines on the UTM campus. In 2002/03 there were approximately 1600 Full-course Equivalents (FCE) students in Biology courses and there are now, 3800 FCE students. The department likewise offers programs that are in high demand. In 2012/13 there were over 307 students enrolled in Biology Specialist Programs and over 834 in Biology Major Programs. (*source: Department of Biology Self-Study 2013*). In the 2012/13 academic year, Biology offered 16 courses with practical sections that will serve over 2,792 students. The department is currently engaged in an academic and strategic planning process to support the growth in enrolment as well as the expansion of lab-based courses. Experiential learning is a top academic priority of the department. To do so, the department plans to reduce group sizes, increase the opportunity for hands-on experience and re-introduce laboratory experiments to courses. This re-design and investment in the related space will support this change in pedagogical techniques.

Phase 4 of the UTM Teaching Laboratory renovation will affect only the 1<sup>st</sup> floor Biology teaching laboratories and their associated preparation rooms, totalling 557 net assignable square meters (nasm). During this project, the teaching laboratories will be relocated from the 1<sup>st</sup> to the 2<sup>nd</sup> floor of the William G. Davis Building. This move will allow Biology teaching laboratories to be located in a busy 2<sup>nd</sup> floor area thus vacating relatively quiet serviced space on the 1<sup>st</sup> floor for research.

*Capital Project: Project Planning Report for the Renovation of UTM Biology Undergraduate Teaching Laboratories*

The Need for a New Facility:

UTM's first science laboratories were built almost 40 years ago and are outdated and inefficient. The renovation is essential to maximize the utilization of the existing infrastructure and will support increased numbers of undergraduate, research-based master's and doctoral graduate programs, and provide the updated infrastructure needed to support today's scientific teaching and research.

Space Program and Functional Plan:

The proposed space program allocation of 598 nasm including the laboratory technician's office (33 nasm) on the 2<sup>nd</sup> floor represents approximately the same area compared to the existing allocation 557 nasm of 1<sup>st</sup> floor teaching laboratories.

The proposed renovation will provide teaching efficiencies by creating two 48-seat laboratories. This allows flexibility in the scheduling of larger class sections as well as the option of splitting the sections into smaller groups (12 to 24 students). Larger classes are frequently perceived as one of the main barriers to quality learning, and there are many studies that point to the challenges of teaching large classes. Often overcrowded and noisy laboratories offer a poor learning environment. To reduce these feelings of over crowdedness, confusion, and frustration, a smaller stations total of 48 students were recommended as an appropriate number for first year students.

Phasing:

The proposed renovations of the undergraduate laboratories in the W.G. Davis Building started in 2012 and were planned to occur over four years (2012-2016) in order to take advantage of the summer semester construction window and to allow for coordination with other capital projects that are planned for the UTM campus.

- Phase 1 - Biology teaching laboratory renovation 4<sup>th</sup> floor (completed in August 2012 )
- Phase 2 - Anthropology teaching laboratory renovation 2<sup>nd</sup> floor (completed in August 2012)
- Phase 3 - Chemistry teaching laboratory renovation 3<sup>rd</sup> floor (completed in August 2013)
- Phase 6 - Physics teaching laboratory renovation (currently under construction)
- **Phase 4 - Biology undergraduate teaching laboratory renovations 2<sup>nd</sup> floor (this project planning report )**

Upcoming and concluding phases:

- Phase 5 - Teaching laboratory renovations 2<sup>nd</sup> floor West side (Summer 2015)
- Phase 7 - Research laboratory renovations - secondary effects (Summer 2016)

Operating Costs:

Provision has been made in UTM's Operating Budget to cover annual operating costs which are expected to increase to \$43,300. It is expected that the project will take approximately 18 months to

*Capital Project: Project Planning Report for the Renovation of UTM Biology Undergraduate Teaching Laboratories*

complete, subject to receiving the necessary environmental and building approvals from local and provincial authorities.

Schedule:

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| • Governance approvals              | November, 2013 to February 27, 2014 |
| • Laboratory Bench/Fume Hood Tender | March 2014                          |
| • Permit Application                | February 2014                       |
| • Advance/Preparatory work          | April 2014                          |
| • General Tender                    | April 2014                          |
| • Construction                      | April-October 2014                  |
| • Occupancy                         | January 2015                        |

**FINANCIAL IMPLICATIONS:**

The overall cost of the project, as well as the delineation of amounts derived from the various sources of funds, will be considered in the *in camera* session of the meeting (a separate cover sheet has been provided to members).

**RECOMMENDATION:**

Be It Confirmed

1. THAT the Project Planning Committee Report for the Renovation of Biology Undergraduate Teaching Laboratories at the University of Toronto Mississauga, dated November 1, 2013, be approved in principle; and
2. THAT the total project scope of approximately 598 gross square meters (approximately 598 nasm), be approved in principle, to be fully funded from Capital Reserves derived from the UTM Operating Budget.

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**DOCUMENTATION PROVIDED:**

- Project Planning Report for the Renovation of Biology Undergraduate Teaching Laboratories at the University of Toronto Mississauga.
- Report Number 2 of the University of Toronto Mississauga Campus Council – December 9, 2013 (see Item 9(d) of the February 12, 2014 Executive Committee meeting package)

**PROJECT PLANNING REPORT FOR THE  
RENOVATION OF BIOLOGY  
UNDERGRADUATE TEACHING  
LABORATORIES AT UTM**

**Phase 4 (2<sup>nd</sup> floor)**

November 1, 2013

Facilities Management & Planning, University of Toronto Mississauga

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## I. EXECUTIVE SUMMARY

In June, 2011, the Ontario government announced capital funding estimated at \$17.5 million for the Renovation of Undergraduate Teaching Laboratories at the University of Toronto Mississauga (UTM). This funding was part of a larger capital funding package of \$52.5 million that was to provide about 70% of the cost of both the teaching laboratories and Phase 1 of the North Building re-construction. That funding enabled UTM to undertake a multi-year renewal program of its teaching laboratories with the first construction beginning in 2012.

UTM's first science laboratories were built almost 40 years ago and are outdated and inefficient. The renovation is essential to maximize the utilization of the existing infrastructure, to support increased numbers of undergraduate, research-based master's and doctoral graduate programs, and provide the updated laboratory setting needed to support today's scientific teaching and research. An external review of the Department of Biology done in November 2010 and pointed out the need for significant attention to be paid to the upgrading of the teaching laboratories; issues related to both the quality and capacity of the existing laboratories.

The proposed renovations of the undergraduate laboratories in the W.G. Davis Building will take place over four years (2012-2016) in order to take advantage of the summer semester construction window and to allow for coordination with other capital projects that are planned for the UTM campus. The following phases are completed or anticipated.

- Phase 1 - Biology teaching laboratory renovation 4<sup>th</sup> floor (completed in August 2012)
- Phase 2 - Anthropology teaching laboratory renovation 2<sup>nd</sup> floor (completed in August 2012)
- Phase 3 - Chemistry teaching laboratory renovation 3<sup>rd</sup> floor (completed in August 2013)
- Phase 6 - Physics teaching laboratory renovation (currently under construction)
- Phase 4 - Biology undergraduate teaching laboratory renovations and relocation from the 1<sup>st</sup> to the 2<sup>nd</sup> floor  
(this project planning report )

Upcoming and concluding phases:

- Phase 5 - Teaching laboratory renovations 2<sup>nd</sup> floor West side (Summer 2015)
- Phase 7 - Research laboratory renovations - secondary effects (Summer 2016)

This proposed project will renovate the second level of the William G. Davis Building, Block D, recently vacated by the Chemical and Physical Sciences Department, creating two large teaching labs that will accommodate all first year biology classes, one preparation room and a technician's office.

The Biology department continues to refine its academic and strategic plans to support growth in enrolment as well as the expansion of lab-based courses. Experiential learning is a top academic priority and the department plans to reduce group sizes, increase the opportunity for hands-on experience and re-introduce laboratory experiments to courses. This re-design and investment in our space will support the expected change in pedagogical techniques.

This renovation project focuses on improving the functionality and quality of the existing Biology teaching laboratories and is the second step in addressing two of the challenges that face the discipline: laboratory specialization, and increasing course demands.

The proposed schedule is based on advanced planning to allow for major construction to commence April 2014 after classes finish. It is hoped that portions of the work, mainly non-disruptive elements, will be performed in advance of that date (possibly March 2014) with a project completion date of January 1, 2015.

The estimated Total Project Cost for this project will be funded from Capital Reserves derived from the UTM Operating Budget. While the government funds provide about 70% of the total cost of the consolidated projects, individual elements are actually paid from different sources depending upon the timing of the specific project and related cash requirements compared with the cashflow from the government (spread over the four years, 2012/13 to 2015/16). Marginal incremental increases in operating costs have been provided for within the UTM Operating Budget.

## **II. PROJECT BACKGROUND**

### **a) Membership**

Mr. P. Donoghue , Chief Administrative Officer, UTM  
Mr. A. Webb, Planner, Campus and Facilities Planning  
Mrs. L. Snowden, Assistant Dean, Office of the Dean  
Prof. B. Stewart, VP Research, UTM  
Prof. S. Stefanovic, Chair Department of Biology, UTM  
Prof. P. Macdonald, Chair Department of Chemical Physical Sciences, UTM  
Prof. K. Wilson, Chair Geography, UTM  
Prof. J. Sidnell, Chair Anthropology, UTM  
Mrs. C. Moon, Staff Department of Biology, UTM  
Mr. P. Goldsmith, Director, Facilities Management & Planning, UTM  
Mr. R. Peters, Facilities Management & Planning, UTM  
Ms. S. Senese, Director Information and Instructional Technology Services, UTM (in place of J.Lim)  
Ms. S. Elias, Assistant Director, Facilities Management & Planning, UTM  
Mr. T. Braukmann, Graduate student, Department of Biology, UTM  
Mr. A. Singh, Undergraduate student, Department of Biology, UTM

### **Sub-Committee Membership**

Prof. B. Stewart, VP Research, UTM  
Prof. S. Stefanovic, Chair Department of Biology, UTM  
Mr. C. Richter, Department of Biology, UTM  
Ms. F. Rawle, Department of Biology, UTM  
Ms. C. Moon, Staff Department of Biology, UTM  
Ms. C. Bouilly, Staff Department of Biology, UTM  
Ms. L. Cheung, Staff Department of Biology, UTM  
Ms. S. Elias, Assistant Director, Facilities Management & Planning, UTM  
Ms. N. Dourbalova, Facilities Planner, Facilities Management & Planning, UTM  
Mr. T. Braukmann, Graduate student, Department of Biology, UTM  
Mr. A. Singh, Undergraduate student, Department of Biology, UTM



## **b) Background Information**

The University of Toronto Mississauga's first science laboratories were built almost 40 years ago and are severely outdated. The laboratories have inefficient layouts and do not provide the flexibility that is required to accommodate the flow-through of larger numbers of students, or the requirements of current technology. Renovation to a substantial part of the William G. Davis Building Block D is needed to accommodate our teaching and research laboratories. This is essential to maximize the utilization of the existing infrastructure in order to support the growth in numbers of the undergraduate, research-based master's as well as the doctoral graduate programs.

In order to successfully provide for the required growth and support, certain planning factors, such as adjacencies or the re-stacking of elements, are necessary in order to reach the final goal.

The William G. Davis Building D-block accommodates several research laboratories. These will be moved to the lower level, a location away from the main pedestrian traffic, which will better suit the type of sophisticated and sensitive research that is undertaken. The upper levels of the D-block will be dedicated to teaching laboratories. The renovation process of the D-block started in the summer of 2011 with the renovation of the Chemistry Teaching Laboratories. This renovation created two (2) large teaching labs for the first and second year chemistry courses, a renovation which contained a significant number of fume hoods. The renovation of the Biology Teaching Laboratory located on the 4th floor and the renovation of the Anthropology Teaching Laboratory located on the 2nd floor were both completed in the summer of 2012. The 3rd floor renovations of both Chemistry and Physics Teaching Laboratories were scheduled for the summer of 2013; Chemistry is complete and Physics will be done by the end of November.

## **c) Statement of Academic Plan**

It is expected that in the next century, biologists will be the scientific leaders using discovery-based science to tackle some of the world's greatest challenges. To support progress in this area, exemplary education of the next generation of scientists in the contemporary field of biology is of vital importance. The University of Toronto Mississauga Department of Biology is therefore engaged in a broad range of scholarly activity across the discipline while engaging its students in learning through discovery.

In recent years the department has expanded significantly and is one of the largest disciplines on the UTM campus. In 2002/03 there were ~1600 FCE students in Biology courses and there are now 3800 FCE students. The department likewise offers programs that are in high demand. In 2012/13 there were over 307 students enrolled in Biology Specialist Programs and over 834 in Biology Major Programs. (*source: Department of Biology Self-Study 2013*). In the 2012/13 academic year, Biology offered 16 courses with practical sections that will serve over 2,792 students.

Like other sciences, education in biology requires students to acquire knowledge and learn methods to develop new knowledge. Science is a process that requires intellectual and technical skills that must be practiced. As such, growth in student numbers has placed strains on the academic programming of the department. Biology has always valued experiential learning, and an effective venue for such learning is a laboratory-based course. The department has re-organized its programs to preserve this method of teaching in spite of increased enrolment numbers. However, sacrifices have been made that include reducing the total number of hours students are in the laboratory (such as taking labs on a bi-weekly rather than weekly basis), increasing group sizes within courses, and cancelling some lab-based courses altogether.

The department continues to refine its academic and strategic plans. It is reasonable to expect that expansion and improvement of lab-based courses, and experiential learning in general, will continue to be a top academic priority of the department. Indeed, Biology plans to reduce group sizes, increase the opportunity for hands-on experience and re-introduce laboratories to courses for which the laboratory component had been removed. Investment in the physical structure will allow UTM Biology to improve its pedagogical techniques, as well as use its space most efficiently to deliver an effective educational experience to its students.

## **d) Space Requirements**

### **Overview of Existing Space**

UTM Biology has a total of nine teaching laboratories comprising of 1,502 nasm supported by 478 nasm of preparation rooms, greenhouse, environmental chambers and storage space. The total area of teaching laboratories (COU Category 2) is 1,980 nasm, spread across several floors of the William G. Davis Building. The first year laboratories are currently located on the 1<sup>st</sup> floor and the remaining teaching laboratories are located on the 4<sup>th</sup> floor (the latter renovated in 2012).

This project, (Phase 4) of the UTM Teaching Laboratory renovation will affect only the 1<sup>st</sup> floor Biology teaching laboratories and their associated preparation rooms, totaling 557 nasm. During this project, those teaching laboratories will be relocated from the 1<sup>st</sup> to the 2<sup>nd</sup> floor of the William G. Davis Building. This move will allow Biology teaching laboratories to be located in a busy 2<sup>nd</sup> floor area thus vacating relatively quiet serviced space on the 1<sup>st</sup> floor for future research laboratory development.

### **Occupant Profile**

The occupants of the newly renovated teaching laboratories will be UTM Biology faculty, staff, teaching assistants and 1<sup>st</sup> year students. With Biology forming one of the three foundational scientific disciplines, along with Chemistry and Physics, the range of scientific activities covered by the discipline is broad and diverse. Such activities will range from investigating the function of single molecules and genes through to the study of whole organisms. In addition to generating foundational knowledge, Biology is closely linked to related disciplines in the health, environmental, and social sciences. Biologists are therefore at the forefront of addressing problems such as climate changes, loss of species biodiversity, food production, and human health. These issues touch on many disciplines and also have political, economic and cultural components.

A significant challenge that educators face is offering students a breadth of Biology-related experience; a challenge that is reflected in the demands placed upon teaching laboratories. The curriculum of most biology departments is planned along sub-disciplinary lines and this has a direct impact on the requirements of the physical laboratory space where much of the hands-on experiential learning occurs.

The first year Biology laboratories and support spaces have specific needs for hands on applications, teaching, preparation and storage space. Biologists have typical laboratory equipment needs such as different types of microscopes, microscope cameras, aquaria, dissection tools and microbiological equipment. It is important to have the equipment and services to grow and maintain a variety living organisms under different conditions. This will be achieved using specially constructed growth facilities adaptable to different growth requirement for both plants and invertebrate organisms. These services will allow technicians to grow and maintain plants and animals in the quantities necessary for the large first year classes. In addition, the first year labs in biology will require particular display cabinets for of a wide variety of invaluable and fragile biological specimens. The goal is to be able to create an environment that effectively brings biology into view within the new lab space and expose students to the wide breath of diversity of living organisms on the planet.

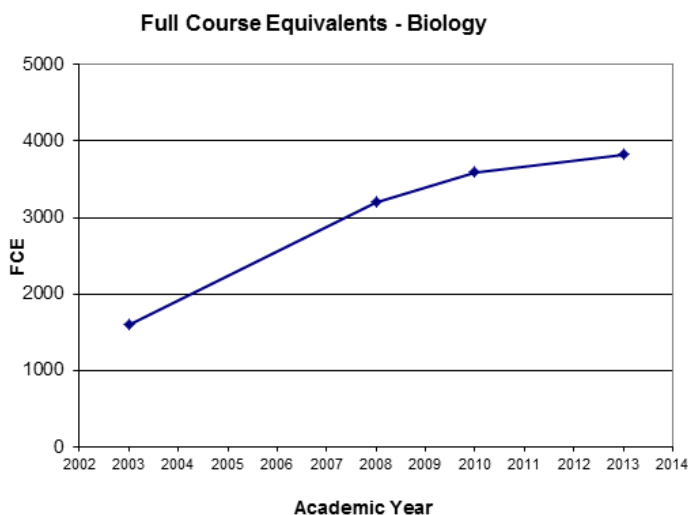
Storage space is required not only for live materials and samples but also for archival collections to ensure proper care and maintenance of those samples. Refrigerators, freezers and incubators are also

an essential component of storing and maintaining student material. Support spaces equipped with adequate bench preparation surfaces, storage, specialized microscopes and Biosafety equipment are required for preparation of lab materials for the first year Biology courses.

A further space-related challenge for the department is the increasing popularity of the program. The department is therefore faced with the challenge of finite laboratory space and the specialization of rooms versus an increasing demand for courses featuring laboratory components. The overall student population has also grown substantially.

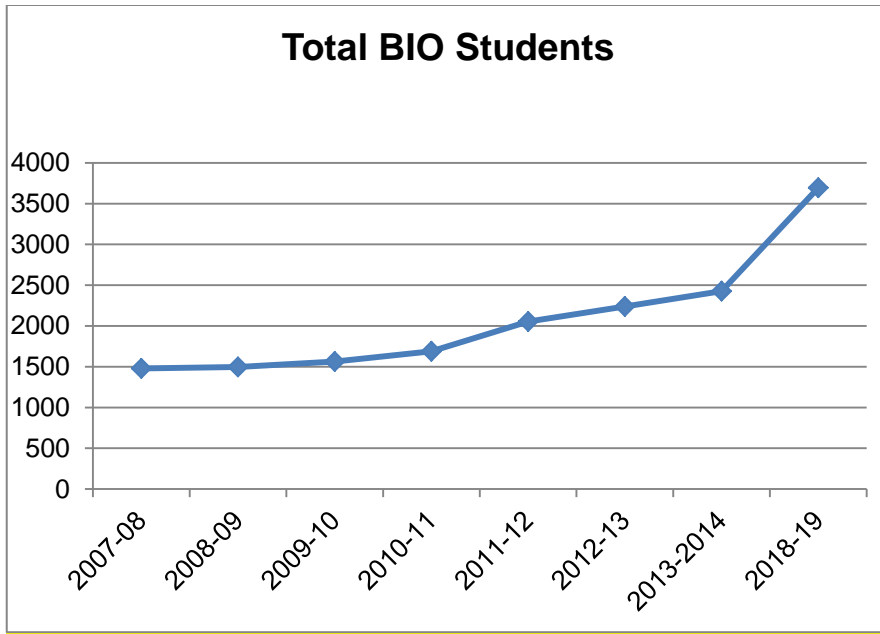
### Enrollment growth

In recent years, the Department of Biology has expanded significantly and is one of the largest disciplines on the UTM campus. In 2002/03 there were ~1600 FCE students in Biology courses and by 2009/10 there were almost 3800 FCE students (*source: UTM Dean's Office*). By 2013, that count had increased to 3825 FCE students.



As noted above, the department likewise offers programs that are in high demand. In comparison to other science departments, Biology has the greatest total number of graduating students and more than 4 times the number of Specialist graduating students compared to any other science departments at UTM.

The number of students enrolled in Biology courses grew from just under 1500 in 2007/08 to more than 2400 in 2013/14 with significant acceleration in that growth beginning in 2011/12 increases. Over the next five-year period, (note the scale shift in the graph below), by 2018/19 that total is conservatively estimated to reach just under 3700. The renovation of the 4th floor Biology teaching laboratories (2012) significantly improved the teaching experience for upper year students. This proposed renovation will follow through with the plan and not only dramatically transform the 1st year laboratories, but provide teaching laboratories that will be able to absorb the overall growth expectations in Biology.



#### Weekly Student Contact Hours

The following tables indicate the Weekly Student Contact Hours (WSCH) generated by student enrolments for each Biology course with a teaching laboratory component (practical hours) for the Fall 2012. Combined with COU space guideline of 0.6nasm per WSCH the total COU recommended area was calculated and compared to the proposed.

**Table #1 – Existing Biology Teaching Laboratory Courses, Fall 2012**

<b>TEACHING LABS</b>					
<b>Course</b>	<b>Enrolment Fall 2012</b>	<b>Practical Hours / Week</b>	<b>WSCH</b>	<b>COU Space Factor</b>	<b>NASM Generated</b>
BIO 152	768	1.5	1,152	0.6	691.2
BIO 204	306	1.5	459	0.6	275.4
BIO 313	24	3	72	0.6	43.2
BIO 314	132	4	528	0.6	316.8
BIO 318	48	3	144	0.6	86.4
BIO 333	24	1.5	36	0.6	21.6
BIO 335	24	3	72	0.6	43.2
BIO 338	39	3	117	0.6	70.2
BIO 354	93	3	279	0.6	167.4
BIO 370	72	3	216	0.6	129.6
FSC 300	23	2	46	0.6	27.6
<b>Total</b>	<b>1,553</b>	<b>28.5</b>	<b>3121</b>	<b>0.6</b>	<b>1872.7</b>

Average WSCH per enrolled student = 2.0

The first year instruction consists of BIO152 in the Fall and BIO153 in the Spring term (enrolment numbers in those two courses are very balanced between Fall and Spring, as is the overall teaching load in the department). As noted in Table #1 above, BIO152 had enrollment of 768 students in 2012. That has grown to 816 in 2013, and is expected to reach 960 students in 2014. This number will further increase with planned campus wide enrollment increase and the specific enrolment growth expected in Biology as noted previously.

The table above illustrates the COU generated space for all Biology courses using November 1, 2012 data; 1872.7 nasm. If we then use the predicted enrollment of 960 students in BIO152 in 2014 when the laboratories become operational, COU generates 864nasm of laboratory space. This is significantly more than the actual space now available for the biology 1st year laboratories (565nasm) or that which will be available through this project (598nasm).

### **Laboratory Schedules**

The laboratories are and will be used over 24 hours per week. Traditionally mornings are dedicated to lectures and afternoons to laboratories. Evening lab sessions are being introduced to accommodate scheduling conflicts and increasing number of students.

**BIO152 Lab Organization - Fall 2014**

		<b>Afternoon A</b>	<b># students</b>	<b>Afternoon B</b>	<b># students</b>	<b>Evening</b>	<b># students</b>
<b>Monday</b>	Lab Bay 1&2	1:00-3:00	2x24	3:00-5:00	2x24		
	Lab Bay 3&4	1:00-3:00	2x24	3:00-5:00	2x24		
<b>Tuesday</b>	Lab Bay 1&2	1:00-3:00	2x24	3:00-5:00	24	6:00-8:00	24
	Lab Bay 3&4	1:00-3:00	2x24	3:00-5:00	2x24		
<b>Wednesday</b>	Lab Bay 1&2	1:00-3:00	2x24	3:00-5:00	2x24		
	Lab Bay 3&4	1:00-3:00	2x24	3:00-5:00	2x24		
<b>Thursday</b>	Lab Bay 1&2	1:00-3:00	2x24	3:00-5:00	24	6:00-8:00	24
	Lab Bay 3&4	1:00-3:00	2x24	3:00-5:00	2x24		
<b>Friday</b>	Lab Bay 1&2	1:00-3:00	2x24	3:00-5:00	2x24		
	Lab Bay 3&4	1:00-3:00	2x24	3:00-5:00	2x24		

Total students every week: 960 anticipated (1000 capacity)

Lab Bay 1&2 will be in use for student scheduled activities minimum of 24 hours

The proposed renovation will use relatively small footprint of student stations. This decision was made to accommodate teaching of four sessions of 24 students. As noted earlier, the growth in demand for Biology courses and the associated enrollment is conservatively expected to grow by at least 5% year over year for the next five-year period. With the completion of this project, teaching laboratory space will be fixed at significantly less than that generated by current COU standards. The laboratory is being designed (as was the upper year teaching laboratory done in 2012) to maximize efficiency and enable optimal throughput/utilization. The combination of increasing enrolment and fixed space will significantly impact utilization.

### **III. PROJECT DESCRIPTION**

#### **a) Vision Statement**

The Department of Biology envisions its students receiving a first-class, contemporary education that reflects the modern field of biology. The expectation is that all students will understand the scientific methods required to advance knowledge, that they will develop the capacity to critically evaluate the world around them, and that some of them will go on to become the next generation biologists. To achieve this vision, students need access to state-of-the-art laboratories equipped with technology and equipment that will enable the latest pedagogical approaches to biology education.

The following are key elements to the vision for new biology laboratories:

- Create a laboratory layout within the building footprint that encourages efficient use of available space by students, staff, instructors and teaching assistants;
- Provide internet-capable workstations at student work areas to enable electronic lab protocols, e-data collection and submission of work;
- Create an environment that promotes teamwork, collaboration and creativity among students, staff and faculty;
- Combine large open spaces for some classroom activities alongside smaller more intimate settings. Consistency in design, technology, furniture and equipment between labs will facilitate flexibility in scheduling and increase room use efficiency;
- Create attractive, welcoming spaces that are ergonomically designed to enable the maximum numbers of students to flow through the space with minimal effort;
- Reclaim natural lighting to the laboratories wherever possible.

Incorporation of these elements into the overall laboratory design will transform the UTM Biology laboratory-based education by creating efficient, attractive space in combination with technology that promotes teamwork and collaboration. To fully achieve the department's educational vision, a joint effort between Biology, Facilities Management & Planning, the Registrar's Office, and Information and Instructional Technology Services is required to implement not only the physical revitalization of the building but also to maintain the space, schedule and timetable the occupation of the labs for its most efficient use.

This vision also recognizes that scholarship at UTM encompasses both teaching and research as inseparable activities. As such, every effort will be made during the planning and construction process to acknowledge that the W.G. Davis Building is an active research environment. The proposed renovations have the potential to significantly disrupt research, so proper redundancy and contingency planning to protect research will take place in parallel with renovation design and implementation.

#### **b) Space Program & Functional Plan**

The proposed space program allocation of 598 nasm, including the laboratory technician's office (33 nasm) on the 2<sup>nd</sup> floor, represents approximately the same area compared to the existing allocation 557 nasm of 1<sup>st</sup> floor teaching laboratories.

The renovation will provide teaching efficiencies by creating two 48-seat laboratories. This allows flexibility in the scheduling of larger class sections as well as the option of splitting the sections into smaller groups (12 to 24 students). Larger classes are frequently perceived as one of the main barriers to quality learning, and there are many studies that point to the challenges of teaching large classes.

Often overcrowded and noisy laboratories offer a poor learning environment. Small stations with a total of 48 students were recommended as an appropriate number for first year students.

The technology incorporated into the laboratory will include computers at each teaching station, direct visual access to a central demonstration counter, and audio-visual teaching presentation stations.

This flexible design offers many advantages, including the active engagement of students in projects of their own choosing, individualized instruction, as well as frequent opportunities for formative assessment by the instructors if necessary. The teaching assistants may also confer with individuals and small groups under this setting either at the student benches, at the instructional area or at moveable tables specifically designed for small group discussions. This approach permits students to also learn many valuable social skills in the spirit of collaboration and cooperation.

The plan proposes a central preparation space, versus the current model of several small preparation rooms. It is expected that this will create space efficiencies and reduce the distance and travel time between preparation space and teaching laboratories. The central preparation space will allow for shared equipment, materials, and document resources thus creating further operational efficiencies for the department. Perhaps most important, a central preparation room will allow for sharing of information and the fostering of community and cooperation among the various technical and academic staff using these spaces.

All of these elements were used and have been experienced in the first Biology teaching laboratory renovation that was completed in 2012.

The new lab design will seamlessly allow for an increase in student enrolment in the first year lab courses and enable the department to efficiently schedule an increased number of labs sessions in the newly designed space.

### UTM Biology Teaching Laboratory Space Program

<b>SPACE USE</b>	<b>CAPACITY</b>	<b>SPACE PROGRAM (NASM)</b>
<b>Undergraduate Teaching Laboratories</b>		
Laboratory #1	48	225
Laboratory #2	48	225
<b>Sub-total</b>	<b>96</b>	<b>450</b>
<b>Laboratory Support Spaces</b>		
Main Laboratory Preparation Room	5	115
<b>Sub-total</b>	<b>5</b>	<b>115</b>
<b>Lab Related Academic Office Space</b>		
Lab Technician Office	2	33
<b>Sub-total</b>	<b>2</b>	<b>33</b>
<b>Grand Total</b>		<b>598</b>







## c) **Building Considerations**

### **Accessibility**

The University of Toronto is committed to ensuring that its buildings and services are accessible to persons with disabilities and requires all consultants to adhere to University's Barrier Free Design Standards.

The laboratory will provide an accessible layout (min 5ft wide isles), no dead end corridors, door operators on main entry doors, access to a barrier-free student station in each teaching laboratory, and electronic teaching podium with voice support and data integration.

### **Safety and Security**

Access to the 2<sup>nd</sup> floor Biology teaching laboratories will be controlled by electronic card system. The doors to the preparation room, technician's offices and between the laboratories will be controlled by mechanical keys. These keys will be distributed to the laboratory technicians only.

All laboratory furniture storage areas are to be lockable to control access to stored apparatus.

### **Computing**

The proposed laboratory will have computer stations integrated throughout the room allowing students to access laboratory materials, course information, and to share experimental data and submit laboratory reports.

Computing and communications will utilize the network already available in the W.G. Davis Building. The laboratory will have several dedicated data ports for presentation areas in addition to a wireless environment throughout all of the laboratories.

## d) **Site Considerations**

### **Campus Planning**

UTM accommodates its academic activities in several buildings across campus. The W.G. Davis Building provides wet laboratories required for teaching and research activities of the physical and life sciences. The North Building Reconstruction and UTM Innovation Complex, both under construction, will provide urgently needed space for academic offices, dry laboratories and classrooms. However, at the present time there is no funded plan to create science expansion, so, the modernization and renovation of the existing serviced space in the W.G. Davis Building for research and teaching laboratories continues to be accorded a high priority.

## **e) Campus Infrastructure Considerations**

The 2011 modernization of the “D Wing” HVAC, Building Automation System, Mechanical and Electrical infrastructure addressed the major shortcomings of that portion of the W. G. Davis Building. The changes in infrastructure have allowed greater environment control while enhancing the safety of HVAC operation particularly fume hood activities.

The required infrastructure and services for the operation of the renovated laboratories are available within the existing W.G. Davis Building providing a foundation for modernization.

The complexity of modern teaching labs has increased operational requirements. The increased ventilation brought on by fume hood requirements has resulted in greater consumption of energy both electricity and natural gas. The installation of high performance fume hoods has allowed UTM to pursue energy savings propositions that were previously not possible from the original HVAC design.

The building’s compressed air system is already servicing existing teaching laboratories. While the compressed air is not of instrument grade quality, it is adequate for Biology teaching requirements.

## **f) Environmental Impact – Construction/Renovation**

Design and construction must be carried out in accordance with all applicable environmental, health and safety legislation and University of Toronto policies and standards.

Older equipment suspected of containing Polychlorinated Biphenyls (PCBs) materials, being removed from laboratories during decommissioning, must be carefully screened for PCBs. The current lighting, fluorescent lighting ballasts may contain PCBs, which are heavily regulated substances under the Canadian Environmental Protection Act. Proper disposal procedures for PCB ballasts must be followed.

The benefits of a lighting retrofit to include the removal of PCBs and replacing them with energy efficient lighting fixtures with ballasts that do not include PCBs or other highly regulated materials. In addition, through a lighting retrofit, the laboratory will reduce energy consumption, and the generation of waste from lamp replacement, due to the much longer lifetime of the proposed lighting retrofits.

Designated substances (e.g. asbestos, lead, silica, mercury, etc.) are materials that, due to the known risks associated with exposure, handling, or storage, are strictly regulated under the Occupational Health and Safety Act. Under the Act, before beginning a project, an assessment shall be conducted to determine whether any designated substances are present at the project site.

Wherever possible, the remediation of any identified designated substances shall be performed in accordance with applicable regulations, prior to any construction and/or renovation activities.

Proper disposal of all designated substances and hazardous materials must be done in accordance with applicable regulations to prevent any environmental impact during waste disposal.

### **g) Environmental Impact – Laboratory Operation**

The proposed renovation addresses this recommendation and the following specific objectives as outlined in the University of Toronto Environmental Protection Policy:

#### Fundamental Principles

- Meet and where possible exceed environmental standards, regulation, and guidelines.
- Meet and where reasonably possible, exceed compliance with applicable federal, provincial and local environmental regulations and other requirements to which the University subscribes.
- Operate so as to minimize any negative impacts on the environment.
- Adopt practices that reflect the conservation and wise use of natural resources.
- Respect biodiversity.

#### Specific Objectives

- Minimize the use of energy, water and other resources, through efficient design, management and practice.
- Minimize waste generation and actively manage the impact of waste, emissions, & effluents generated by University activities.
- Minimize the use of chemicals and toxic substances to reduce environmental exposure and chemical wastes.
- Minimize noise and odour pollution from University activities.
- Manage the use of hazardous substances in accordance with regulatory requirements and established environmental practices, including scientific research practices.
- Promote sustainable use of materials and resources to reduce negative environmental impacts, while encouraging waste minimization.
- Include biodiversity and environmental concerns in planning and landscape decisions and minimize negative impacts of University activities on biodiversity and natural spaces.

### **h) Environmental Impact – Waste Management**

The University is committed to being a positive and creative force in the protection of the local and global environment through its teaching, research, and administrative environments. It also recognizes that it and all members of the University community have the responsibility to act in ways consistent with its fundamental principles of minimizing negative impacts on the environment, and human health, and the conservation and wise use of natural resources.

### **i) Secondary Effects**

No significant secondary effects are associated with this project. Construction will be scheduled to occur primarily over the summer and fall months of 2014.

### **j) Staging**

No staging will be required for this project, as the space to be renovated was recently vacated by the Department of Chemical and Physical Sciences.

## **k) Phasing**

The renovations of the undergraduate laboratories in the William G. Davis Building will take place from 2012 to 2016. This approach allows us to take advantage of the summer semester construction window and allow also for coordination with other capital projects that are planned for the UTM campus:

- Phase 1 - Biology teaching laboratory renovation 4<sup>th</sup> floor (completed in August 2012 )
- Phase 2 - Anthropology teaching laboratory renovation 2<sup>nd</sup> floor (completed in August 2012)
- Phase 3 - Chemistry teaching laboratory renovation 3<sup>rd</sup> floor (completed in August 2013)
- Phase 6 - Physics teaching laboratory renovation (currently under construction)
- Phase 4 - Biology undergraduate teaching laboratory renovations including relocation from the 1<sup>st</sup> to the 2<sup>nd</sup> floor  
(this project planning report )

Upcoming and concluding phases:

- Phase 5 - Teaching laboratory renovations 2<sup>nd</sup> floor West side (Summer 2015)
- Phase 7 - Research laboratory renovations - secondary effects (Summer 2016)

## **l) Schedule**

The proposed UTM Teaching Laboratory Renovation - Phase 4 (Biology 2<sup>nd</sup> floor) will take place between April 1 and January 1, 2015 .

Biology will make provisions to maximize the construction window by allowing decontamination and subsequent demolition to begin as early as possible (potentially the end of March 2014).

UofT and UTM governance approvals	November 2013 to February 27, 2014
Laboratory Bench/Fume Hood Tender	March 2014
Permit Application	February 2014
Advance/Preparatory work	April 2014
General Tender	April 2014
Construction	April- December 2014
Occupancy	January 2015

The proposed schedule is based on advanced planning to allow for construction to commence in April immediately after classes finish. Preparatory work such as the abatement and demolition of these laboratories will likely proceed in March since the space will not be occupied. Careful coordination will be required to ensure that the early work does not have a negative impact on other users of the W.G. Davis Building D-block.

## IV. RESOURCE IMPLICATIONS

### a) Total Project Cost

The total estimated cost of the project includes estimates or allowances for the following items:

- construction cost (propose construction management as it was successfully used for other phases of the project)
- contingencies
- taxes
- hazardous waste removal
- secondary effects
- demolition
- permits and insurance
- professional fees
- moving, staging
- furniture and equipment (to accommodate new teaching methods)
- computer and telephone terminations
- security (combination of electronic card access and hard keys)
- commissioning

### **Equipment and Furniture Cost**

This renovation will include an allowance for new equipment required for the new space to accommodate new experiment and changes in the course curriculum. Appendix C, 'Equipment List (available on request), includes a full list of existing and new equipment, as well as furniture required for the project.

### b) Operating Cost

We foresee that the cost of utilities in the renovated area will be reduced or remain the same because the number of Fume Hoods will be reduced and modern electronic BAS system such as Aircuity (used on the 4<sup>th</sup> floor) will be used to ventilate the room in a safe and efficient manner.

Due to the increased usage of these laboratories, it will be necessary to allow for increased cleaning costs associated with the maintenance of these areas. It is anticipated that these costs will increase from their current level of \$ 25,300 per annum to approximately \$ 43,300 per annum. Provision has been made within the UTM Operating Budget to cover these costs.

### c) Funding Sources

Phase 4 will be funded from Capital Reserves derived from the UTM Operating Budget.

## **V. RECOMMENDATIONS**

Be It Recommended to the Academic Board:

1. THAT the Project Planning Committee Report for the Renovation of Biology Undergraduate Teaching laboratories at the University of Toronto Mississauga, dated November 1, 2013, be approved in principle; and.
2. THAT the total project scope of approximately 598 gross square meters (approximately 598 nasm), be approved in principle, to be fully funded from Capital Reserves derived from the UTM Operating Budget.



## **APPENDICES**

- Appendix A: Existing Space Inventory
- Appendix B: Room Specification Sheets (available on request)
- Appendix C: Equipment List (available on request)
- Appendix D: Total Project Cost
- Appendix E: Environmental Checklist (available on request)

## **APPENDIX A: EXISTING SPACE INVENTORY**

The following table summarizes the space inventory affected by the proposed renovation

**Table – Existing UTM Biology Teaching Laboratory Space Inventory**

Flr	Rm	Cat	Cat Name	Share Type	Percent	Occ	Area (nasm)	Use Current	Proposed
1	1080	02.1	Sched Class Lab	None	100	24	120.66	BIO	unallocated
1	1082	02.1	Sched Class Lab	None	100	24	121.74	BIO	unallocated
1	1085	02.1	Sched Class Lab	None	100	24	121.74	BIO	unallocated
1	1087	02.1	Sched Class Lab	None	100	24	102.45	BIO	unallocated
4	4071	02.1	Sched Class Lab	None	100	48	219.21	BIO	BIO
4	4072	02.1	Sched Class Lab	None	100	48	219.13	BIO	BIO
4	4073	02.1	Sched Class Lab	None	100	36	157.28	BIO	BIO
4	4076	02.1	Sched Class Lab	None	100	48	220.09	BIO	BIO
4	4077	02.1	Sched Class Lab	None	100	48	219.55	BIO	BIO
							1501.85		
1	1081	02.3	Undrgr Lab Supt	None	100	0	24.30	BIO	unallocated
1	1084	02.3	Undrgr Lab Supt	None	100	0	20.67	BIO	unallocated
1	1086	02.3	Undrgr Lab Supt	None	100	0	45.63	BIO	unallocated
2	2064	02.3	Undrgr Lab Supt	None	100	0	7.83	BIO	BIO
4	4007	02.3	Undrgr Lab Supt	Space	50	0	27.41	BIO	BIO
4	4074	02.3	Undrgr Lab Supt	None	100	0	177.05	BIO	BIO
4	4074A	02.3	Undrgr Lab Supt	None	100	0	13.41	BIO	BIO
4	4088	02.3	Undrgr Lab Supt	None	100	6	10.25	BIO	BIO
5	5036	02.3	Undrgr Lab Supt	Space	75	1	21.68	BIO	BIO
5	5036B	02.3	Undrgr Lab Supt	Space	60	0	129.89	BIO	BIO
							478.12		
Category 2 Total							1,979.97		

**Table – Proposed Space for Renovation**

<b>Flr</b>	<b>Rm</b>	<b>Cat</b>	<b>Cat Name</b>	<b>Share Type</b>	<b>Percent</b>	<b>Occ</b>	<b>Area (nasm)</b>	<b>Use Current</b>	<b>Proposed</b>
2	2048	3.1	vacant	Space	100	0	84.58	unallocated	BIO
2	2048	4.3	vacant	Space	100	0	36.25	unallocated	BIO
2	2049	3.1	vacant	Space	100	0	45.63	unallocated	BIO
2	2052	2.1	vacant	Space	100	0	216.62	unallocated	BIO
2	2052A	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2052B	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2052C	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2052D	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2052E	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2052F	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2052G	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2052H	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2053	2.3	vacant	Space	100	0	30.57	unallocated	BIO
2	2053	4.4	vacant	Space	100	0	15.06	unallocated	BIO
2	2055	2.1	vacant	Space	100	0	106.4	unallocated	BIO
2	2055 A	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2055 B	2.3	vacant	Space	100	0	3.28	unallocated	BIO
2	2055C	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2055D	2.3	vacant	Space	100	0	3.15	unallocated	BIO
2	2055K	16.2	vacant	Space	100	0	24.30	unallocated	BIO
							597.99		

	<b>Use Current [nasm]</b>	<b>Proposed Use</b>	<b>Proposed [nasm]</b>
<b>Biology</b>	1423	Phase 4	598
<b>Unallocated</b>	598	Phase 7	478