PROJECT REPORT

FOR

A NEW SCIENCE BUILDING

AT THE UNIVERSITY OF TORONTO AT SCARBOROUGH (UTSC)

May 02, 2005

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PROJECT REPORT FOR A NEW SCIENCE BUILDING AT THE UNIVERSITY OF TORONTO AT SCARBOROUGH

I. EXECUTIVE SUMMARY

- In the context of enrolment growth for the University of Toronto, associated in the first instance with the double cohort of 2003-04, the University of Toronto at Scarborough will by 2007-08 expand enrolment by 65 to 70 per cent over its 2000-01 enrolment. The New Sciences Building is the last of several projects at UTSC constructed to accommodate this expansion. A new Science Building at UTSC is urgently required to support and provide the facilities for the development of the physical and environmental sciences as well as the life sciences research endeavours on the campus.

- The New Science Building project is planned to have two phases of two almost identical and adjacent structures that together will address all the research and office needs for the sciences at UTSC, and will provide an innovative and advanced set of facilities for scientific research in the eastern GTA.

- This Report recommends construction of Phase One of the New Sciences Building project which is primarily dedicated to research laboratories and offices for science faculty, and will meet the essential needs for science facilities at UTSC. Without Phase 1 UTSC will not be able to provide research facilities for the faculty who will be hired to teach the planned enrolment growth.

- For Phase One a new building of 2543 net assignable square metres (nasm) or a maximum of 5075 gross square metres, is recommended on a site adjacent to the existing Science Wing overlooking Highland Creek Valley. The project also includes the rectification of several deferred maintenance issues, plus renovations to existing research facilities that were built 40 years ago and requires serious upgrading..

- The New Science Building will house 16 laboratories designed as generic wet labs with a core of support areas, 16 faculty offices and 24 offices for graduates and post doctoral fellows and a 150 seat classroom. The planned design has been driven by the need to incorporate as much flexibility in the future use of the facilities as possible.

- The design and construction schedule for the New Science Building indicates occupancy in January 2008.

- The total project cost is estimated at $31,500,000.

- The annual operating costs for the New Science Building are estimated at $300,000 in

2008 dollars. The long-term budget model for UTSC includes these anticipated expenses.

- The planned sources of funding for the project are identified below, however it is proposed to request the approval of only $3,000,000 at present to allow for the design to proceed to the *call for tender* stage of planning. This will enable sufficient time, through to March 2006, to confirm the various sources of external funding that are required for the project as noted below.

- Planned Funding Sources:

    1) A cash allocation of $3,000,000 from the one-time-only fund identified in the 2004/05 operating budget of the Office of the Provost for academic projects seriously restricted by shortcomings in infrastructure and deferred maintenance. These funds will suffice for Phase 1 of the project to proceed to design and tender and will, in the total context of the project, contribute to the direct infrastructure costs of the project currently estimated at $3,050,000.
    2) The University's Capital Plan allocates a mortgage capacity of $20 million for this project. The repayment of the $20 million mortgage, commencing upon completion of the project in December 2007, will be paid from the operating budget of the University of Toronto at Scarborough. The capacity to address these charges has been addressed and confirmed by the Vice-President and Principal of UTSC.
    3) The allocation of $4.5 million from UTSC carry-forward funds.
    4) Funding from external sources in the amount of $4.0 million to support the project that could potentially materialize within the next twelve months.

- While the planning for this project will proceed as rapidly as is practical towards a January 2008 completion date, a review of all secured funding resources will be undertaken in April 2006 prior to the commencement of construction, anticipated to occur in the early spring of 2006.

- The proposed site for the New Science Building at the end of the Science Wing is broadly consistent with the original John Andrews plan for Scarborough Campus and with the 2001 Master Plan.

- The project has a number of Secondary Effects including upgrades to existing teaching and research facilities in the Science Wing, and two major deferred maintenance problems – the installation of new boilers in the central plant that will provide heat for the New Science Building and improve the delivery of steam to other buildings on campus, and the reconstruction of a major fire route to comply with current code.

- An outline proposal for Phase Two of the New Science Building is included in this

Project Report; Phase One will be designed with this possible expansion in mind. Phase Two is expected to be about 2500 nasm, and also to consist primarily of research laboratories and offices. Phase 1 and Phase 2 of the New Science Building will together bring UTSC to the level generated by COU guidelines for science space requirements

- The University has allocated no mortgage room to Phase Two, so this will have to be built entirely from cash-in-hand, such as donations or capital grants.

- Criteria for the selection of capital projects applied to the New Science Building

1. Mission Objectives :
The New Science Building is essential for the fulfillment of the enrolment growth plan at UTSC (Section V.B)

2. Policy Objectives:
This project is consistent with all policies of the University related to space and capital construction at the University

3. Provincial Space Standards:
UTSC is 4463 nasm below COU generated space standards for Science. Phase 1 of the New Science Building will reduce this deficit to about 2400 nasm, and Phase 2 will eliminate the deficit. (Section V.B)

4. Strengthening Scholarship
The New Science Building will provide an international quality research facility.

5. Providing Academic Leadership
The New Science Building will be the home of a science institute that will house a number of high profile research centres (Section III)

6. Student Experience
The New Science Building has an undergraduate classroom that is essential to meet the instructional needs at UTSC. It also includes 18 offices for graduate students and will be an important facility for graduate research, and access to research experience. (Section VI)

7. Economic Consistency
The New Sciences Building is funded by a mortgage of $20,000,000, as indicated in the University's Capital Plan, and $11,500,000 million down payment. (Section XI)

8. Resources
Funds to cover all capital and operating costs are in place and have been modeled in the UTSC long-term budget model. (Section XI)

9. Deferred Maintenance
The New Science Building Project will make possible a major upgrade to the central plant at UTSC that will provide heat and steam to the new building, plus a code required upgrade to a fire route and renovations to existing science facilities. (Section IX)

II. MEMBERSHIP AND TERMS OF REFERENCE

Membership

Edward Relph, (Chair), Special Advisor on Campus Development, UTSC
Ragnar-Olaf Buchweitz, Vice Principal and Dean, Professor of Mathematics, UTSC
Charles Dyer, Chair, Physical and Environmental Sciences, Professor of Astrophysics, UTSC
Rudy Boonstra, Vice Principal Research, Professor of Biology, UTSC
John Kennedy, Chair, Life Sciences, Professor of Psychology, UTSC
John Scherk, Chair, Computer and Mathematical Sciences, Associate Professor of Mathematics, UTSC
Roberta Fulthorpe, Associate Professor, Physical and Environmental Sciences
Myrna Simpson, Assistant Professor, Physical and Environmental Sciences
Tuhin Giri, Lecturer, Life Sciences, UTSC
Stephen Hayward, Graduate Student, Physical and Environmental Sciences
Marty Niewiadomski, Graduate Student, Life Sciences
Lendyl D'Souza, Undergraduate, Life Sciences and President of SCSU
Kim McLean, Chief Administrative Officer and Assistant Principal, UTSC
Julian Binks, Capital Projects Office, University of Toronto
Jim Derenzis, Director, Facilities Management, UTSC
Gail Milgrom, Office of the Vice-Provost, Space and Facilities Planning, University of Toronto
Mike Richard, Director, Projects Management, UTSC

The original committee for a New Science Building was struck in September 2001 with a reporting date of December 2001. However, funding for the proposed building was not forthcoming and the committee was adjourned before the final report was completed. The committee was reconvened in 2002 with a rather different membership, but again no funds were available therefore the committee was unable to complete a report. The committee was reconvened in Spring 2004. This report is the product of that committee, though it draws on the work of the earlier versions of the committee. Members of those earlier committees were the following:

Maydianne Andrade, Assistant Professor, Division of Life Sciences, UTSC
Dan Bandurka, Undergraduate Student, Division of Life Sciences, UTSC
Brian Greenwood, Professor, Division of Physical Sciences, UTSC
Nicole Januszczak, Graduate Student, Division of Physical Sciences UTSC

Lisa Jeffrey, Professor, Computer and Mathematical Sciences, UTSC (from Sept 03)
Adriana Koufis, Administrative Assistant, Division of Physical Sciences, UTSC
Mike Richard, Manager, Facilities Management, UTSC
Dan Riggs, Professor, Division of Life Sciences, UTSC
Sundeep Singh, Undergraduate Student, Division of Life Sciences, UTSC
Jim Thompson, Chair, Division of Physical Sciences, UTSC
Knud Wall, Laboratory Technician, Division of Life Sciences, UTSC
Frank Wania, Assistant Professor, Division of Physical Sciences, UTSC
John Youson, Chair, Division of Life Sciences, UTSC

The committees have generated one previous report. *A Project Report on the Renovation of Science Teaching Laboratories*. This report was approved by Governing Council in January 2004. An appendix of the report identified a multi-phase strategy for the upgrading of science facilities. Its' main phases were as follows:

Phase 1 : Renovation of teaching laboratories in 2004. This phase has been completed.
Phase 2 : Improvements to research laboratories in 2004-05 which has been partially implemented.
Phase 3 : Renovation of the soil erosion laboratory in 2005-06. This is on hold pending the proposal for the new science building.
Phase 4 : The construction of a new science building, planned for 2006-07 or 2007-08, the subject of this report.

The following terms of reference have been modified from those approved in 2001 to reflect changing dates and circumstances. The revised terms of reference were reported to Planning and Budget Committee in February 2005.

Terms of Reference

1. Develop a flexible laboratory and office space programme suitable to the future needs of Life and Physical Environmental Sciences at UTSC.
2. Recommend a preferred site for the proposed New Science Building that will permit connection to the existing Science Wing. The site should also allow for links to new classrooms.
3. Make recommendations about the future of the existing Soil Erosion Laboratory and the existing Sprung Pavilion classroom.
4. Demonstrate how the proposed changes will take into account the space standards of the Council of Ontario Universities, and the University's space standards.
5. Identify the functional relationships between the elements of the detailed space and renovation proposals.
6. Identify all secondary effects, including the reuse of vacated space, the impact on parking and traffic movements, the temporary effects of construction, impacts on campus services and infrastructure, and include recommendations about these.
7. Identify all communications, requirements, equipment and furnishings and their related

costs.
8. Identify all security and personal safety requirements and their related costs.
9. Identify any site plan implications, with reference to the design guidelines and other issues included in the University of Toronto at Scarborough Master Plan 2001.
10. Provide an estimate of total project cost, including construction, communications, all fees and contingencies, and projected increases to the annual operating costs of the University of Toronto at Scarborough.
11. Identify a funding plan for capital and operating costs.
12. Report by 31 March 2005.

III. BACKGROUND INFORMATION and VISION

A. Summary of Events since 2001 leading to this Report

Enrolment plans for the University of Toronto at Scarborough indicate enrolment growth of about 65 per cent between 2000-01 and 2007-08. The UTSC Master Plan 2001 indicated several academic and other buildings that would be required to accommodate this level of growth, including an extension to the Sciences Wing with a total area of 8000 gross square metres (approximately 4,400 nasm). The other buildings have been completed or are under construction, and the New Science Building has now been identified as the highest priority for UTSC, and one of the highest priority projects at the University of Toronto.

A project committee for a New Science Building at Scarborough was formally struck in September 2001, when it was anticipated that Provincial funding might become available, and the committee prepared a draft space programme for a building of 4,900 nasm, with 1600 nasm of research labs, 1200 nasm of teaching labs, 700 nasm of classrooms, offices for 33 faculty and a number of graduate students. By early 2002 it became clear that the Province would not provide capital funding for this, and the project report was not completed. However, the committee continued to meet, and made some modifications to the proposal to respond to changing opportunities for funding. A multi-phase renovation and construction schedule for science facilities was developed, and this included a new building as the culminating phase. A project report for the first phase of this multi-phase schedule - the renovation of science teaching laboratories - was submitted in Fall 2003 and approved by Governing Council in January 2004. These renovations were completed in the summer of 2004 and the renovated teaching laboratories are currently in use. This initiative met critical teaching needs in the sciences at UTSC, but the problem of additional space for research in science remains unresolved.

Enrolment growth plans for UTSC anticipate increased enrolment in the Sciences, and the faculty complement plan requires that 13 new appointments in the Sciences be made between 2004 and 2008. The simple fact is that there is no space available to provide research laboratories or offices for these new hires. New faculty often have to be housed in laboratories created out of converted space that is barely sufficient for their needs. A New Science Building at UTSC is essential if the academic plans for UTSC are to be implemented.

In February 2005, with Provostial approval, UTSC hired the consulting firm Sequitur Inc to provide direction about appropriate ways to promote innovative research collaborations that will build on existing research strengths at UTSC. Their aim was to develop clusters of research activity that can be located in the New Science Building, and which should attract research funding. Sequitur has been involved in a variety of other university, hospital, and related strategic planning and marketing initiatives. Sequitur's work is especially important for funding Phase 2 of this project. They are providing direction to make this a highly innovative facility designed to expand the boundaries of science research at UTSC, and enhance the scientific stature of UTSC by creating a facility of international significance. This requires a high degree of strategic management, inter-disciplinary team coordination, and a thorough approach to both public funding agencies and private organizations. Sequitur will also be involved in the coordination of UTSC's CFI (and other public financing) processes in relation to the science development program and engage private financing where necessary and possible.

B. Context and General Need for a New Science Building at UTSC.

There are three Science Departments at UTSC: Life Science (which includes Biology and Psychology); Physical and Environmental Science (Astronomy, Chemistry, Environmental Science and Physics); and Computer and Mathematical Science (CMS). Almost all of the offices, laboratories and administrative facilities for these are housed in the Sciences Wing. CMS has a relatively light demand for teaching laboratory space, and none for research laboratories, although there is a possibility that CMS faculty will participate in research teams with Life and Physical/Environmental scientists. Both Life and Physical/Environmental Sciences have substantial space allocations for teaching and research laboratories. Current plans call for several growth appointments in each of these departments between 2004 and 2008. In addition to these it is anticipated that four of the five Chemistry faculty and one Physics appointment who currently have research labs at St. George will move to UTSC in the next four to five years both because of space pressures there and to concentrate research at UTSC. There are also seven retirement replacements in Life Science, eight retirement replacements in Physical and Environmental Science and one in Computer and Math Science that will occur by July 2008 and which have been included in the UTSC budget plan. Of these new appointments at least nine are in fields that will generate needs for renovated laboratory facilities.

The Science Wing is a massive, poured concrete structure, opened in 1965, that poses significant problems for contemporary science research. Many of the current laboratories are windowless. A number have been carved out of old storage areas on the basement level and are inadequate for the demands placed on them. Environmental controls and air handling systems do not provide the level of control associated with growth chambers; the linearity of the building means that some facilities, such as glass-washing and animal housing, are at the very end instead of being centrally located to the laboratories. The thick concrete walls do not allow flexibility or adaptation to changing needs.

In spite of these problems, some research laboratories have been substantially upgraded

in the last five years, most notably a CFI funded Centre for the Neurobiology of Stress, and an Environmental NMR facility. Smaller scale renovations have been completed in the laboratories of individual faculty who have been hired in the last few years to ensure that they meet the demands for twenty-first century research. There are, however, few remaining opportunities either for significant renovations or for converting other spaces to research.

In addition to the laboratory problems there is a serious shortage of offices for existing faculty, post-doctoral fellows and graduate students, especially in Life Science. There are insufficient offices available for the anticipated growth in the faculty complement and in graduate students.

In short, the blunt reality is that whatever renovations are made to the Sciences Wing as indicated in phases 1, 2 and 3 of the comprehensive plan for upgrading science facilities at UTSC, and whatever bits of space can be claimed through the reallocation of space to Sciences as other new buildings open, there will still not be enough space available for research labs and offices for the faculty needed to instruct the planned enrolment increases in science programmes at UTSC.

C. Vision for a New Science Building at UTSC.

While the New Science Building has to accommodate the immediate demands for space for new faculty, graduate students and their research, and classroom, it aims to do much more than this. The intention is that it will create a new institute for scientific research at UTSC, one that will house several innovative centres that build upon and extend the substantial research strengths of the Life and Physical Sciences on the campus and contribute significantly to the international reputation of research at the University of Toronto. It is proposed that research activities in the new building will focus on areas that reinforce current research strengths. The precise character of the areas is being determined, but they will probably include environmental contaminants, global warming and climate, and studies of cognition. The science institute will contain a number of centres, with the expectation that most faculty will belong to more than one of these. In addition, there will be close contact with colleagues in the existing Centre for the Neurobiology of Stress. The resulting interdisciplinarity will encourage both independent research and allow for collaboration among researchers, allowing them to progress rapidly in their understanding of fundamental processes affecting the Earth.

Provision also has to be made for other types of research facilities, including the laboratories for chemists who will be relocated from the St. George campus. To meet this range of requirements the New Science Building will require an excellent backbone of services to support a mixture of wet and dry laboratories, meeting spaces to facilitate the free exchange of ideas, and offices to accommodate faculty, post-doctoral fellows and graduate students. Because the demands of research are changing rapidly the new Sciences Building has to be designed to be flexible and capable of being adapted to changing requirements.

It is essential that the New Sciences Building connect with the existing Science Wing to

take advantage of existing resources such as the animal facility and departmental offices. It is anticipated that this connection will take the form of a bridge connecting level 5 of the S Wing with the third floor of the new building.

The new building will extend the Science Wing in a manner consistent with the Master Plan, so that it will on one side overlook Highland Creek and on the other frame the open space of the west campus playing field. The building will be designed to a high level of energy efficiency, and as far as possible to meet LEED standards, and because this is consistent with the spirit of the environmental science research that will occur in it.

The New Science Building will have offices for graduate students, post-doctoral fellows and visiting researchers as well as faculty; it will have state-of-the-art yet adaptable laboratories filled with natural light, grouped to form research clusters. These clusters will share resources and small meeting spaces to encourage further the interdisciplinary exchanges that have always been an outstanding feature of science research at UTSC.

IV. ACADEMIC AND OTHER PLANS AND SPACE NEEDS

The primary need for the Sciences Building derives from the plans for enrolment growth for UTSC that have been developed since 2001. Enrolment growth requires more faculty, more teaching assistants, more staff and more space for classrooms. The details for growth have been identified in the departmental proposals in the UTSC submission for the academic plan "Stepping Up" prepared in summer 2004.

A. Undergraduate Enrolment Growth

The plan that is the foundation for this capital project is the intention to achieve enrolment growth at UTSC of about 65 per cent over 2000-01 levels by 2007-08 and then move to steady state by 2010-11. Projections from the 20 Jan 2005 enrolment growth model are summarised in Table 1.

	Actual	Actual	Actual	Actual	Projected	Projected	Projected	Projected	Projected
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2010-11
Headcount	5752	6029	6762	8035	8761	9294	9466	9305	9119
Total FTE	4637	4888	5499	6502	7136	7644	7802	7664	7500

TABLE 1 : PROJECTED UNDERGRADUATE ENROLMENT GROWTH AT UTSC
[from Planning Office Enrolment Growth Model 20 Jan 2005]

It is difficult to project FTE enrolment specifically for the Sciences because this is a function of programme enrolments which do not include service teaching. A better indicator of projected growth can be obtained from full course enrolments (FCE). These are shown in Table 2 for 2003-04 and projected for 2007-08.

	2000-01 FCE	2003-04 FCE	2007-08 FCE	% Change 00/01 to 07/08
Life Science	3,938	7,025	8,717	121%
Physical Env Science	1,595	2,970	3,671	130%
CMS	3,717	3,997	5,371	44%
Total Sciences	**9,250**	**13,992**	**17,759**	**92%**
Other UTSC	**15,857**	**21,702**	**28,460**	**79%**
TOTAL UTSC	**25,107**	**35,694**	**46,228**	**84%**

TABLE 2 : CURRENT AND PROJECTED UNDERGRADUATE ENROLMENTS IN SCIENCE AT UTSC BY FCE
[from Office of CAO UTSC]

Table 2 indicates that the plan is to maintain about 39% of all student course enrolments in the Sciences; in other words growth in the Sciences keeps pace with overall growth. However, this disguises the fact that the growth is concentrated in three disciplines. From 2000-01 to 2003-04 Psychology FCE enrolments increased 100%, Biology FCE enrolments increased 66% and Chemistry enrolments increased 92%, in comparison with the overall rate of increase at UTSC of 42%. In 2003-04 there were over 1000 students in first year courses in Biology, Psychology and Chemistry. This is not expected to change.

These planned enrolment increases in the Sciences require additional faculty and TAs. More faculty means increased research facilities. To meet the demand for more TAs there need to be more graduate students on campus. Professors and graduate students both require additional space for offices. It has been possible, through sharing and some creative renovations, to accommodate the growth between 2000-01 and 2004-05. These options have now been used up, and in the absence of a new building there appears to be no way to meet the growth from 2005 to 2010.

B. Graduate Student, TA and PDF Growth

In 2000-01 there were 35 graduate students officially located at UTSC (as indicated by the preferred location for the dedication of incidental fees). By 2003-04 this number had grown to 62. Plans call for a further increase to a total of at least 140 graduate students by 2007-08, and perhaps as many as 185. The great majority (over 90 per cent) of these students are in Life and in Physical and Environmental Sciences. A professional M.Sc. programme in Environment Science has already been approved by University governance, has been reviewed by OCGS and the first students should be on campus in Fall 2005. There are several plans being developed for more graduate programmes.

	2003-04	2007-08		Increase
Graduate Students at UTSC	62	140		78
RAs and PDFs at UTSC	16.6	29		12.4
Faculty in Science Depts	89.61	103		13.39
Administrative Staff in Science	20.2	20.2		0

*** A further 5% to 10% growth is anticipated**

TABLE 3 : PLANNED INCREASES IN GRADUATE STUDENTS, PDFs, FACULTY AND STAFF IN THE SCIENCES AT UTSC
[from information provided by Departments to Vice Principal Research, 2004]

Enrolment growth requires additional teaching assistant support. The budget model for growth at UTSC indicates substantial increases in budget allocations for TAs in the Sciences by 2007-08. The model allows for about 10 additional teaching assistants in Life Sciences over 2003-04, 5 in Computer and Mathematical Sciences and 12 in Physical and Environmental Sciences. These additional TAs will require space for offices and for meeting with undergraduates, in addition to the space required by graduate students. A particular concern is that the existing Math Aid room, where students are counseled about math problems, is too small for the demands placed upon it.

In 2003-04 there were 17 Research Associates and Post Doctoral Fellows based at UTSC – all of them in the Sciences. It is difficult to project the rate of increase of these, but an index based on the recent shifts in the numbers of PDF supervisions suggests that this could rise to 29 by 2007-08, probably with all of them based in the Sciences.

C. Faculty Growth in Sciences

Faculty positions in the Sciences are planned to increase at a slower rate than undergraduate enrolment growth. The projected increases in faculty in the Sciences has been determined through discussions between the Dean and the individual Chairs about appropriate ways to allocate enrolment growth funds for their respective departments (more faculty, more TAs, improved equipment budgets etc), and have been included in the growth budget model for UTSC that projects expenditures to steady state. Faculty growth positions for the Sciences are as follows:

	Complement 2000-01	Complement 2004-05	Steady State Approved Complement 2007-08	Steady State Complement with further anticipated growth
Comp and Math Sci	**27.5**	**29**	**31**	**34**
Tenure stream	13.5	16	18	
Lecturer	14	13	13	
Life Sciences	**29.5**	**37.5**	**42**	**46**
Tenure stream	26.5	34.5	38.5	
Lecturer	3	3	3.5	
Phys and Env Sci	**25**	**24**	**30**	**33**
Tenure stream	19	15	21	
Lecturer	6	9	9	
Total Science Positions	**82**	**90.5**	**103**	**113**

TABLE 4 : RECENT, CURRENT AND PROJECTED FACULTY GROWTH IN SCIENCES AT UTSC
(growth data from VP and Dean, CAO's Office, Planning Office. Growth positions are included in the growth budget model for UTSC.)

In Fall 2004 there were an additional 13 growth positions in Sciences planned to be filled by 2007-08 (there are also some discretionary funds for up to five growth positions at UTSC that could be allocated to Science if enrolment demand and other factors warrant this). All of these positions will require offices, and at least 11 of the 13 are expected to require research laboratories. There is already a shortage of offices in CMS and in Life Sciences. In addition of the 90 current faculty in Science, fifteen will retire by 2010, and most of their replacements will require renovated laboratories. Furthermore, under the Framework for Academic Administration of the Three Campuses, approved by Governing Council in June 2002, it is expected that faculty will normally conduct their research and teaching on a single campus. To implement this for UTSC, as faculty who now have research labs at St George retire (to occur by 2007-08) these research labs will be relocated to UTSC. Four chemistry research labs and one research lab in Physics will be repatriated to UTSC under this new policy.

The need for offices and labs to accommodate growth appointments is exacerbated by the fact that some of the existing offices are in space that has been converted from closets or subdivided from former corridors. To attract new faculty as retirements occur it will be necessary to provide good quality space. Similarly several of the research labs are grossly inadequate, the product of repeated subdivisions and conversions in awkward basement space. No further growth in administrative staff in the sciences has been planned or budgeted. However, in the event that the existing departments separate into smaller departments some additional administrative staff and space will be required.

V. SPACE NEEDS FOR THE SCIENCES AT UTSC

A. Overview of Existing Space

In Fall 2004 the three science departments together occupied approximately 10,000 net assignable square meters (nasm) at UTSC, including about 180 nasm in offices in the Bladen and Humanities Wings, and 120 nasm of research facilities in the basement of the Humanities Wing.

The space is inventoried in the categories shown in Table 5 for the three science Departments.

	Life Science Actual	**Physical Sciences Actual**	**CMS Actual**	**Total Actual 2004-05**
Faculty, Graduate, Staff Offices	1051	696	621	2200
Research Labs	2972	1081	0	4052
Teaching Labs	1742	1700	109	3551
Unassigned				170
Total Nasm	**5767**	**3476**	**730**	**9974**

TABLE 5 : SPACE ALLOCATED FOR SCIENCE AT UTSC 2004-05
(based on space inventory data acquired for 2004/5 COU Physical Facilities submission)

Research laboratories for faculty in Chemistry have until recently been located in the Lash Miller building on the St. George campus. The Chairs of Chemistry and of Physics have agreed that, upon the retirement of the faculty (to occur by 2007-08) who currently have research labs at St. George, these labs will be relocated to UTSC. This will make valuable research space available in the St. George department and necessitate facilities for a core group of chemists at UTSC. A similar arrangement has been made for a physics appointment.

B. Nominal Space Requirements – UTSC Science Divisions – Steady State

An analysis of the space needs for the Sciences at UTSC, in steady state, including the relocation of facilities from the St. George campus, was prepared using the Council of Ontario Universities space standards and is shown below. This analysis identifies not only the space requirements but also the assumed profile of academic and non-academic staff and graduate students anticipated in steady state.

STEADY STATE PROJECTIONS

	Life Sci	Phys Sci	CMS	Totals	Shortfall
ACADEMIC STAFF OFFICES					
# FTE Academics (Non-Tenure Stream)	3.5	9	13	25.5	
# FTE Academics (Tenure Stream)	38.5	21	18	77.5	
# PdF (.5 per Tenure Stream)	19.75	10.5	9	39.25	
Office Nasm Generated (13 per FTE + 15% + 6.5 per PdF)	756	517	522	1,795	
Office Nasm Current	508	442	502	1,451	344
# Offices Generated (1 per FTE + 15% + .5 per PdF)	58	40	40	138	
# Offices Current	40	30	33	103	*35*
GRADUATE STUDENT OFFICES					
#FTE Grads (2.5 Per FTE Tenure Stream, Life & Phys)	96.25	52.5		148.75	
Office Nasm Generated (4 nasm per FTE)	385	210	0	595	
Office Nasm Current	316	142	40	499	96
RESEARCH LABS					
45 nasm per FTE Tenure Stream (Psych 30)	1,463	945		2,408	
22.5 nasm per PdF& FTE Grad Student (Psych 11.25)	1,901	1,418		3,319	
Research Labs Generated	3,364	2,363	0	5,726	
Research Labs Current	2,972	1,081	0	4,053	1,673
NON-ACADEMIC STAFF OFFICES					
#FTE Non-Academics requiring office space	5.95	10.27	4	20.22	
Non-Academic staff offices generated (13 nasm per FTE)	77	134	52	263	
Non-Academic staff offices actual	50	65	66	182	81
DEPARTMENTAL SUPPORT SPACE					
Dept Support Space Generated (25% of office space)	232	176	143	552	
Dept Support Space Current	178	47	12	237	314
TEACHING LABORATORIES					
Weekly Student Contact Hours	*5645*	*3626*		*9271*	
Teaching Laboratories Space Generated	*3360*	*2146*		*5506*	
Teaching Laboratories Space Actual	1743	1700	109	3552	1,954
Total Generated Nasm Sciences	8,175	5,544	717	14,437	
Total Sciences Space Inventory Current	5,767	3,477	730	9,974	
TOTAL STEADY STATE SHORTFALL/CURRENT	-2,408	-2,068	13	-4,463	**4,463**

TABLE 6 : SPACE SHORTAGES IN THE SCIENCES (USING COU GUIDELINES)

The 4,500 nasm identified in the Shortfall column give a strong indication of the severity of the potential space shortage in Sciences to be experienced with continuing enrolment growth. If growth continues as it is planned and projected and no additional space is provided to meet the needs of Sciences, by 2007-2008 actual space will be about 70% of what is required according to COU standards. In the absence of further construction, the repatriation of research labs for chemistry and physics faculty, will exacerbate UTSC's already acute space shortages.

A preliminary macro analysis of all three campuses in steady state has been prepared by the Planning Office that suggests that the overall space at UTSC will be at approximately 66% of the COU guidelines. Thus there will be significant space shortages on the campus as a whole, and especially in Life and Physical Sciences.

The projected increases in enrolment and the need for additional space go hand in hand. *Since there is already a serious space shortage for Sciences, it will be impossible to accommodate the planned increases in science professors and graduates at UTSC without a new building. And without the projected new faculty positions it will be impossible to meet all the instructional needs for projected increases in enrolment in Sciences at UTSC.*

C. Reallocation of Existing Space for Sciences Expansion

Additional space for the Sciences is to be provided through conversion of the current administrative offices and Council Chamber on S4, approximately 500 nasm. With the construction of the Arts and Administration Building most of the administrative offices on the fourth floor of Science Wing will move to the new building. This will permit those areass to be used to meet the needs of the Sciences. Since the space is contiguous with the laboratories and administrative offices on the rest of fourth floor it will provide an appropriate addition to the Science space inventory. The details of the reoccupation of this space have yet to be developed, but it includes a mixture of windowed and inside spaces that will probably be used for offices and perhaps for some dry labs. It is very probable that the Physical and Environmental Sciences Departmental Office will move to this area. Also facilities for the new M.Sc.Env programme will be based here, at least until the new building opens. The cost for this reallocation of space is part of the Arts Classroom project.

D. Strategies for Resolving Space Needs in the Sciences at UTSC by 2007-08

The preceding analysis indicates that UTSC will need 4500 nasm of new space for the Sciences to meet COU guidelines in steady state enrolment. A further 1,000 nasm may be required if an anticipated increase of 10 FTE in the three science divisions is realized. In a perfect world, with unlimited funding for capital construction, this requirement would determine the proposed size of the new building. However, the reality is that confirmed funding for this project is limited to about $31.5 million, and this will permit the construction of a building with half the space needed to meet the COU guidelines. Alternative sources of funding, for instance, from granting agencies such as CFI are being pursued aggressively to meet the remaining needs, and if these are forthcoming then it should be possible to add to the space in the new Sciences Building. However, it is extremely unlikely that these sources can be confirmed prior to the submission of this report for governance approval in the University. For example, construction will begin early in 2006 but the earliest the results of a CFI application could be known is at the end of 2006.

To address this possibility, a two-phase strategy is developed in this report. Phase One

proposes a space programme that is adjusted to the capital funding of $31.5 million that is currently available, after making allowances for estimated costs of any secondary effects and infrastructure needs. The second phase identifies a conceptual space programme for expansion to meet needs up to the COU standards. This second phase will assign priorities to space needs, so that if only part of the additional funding becomes available, expansion can be scaled to those funds. It is envisaged that, in terms of construction, the second phase will be a horizontal extension, and that a conceptual design for Phase Two will be undertaken as part of Phase One. As soon as additional funding sources are confirmed, the detailed design of this second phase can begin, but should no such funds become available the first building will meet essential needs and be fully functional.

In the event that additional funding should become available early in schematic design (about September 2005), it is possible that an expansion and/or revision to the space programme may be required. In effect, part of Phase Two could be added to Phase One.

In order to facilitate this phased approach, and to expedite the writing of this report when all the new occupants of Phase One are not known, an emphasis is placed on modular designs for generic laboratories. These are laboratories that have a well-developed service core, but in detail they can be adapted to many different types of research as personnel and priorities change.

VI. PROPOSED SPACE PROGRAMME FOR A NEW SCIENCE BUILDING

A. Introduction

The analysis of space needs in the previous section indicates that a science building of approximately 4,500 nasm will be required to bring UTSC to the COU guidelines for space in the Sciences and to meet additional requirements for chemistry research labs as these are transferred from St. George. (A further 1,000 nasm may be required if an anticipated increase of 10 FTE in the three science divisions is realized, although at present no sources of funding for this additional increase have been identified) It is also the case that a two phase approach to the construction of the new facility is needed, with Phase 1 being determined by the amount of funding that is confirmed and Phase 2 being the expansion from this to 4500 nasm.

B. Phase One New Science Building Space Programme based on Available Funding of $31.5 total project cost

The space programme that can be achieved using funding already in place has been estimated by allocating all secondary and associated costs against $31.5 million available, and then working out what can be built for the balance. These are detailed in Section IX. The space programme derived in this way is shown in Table 7.

The generic research laboratories comprise the largest element of the space programme. A generic laboratory is a laboratory equipped with the basic infrastructure that will be required in

a wet laboratory suitable for chemistry research. A generic laboratory is one that can be adapted for almost any type of research in the future, without needing expensive renovations. The detailed fittings and furnishings are to be added when a specific user is identified and paid for from research start-up or other funds.

This space programme resolves much of the shortfall in research laboratory space at UTSC but does not directly address the shortfall in teaching laboratory space. Rather than situate new teaching laboratories in a new building where they will be isolated from existing support services and other laboratories, the intention is to convert research areas in the Science Wing to teaching laboratories (their original use), and move research activities to the new building. This will mean that most teaching areas will be contiguous, and most research facilities will be contiguous and can share security and support facilities. Some of the funds identified in Section IX Secondary Effects will be used for this reconversion to teaching uses.

A classroom facility has been included in the space programme because UTSC is severely underserved in this area. An analysis prepared jointly by UTSC and Campus and Facilities Planning indicated that to meet the most critical instructional space needs for enrolment growth in steady state an additional classroom with a capacity of 150 stations or more is required. The space programme assumes a 150 seat room with continuous desks, but if the seating takes the form of tablet arm chairs the capacity can be significantly increased without increasing the space. The decision about preferred seating will be made on the basis of a further analysis of needs that will be completed prior to the appointment of an architect. While the New Science Building is under construction the Sprung Pavilion, that is to be relocated,can meet some of the demand for teaching space and can also be used as an exam facility.

New Science Building at UTSC - Phase One Space Program

# Rooms	Room Use	Nasm Per Room	Total Nasm Per Room Use	**Total Nasm**
CLASSROOMS and STUDY SPACE				
1	150 seat	250	250	
				250
RESEARCH LABS				
16	generic wet labs	70	1120	
various	lab support areas that could be dedicated, departmental and/or central; calculated at 40% of the generic labs and may consist of the following types of rooms: *small meeting room (16-seat) 28.0 nasm each (2)* *chemical prep 12.0 nasm each (6)* *wet instrumentation rooms 12.0 nasm each (10)* *cold rooms/misc 12.0 nasm each (4)* *dry instrumentation rooms 12.0 nasm each (6)* *data analysis/storage rooms 12.0 nasm each (4)* *autoclave room 12 nasm (1)* *other (growth chamber, clean room, etc.)* *To a total of 448 sq.m.*		448	
				1,568
ACADEMIC OFFICES				
16	faculty	12	192	
8	pdfs/ras (2 stations per 12 sq.m. office)	12	96	
16	graduate (3 stations per 12 sq.m. office)	12	192	
				480
ADMINISTRATION/OTHER				
4	technicians	6	24	
2	non-academic staff	13	26	
1	office supplies/storage/machine room	25	25	
1	common room space	50	50	
1	meeting room	75	75	
1	ground floor lobby/showcase area	45	45	
				245
			TOTAL	**2,543**

TABLE 7 : SPACE PROGRAMME FOR PHASE ONE NEW SCIENCE BUILDING

In addition to the assignable space detailed in the space programme, the design of the New Science Building must also include the following non-programme spaces:

- Delivery area – an area similar to that in the Management Building will be required for garbage storage and major deliveries. This might be appropriately combined with the Janitor's closet on the ground floor.
- A secure, small closet for storing radioactive waste should be included as part of the delivery area.
- Data and Communications closets – one every other floor, possibly combined with electrical closets
- Security Closet – one on a middle floor, stacked with data closets to use opening in floor plate
- Janitors' Closets. One per floor. The closet on the ground floor (preferably) or at the basement level, must be about 2.5m wide by 6m long, (to permit storage of maids carts, floor scrubber machine and vacuums), and include a slop sink, one dedicated outlet for recharging equipment, and storage shelves. The other closets can be smaller but should be about 1.5m x 3m and include a slop sink and storage.
- Washrooms. The provision of washrooms should exceed minimum code requirements on the ground level.
- Accessible Washrooms. In addition to code requirements a fully accessible washroom large enough to accommodate a scooter should be located on the ground floor adjacent to the lecture theatre.
- Elevator. One elevator is proposed. It should be large enough to transport laboratory equipment. Elevator access will be required to all levels.
- All necessary mechanical and electrical rooms including penthouse space

The net assignable to gross factor for this building is to be 1.97. This is relatively generous because a special space allowance is needed for the bridge that will connect the New Science Building to the S-Wing and because the classroom will require a crush area. It is important that the additional space allowed by the gross-up of 1.97 be used judiciously to reinforce the important public spaces in this building such as crush space at the entrance to classroom and the ground floor lobby/showcase area.

In summary, the space programme is for 2,543 nasm, or 5,000 gross square metres, plus a bridge of approximately 75 gsms, for a total of 5,075 gross square metres.

C. Phase Two - Space Programme

There is at this stage no detailed space programme for Phase Two. This programme will be developed both on the basis of information gathered from scientists at UTSC about research teams, types of research labs and requirements, and in relation to the shortfalls indicated in Table 6 that cannot be met in Phase One.

Of the total estimated shortfall of about 4500 nasm, Phase One will provide about 2250

nasm (the classroom space of 250 nasm is not part of the shortfall). An additional structure is required that will provide 2250 nasm of science related facilities.

Phase Two will mostly add new research facilities. The remaining shortfall in teaching laboratory space will be resolved by the conversion of existing research areas in the Science Wing to teaching laboratories where they will be contiguous and can share appropriate support facilities. Phase Two will therefore be dedicated to research and compatible with Phase One. With the completion of Phase Two it is expected that the shortfalls in office, research and teaching laboratory space identified in Table 6 will have been resolved

Phase Two is intended to provide space that will enhance and expand Phase One in order to create a coherent, adaptable and innovative facility for scientific research on the campus at UTSC. It is expected that this will be funded largely from a combination of research awards, donations and commercial sources. Because these are not yet known and because the funding could in some cases be contingent on the provision of specific facilities, it is not at this stage possible to provide a detailed space programme. The space programme is, however, expected to consist primarily of research laboratory spaces similar to Phase One, but also possibly containing some dry labs. In addition there will be office space, some limited administrative areas and a ground floor area that will be used to showcase research at UTSC.

It is expected that discussions with science faculty and the targeting of research directions will allow the space programme for Phase Two to be detailed by about July 2005. At the present time it is thought that specialized research facilities might include some combination of cold rooms, clean rooms, perhaps a virtual reality cave, and possibly a computer laboratory dedicated to the analysis of very large data sets, because there are active researchers at UTSC who could greatly benefit from these types of facilities.

VII. FUNCTIONAL RELATIONS

The committee has carefully considered the ways in which the various spaces in Phase One of the New Science Building should be arranged, both horizontally and vertically**.**

The space programme for this building identifies four major elements:

- research laboratories
- classroom
- faculty and graduate student offices
- meeting areas

Within the research laboratories careful attention must be paid to the organization of facilities in each 70 nasm laboratory so that these offer the possibility of expansion or contraction with changing use. The demising walls should be designed to permit them to be relocated in the future, and in the context of a substantial renovation, so that one laboratory of about 100 nasm and another of 40 nasm can be created without having to reconstruct ventilation

systems. This will require attention to the relationshihp between window mullions, the HVAC and lighting systems.

The classroom has to be fully accessible to undergraduate students and should be located on the ground floor.

The research laboratories must be completely secure but must be as close as possible to faculty and graduate student offices. To accomplish this, on each floor of the building the research areas will be located behind a security perimeter, with related faculty offices and graduate offices primarily located outside of the perimeter because they must be accessible to undergraduate students. It is expected that the security system will require card access. Some offices for graduate students and post doctoral fellows can be located behind the security doors. An appropriate arrangement would have the offices stacked at one end of the building, with the elevator opening into this public zone.

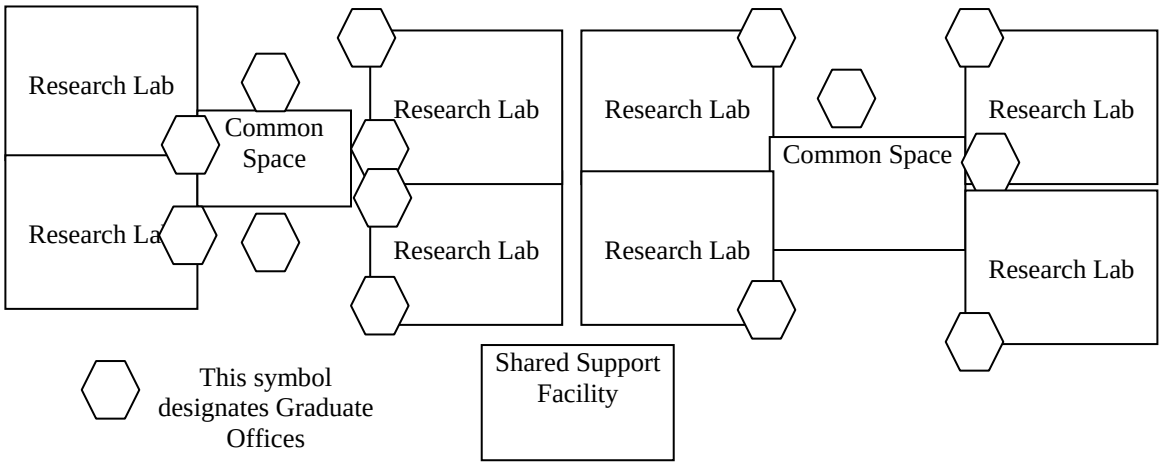
On each floor there will be a meeting or common area. On the ground floor this will be an area adjacent to the classroom that can also be used during conferences for registration and serving coffee, and during regular use can serve as a lounge or study area for students. On upper floors these meeting areas will be within the secure zone because they are intended to provide places where researchers can meet for coffee or in small discussion groups to exchange ideas.

There will be a bridge connecting the new building to the Sciences Wing. One of the common areas should be located at the landing of this bridge in the new building. It is anticipated that this will be in the centre of movement between the old and new buildings causing users to meet. It should be designed to be conducive for informal meetings and discussions.

All corridors in the new building should terminate with windows. The ends of the corridors can serve as very small lounge areas, perhaps with a coffee table and two or three chairs, again creating useful areas for researchers to meet informally.

Within the research lab/secure area the Project Committee formulated a clear sense that the space should be arranged in clusters of academically related research laboratories, each around a common service core, perhaps including a small meeting/common area. This is intended to facilitate informal meetings and exchanges. Wherever possible there will be shared preparation facilities and instrument rooms in order to achieve efficiencies of use and to facilitate interaction between researchers.

The offices for graduates and pdfs should be close to the labs but not necessarily integrated with them.



Functional Relations between Phase One and Phase Two

The New Science Building is intended to have two phases with almost identical gross floor areas. The timing of Phase Two is not yet established but it could follow quickly after Phase One. This has several implications for site and design of Phase One, and it will be necessary to develop a concept plan for Phase Two in association with the concept plan for Phase One. This will require several considerations that depend on whether the two phases are contiguous or take the form of two separate but linked buildings.

a) Phase One must be situated to allow room for an adjacent building of equivalent size.
b) It will be necessary to include in the design of the electrical services, steam and chilled water services for Phase One, sufficient capacity to accommodate the needs of Phase Two. The total project cost allows for this requirement.
c) Core areas of Phase One should be designed and located so that they will functionally relate to equivalent areas in Phase Two. For instance, the elevators and some fire exits could be functionally related in the two phases to enable sharing between the two phases.
d) Corridors in Phase One should, where appropriate, be designed to connect with corridors in Phase Two.
e) Secure areas and public areas might be combined in the two phases
f) The ground floor in particular needs to be designed so that the connections between the two phases will be almost seamless.

VIII. SITE AND ENVIRONMENTAL CONSIDERATIONS

Potential sites for the New Science Building are constrained by planning and environmental considerations.

The Campus Master Plan 2001 shows an extension from the existing Science Wing, wrapping around the Soil Erosion Laboratory. However, this extension, as shown on the Master Plan, would result in odd shaped and potentially terraced buildings as well as tie the design of the new building to existing floor heights. These elements would limit the flexibility of design.

In addition, part of this intended site is now restricted because of a change to the City of Toronto Ravine Protection By-Law. The Ravine Protection Line was developed in 2003 and includes a set-back from top of bank that extends beyond the former 10 metre setback, and is determined by local conditions involving slope stability and trees.

In summary, the University has concluded that the Master Plan site poses numerous problems that could seriously constrain the design of a flexible research facility. The conclusion is that the University would be better served by a stand-alone building with an enclosed connection to the S-wing.

Depending on the configuration, the New Science Building may have to avoid most of the areas variously identified by the City as Natural Heritage areas and as zones governed by the Ravine Protection By-Law. However, some negotiation with the City about these precise boundaries should be considered because they do offer significant site constraints.

The outline of the building proposed in the Master Plan, the top of bank and the ravine protection line are shown in Figure 1.

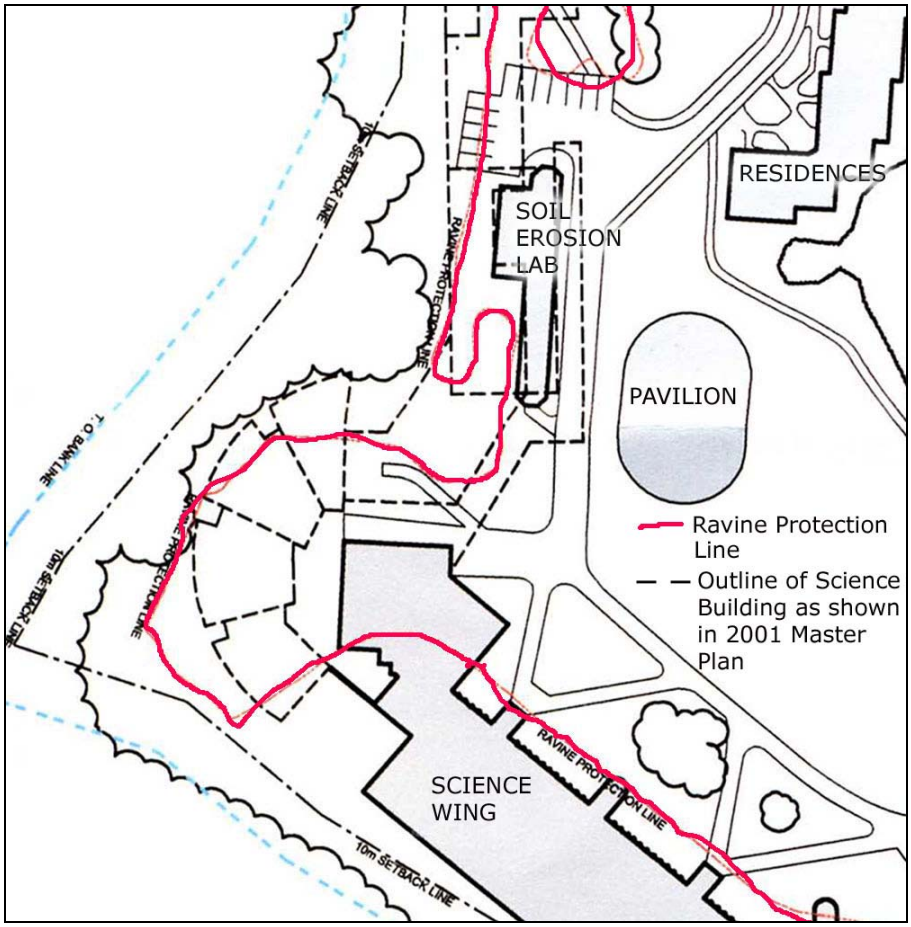


Figure 1: Site Area of New Science Building showing Ravine Protection Line and Outline of Science Extension in 2001 Master Plan

The site proposed for the New Science Building is at the south-west end of the playing field adjacent to the Science Wing.

- The new building will either displace the Soil Erosion Lab or be located on its east side. The Soil Erosion Laboratory is long and narrow building, designed for a single purpose. It is not suitable for renovation for offices and laboratories. This soil laboratory may well be on the best site for the new building. If it can be protected it could provide useful possibilities for providing inexpensive space for science research activities, such as growth chambers and storage for environmental science equipment. Its value for these uses should be carefully assessed. If the soil erosion building is displaced by new construction some alternative structure will have to be built to accommodate storage of environmental science field equipment and other materials displaced by the demolition of the portables, and to provide space for the maintenance of that equipment. This could be an industrial prefabricated structure, such as a Butler building. It will need vehicle access. The total project cost allows for either possibility.

- The New Science Building will entirely displace the Pavilion - a 300 seat classroom in a temporary and demountable structure that will be relocated elsewhere on campus and either reused as a classroom or converted to other uses. It should not intrude beyond the present site of the Pavilion into the open space to the east, which is used for intramural activities and orientation, and is identified in the 2001 Master Plan as an open space that is to be protected.

- In the planning for both Phase One and Phase Two of the New Science Building consideration needs to be given to a reasonable set back from the existing residences and allow for appropriate fire route and pedestrian access.

- There will have to be a fire route to the new building and the western end of the Science Wing. The current fire route is no longer compliant with code requirements and will be reconstructed as part of this project. It follows the original Andrews design, but it is not necessary to maintain its existing alignment if a different alignment will facilitate the site of the new building. The committee has considered the possibilities that it may be relocated closer to the north west face of the S-Wing to allow an expansion of the playing field and may form a continuous loop through the residences and back to Military Trail. It will serve both as a fire route and a service road.

- It is essential to connect the New Science Building to the existing Science Wing by a bridge. This will allow the use of existing facilities, such as the vivarium, without going outside, and to ensure the effective continuation of the original Master Plan. At the same time it will be necessary to maintain an access route around the New Science Building to allow access for grounds and maintenance equipment to the south side of the Science Wing.

- Given the constraints of this site it is expected that Phase One of the science building will have a footprint of about 1200 gross square meters. It is imperative that the site of the first phase allow enough room for the addition of Phase 2. With a mechanical penthouse and modern floor to ceiling allowances, it is expected that the new buildings may be slightly higher than the adjacent Science Wing.

- Figure 2 shows the boundaries of the site. The area at the end of the Science Wing currently occupied by portables is considered to be a secondary site area, that might be used as the location for storage buildings but is not considered suitable for Phase One or Phase Two because of the constraints imposed by the top-of-bank, the ravine protection line and its awkward configuration that could both compromise the internal organization of the buildings and drive up construction costs.

- Figure 2 also shows that the open space to the east of the site is a no-build area that will continue to be used for recreational activities. If the building site approaches this then it is imperative that design adjustments be made to accommodate this recreational use, such as an appropriate landscaped setback.

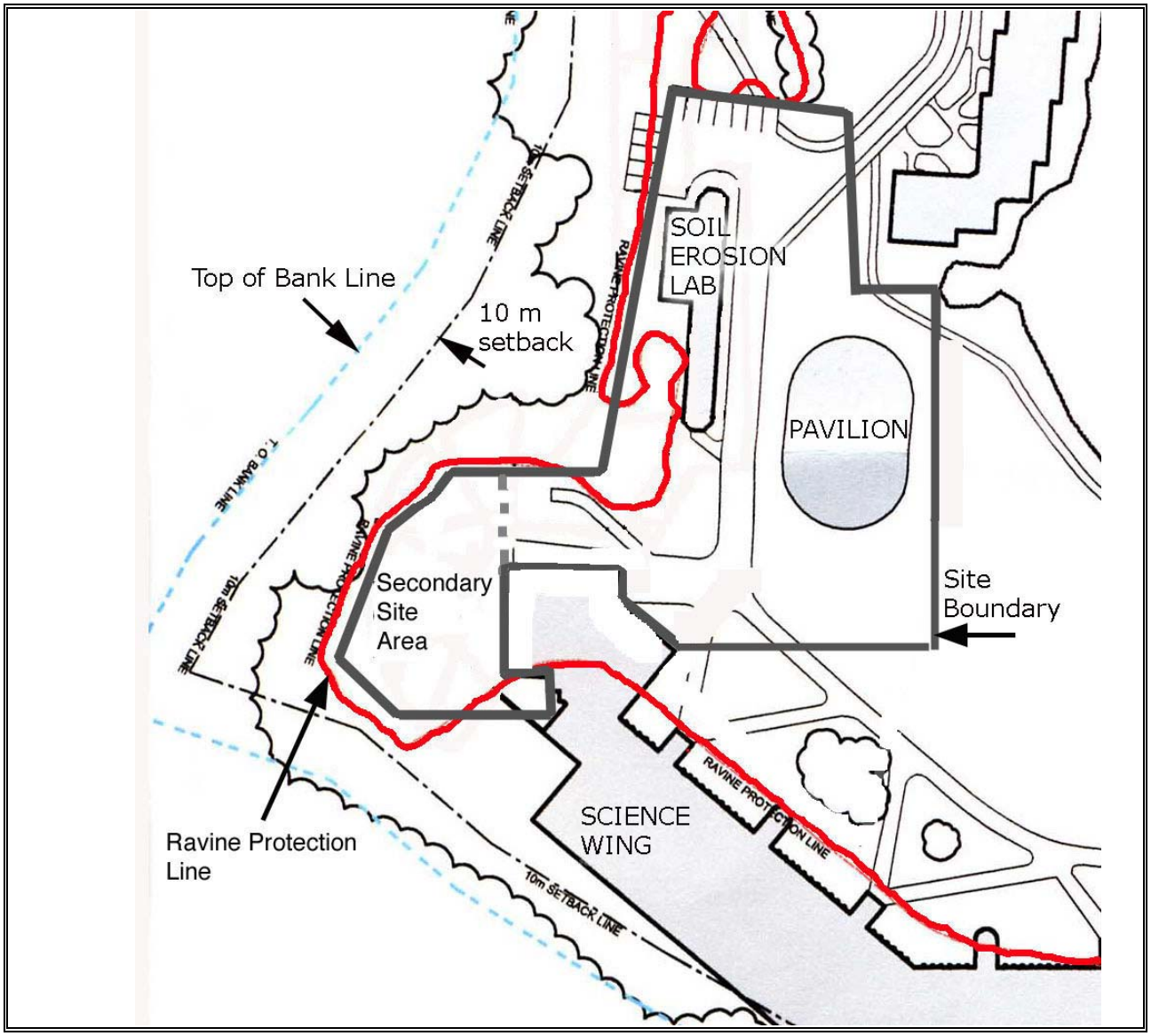


Figure 2 : Boundaries for the site for both Phase One and Phase Two of the New Science Building, showing secondary site area.

- It is also known that the main services to campus, including water supply, sewers and power run under or adjacent to this site. These are shown in Figure 3. It is likely that a separate tender package will be required to relocate the necessary services and undertake whatever demolition and site clearing is required.

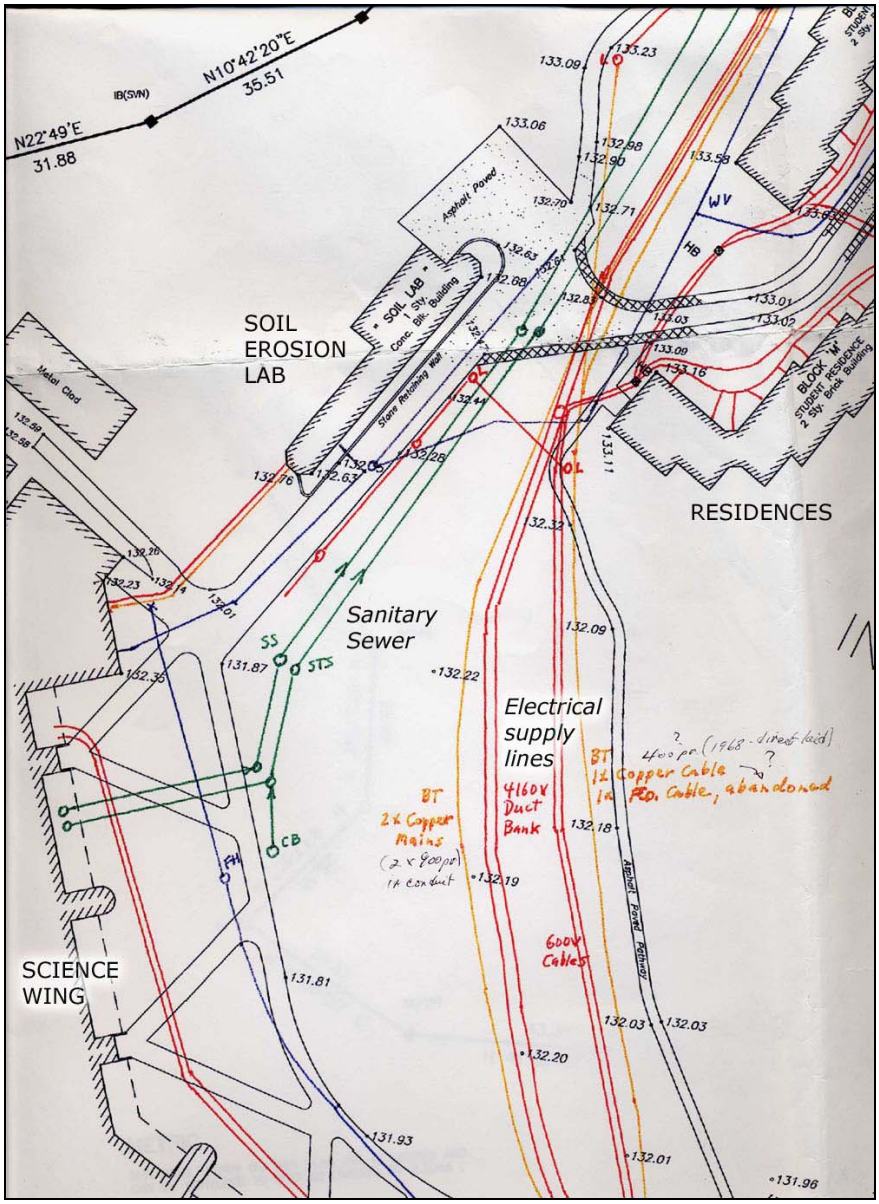


Figure 3: Approximate location of services on the potential site of the New Science Building. Note that this drawing does not show the Pavilion.

IX. SPECIAL CONSIDERATIONS AND SECONDARY EFFECTS

A. Infrastructure Upgrades

It will not be possible to operate a New Science Building without some substantial upgrades to central infrastructure, in particular the replacement and reconfiguration of the boilers that are required to provide heat and steam for the new building. These upgrades have been identified in a multi-phase for the improvement of infrastructure at UTSC that has been approved in principle both by AFD and the Planning and Budget Committee in the context of various other infrastructure projects. In order to provide sufficient and dependable steam for the new building it will be necessary to replace two, inefficient, thirty-nine year old boilers with four smaller, new boilers that will provide increased capacity while reducing operating and utility costs. This will resolve a major deferred maintenance problem at UTSC, and it will have substantial benefits for the entire campus.

The estimated total project cost for the replacement of the boilers, including all fees and taxes, plus all required asbestos removal, has been taken from the Phase 5 plan for infrastructure improvements at UTSC. It is based on information provided by mechanical engineering consultants.

This work is essential for the functioning of the New Science Building. It is, however, included in the total project cost as a separate line item because it is a specialized project and will be undertaken through a separate tender process.

B. Possible Relocation of Services

It was noted in the section on Site that the New Science Building could disturb some of the main services to the campus. An allocation has been made in the construction budget to cover this possibility.

C. Possible Secondary Effects

The New Science Building has numerous effects, some of which are secondary and others that are related to the project and will need to be accomplished in order to ensure that all science facilities at UTSC are of consistent quality and that the building can function efficiently. Note that these are not included in the main tender for the New Science Building but will be undertaken as separate projects. The budget for the construction of the New Science Building is net of the costs of these secondary and associated effects.

The estimated total costs for each of the secondary and associated effects are shown in Table 8. Some of these costs are based on firm information but others are based are less substantial information and are, in effect, allowances. In the event that they are too high or perhaps not required at all, the budget allocated to them will, in the first instance, be allocated to any additional unanticipated secondary effects, and in the second instance will be allocated to

any matching funds required for Phase Two of the New Science Building Project, and in the third instance will be allocated to the building project itself.

Item	Description		Total Estimated Cost
Chemistry Teaching Lab Upgrades SW151 SW165	Phase 2 of Chemistry Teaching Renovations for upper level courses		$600,000
Biology Teaching Lab Renovations	Upgrades for new course, fume hoods, and additional rooms		$200,000
Upgrades to Research Facilities in S-Wing	Additional emergency power circuits, additional storage and office space for Animal Facility, upgrades to cold rooms		$250,000
Rationalisation of space in S-Wing	To provide more efficient clusters of research and other activities		$250,000
Relocation of Sprung Pavilion	Costs for demounting and remounting pavilion, including concrete pad and all services		$535,000
Renovations of Soil Erosion Lab	Base costs of conversion of Soils Lab for Growth Chambers, storage etc or provision of an alternative structure to house these (at a premium of $100,000 over amount in TPC)		$150,000
Demolition and Removal of Portables			$75,000
Relocation of Grounds Vehicles Compound	If required		$50,000
New Emergency Generator for S-Wing			$300,000
Replacement of S-wing fire doors	If required – replace non-latching doors with latching doors to meet current code		$100,000
Rental of Cabins	If required – rental of cabins for temporary storage and offices		$15,000
Total Secondary Effects			$2,525,000
Central Infrastructure Upgrades	Replace existing main boilers to provide steam for new building and address a deferred maintenance problem		3,050,000

TABLE 8: SECONDARY AND ASSOCIATED EFFECTS AND ESTIMATED COSTS

1. Chemistry Teaching Laboratory Upgrades

The renovation of Chemistry Teaching Labs completed in Fall 2004 was the first of a two phase project. Enrolment in undergraduate chemistry courses has more than doubled since 2002-03 and this high level of enrolment is expected to be sustained as faculty research facilities are repatriated from St. George and enrolments increase in the specialist programme in Chemistry.

The second phase of renovations will involve modifications to S151 and S165 to increase fume hood capacity and to provide up-to-date facilities. The intention is to locate the fume hoods on the perimeter of the laboratories, and to equip them for upper level courses. Costs are estimated on the basis of expenditures on the renovations completed in 2004

2. Biology Teaching Laboratory Renovations

As part of the Phase 1 renovations the Biology Teaching Labs received minor

modifications. With continuing high enrolments in Biology courses and a high retention rate, there is a need for more technically sophisticated teaching laboratories suitable for upper level courses, and for reorganization and expansion of laboratory support areas. The average scheduled use of teaching labs in 2004-05 is 22 hours per week, which is four hours a week over the COU guideline.

The preferred area for conversion to a Biology teaching laboratory is a room close to existing support areas, near S135. This lab might be dedicated to dissections and specially equipped to remove preservative fumes. All Biology teaching laboratories on level 3 should be equipped with fume hoods, and require new floors and other renovations. New ducting was installed in association with the 2004 chemistry lab renovations. The costs of the installation of the new fume hoods in four existing laboratories, plus the renovations to convert an existing space into a new teaching lab, are based on recent modifications to other laboratories.

3. Upgrades to Research Facilities in the Science Wing

Many of the individual research labs in the Science Wing have been fitted out in the last few years by individual researchers, but there are some shared facilities that need to be upgraded. These are the research autoclave, the walk-in cold rooms, and the installation of emergency showers and eye-wash stations where these do not currently exist.

The number of emergency outlets needs to be substantially increased to ensure that essential equipment, such as ultra-cold freezers, keeps running during power outages.

The animal facility is on the sixth floor in very constrained quarters, and there are seriously inadequate facilities for food storage and for a related office. The actual animal facility cannot be renovated without raising difficult issues of upgrades to comply with current codes, but the reallocation of space associated with this project and with the opening of the Arts and Administration Building, will make available some space immediately adjacent to the existing animal facility that can be incorporated as a storage and office area. This will require some minor construction and the relocation of security equipment.

4. Rationalisation of existing space arrangements in the Science Wing to create clusters

Workshops associated with the development of this project report repeatedly identified difficulties associated with the fact that so many researchers have offices and labs on several different floors that are widely separated. The movement of some faculty into the new building will create an opportunity to correct these inefficiencies by reorganizing and reallocating facilities so that labs and offices are conveniently located, and groups of researchers are in contiguous locations. It will also permit the reclamation and rationalization of teaching laboratories a number of which have been taken over for research.

5. Relocation of the Sprung Pavilion

It is very probable that the new building will take up all or part of the site of the current Sprung Pavilion building. The building will have to be relocated, a process that will require removing all the mechanical and electrical fittings and fixtures, pouring a new concrete pad in the new location, demounting the structure itself and reinstalling. Cost estimates are based on original installation costs and information provided by Sprung. The structure will have to be relocated by the end of November 2004 if the construction schedule is not to be adversely affected.

6. Possible Renovation of the Soil Erosion Laboratory

If, from a campus planning perspective, a satisfactory solution for the site of the new building is found that retains the existing Soil Erosion Laboratory, then a modest renovation of the interior of that building could be undertaken. This building is in good condition and provides relatively inexpensive space that would be suitable for a number of activities associated with the New Science Building, for instance the installation of growth chambers, and/or the storage and maintenance of environmental science field equipment.

The retrofitting of the Soil Erosion Lab for such purposes would not require extensive work. Some preliminary cost estimates for similar renovations obtained in 2004 for renovations to this building and these have provided the basis for the current cost estimate.

If the New Science Building is located on the site of the Soil Erosion Laboratory, space for environmental and other storage and for growth chambers will have to be provided in an alternative structure, such as a prefabricated Butler Building. In this instance the allocation for renovation will simply be redirected to the new structure.

7. Demolition and Removal of Portables

The portables were installed in 1971 as temporary structures. They are now in poor condition, extremely expensive to heat and cool because they have no insulation, and badly located for almost every purpose. They may also be on part of the site for the New Science Building. The cost estimate is based on recent experience with demolition elsewhere on the campus. These portables have until recently been used as temporary classrooms, but all classes have now been scheduled in proper classrooms. However, there is about 220 nasm of storage, about 60 of it for Environmental Science, currently located in portables and some of this will have to be replaced

8. Move Grounds Vehicle Compound

The grounds vehicles were moved to a new secure compound adjacent to the Soil Erosion Laboratory in 2004, when the delivery tunnel was renovated and modified for more efficient uses than parking. The cost estimate is based on the 2004 construction cost for the existing facility.

9. New Emergency Generator for Science Wing

The emergency generator is about 40 years old, in very poor condition and incapable of meeting the demands placed on it by new science research equipment. The estimated cost for replacement has been provided by Facilities Management. Note that this new generator should provide sufficient capacity for both the new and the existing building.

10. Replacement of Science Wing Fire Doors

The proposed renovations to teaching and research facilities in the Science Wing could raise a code issue; the existing fire doors do not latch and it is possible that a condition of building permit will require that all of them be replaced with latching doors. The estimated cost of this work is a contingency allowance and subject to revision.

11. Rental of Cabins for temporary offices and storage

The New Science Building will not open until January 2008 at the earliest, and in the meantime it will be necessary to accommodate some faculty offices needs and equipment storage needs. There is no space in the existing buildings, especially for storage, so this is most expeditiously achieved by renting trailers (as has been done recently at UTM), perhaps for two years. A contingency allowance is being made and this can be revised when precise needs are known.

B. Computing and Telecommunications

This building has to have a high standard of connectivity with sufficient bandwidth to permit researchers to connect to the central Sun computing cluster. It should be wireless wherever possible, but all laboratories, offices and classrooms are to have data drops.

C. Standards of Construction and Quality

The New Science Building will accommodate pre-eminent researchers and the design should be of a high quality. This is especially important in terms of the likelihood of the Phase Two part of the building, which will probably include spaces for international conferences and visiting researchers.

All research labs need to be constructed of materials that will be resistant to chemical spills and fumes. Labs and offices should take the fullest possible advantage of the site of the building adjacent to Highland Creek, and should have generous office windows that are operable. Corridors should terminate at windows. The building should have a distinctive entrance.

The budget assumes a four storey building, plus penthouse, with a floor to floor height of

five metres at ground level, and 4.2 metres for the upper floors. It further assumes that the building will have a double loaded corridor arrangement, similar to the Davenport wing of the Lash Miller building at St. George. The budget also assumes that for the cladding there will be a mixture of about 50% curtain wall and 50% masonry or equivalent.

D. Landscape and Design Requirements

The site of the New Science Building is adjacent to Highland Creek ravine and woodlots, and it may house facilities for the Environmental Sciences Programme. The landscaping should be sensitive to the site and the intended uses of the building. This building will form the backdrop to the open space on the north side of the Science Wing, which is well used for recreational activities. It must preserve and enhance that space and the active uses that currently occur there.

At the same time, it is essential that the architectural design respect the powerful architecture of the John Andrews building. Attention should also be given to the urban design considerations of the campus, especially the relationship between pedestrian and non-pedestrian realms.

E. Energy Efficiency and Green Design

The UTSC campus has two buildings at LEED standards and is developing a reputation for energy efficient design. The New Science Building should continue this practice of green building and should be designed as far as possible to LEED certifiable standards. Especial attention should be paid to ensuring the highest levels of energy efficiency that provide a payback period no greater than about six years. However, some features of green design that have been used in the Student Centre, for example low-flush toilets and waterless urinals, have not proved satisfactory, and attention must be paid to ensure that design of such fixtures is consistent with institutional research uses rather than green ends.

F. Parking, Entrances, Site Servicing

The UTSC campus is currently governed by a parking by-law that requires 2.15 parking spaces per 100 gross square metres. The New Science Building will be about 5000 gross square metres and will generate 108 additional parking spaces. The UTSC campus is in excess of the by-law requirement generated by built space. No additional parking spaces must be provided.

Vehicular access to the building can only be through Phase 3 residences or along the fire route adjacent to the Science Wing. Careful analysis is required to ascertain which of these will be the least disruptive option to the campus as a whole and the building should be designed to reflect this.

Site servicing will, at least, in part, make use of the central facilities on the campus, including the central steam plant and cooling towers. These are being renovated and upgraded in

a multi-phase plan to provide additional capacity for new buildings. The major secondary effect of the New Science Building is the installation of new boilers in the central plant (Phase 5 of the Infrastructure Upgrade programme). This project will not be possible without this upgrade; at the same time it provides an opportunity to address a serious deferred maintenance problem from which most buildings on the campus will benefit.

X1. ESTIMATED TOTAL PROJECT COSTS

The firm of AW Hooker, cost consultants, was retained to assist in setting a reasonable budget for a building of this type. Their estimate for the construction amount includes escalation to an anticipated tender in March 2006. The estimate is for a four storey building plus penthouse, with a total gross area not greater than 5,000 GSM. In addition to this are allowances for the construction of a bridge (including associated work in S-Wing), for the relocation and upgrade of the fire route and for the expected relocation of existing site services. The estimated construction cost for this work before tax is $18,095,000.

There are, however, a number of secondary projects that are not included in this cost estimate, including the upgrade of the central boiler plant, replacement of the S-Wing emergency generator, the renovation of chemistry teaching laboratories, and the upgrading of existing research facilities in the Science Wing. These are listed in Section IX, and shown in the cost detail in Appendix 4. It is estimated that these will add a total of $5,375,000 bringing the total estimated cost for the New Science Building project to $31,500,000.

The maintenance, operating and utilities cost of the New Science Building is estimated at $110 per net assignable square metre at 2008 costs. At 2543 nasm, the annual operating and maintenance costs are estimated at $279,730. Provision for this has been made in the UTSC long-term budget model.

XII. SOURCES OF FUNDING FOR CAPITAL AND OPERATING COSTS

The Science Building at UTSC is identified in the Capital Plan with a projected borrowing contribution of $20 million. The projected cost for phase 1 of the Science Building is $31.5 million.

The planned sources of funding for the project are identified below, however it is proposed to request the approval of only $3,000,000 at present to allow for the design to proceed to the call for tender stage of planning. This will enable sufficient time, through to March 2006, to confirm the various sources of external funding that are required for the project as noted below. Should the project not proceed according to the schedule outlined, any additional costs incurred as a result of delays with be carried by UTSC.

Planned Funding Sources: $20 million borrowing: The repayment of the $20 million mortgage, commencing upon completion of the project in December 2007, will be paid from the operating budget of the University of Toronto at Scarborough. The capacity to address these

charges has been addressed and confirmed by the Vice-President and Principal of UTSC.

Planned Funding Sources: $11.5M: Additional funding for the project is required and will be derived from the following sources.

1. Cash allocation of $3,000,000 from the one-time-only fund identified in the 2004/05 operating budget of the Office of the Provost for academic projects seriously restricted by shortcomings in infrastructure and deferred maintenance. These funds will suffice for Phase 1 of the project to proceed to design and tender and will, in the total context of the project, contribute to the direct infrastructure costs of the project currently estimated at $3,050,000.

2. The allocation of $4.5 million from UTSC carry-forward funds.

3. Funding from external sources in the amount of $4.0 million to support the project that could potentially materialize within the next twelve months. The various options that are available for consideration include:
    a. new support for capital projects from the Government of Ontario that could result from the spring budget.
    b. submission of CFI [Canadian Foundation for Innovation] proposals by UTSC faculty members that will support the development of these new science research facilities in targeted areas of research endeavour.
    c. elect, prior to the commencement of construction, anticipated for April, 2006, to proceed to shell-in the fourth floor of the project. This will result in a savings of approximately $1 million and could provide immediate savings were the project short of funds.
    d. delay the implementation of those secondary effects components of the project that can be delayed to post April, 2006. At this time the funding resources could be identified with no negative planning impact on the project. The total cost of the secondary effects that can be delayed to beyond April 2006 is estimated to be $1 million.
    e. In April, 2006, prior to commencement of the construction of the science building the availability of all funds would be reassessed. The possibility of additional funding through either cash contributions and or short term loans up to a maximum of $4.0 million would also be considered in the context of what new funding sources were available.

This approach allows Phase 1 of the Science Building to proceed through the detailed planning stage and will require a detailed re-evaluation of the situation prior to the commencement of the construction in April, 2006.

In contrast it is currently assumed that Phase 2 will have to be funded entirely from donations and grants. It must also be noted that the University's Capital Plan does not include any allowance for mortgage room for Phase 2 of this project so the funds will have to be

available at the beginning of the project or an alternative source of borrowed funds, acceptable to the University, will have to be found.

The maintenance, operating and utilities costs of Phase 1 of the New Sciences Building are estimated at $110 per nasm at 2008 costs. At 2543 nasm the annual operating costs are estimated at approximately $300,000. Provision for this has been made in the UTSC long-term budget model.

XIII. SCHEDULE

The projected schedule for the New Science Building, as prepared by Capital Projects, is as follows:

Architect selection	May-June 2005
Relocation of Sprung building	November 2005 (no later than)
Preliminary sitework tender	January 2006
Preliminary sitework	March- April 2006
Tender main contract	March 2006
Construction 19 months	November 2007
Commissioning and move-in	December 2007 January 2008.

XIV. RECOMMENDATIONS

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

Subject to the project returning to Planning and Budget Committee for consideration of further funding sources when those can be identified,

1. THAT the Project Planning Report for Phase 1 of the Science Building at the University of Toronto at Scarborough, comprising a total of 5075 gross square metres, be approved in principle;

2. THAT a cash contribution in the amount of $3,000,000 from the one-time-only fund identified in the 2004/05 operating budget of the Office of the Provost for academic projects seriously restricted by shortcomings in infrastructure and deferred maintenance will be made available to undertake the design [June, 2005 to March, 2006] through to the tender stage of the development.

3. THAT all subsequent phases of the Science Building, consistent with established policy, will require formal approval by Governing Council and will require that the Project Planning Reports for each phase be reviewed by the Planning and Budget Committee.

APPENDIX 1

SUMMARY SPACE INVENTORY OF SCIENCE FACILITIES AT UTSC, FEB. 2005

Sum of Net Assignable Sq.M.							
Dept Name	Teaching Labs	Research Labs	Academic Offices	Grad Student Offices	Non-Academic Staff Offices	Other Depart Space	Total Nasm
Life Sciences							
SC-Biochemistry	0	70	12	20		0	101
SC-Botany	90	458	76	20		0	645
SC-Life Science	1,631	935	27		50	91	2,735
SC-Microbiology	0	90	16			0	106
SC-Psychology	21	707	195	212		87	1,223
SC-Zoology	0	712	181	64		0	957
	1,743	2,972	508	316	50	178	5,767
Computer and Math Sciences							
SC-Computer Sci	30	0	271	22		0	322
SC-Math Sci	0	0	89		66	12	168
SC-Mathematics	79	0	111	19		0	208
SC-Statistics	0	0	32			0	32
	109	0	502	40	66	12	730
Physical Sciences							
SC-Astronomy	13	0	17	9		0	38
SC-Chemistry	1,050	326	181			3	1,561
SC-Env&EarthSci	144	693	132	115		0	1,084
SC-Physical Sci	49	62	20		49	43	223
SC-Physics	444	0	92	18	16	0	570
	1,700	1,081	442	142	65	47	3,477
Total Sciences	3,552	4,053	1,451	499	182	237	9,974

APPENDIX 2:

SUMMARY OF MULTI-PHASE CAPITAL PLAN FOR SCIENCES AT UTSC

[the full version is included in the Project Report for the Renovation of Chemistry Teaching Laboratories, approved Fall 2003)

PHASE 1 Sci –2003-04 **Chemistry Teaching Laboratories**	Project completed September 2004
PHASE 2 Sci – 2004-05 **Research Laboratories/offices**	In progress not at single project but through several small renovations and conversions to provide research laboratories
PHASE 3 Sci – 2005-06 **Soil Erosion Laboratory Renovation**	Project on hold – renovations may be undertaken as part of New Science Building, or Soil Lab could be demolished to make for new building
PHASE 4A Sci 2006-07 **Science Wing Balcony Enclosures**	Under consideration as an independent project – needed to provide offices for new faculty whose appointments begin before 2007-08
PHASE 4B Sci – 2006-07 **New Science Building**	Proposed in this project report – implementation delayed one year from original plan proposal

APPENDIX 3

Project Title: # UTSC Science building

TABLE 1: Total Project Cost Estimates

	Items	
A	Construction amount	18,095,000
	Construction Contingency	1,275,000
	Applicable GST	450,000
	Total, including GST	**$19,820,000**
B	Infrastructure Upgrades in Sector	3,050,000
C	Secondary projects	2,525,000
D	Demolition of Soils bld (if required)	100,000
E	Landscaping	inc
	Permits & Insurance	195,000
	Professional Fees	2,750,000
F	Computing Infrastructure	80,000
G	Telephone Terminations	25,000
	Audio/Visual	100,000
	Moving	100,000
	Staging	0
H	Furnishings: Department	550,000
H	Furnishings: Classrooms	60,000
H	Equipment	500,000
I	Security & access systems	100,000
	Signage: Interior & Exterior	55,000
	Signage: Donor Recognition	10,000
	Groundbreaking & Building opening	30,000
J	Miscellaneous	15,000
	Project Contingency	735,000
K	Finance Costs	700,000
	Total Project Cost Estimate GST	**$31,500,000**
	prepared	jcb Apr 21 2005

Notes:

A per AW Hooker 11 Mar 2005, 5,000 GSM on four floors with PH.

Base estimate 5,000 GSM	$16,800,000
Bridge to S Wing incl. alter.	$485,000
fire route work	$410,000
relocate existing services	$300,000
extra landscape over estimate	$100,000
total construction contract estimate	**$18,095,000**

B main boiler replacement. Amount is inclusive TPC.

C secondary projects:

	TPC amounts
Teaching lab upgrades	$600,000
Biology Teaching Lab upgrades	$200,000
upgrades to Research labs.	$250,000
Rationalize space in S Wing	$250,000
Sprung relocate	$535,000
Repair or replace Soils bld. (see note)	$150,000
demo portables	$75,000
relocate grounds vehicle area	$50,000
new emergency generator for S Wing	$300,000
fire doors in S Wing	$100,000
rental	$15,000
total	**$2,525,000**

D If soils building is retained, then the demolition allowance may be transferred to the upgrade.

E approximately $250,000 included in construction amount for hard and soft landscaping in vicinity of building.

F Backbone connection to building, wireless hardware.

G allow for new sets & relocates.

H see schedule

I allows for up to 18 doors to have card control.

J trades, advertising etc

K see schedule.

APPENDIX 4

CASH FLOW

UTSC Science building, project cashflow estimate.

Approval in June 2005, tendered in March 2006.

Cash flow by quarter

Quarter	may-jul	aug-oct	nov-jan	feb-apr	may-jul	aug-oct	nov-jan	feb-apr	may-jul	aug-oct	nov-jan
	2005	2005	2005/6	2006	2006	2006	2006/7	2007	2007	2007	2007/8
Approval & Cons. Select											
Design											
Tender & Construction											
		Sprung reloc	Sprung reloc	Demo reloc etc					boiler	replace	Jan-08 occupancy
Funding:											
available funds	$0	$937	$1,172	$891	$0	$0	$0	$0	$0	$0	$0
long term financing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
subtotal	**$0**	**$937**	**$1,172**	**$891**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Expenditure:											
proff fees & permits.	$0	$687	$687	$882	$98	$98	$98	$98	$98	$98	$101
Sec effects, demo, infrastructure	$0	$250	$285	$375	$0	$0	$0	$0	$1,500	$1,550	$0
construction		$0	$0	$500	$2,477	$2,477	$2,477	$2,477	$2,477	$2,477	$2,477
furn,equip, misc.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,180	$1,095
subtotal, not including interest	**$0**	**$937**	**$972**	**$1,757**	**$2,575**	**$2,575**	**$2,575**	**$2,575**	**$4,075**	**$5,305**	**$3,673**
net cash flow	**$0**	**$0**	**$200**	**($866)**	**($2,575)**	**($2,575)**	**($2,575)**	**($2,575)**	**($4,075)**	**($5,305)**	**($3,673)**
1 interest rate	2.80%	2.80%	3.05%	3.05%	3.25%	3.25%	3.25%	3.50%	3.50%	3.75%	3.75%
open bal	$0	$0	$0	$200	($668)	($3,259)	($5,871)	($8,504)	($11,164)	($15,355)	($20,829)
change	$0	$0	$200	($866)	($2,575)	($2,575)	($2,575)	($2,575)	($4,075)	($5,305)	($3,673)
int exp	**$0**	**$0**	**$0**	**($2)**	**($16)**	**($37)**	**($58)**	**($86)**	**($116)**	**($169)**	**($212)**
close bal	$0	$0	$200	($668)	($3,259)	($5,871)	($8,504)	($11,164)	($15,355)	($20,829)	($24,714)

Notes:

1 I expect to pay 90 Day T-Bill rate plus 0.25% for short term financing.

prepared jcb 21st April 2005.

APPENDIX 5:

ROOM SPECIFICATION SHEETS

AVAILABLE ON REQUEST