# University of Toronto TORONTO ONTARIO M5S 1A1

OFFICE OF THE VICE-PROVOST, SPACE AND FACILITIES PLANNING

TO: Planning and Budget Committee

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DATE: April 1st, 2003 for April 15th, 2003

AGENDA ITEM: **#5**

**ITEM IDENTIFICATION:**

Project Committee Report to Upgrade and Renovate the Undergraduate Chemistry Laboratories within the Lash Miller Building Project.

**JURISDICTIONAL INFORMATION:**

Under the Policy on Capital Planning and Capital Projects, the Planning & Budget Committee reviews the Project Planning Report prepared for a capital project and recommends to the Academic Board approval in principle of the project.

**PREVIOUS ACTION TAKEN:**

The undergraduate laboratories in support of the first year chemistry programs have not received any substantial upgrade since the Lash Miller Building was constructed in 1961. With the substantial increase in recent years in chemistry course enrolments as well as the anticipated expansion in the in the fall of 2003, it is essential to modernize the facilities to maximize the throughput of students. It is also important to improve the laboratory experience so that students can undertake individual experiments, use micro quantities in this experimentation whilst reducing the extent of the supervision required. It is the intent to create the laboratory experience that will be at the leading edge of chemistry laboratory education.

## BACKGROUND:

These undergraduate laboratories are located on the basement, first and second stories of the Lash Miller Building at 80 St. George Street. The facilities were built in 1961 and, with the exception of two rooms, have not been updated since. Several factors necessitate the immediate renovation of three laboratories, rooms 217, 221 and 224 in time for the 2003 fall session.

The projected enrolment increases for 2003 first-year chemistry courses, as a result of the double co-hort, cannot be handled within the existing laboratories. Increased throughput in the existing facilities is not possible without significantly sacrificing safety and detracting from the overall learning experience. Furthermore, the methods for delivering the laboratory component of chemistry courses has changed over the last 40 years and the current arrangement does not facilitate updated teaching

methods. Consequently, when compared with other peer institutions, there is a loss of quality in the delivery of the programs.

The completion schedule for this project is very ambitious and every effort will be made to have the project completed in advance of the start of the fall term or as soon as is possible thereafter.

During the summer of 2003, an independent project to replace the heat exchangers and heating coils within the Lash Miller Building will be undertaken at a cost of $767,000. This project will be funded through the Facilities Renewal Fund [FRP] and will be approved by the Accommodation and Facilities Directorate [AFD]. It addresses a significant deferred maintenance item that could possibly reduce the need for an additional heat exchanger in the proposed Lash Miller laboratory upgrade being considered by the Planning and Budget Committee. The extent of these savings, if any, is estimated at $20,000 will only be established once the detailed design has been completed.

Under the Policy on Capital Planning and Capital Projects, the Project Committee will continue through the implementation phase. The Working Executive of the Project Committee will comprise the lead User, a Planner and Implementer all of whom have been intimately associated with the project definition since its inception; the Working Project Executive for the Upgrade and Renovation of the Undergraduate Chemistry Laboratories within the Lash Miller Building Project will comprise:

| | |
|---|---|
| **User:** | S. A. Mabury, Professor and Associate Chair Undergraduate Studies, Dept. of Chemistry |
| | R. de Souza, Director Planning & Facilities, Arts and Science |
| **Planner:** | E. Sisam, Director, Campus & Facilities Planning |
| **Implementer:** | J. Binks, Capital Projects, Facilities and Services |

This Working Executive will expand to include the Project Manager, George Phelphs. The role of the Working Executive is to ensure the successful completion of the project and to ensure that the user needs and concepts introduced into the Project Planning Report are addressed throughout the process of consultant selection, design and implementation which are carried out under the direction of the Chief Capital Projects Officer.

**FINANCIAL AND/OR PLANNING IMPLICATIONS:**
Funding for this project will be derived from support already received from the Ontario Government to address the increased enrolments at Ontario Universities. Financial support will also be forthcoming from the Department of Chemistry and the Faculty of Arts and Science.

The project is to address the laboratory need in support of first year chemistry courses; the total project cost to accomplish this is estimated at $5,107,787. In the years immediately ahead it will be necessary to also upgrade and redevelop the chemistry laboratories for 2nd and 3rd year chemistry course offerings. In anticipation of this need, it is recommended to include in the current approval an additional expenditure of $395,405 to address the anticipated infrastructure requirements for the 2nd and 3rd year laboratories. This additional scope of work is identified precisely on page 15 of the Project Planning Report and there are cost advantages to completing this work at this time.

The total project cost is the sum of these two components and is estimated at $5,503,192. The resource funds that have been assembled for the project amount to $5,600,000.

It is to be noted that the projected costs include significant equipment items, these are: $255,775 for audio video equipment, $750,000 for laboratory benches & fumehoods and $300,000 for laboratory

equipment, the latter item need only be purchased 30 days prior to being required in September, 2003. Given the relative magnitude of the equipment costs plus the opportunity to delay the purchase of the laboratory equipment, the renovation can proceed within the projected cost range of $5,300,00 to $5,600,000. Costs can be evaluated at that time and the equipment purchased within the planned projected cost of $5,503,192.

Furthermore, it should be noted that the projected prices for the renovation are reasonably firm since extensive renovation of infrastructure services were completed within the Lash Miller / Davenport Building in 1999. All savings on this project, including the full contingency, are to be directed to additional space improvements planned for the Sidney Smith Patio redevelopment patio to create additional student study space.

**RECOMMENDATION:**
The Planning & Budget Committee recommends to the Academic Board

1. THAT the Project Planning Report to Upgrade and Renovate the Undergraduate Chemistry Laboratories within the Lash Miller Building be approved in principle.

2. THAT the project scope to upgrade and renovate the undergraduate chemistry laboratories within the Lash Miller Building be approved at an estimated total project cost of $5,300,000 to $5,600,000 with funding as follows:

    (i) Contribution of $4,000,000 from approved growth enrolment funds to be allocated by the University of Toronto towards this project.

    (ii) Contribution of $700,000 from the Department of Chemistry, and

    (iii) Contribution of $900,000 from the Faculty of Arts and Science

# PROJECT PLANNING REPORT
# FOR THE DEPARTMENT OF CHEMISTRY
# UNDERGRADUATE WING RENOVATION
# 80 St. George Street

**10 April 2003**

25965

## TABLE OF CONTENTS



## APPENDICES

## EXECUTIVE SUMMARY

Undergraduate laboratories are located on the basement, first and second storeys of the Lash Miller Building at 80 St. George Street. These facilities were built in 1961 and, with the exception of two rooms, have not been updated since.

Several factors necessitate the immediate renovation of three of these laboratories in time for the 2003 Fall session. The remaining labs (second and third year laboratories) are planned to be renovated within the following year (Phase II).

Firstly, the projected enrolment increase for 2003 first-year chemistry courses due to the double cohort, cannot be handled within the existing laboratories. While the lecture sections can accommodate additional students, the laboratory sections have reached available capacity. As this enrolment advances, there will be increased pressure on facilities for upper year courses.

Secondly, the lab capacity as built, has been diminished by as much as 50% due to increased health and safety awareness, building codes, and current legislation. Quite simply, increasing throughput in the existing facilities is not possible without significantly sacrificing safety and detracting from the overall learning experience.

Thirdly, the current locations for teaching staff are largely inaccessible to students as they are situated behind laboratories throughout the building. Accessibility to teaching staff is considered key to enriching the learning experience for students.

Lastly, methods for delivering the lab portion of chemistry courses have changed over the last 40 years and the current arrangement does not facilitate updated teaching methods. Consequently, compared with other peer institutions there is a loss of quality in delivering the programmes.

To accommodate 2003 enrolment, renovations must be made to three, second-floor first-year laboratories (Phase 1). To accommodate this same enrolment, and future projected increases due to other demographics, renovations must be made to remaining labs for upper year laboratories (Phase II). The report that follows addresses Phase I renovations.

## I. Membership

Stu Whittington, (Interim Chair), Professor and Chair, Department of Chemistry
S. A. Mabury, Professor and Associate Chair Undergraduate Studies, Department of Chemistry
Adrienne De Francesco, Building Program Manager, Department of Chemistry
Ray deSouza, Director, Planning & Infrastructure, Arts and Science
George Phelps, Project Manager, Capital Projects Office
Helen Ohorodnyk, Lecturer, Department of Chemistry
Cecilia Kutas, Lecturer, Department of Chemistry
Francis Panosyan, Graduate student, Department of Chemistry.

In addition, the following were consulted on various components of the project:
Paul Ruppert, Director, Technology, Faculty of Arts and Science
Geoffrey Chin, Planner, Faculty of Arts and Science

## II. Terms of Reference

1. Determine a space program for the undergraduate facilities for the Department of Chemistry which will accommodate enrolment increases, current health and safety standards and flexible teaching methods, at 80 St. George Street.
2. Demonstrate that the proposed space program will take into account the Council of Ontario Universities and the University's own space standards.
3. Plan to realize maximum flexibility of space to permit future allocations as program needs change.
4. Identify the capital cost of construction, any renovations, data and communications requirements and the cost of equipment and furnishings.
5. Identify any costs associated with the transition during construction and secondary effects resulting from construction of this project.
6. Identify all proposed sources of funding.
7. Report by February 1, 2003.

## III. Background Information

The 4-storey Davenport Building (plus basement and penthouse) at 70 St. George Street, intersects the 6-storey Lash Miller building (plus basement and penthouse). The top two floors of the Davenport Building were constructed in October 2000 and house research labs. The remaining lower level floors house teaching labs. This part of the building was constructed in 1961.

With the exception of two rooms (LM9 and LM3), the three levels of teaching labs have not been updated since the building first opened.

In 1997, LM9 was renovated to be the premier teaching and research instrument lab for environmental analytical science in North America by providing access to state of the art instrumentation. The room was constructed to house $1.1M of equipment and today has $1.3M of equipment. The renovations and equipment were funded through the following sources: $120K from the Dean's Office, Arts & Science; $100K from the Dean's Office, Applied Science and Engineering; $120K from the Vice-President, Research and International Relations; $50K from the Departments of Zoology, Botany, Geography and Geology; and $250K (plus large equipment discounts) from Perkin Elmer.

Prior to 1999, the U/G Computing Lab was located in LM3. This had been a teaching lab that had been hastily converted from wet lab space to workstations. In 1999, LM119 was renovated to accommodate a classroom setting with 45 computer workstations; the facility in LM3 was relocated to this new space. Funding for this renovation came from the Davenport gift.

## IV. Academic Plan

### a. Statement of Academic Plan

The Department of Chemistry has a long and illustrious history dating back to the earliest years of the University of Toronto. Over the last 10 years Chemistry has achieved a level of excellence and influence that clearly places it first in Canada competitive with the very best chemistry departments in the world.

This recent success has been achieved through: 1) a significant renewal of Chemistry with 20 'new' faculty hires; 2) a complete overhaul of the departments research infrastructure with addition of the Davenport building and renovation of research labs in Lash Miller; 3) improved departmental administration and support; and 4) significant department-based development efforts. Further, a very thorough renewal of the lecture portion of the undergraduate offerings has been implemented covering the first two years of the program. Combining these changes with the decision to place the very best teachers in these courses has resulted in more positive student reviews and rapidly rising enrolments in our upper level courses.

One significant area requiring improvement remains: the physical lab instructional space, built to 1960's standards. The utilization of the existing undergraduate laboratory space will be used more intelligently through a smart renovation to yield a lab facility that will directly impact the ability to provide for the 'double cohort' and 'echo' generation with the absolute best in science labs. These labs will allow students to directly experience science as it occurs in industry and will increase the number of students graduating with physical science degrees and better prepare them for making significant contributions to Canada. These renovations are essential to the growth and future success of the Chemistry teaching program.

### b. Research

Chemistry as a discipline is in a state of vigorous growth and re-definition. This is reflected in the fact that, as a discipline, Chemistry received substantial reallocation increments in the three NSERC reallocation exercises carried out so far. Areas such as biological, computational, materials and environmental chemistry have emerged as mainstreams, bringing with them dozens of new research paradigms and interdisciplinarities. New chemical themes, or more correctly, new interdisciplinary thrusts heavily dominated by chemistry, have already stimulated tens of billions of dollars of investment in the private sector and billions of dollars in research support world-wide. These include research enterprises such as combinatorial chemistry, supramolecular chemistry, self-assembly, nanostructural chemistry and high-power computation/simulation.

The University of Toronto's Department of Chemistry has been an international leader in bringing about these transformations which have in turn, coloured our complement renewal strategies and begun to impact the undergraduate program. Biological Chemistry has become a major departmental theme, affecting not only the work of individuals drawn from the old organic subdivision but also by cutting across all traditional sub disciplines and disciplines beyond the department – consequently establishing itself as a true interdiscipline.

The Department, with representation across the three campuses, currently consists of 43.6 tenured or tenure-stream faculty, 14 lecturers, and 15 emeritus professors (10 of which have significant presence in the Department). Additionally, there are 6 cross-appointed faculty and 7 adjunct professors. The department has significant research strength in the area of organic synthesis, biological and medicinal chemistry, ultra fast dynamics, nanotechnology, self assembly, surface chemistry, advanced materials and polymer chemistry, chemical sensors, and environmental chemistry.

Without question the department has the most distinguished theory/computation/simulation group in North America that makes superlative use of, and provides unequalled graduate training in high performance computing. In experimental chemical physics, this eminence has not diminished – primarily through the presence of Miller and Polanyi.

Several faculty are cross-appointed to, or engage in significant collaborative research with members of other departments, faculties and the teaching hospitals. Several members of other departments are cross-appointed to Chemistry (e.g. Shoichet, Sherwood Lollar, Simpson).

The Chemistry department is one of the most research-active departments in Canada. Every faculty member is heavily engaged in research. Nearly $7 M in research funding is attracted yearly, with some 30% coming from non-Council sources. The average NSERC grant in Chemistry at U of T is greater than that of any other Canadian chemistry department. This is remarkable in view of the youthfulness of the department.

Significant professional relationships have been formed with some 50 companies. Over the past 10 years faculty from the Department have written over 65 patents and spun off 6 companies. The Department has one of the largest suites of instrument facilities in the country, purchased through grants and user fees. Research in our department is a vibrant, going and growing concern. Among the many recent highlights, has been the remarkable success enjoyed by the materials group who were awarded a large CFI/ORDCF grant (approximately $10M) and many “New Opps” based CFI/ORDCF received by the newest faculty representing many millions in research infrastructure funding.

c. Teaching

Chemistry prides itself on the excellence of its teacher scholars and their influence in research and teaching. The mandate to infuse undergraduate courses with the excitement of research is taken seriously and thus all chemistry faculty are involved in undergraduate instruction. We recently embarked on recruiting new Lecturers as ‘faculty’ expecting as much scholarship of them as we do research faculty and differing only in approach. A number of former ‘tutors’ have also switched to the Lecturer stream aspiring to a higher pedagogical contribution to Chemistry courses.

The ANALEST instrument facility suspends the notion that teaching and research occur at separate times and places and provides access for our undergrads to the most advanced instrumentation available. Continuing the department’s excellence in research requires that more undergraduates are stimulated to study, graduate and move on to advanced degrees in chemistry.

d. Undergraduate Program

Enrolment in chemistry specialist, major and minor programs doubled between ‘94 and ‘99. Full course equivalent enrolments increased from approximately 2900 to 3600 in the same period. Specialist programs were established in Environmental Chemistry and Biological Chemistry. Although these have run for fewer than 4 years, their enrolments have been increasing steadily. The 3rd year environmental chemistry course (CHM 310H) is one of the most successful science courses in the Faculty with an enrolment close to 100 students.

Over the past 5 years the first and second year programs were revised significantly, especially in the "specialist stream" (CHM 151Y, 225Y, 238Y, 249H). The content of this suite of courses was designed holistically, under the presumption that students who take CHM 151Y will likely also enrol in the others. In this way a non-traditional approach could be developed for this stream with respect to the choice and distribution of topics and didactic strategy. The result has been very gratifying. CHM 151Y, taught by three of the Department's best teacher/scholars, has enjoyed unprecedented student acceptance, and enrolment in the second and third years specialist courses stands at an all-time high.

To more effectively coordinate with significant changes in the basic medical sciences programs Chemistry instituted drastic changes in our general first and second year offerings. The first year 'general chemistry' course was overhauled, carefully selecting content to streamline it to a half-course (CHM 139H). Consequently, the first semester of 'second year organic' became a first year half-course (CHM 138H). Further, 'second year physical chemistry for life sciences' is now a half-year course (CHM 220H) and 'second year organic' is now CHM 247H. This initially resulted in a large drop in the overall FCE (2622 in 2001/2002) since effectively one full year of large course enrolments was removed from the department complement.

This occurred for purely pedagogical reasons. It was believed to be a risk worth taking in order to effectively overhaul first and second year courses to better service partner departments/programs. In addition, it was important to directly address the relative lack of enthusiasm for first year offerings among far too many students. The inclusion of significantly more 'organic' in first year, combined with placing our very best instructors in these courses, has resulted in remarkably high student evaluations and major enrolment increases in second year courses (38% in CHM 247 organic and 32% in physical CHM 220) in 2002/2003 over the previous year. This is the best evidence for success in these changes. The enhanced enrolment is a direct result in improvements to these offerings and the numbers will further enhance enrolment in our upper division courses in the coming years.

It should be noted that these enrolment enhancements are separate from those due to 'double cohort' issues. The first year enrolment for the current year (2002/2003) has risen to 1600 overall from less than 1200 of last year. The impact on upper level courses will result from the general overall increases in the Faculty and from enhanced effectiveness in first and second year courses. This presents specific challenges to the faculty and physical plant to effectively administer the courses.

The Department currently supports six specialist programs;1) The largest is the general Chemistry Specialist; 2)Materials Science which was thoroughly revised and is now enjoying significant growth; 3) Chemistry and Geology (maintained in response to the wishes of the Geology Department); 4) Chemical Physics which always enrolled few but the very best students, and the newer programs in 5) Biological and 6)Environmental Chemistry which are surging in popularity make up the other five programs.

ANALEST was created in order to support the environmental program, a superbly equipped and unique analytical/environmental instrumentation laboratory, which is being used by undergraduates from several departments both in A & S and Applied Science and Engineering. A modern undergraduate computer laboratory was built housing up to 50 workstations, which is used for both scheduled computational instruction and as a computer access resource for all Arts and Science undergraduates.

e. Graduate Program

Graduate enrolment was maintained at approximately 140 students during a period that saw significant graduate enrolment reduction in SGS division III (1994 to 1999) but student quality was

consistently and deliberately increased over the past five years. With the recent large number of new faculty hired the need for more graduate students became more critical thus total graduate student numbers inched up to 162 for 2001-2002.

A large boost to enrolment resulted from the intake of 61 students during the current cycle (2002/2003) with the number of registered graduate students as of December 31, 2002 reaching 186. These students had superb records and high averages. The lowest averages, B+, were held by only 3 students out of the group. This is well above the Graduate School requirement (B) and more stringent than any other graduate chemistry program in Ontario-- possibly in Canada. In addition, 132 post-doctoral fellows, research associates, and other research personnel work in the department.

The median time of completion of the Ph.D. has decreased to 4.6 years, the second shortest time in the Faculty of A & S. In essence this is equivalent to increasing the number of BIU-supported graduate students while maintaining the steady state number of graduate students constant. Since 1990 the Department has graduated 203 Ph.D.s in Chemistry . This represents 0.43 graduates per faculty member per year assuming the average size of our graduate faculty in that twelve-year period to be 40, not including adjunct and cross-appointed graduate faculty.

Over the past 10 years various aspects of our graduate admission and retention process were streamlined. Most queries now come and are dealt with over the Internet. The graduate office has been redesigned to make it more welcoming to students. A Graduate Students' Committee, Advisory to the Chair has been created. The creation of ANALEST has had a significant effect on research in analytical and environmental chemistry, primarily in the Chemistry Department but also in departments such as Chemical Engineering, Geology and Geography. Recently, the Chemistry Teaching Fellows Program was initiated to provide an opportunity for graduate students to gain a mentoring experience with a faculty member on a pedagogical project of high value to the undergraduate program.

f. The Future

***Faculty Growth***

The last 10 years saw an incredible boon in faculty recruitment and significant reduction in the average age of the faculty overall. Over the next three years only modest hires are anticipated. Currently there is a search for a Lecturer in Analytical Chemistry, and another search will be initiated soon for a research faculty position in organic chemistry. A number of CRC positions will be filled in the near future including one in Climate and two others in the area of biological chemistry.

***Graduate Student Growth***

Chemistry expects to continue selectively recruiting 40 to 45 of the best and brightest graduate students available. Recent additions of highly energetic faculty have resulted in a renewal in recruitment efforts to increase the number of qualified applicants and recruit those accepted. The recent addition of new research space (Davenport 57,000 sq ft) and nearly completed renovation of all labs in Lash Miller have provided room for a significant increase in student numbers (e.g. 61 new students this year) and improved quality of experience.

It is expected that the reputational enhancements resulting from the increase in number and quality of research emanating from Chemistry will successively result in ever better applicant pools. Consequently, steady-state grad student numbers will hover between 160 and 200 with variations coming slowly in relation to the grant success of faculty, scholarship support available from UofT and increasing pool of departmental money raised, and vagaries of the economy.

***Undergraduate Student Growth***

The Department is projecting first year enrolment of 2000 for the 2003/2004 academic year due to double cohort induced increases. The higher enrolments in the lecture side of the courses can be accommodated if adequate TA budgets reflecting enrolment increases are forthcoming, along with the current faculty complement, as augmented by projected hires in both the research faculty and lecturer streams. The significant challenge, however, comes from the difficulty in maintaining a quality and safe learning environment in the lab components of these courses within the existing facilities.

In Fall 2002 planning was initiated for significant renovations in our undergraduate laboratories. This was driven by the necessity of working within outdated facilities while facing rapidly rising enrolments. Renovations to undergraduate laboratories are urgently required to address health and safety concerns and the very real need to update our lab course pedagogies. Renovations will proceed in three phases with Phase I addressing the west side of the second floor where overwhelming enrolment increases in CHM 138 and CHM 247 will be felt. These renovations will directly address the enrolment budge that will arrive in fall 2003 increasing the capacity to 128 (a 42% increase). These labs now handle courses with enrolments of 90 students, that are being taught in laboratories initially planned for classes of 48 students.

Subsequent phases will address first floor, basement, and the rest of the second floor. The objective is to renovate these areas to significantly increase efficiency and air quality by increasing the number of fume hoods, the key to delivering adequate, safe and exciting programs to more students. Indeed, the objective is to have all undergraduate students work in hoods whenever working with any chemicals, a practice in effect with the graduate students. Other improvements will be incorporated within the labs to enhance the teaching function.

Appendix III outlines Chemistry current years courses, with labs, enrolment numbers, and projected numbers for the next 5 years.

## V. Functional Plan

### Overview of Existing Space

The undergraduate laboratories of the Department of Chemistry occupy 4,729 net assignable square meters (nasm) on three levels at 80 St. George Street.

The space is inventoried in detail in Appendix I. A brief summary is presented in the following chart.

| Space Category | NASM |
|---|---|
| Laboratory | 4,011 |
| Preparation space and equipment room | 578 |
| Teaching staff office | 140 |
| Total | 4,729 |

A teaching laboratory is defined as a room used for instruction of undergraduate students. It contains special purpose equipment or is arranged in such a way that would restrict the use of that room to a particular field of study.

There are 14 teaching laboratories accommodating a range from six to forty workstations, used for undergraduate teaching by the Department of Chemistry in the building. These facilities date back to 1961 and little has been done in the past 40 years to retrofit the space with current base equipment (defined as fume hoods and a/v services). Consequently, labs that were originally designed to accommodate 40 students are currently used for as few as 6, to respect current health and safety codes, see Appendix II (Lab Capacity vs. Use). Existing fume hoods are inadequate in number and design.

Current methods for delivering undergraduate programs have changed and the existing facilities interfere with incorporating some of these methods. For example, chemical procedures must be done in fume hoods as per current health and safety requirements. Because the number of fume hoods is limited, experiments involving more chemical usage cannot be done, thus depriving the program of more current teaching methods and severely restricting throughput.

The projected enrolment increases in 2003 and beyond, due to the double co-hort and on-going demographic shifts, cannot safely or effectively be accommodated in the existing facilities. As fume hood limitations restrict current enrolments, they will cripple the Departments ability to cope with further increases thereby necessitating that undergraduate enrolment be capped. Historical and projected enrolments are found in Appendix III.

Offices of teaching staff are not readily accessible to students. These are located within several labs. To gain admittance, students must ring a remote bell, be buzzed in and then walk unsupervised through labs to get to the offices. Accessibility of teaching staff is considered key to enhancing the learning experience for students.

This document defines renovations which must be made to increase lab capacity to meet enrolment targets and improve upon the existing level of learning experience. The renovations addressed as Phase I relate to three labs only. Renovations to these labs are critical to accommodating projected Fall 2003 enrolments for CHM138 and CHM247. These courses have the largest enrolments AND the requisite practical labs require fume hood space for each person due to chemical usage.

The impact of first-year enrolment increases will be felt in the following year as the first-year students move to second-year labs. Consequently Phase II renovations, which address the remaining 3,671 nasm, must be complete for Fall 2004 enrolments. While it is preferable to begin planning for these renovations today, the planning, design and construction process for Phase I must shape Phase II renovations. Accordingly, this document does not address Phase II renovations.

All renovations are to existing facilities and therefore do not have any impact on overall space allocation.

**Summary of Space Utilization Analyses**

CHM138 is offered as a half course in each of the Fall and Spring terms. The program consists of:

| | **Weekly** | **Bi-weekly** |
|---|---|---|
| 3 lectures | 12 labs (6 per half course), 4 hours each<br>1 tutorial | |

2002 calendar information for this course is contained in Appendix IV.

To accommodate actual enrolment of 1600 students in the 2002 Fall and Spring terms, labs were scheduled for 4-hour blocks every day and two evenings. Each student had to attend one of these blocks within a 2-week period to satisfy the biweekly four-lab requirement. Of the 1600 students, 1000 satisfy the lab component requirement in the Fall session while the remaining 600 satisfy the requirement in the Spring session.

Labs were held in 5 rooms as follows.

| Room # | Time slots | Number of lab sessions in 2-week period | # of students | Total number of students per room served in 2-week period | |
|---|---|---|---|---|---|
| 113 | M 1-5 | 2 | 30 | 60 | |
| | T 1-5 | 2 | 30 | 60 | |
| | W 1-5 | 2 | 30 | 60 | |
| | R 1-5 | 2 | 30 | 60 | |
| | F 1-5, alternating weeks | 1 | 30 | 30 | |
| | R 6-10 | 2 | 30 | 60 | |
| | | | | | 330 |
| 117 | M 1-5 | 2 | 32 | 64 | |
| | T 1-5 | 2 | 32 | 64 | |
| | W 1-5 | 2 | 32 | 64 | |
| | R 1-5 | 2 | 32 | 64 | |
| | F 1-5, alternating weeks | 1 | 32 | 32 | |
| | R 6-10 | 2 | 32 | 64 | |
| | | | | | 352 |
| 217 | T 1-5 | 2 | 32 | 64 | |
| | R 1-5 | 2 | 32 | 64 | |
| | | | | | 128 |
| 221 | T 1-5 | 2 | 32 | 64 | |
| | R 1-5 | 2 | 32 | 64 | |
| | | | | | 128 |
| **Total Number of Students Accommodated in a 2-week period** | | | | | **938** |

The CHM247 program requires each student to participate in six 4-hour labs in the Winter session only. The labs are offered every two weeks. Enrolment for the course in Fall 2002 was 867. This translates to 3468 lab hours in a 2-week period.

Labs were held in 3 rooms as follows.

| Room # | Time slots | Number of lab sessions in 2-week period | # of students | Total number of students per room served in 2-week period |
|---|---|---|---|---|
| 217 | T 9-1 | 2 | 30 | 60 |
| | W 9-1 | 2 | 30 | 60 |
| | R 9-1 | 2 | 30 | 60 |
| | | | | 180 |
| 221 | T 9-1 | 2 | 30 | 60 |
| | W 9-1 | 2 | 30 | 60 |
| | R 9-1 | 2 | 30 | 60 |
| | | | | 180 |
| 224 | T 9-1 | 2 | 30 | 60 |
| | W 9-1 | 2 | 30 | 60 |
| | R 9-1 | 2 | 30 | 60 |
| | | | | 180 |
| **Total Number of Students Accommodated in a 2-week period** | | | | **540** |

While the rooms noted in the preceding charts are being used almost to their 1960 design capacity, it should be noted that this is not according to safety standards because fume hood space is lacking. Without alternatives, the Department has allocated students amongst inadequate facilities. This cannot be continued for the increasing enrolments without seriously jeopardizing the program and health and safety requirements. Fume hood space and related HVAC capacity are limiting factors in class size. Expanding the existing capacity is key to improving undergraduate facilities in the building.

**Summary of Space Requirements and Proposed Renovations**

In Fall 2003, two enrolment increase effects must be accommodated: firstly, the anticipated double cohort (and beyond) enrolments of 2000 in CHM138; and secondly, the CHM247 enrolments of 1000 as a result of current 2002 CHM138 enrolment. Enrolment in CHM247 is projected to peak at 1050 in 2004 (see Appendix III).

The current facilities used to deliver CHM138 to 1600 students are inadequate. To add any more students to these facilities is to work beyond acceptable boundaries of safety and comfort. Appropriate facilities, as outlined in Appendix V, Room Specification Sheets, will be designed and built to accommodate maximum class sizes of 48 students, up from 30 as shown in the table above.

The west half of the second floor, rooms 217 to 227 comprising 1,058 NASM, will be redesigned to accommodate 128 students with adequate fume hood, bench space and support facilities in which to work comfortably and safely. This increases the capacity of this whole space from 90 students per day, to 128 students per day.

Running 11 lab sessions in a two-week period in this new space would allow an enrolment in CHM138 of 1408 in one term. Consequently the 2003 enrolment can be met by hosting 1408 in the Fall lab term offering and the remaining 600 in the Spring term.

Because of the increased number of students in each room, layout which will facilitate evacuation procedures is critical. Benches are oriented for ease of evacuation and audio services would include "emergency" broadcast across the whole space.

In these facilities, each student "learning station" would consist of two feet of fume hood and four feet of bench space. Fume hood services per person include power (2 duplex),vacuum, cooling water (but no drains), vacuum, steam and compressed air; the bench space associated with each learning station requires one duplex outlet and data connection (wireless). Shared equipment such as balances, melting point apparatus, hand-washing sink and eyewash station, would be provided for groups of learning stations. The labs would be equipped with audio/visual equipment for teaching purposes. Separate fume hoods for dispensing chemicals and collecting waste are also required in a ratio of 1-four foot hood to 16 learning stations.

A preliminary mechanical engineering report commissioned by Chemistry identifies solutions for increasing the fume hood capacity in the three rooms noted.

Accessibility to teaching staff is equally important to delivering the program and enhancing the learning experience. Accordingly, offices for teaching staff and rooms for tutorials for up to 20 students are part of this renovation. Ideally 6 teaching staff offices, 2 technician spaces, one tutorial room (for 20) are required. Each office is designed to provide access from the hallway.

To prepare for the improvements to laboratories for the 2004 enrolments adequate infrastructure must be designed now, with space and equipment purchased to shorten the time for renovation for Phase II.

## VII. Environmental Impact

Increased use of resources will accompany increased enrolments. In addition, enhancements to the air handling system to accommodate an increase in fume hoods would result in higher emissions and consequently require appropriate jurisdictional approvals.

Water consumption would decrease since the current method for supplying vacuum to each bench requiring running water which is directly disposed of, would be replaced with a mechanical pump system, similar to that found in the research labs in the Davenport Building. The use of water for cooling distillation units will be replaced by a closed loop cooling system thereby saving significant amounts of water. All other University policies regarding environmental impact will be met.

## VIII. Special Considerations

As the renovation is to existing space, external factors are not affected—with the exception of MOE approvals.

a. Standards of construction and quality

Current standards are expected. It is anticipated that some existing non-conforming conditions will be updated.

b. Landscape requirements

Both phases are contained within the building and do not have any impact on surrounding landscape.

c. Accessibility and personal safety

The undergraduate wing is accessible through an elevator in this portion of the building; the building itself is ramp-accessible. Workstation spaces will be designated for students in wheelchairs.

d. Computing and communications

Data and audio/visual services are required. The building currently enjoys a high level of connectivity and this will be extended to the renovated space.

e. Environmental issues

The fume hood exhaust will be limited to existing approval levels. Currently an Environmental Impact Assessment (EIA) is being pursued and preliminary indications are that the increase in fume hood capacity does not add significantly to what is allowed under the current certificate of approval for the building.

f. Hazardous waste disposal

Chemistry has a strict waste disposal policy which is adhered to in all undergraduate and research labs. Waste collection and disposal is routine in the building. However, there will be an increase in the quantities removed as a result of increased enrolment. Because the new individual learning stations will not have water and drain, policing the waste disposal policy will be less onerous. Consequently teaching staff can use the time they currently spend policing to teach.

g. Campus planning issues

None.

## IX. Resource Implications

In order to undertake the renovations without affecting scheduled labs over the Winter and Spring terms, construction must start in early May, 2003 (after the last day of classes) and be completed in the late summer (to allow sufficient set-up time for Fall labs). Should the construction period lengthen, alternate locations to teach these courses must be found.

Standard construction costs including demolition, asbestos removal, professional fees, etc. apply.

Infrastructure upgrades in the sector

None are forseen.

Operating costs

These are limited to costs for increased enrolment related to the additional fume hoods installed in the laboratories.

c. Approximately $300,000 is required to purchase the necessary equipment (e.g. glassware, thermometers, etc) and minor instrumentation (melting point, balances etc) to handle the expected increase in enrolments and the workstations envisioned in the renovation plan.

d. Total project costs

The total project cost estimated for the Phase I renovations to undergraduate laboratories on the west side of the second floor of Lash Miller is $5,107,787, including all equipment and furnishings. Infrastructure capacity in anticipation of the Phase II renovation to undergraduate laboratories planned for 2004, is separately estimated to be $395,405.

The scope of work associated with the additional cost of $395,405 is as follows:

- Both exhaust fans ordered and installed at the same time.
- An enlarged air-cooled chiller specified to accommodate the full load of both 1st and 2nd floor laboratories instead of a second chiller being installed at a later date. Two chiller pumps would be sized to accommodate the increased load (as opposed to adding a third chiller pump in 2004).
- Two laboratory equipment chillers would be sized to accommodate the full loads of both floors (as opposed to adding a third pump in 2004).
- The glycol heating system would be designed to accommodate both floors with two large pumps installed at this phase.
- An additional electrical substation required by the additional equipment.

e. Secondary effects

It is anticipated that Phase I construction can be done over the summer session without any impact on the labs run during this same session in Phase 2 space.

## XI. Other Related Costs

Not Applicable.

## XII. Funding Sources and Cash Flow Analysis

Funding for this project comprises:

| | |
|---|---|
| Approved Enrolment Growth Fund | $4.0 m |
| Faculty of Arts and Science | 1.0 m |
| Department of Chemistry | 0.6 m |

## XIII. Schedule

As indicated, construction must begin in early May and be complete by the end of August to allow for teaching to occur in the space in September. This very tight timeline must be adhered to otherwise other space must be found for these courses in the fall. This schedule must be reviewed at the end of June to verify date of completion and make alternate arrangements should the laboratories not be finished in time.

## XIV. Recommendations

That the Planning and Budget Committee recommend to the Academic Board:

1. THAT the Project Planning Report for to Upgrade and Renovate the Undergraduate Chemistry Laboratories in the Lash Miller Building be approved in principle.

2. THAT the project scope to upgrade and renovate the undergraduate chemistry laboratories within the Lash Miller Building be approved at an estimated total project cost of $5,300,000 to $5,600,000 with funding from:

    (i) Contribution of $4,000,000 from approved growth enrolment funds to be allocated by the University of Toronto towards this project;

    (ii) Contribution of $600,000 from the Department of Chemistry; and

    (iii) Contribution of $1,000,000 from the Faculty of Arts and Science

**Appendix I – Space Inventory Report**

| Room# | Type | NASF | NASM | Room# | Type | NASF | NASM | Room# | Type | NASF | NASM | Total NASF | Total NASM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | lab | 2,610 | 247 | 102 | lab | 3,690 | 349 | 206 | lab | 1,890 | 179 | | |
| 7 | prep/office | 320 | 30 | 102B | prep | 209 | 20 | 207 | stge | 168 | 16 | | |
| 8 | prep/office | 130 | 12 | 103 | prep | 133 | 13 | 208 | inst | 180 | 17 | | |
| 9 | ANALEST | 1,943 | 184 | 104 | prep | 342 | 32 | 209 | prep | 270 | 26 | | |
| 14 | lab | 3,600 | 341 | 105 | prep | 171 | 16 | 210 | prep/lab | 360 | 34 | | |
| 15 | prep/office | 440 | 42 | 106 | lab | 2,757 | 261 | 211 | lab | 2,745 | 260 | | |
| 16 | prep/inst | 220 | 21 | 107A | office | 168 | 16 | 212 | stge | 336 | 32 | | |
| 17 | inst | 160 | 15 | 108 | office | 298 | 28 | 213 | office | 273 | 26 | | |
| 18 | lab | 3,658 | 346 | 109 | stge | 126 | 12 | 217 | lab | 3,276 | 310 | | |
| 19 | prep/inst | 220 | 21 | 113 | lab | 3,720 | 352 | 218 | office | 120 | 11 | | |
| | | | | 114 | prep | 414 | 39 | 218A | office | 90 | 9 | | |
| | | | | 115 | prep/inst | 144 | 14 | 219 | inst | 180 | 17 | | |
| | | | | 116 | inst | 189 | 18 | 220 | prep | 440 | 42 | | |
| | | | | 117 | lab | 3,600 | 341 | 221 | lab | 3,600 | 341 | | |
| | | | | 117B | inst | 189 | 18 | 222 | office | 210 | 20 | | |
| | | | | 119 | comp lab | 2,400 | 227 | 224 | lab | 2,880 | 273 | | |
| | | | | 121 | office | 322 | 30 | 226 | prep | 192 | 18 | | |
| | | | | 122 | stge | 378 | 36 | 227 | prep | 192 | 18 | | |
| **Totals** | | **13,301** | **1,259** | | | **19,250** | **1,822** | | | **17,402** | **1,648** | **49,953** | **4,729** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| lab | 9,868 | 934 | | 13,767 | 1,303 | | 14,391 | 1,362 | 38,026 | 3,600 |
| ANALEST | 1,943 | 184 | | | | | | | 1,943 | 184 |
| comp lab | | | | 2,400 | 227 | | | | 2,400 | 227 |
| office | | | | 788 | 75 | | 693 | 66 | 1,481 | 140 |
| prep | | | | 1,269 | 120 | | 1,094 | 104 | 2,363 | 224 |
| prep/lab | | | | | | | 360 | 34 | 360 | 34 |
| prep/inst | 440 | 42 | | 144 | 14 | | | | 584 | 55 |
| prep/office | 890 | 84 | | | | | | | 890 | 84 |
| inst | 160 | 15 | | 378 | 36 | | 360 | 34 | 898 | 85 |
| stge | | | | 504 | 48 | | 504 | 48 | 1,008 | 95 |
| **Totals** | **13,301** | **1,259** | | **19,250** | **1,822** | | **17,402** | **1,648** | **49,953** | **4,729** |

| | | | | | |
|---|---|---|---|---|---|
| Grand Total Phase 1, rooms 217 to 227 | 11,180 nasf | 1,058 NASM | Total Labs incl comp, ANALEST | 42,316 nasm | 4,011 NASM |
| Grand Total Phase 2 | 38,773 nasf | 3,671 NASM | Total Prep and Support Rooms | 6,103 nasm | 578 NASM |
| | | | Total Office | 1,481 nasm | 140 NASM |

## Appendix II – Lab Capacity vs. Use

The following table outlines all instructional laboratories in Lash Miller and the number of hours per week each laboratory is used for scheduled instruction in Fall 2002.

| Room # | # bench stations currently used | # bench stations reduced capacity[1] | # bench stations potential[2] | NASM | # Scheduled Hrs/Wk Fall 02 | Courses and Comments |
|---|---|---|---|---|---|---|
| 6 | 14 | 14 | 40 | 239 | 20 | 314, 328,379, 410 |
| 9 | !~50 | Not applicable | ~50 | 178 | 20 | 314, 410, 217 + various; renovated to high efficiency; teaching & research |
| 14 | 40 | 40 | 50 | 335 | 16 | 139 doesn't use fume hoods; 217 |
| 18 | 40 | 40 | 50 | 322 | 16 | 139 doesn't use fume hoods |
| 102 | 28 | 18 | 42 | 330 | 7 | 151, 249 |
| 106 | 20 | 12 | 25 | 244 | 19 | 151, 348, 346 |
| 113 | 38 | 15 | 50 | 334 | 24 | 138 |
| 117 | 32 | 12 | 50 | 288 | 24 | 138 |
| 119 | n.a. | n.a. | n.a. | 288 | 43 | Computer lab |
| 206 | 6 | 3 | 15 | 168 | 40 | Inorganic lab is highly fume hood intensive; 238,338,438 |
| 211 | 10 | 6 | 25 | 251 | 40 | Inorganic lab is highly fume hood intensive; 238,338,438 |
| 217 | 32 | 10 | 50 | 336 | 24 | 247, 138 |
| 221 | 32 | 8 | 50 | 258 | 24 | 247, 138 |
| 224 | 32 | 8 | 40 | 285 | 24 | 247, 138 |

[1] The reduced capacities are a function of the number of available fume hoods. The value represents the number of students that can be safely accommodated under current fume hood conditions. NOTE: the 'currently used' values represent students doing some experiments on a 'bench' when they should be done in a hood ~ enrolment pressures simply have not allowed us to only accept those we can accommodate.

[2] Potential is based on the size of the room and the number of 'bench spaces'. An assumption is that students need approximately 8 linear feet of bench space per student For any course using fume hoods this value is entirely dependent on appropriate fume hood access.

## Appendix III - Course Enrolment

| Course | Actual 2002 Enrolment | Projected Enrolments | | | |
|---|---|---|---|---|---|
| | | 2003 | 2004 | 2005 | 2006 |
| 138 | 1600 | 2000 | 1850 | 1600 | 2000 |
| 139 | 1550 | 1950 | 1850 | 1600 | 1950 |
| 151Y | 103 | 120 | 120 | 120 | 120 |
| 217 | 25 | 35 | 40 | 25 | 35 |
| 220 | 500 | 600 | 750 | 650 | 600 |
| 238Y | 69 | 80 | 90 | 69 | 80 |
| 247 | 687 | 850 | 1050 | 800 | 900 |
| 249 | 48 | 48 | 48 | 48 | 48 |
| 314Y | 16 | 20 | 25 | 30 | 20 |
| 326 | 15 | 20 | 25 | 30 | 20 |
| 328 | 9 | 15 | 20 | 25 | 15 |
| 338 | 24 | 30 | 35 | 40 | 30 |
| 346 | 18 | 25 | 30 | 35 | 25 |
| 348 | 36 | 40 | 45 | 50 | 40 |
| 379 | 17 | 20 | 25 | 30 | 20 |
| 410 | 11 | 20 | 25 | 30 | 20 |
| 438 | 3 | 10 | 10 | 10 | 10 |
| **Totals** | **4731** | **5833** | **5938** | **5092** | **5933** |

## Appendix IV - Calendar Information

CHM138

3 lectures, 4 lab hours (A), 1 tutorial (A)

Fall

| | |
|---|---|
| L0101 MWF 9 | P0101/2 M 1-5 (A) |
| L0201 TRF 11 | P0201/2 T 1-5 (A) |
| L5101 T 7-9, R 7-9 (A) | P0301/2 W 1-5 (A) |
| L2001 T 7-9, R 7-9 (A) (PHM) | P0401/2 R1-5 (A) |
| | P0502 F 1-5 (A) |
| | P5402 R 6:30 -10:30 (A) |
| | P2001 R 6:30 -10:30 (A) |

Winter

| | |
|---|---|
| L0101 MWF 12 | P0101/2 M 1-5 (A) |
| L0201 TRF 9 | P0201/2 T 1-5 (A) |
| | P0301/2 W 1-5 (A) |
| | P0401/2 R 1-5 (A) |
| | P0501 F 1-5 (A) |

CHM247

3 lectures, 4 lab hours (A)

Fall

| | |
|---|---|
| L5101 M 7-9, R 6-8 (A) | P5101 R 6-10 (A) |

Winter

| | |
|---|---|
| L0101 MWF 1 | P0201/2 T 9-1 (A) |
| L0201 MTR 4 | P0301 W 9-1 (A) |
| L2001 MWF 1 | P0401/2 R 9-1 (A) |
| | P2001 W 9-1 (A) (PHM) |

## Appendix V – Room Specification Sheets

SECTION A:

Room Name: Laboratory for 48 students
Number of Rooms Required: 3
NASM Per Room:

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| teaching first year chemistry course |

B. Number of occupants, resident:

| |
|---|
| 0 |

C. Number of occupants, transient

| |
|---|
| 48 |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | prep room, TA offices, teaching staff offices |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | |
| Data: | |
| Audio/Video: | |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | |

SECTION C:

H. Lighting Requirements

I. Power Requirements

J. Building Services Requirements

K. Special Systems

L. HVAC

M. Plumbing

N. Special Finishes

O. Special Requirements and Other Considerations

**48 learning stations**; each learning station requires:

- 2 lineal feet of fume hood, fume hood services 2 duplex receptacles standard power, compressed air, steam, cooling water, vacuum, distillation racks, ability to see through the back and sides of fume hood
- 3 to 4 lineal feet of bench space with one standard power duplex receptacle and one data connection
- lockable storage space for specialty glassware (3- 8 inch x 24 inch drawers)
- lockable stoarage space for personal belongings (1- 8 inch x 24 inch drawer)
- coat hook for coat and knapsack

**common space per 4 learning stations**

- 1 balance (front loading in 2-foot x 2-foot space)
- 2 melting point apparatus (front loading in 2-foot x 2-foot space)
- storage for stirrers, hotplates, heating mantles
- handwashing sink
- eyewash station

**common space per 16 learning stations (a TA module)**

- presentation area for tutor to do preliminary instruction
- 2 lineal feet of fume hood, no services, for dispensing chemicals
- 2 lineal feet of fume hood, no services, for collection of liquid waste
- vented space below fume hood for contaminated solid waste and sharps

**overall lab**

- audio/visual for data projection and VCR, 1 screen per 16 learning stations with capacity for simultenous or independent broadcast

P. Safety and Security Considerations

safety shower, 1 at each exit
fire extinguishers

SECTION A:

Room Name: teaching staff private office

Number of Rooms Required: 4
NASM Per Room: 12

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| course preparation, correspondence, meeting with students (1 or 2), quiet workspace |

B. Number of occupants, resident:

| |
|---|
| one |

C. Number of occupants, transient

| |
|---|
| none |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | laboratory |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | laboratory |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | telephone |
| Data: | 2 ports |
| Audio/Video: | none |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | desk, bookcase, filing cabinet |

SECTION C:

H. Lighting Requirements

I. Power Requirements
2 duplex per desk plus one per remaining wall

J. Building Services Requirements
HVAC

K. Special Systems

L. HVAC

M. Plumbing
none

N. Special Finishes
standard

O. Special Requirements and Other Considerations

P. Safety and Security Considerations
viewing window

SECTION A:

Room Name: TA meeting room for 20
Number of Rooms Required:
NASM Per Room:

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| for tutorial assistant to conduct tutorial session every 2 weeks |

B. Number of occupants, resident:

| |
|---|
| none |

C. Number of occupants, transient

| |
|---|
| 20 plus TA |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | lab |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | none required |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | rough-in |
| Data: | 2 ports |
| Audio/Video: | digital and VCR; blackboard |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | seating for 20 with tablet arm plus presentation space |

SECTION C:

H. Lighting Requirements

I. Power Requirements

J. Building Services Requirements

K. Special Systems

L. HVAC

M. Plumbing

none

N. Special Finishes

acoustics for meeting room

O. Special Requirements and Other Considerations

P. Safety and Security Considerations

viewing window into space

SECTION A:

| | |
|---|---|
| Room Name: | Technician space |
| Number of Rooms Required: | 1 |
| NASM Per Room: | 5 |

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| desk/work space for technican |

B. Number of occupants, resident:

| |
|---|
| 2 |

C. Number of occupants, transient

| |
|---|
| none |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | lab |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | lab |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | rough-in |
| Data: | 2 ports |
| Audio/Video: | none |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | desk, filing space, book shelves |

SECTION C:

H. Lighting Requirements

I. Power Requirements

J. Building Services Requirements

K. Special Systems

L. HVAC

M. Plumbing

N. Special Finishes

O. Special Requirements and Other Considerations

P. Safety and Security Considerations

SECTION A:

Room Name: prep room
Number of Rooms Required:
NASM Per Room:

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| |

B. Number of occupants, resident:

| |
|---|
| |

C. Number of occupants, transient

| |
|---|
| |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | |
| Data: | |
| Audio/Video: | |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | |

SECTION C:

H. Lighting Requirements

I. Power Requirements

J. Building Services Requirements

K. Special Systems

L. HVAC

M. Plumbing

N. Special Finishes

O. Special Requirements and Other Considerations

P. Safety and Security Considerations

SECTION A:

| | |
|---|---|
| Room Name: | emeritus office |
| Number of Rooms Required: | 2 |
| NASM Per Room: | 10 |

SECTION B:

A. Space purpose and type of activity:

| |
|---|
| work space for emeriti professor |

B. Number of occupants, resident:

| |
|---|
| one |

C. Number of occupants, transient

| |
|---|
| none |

D. Space relationships:

| | |
|---|---|
| Adjacent to: | labs |
| Close to: | |
| Separate from: | |

E. Visual relationships:

| | |
|---|---|
| Adjacent to: | |
| Close to: | |
| Separate from: | |

F. Communications:

| | |
|---|---|
| Voice: | telephone |
| Data: | one port |
| Audio/Video: | none |

G. Furniture and Equipment, Fixed

| | |
|---|---|
| Existing: | |
| New: | desk, filing cabinet, bookshelves |

SECTION C:

H. Lighting Requirements

I. Power Requirements

J. Building Services Requirements

K. Special Systems

L. HVAC

M. Plumbing

N. Special Finishes

O. Special Requirements and Other Considerations

P. Safety and Security Considerations

## Appendix VI – Total Project Cost Estimate

**Project Title:** Lash Miller Undergraduate Laboratory Project no 73 -01-080

**TABLE 1: Total Project Cost Estimates**

Column 1 will be completed with the Project Planning Report.
Column 1-5 will be included in the Project Implementation Report.

| Items | Project Planning Report | Concept Design | Design Devel't | Drawings @ 90% | Tender | 100% Complete |
|---|---|---|---|---|---|---|
| | | | | | | |
| Construction Cost | 3,043,890 | | | | | |
| Construction Contingency | 297,889 | | | | | |
| Applicable GST | 77,195 | | | | | |
| **Total Construction Costs, including taxes** | **$3,418,974** | | | | | |
| | | | | | | |
| Site Services, new | | | | | | |
| Infrastructure Upgrades in Sector | | | | | | |
| Secondary Effects | | | | | | |
| Demolition | | | | | | |
| Landscaping | | | | | | |
| Permits & Insurance | 19,439 | | | | | |
| Professional Fees | 303,139 | | | | | |
| Computer Wiring | | | | | | |
| Telephone Terminations | 20,462 | | | | | |
| Audio/Visual | 255,775 | | | | | |
| Moving | | | | | | |
| Staging | 10,231 | | | | | |
| Furnishings: Department | | | | | | |
| Furnishings: Classrooms | | | | | | |
| Equipment: Note A | 1,074,255 | | | | | |
| Security & Access Systems | | | | | | |
| Signage: Interior & Exterior | 512 | | | | | |
| Signage: Donor Recognition | | | | | | |
| Groundbreaking & Building Opening | | | | | | |
| Miscellaneous | 5,000 | | | | | |
| Finance Costs | | | | | | |
| Project Cost Escalation | 0 | | | | | |
| | | | | | | |
| **Total Project Cost Estimate GST included** | **$5,107,787** | **$0** | **$0** | **$0** | **$0** | **$0** |

prepared G Phelps **7-Apr-03**

Notes: A Consists of $750,000 for lab benches and fume-hoods and $300,000 for loose equipment

Revised April 4/03

**Project Title:** Lash Miller Undergraduate Laboratory Service Upgrades

**TABLE 1: Total Project Cost Estimates**

Column 1 will be completed with the Project Planning Report.
Column 1-5 will be included in the Project Implementation Report.

| Items | Project Planning Report | Concept Design | Design Devel't | Drawings @ 90% | Tender | 100% Complete |
|---|---|---|---|---|---|---|
| | | | | | | |
| Construction Cost Note A | 330,000 | | | | | |
| Construction Contingency | 33,000 | | | | | |
| Applicable GST | 8,385 | | | | | |
| **Total Construction Costs, including taxes** | **$371,385** | | | | | |
| | | | | | | |
| Site Services, new | | | | | | |
| Infrastructure Upgrades in Sector | | | | | | |
| Secondary Effects | | | | | | |
| Demolition | | | | | | |
| Landscaping | | | | | | |
| Permits & Insurance | | | | | | |
| Professional Fees | 24,020 | | | | | |
| Computer Wiring | | | | | | |
| Telephone Terminations | | | | | | |
| Audio/Visual | | | | | | |
| Moving | | | | | | |
| Staging | | | | | | |
| Furnishings: Department | | | | | | |
| Furnishings: Classrooms | | | | | | |
| Equipment | | | | | | |
| Security & Access Systems | | | | | | |
| Signage: Interior & Exterior | | | | | | |
| Signage: Donor Recognition | | | | | | |
| Groundbreaking & Building Opening | | | | | | |
| Miscellaneous | | | | | | |
| Finance Costs | | | | | | |
| Project Cost Escalation Dean's Office, Faculty of Arts and Science | 0 | | | | | |
| | | | | | | |
| **Total Project Cost Estimate GST included** | **$395,405** | **$0** | **$0** | **$0** | **$0** | **$0** |

prepared George Phelps **April 7 2003**

Notes: A consists of premium to upgrade building mechanical and electrical to provide capacity for future phases of undergraduate laboratories.