

SIMON FRASER UNIVERSITY
Senate Committee on University Priorities
Memorandum

TO: Senate

FROM: John Waterhouse
Chair, SCUP and
Vice President, Academic

RE: Environmental Science Program

DATE: February 13, 2007

The Senate Committee on University Priorities (SCUP) has reviewed the External Review Report on the Environmental Science Program, together with responses from the Program and Dean of the Faculty Science, and input from the Associate Vice President, Academic.

Motion :

That Senate approve the recommendations from the Senate Committee on University Priorities concerning advice to the Environmental Science Program and the Dean of Science on priority items resulting from the External Review.

The report of the External Review Committee* for the Environmental Science Program was submitted in May following the review team's site visit, which took place March 2 & 3, 2006. The response from the Environmental Science Program and the response from the Dean were received in October 2006.

The Review Team believes that the 'formation of a Department of Environmental Science within a new Faculty of the Environment would be of significant benefit, both internally and externally'. In addition to this major strategic issue (which is not within the purview of the Program), a number of other recommendations were made that do fall within the discretion of the Program and the Faculty of Science. A high level of support for these recommendations exists within the Program and the Faculty of Science. There was also a call for increased resources to be directed to the Program.

SCUP recommends to Senate that the Environmental Science Program and the Dean of Science be advised to pursue the following as priority items.

1. Faculty & Department Structure

- The Program, the Department of Geography and the School of Resource and Environmental Management should participate fully in the process initiated by the Vice President Academic for reviewing the effectiveness of the Faculty structure at SFU.

2. Program Curriculum

- Review the entire Program to ensure that it recognizes national initiatives in terms of curriculum goals and prepares its students to become effective environmental problem-solvers and employable professionals.
- Consider the possibility of the curriculum containing an identifiable core which includes at least one or two courses per year with an Environmental Science label, beginning in the first year.
- Review the high number of prescribed courses, which create scheduling problems for students, with a view to increasing the options for both independent study and field experience for students.
- Ensure that faculty appointed to the Steering Committee play a positive role as departmental representatives and as participants in the interdisciplinary Program.
- Involve students in the formation of a curriculum committee.

3. Marketing & Visibility

- Consider ways of marketing the Program more aggressively as an alternative for Science students and exposing the innovative and interdisciplinary graduate Programs in the environmental field, both domestically and internationally.
- Redesign the Program web site to indicate that it is a major offering at SFU.
- Bring to the attention of the students the increasing requirements by the profession for certification as environmental practitioners.

4. Space

- Review the Program space requirements as space inventory becomes available and ensure faculty and students are kept abreast of progress being made in this regard.

* Dr. Christine Campbell, (Memorial University of Newfoundland)
Dr. Fred Michel (Carlton University)
Dr. Michael Moss (Royal Roads University)

CC Michael Plischke , Dean, Faculty of Science
Alton Harestad, Director, Environmental Science Program.

External Review Report:

**Environmental Science Program,
Simon Fraser University.**

Submitted by:

Dr. Christine Campbell,
Environmental Science Program,
Sir Wilfred Grenfell College,
Memorial University of Newfoundland.

Dr. Fred Michel,
Institute of Environmental Science,
Carleton University.

Dr. Michael Moss,
Canadian Centre for Environmental Education,
Royal Roads University.

May, 2006.

Executive Summary

In its current form the undergraduate degree program in Environmental Science at Simon Fraser University fails to meet its goals and objectives. The curriculum, of what should be a strong interdisciplinary program, reflects the many problems of a university that is designed with a faculty and departmental structure supporting traditional disciplines. Due to an ongoing critical lack of resources- faculty, financial, courses, a supportive administrative structure, and promotional activities, the program has failed to develop or to reflect the changes taking place in society and in professional areas related to the field. The fact that the program has survived for a decade is largely a reflection of the work of the current and previous Program Directors and enthusiastic involvement of the Faculty administrative assistant. The role of these three people is fully recognized and appreciated by the students in the program.

The External Review Committee is, however, of the opinion that given the current move toward a restructuring of the Faculty model at SFU and the recognition of the value to the future of the University of an Environmental Science program, that the formation of a full Department of Environmental Science within a new Faculty of the Environment would be of significant benefit, both internally and externally.

1. Current Program Overview

The Environmental Science program at SFU currently consists of a broad science-based degree with specialization in 6 distinct streams or areas of emphasis. These 6 streams are Biology, Chemistry, Environmetrics, Physical Geography, Pollutant Transport and Quantitative Techniques for Resource Management. An Honours focus and a Co-op option are also associated with the program.

Division of the program into the separate streams was appropriate at the time that the program was devised, as the strengths of the contributing university departments were clearly represented. However, since reaching peak levels in 1999, Environmental Science at SFU has seen a continuous decline in the number of declared Majors (from 72 in Fall 1999 to 35 in Fall 2005). There were 41 declared Majors listed in Spring 2006. Only two streams can be said to be well-subscribed: Biology (43% of declared Majors in 2005) and Physical Geography (40% of declared Majors in 2005). Few students enter the Chemistry stream (14% of declared Majors in 2005), while Environmetrics, Pollutant Transport and Quantitative Techniques in Resource Management are seemingly not attracting

sufficient students to ensure stream viability. The majority of the students in the program do not pursue the Honours option. Co-op is popular, even though this option does result in longer time to completion of the degree.

- *Given the decline in the numbers of students and their concentration into only two of the six streams, despite an increasing awareness and emphasis on Environmental Science in society at large (and in intermediate/secondary schools), it is clearly time for a change to the current program in Environmental Science at SFU.*

2. Program Assessment

2.1. Recruitment and Admissions

New and innovative programs introduced into university curricula need to spend extra effort in making their programs known. This has apparently not been the case with the Environmental Science program at SFU. The program is not well-known within the University, either by the administration, the faculty or its students. It does not have a high profile outside the University. Despite this, students from across Canada have come to Simon Fraser specifically for environmental science.

Current recruitment aids for the program include some posters and brochures, a web site and coloured sheets outlining stream course requirements. On-campus recruitment is hampered by the lack of an Environmental Science office. Local off-campus recruitment is constrained by the Director's schedule. Current recruitment efforts are not leading to the number of admissions that would be anticipated in an interdisciplinary program of this type. It is expected that a program in Environmental Science could increase in numbers given the nationally-occurring demand for qualified graduates in the environmental professions. By addressing certain critical curriculum issues (see sections below) Environmental Science at SFU might potentially double its student numbers over the next few years.

- *The program needs to be marketed more aggressively at the high school level, e.g. by contacting high school science heads and school counselors directly with pertinent and easily understood information on the attractiveness of environmental science as an alternative for science students. Marketing as an "applied" science has proven to be a very successful alternative to the more common "hard" sciences. The career potential for program graduates should be emphasized.*
- *The web page needs to be redesigned and the profile of the program given far greater prominence as a major academic offering at SFU.*

2.2. Student Feedback

The Review Committee met with six students as well as receiving some written submissions. Students were enthusiastic about the Environmental Science program and were unanimous in the high regard in which they held the Directors (current and previous) and also Ms. Rosemary Hotell (Faculty Assistant). Students felt that the broad background of the program was its biggest strength, with the opportunity to take a range of science courses as well as courses in statistics, economics and REM. However, all students felt that the program could definitely be improved. They had several concerns with the current set up. Their major observations are:

1. The current streams are very rigid. The lack of flexibility was thought to impede recruitment. Many students had to get numerous waivers from the Program Director in order to obtain courses. Required courses were often not available nor could students fit them into their timetables at the required points. Specific instances cited of these problems were that several students had to obtain waivers in order to take more Earth Science courses than specified. Students outside the Chemistry stream mentioned that CHEM 317-2 (Analytical Environmental Chemistry) was a course they viewed as having direct relevance; they viewed it as a useful option but had difficulty entering the course because of the pre-requisite structure and scheduling.
2. Students felt very isolated in going through the program as there were no common environmental science courses between second year (EVSC 200-3) and fourth year (EVSC 401-1 and EVSC 491-3). Also, these three courses were the only ones in the program to adequately integrate the theme of environmental science.
3. A fact related to the above is that there is no designated common-room space on campus for Environmental Science students either to meet or work.
3. Some students considered there to be too much overlap in content between EVSC 200, REM 100 and GEOG 100. The first two of these are required in the program.
4. Some students felt that there should be more upper-level courses identified that specifically address the needs of senior environmental science students. They also pointed out that a number of upper-level courses that were available lacked content at the advanced level they sought. Examples of this situation were GEOG 316 (Biogeochemistry) and PHYS 346 (Energy and the Environment). Too much time in these courses was devoted to reviews of

material from earlier courses. Students saw this as a consequence of having to address the content to students from a wide range of backgrounds and competencies.

5. Most students found Co-op to be very valuable both academically and professionally. However, they noted that by taking the co-op option their time to degree completion was lengthened well beyond the norm. This was seen primarily as a consequence of required courses being offered only once a year, and resultant course scheduling conflicts with Co-op semesters.
6. There was no opportunity for students to take interdisciplinary Independent Research projects or Honours projects in Environmental Science.
7. Some courses could be optional, rather than required, in the program. Students mentioned, in particular, ECON 105-3 (Macroeconomics) and PHYS 346-3 (Energy and the Environment).
8. Students thought there could be more field courses or field experiences in the program, instead of just the one fourth year field course (EVSC 491). They identified the need for a course, or part of a course, that explored and outlined career options and professional requirements in the environmental sector. Suggestions were made that some of the REM courses could be made more relevant to Environmental Science.

By way of summary, it is very evident from the students' comments that despite their appreciation for the fine support given to them by the current and past Program Directors and Ms. Hotell, they have some major concerns with the program and the support given to the Program by the SFU Administration. They have identified major program deficiencies and at the same time are sufficiently cognizant of the field to have identified remedies and possible solutions. Their specific course and program-related observations are acknowledged by the External Review Team and are incorporated into the discussion in Section 5.2 of this report. The student's general recommendations are:

- *That the SFU Administration should enhance the support given to students in the Program by supporting their calls for more flexibility within the Program, increased options for both independent study and field experience, more Program cohesion, and more control over required course scheduling by the Program Director.*
- *That SFU provide both a visible administrative centre for Environmental Science with work space and meeting areas for its students.*

2.4. Graduate School and Career Preparation

The Program has a successful record of placing students in graduate programs both at SFU and elsewhere. Graduates from the Program appear to have had little difficulty in entering Master's degree programs reflecting the discipline base of their undergraduate stream. The interdisciplinary Master's degree program offered by the School of Resource and Environmental Management appears to be the most popular choice. However, given the increasing demand by employers for graduates with an interdisciplinary perspective it is difficult to see how SFU Environmental Science graduates gain any appreciation of the number of program offerings, at the Masters level beyond SFU, which would permit them to follow an interdisciplinary perspective. More often than not such Masters programs are developed in response to a recognized need and thus provide higher than normal employment opportunities. Currently, the time the Director has to develop an awareness of such programs is minimal. Even if the Director were sufficiently knowledgeable about such programs there is little opportunity to transmit this information to the students since there is no upper-level course where these opportunities can be discussed nor is there a central administrative location from where this information can be displayed to senior undergraduates in the Program.

Both faculty members and students seemed to be equally unaware of the changes now taking place within the emerging environmental profession. The profession is becoming increasingly organized in terms of its breadth, occupational standards, and professional certification. Although not a requirement, several university environmental science programs are adapting their curricula to provide their graduates with a head start on professional certification as Canadian Certified Environmental Professionals (CCEP). Obtaining the CCEP designation within five years of graduation is becoming increasingly the professional standard. CCEP is a nationally-recognized credential. It is incumbent on the Director and faculty associates to be aware of such professional developments and recognizing them in any curriculum redesign should be a major focus alongside the current recognition given to the P.Ag, P.Bio., and P.Geo. credentials. Becoming familiar with the role of the Environmental Careers Organization of Canada (ECOCanada), as this relates to professional development and career options, should be a priority for the Director or the program faculty

- *The Program should immediately find the means whereby information on the breadth of innovative and interdisciplinary graduate programs in the environmental field, both domestic and international, can be made available.*

- *The Program should bring to the attention of its students the increasing requirements by the profession for certification as environmental practitioners.*

3. Resources

3.1 Faculty

The program is run by the Director, who is a cross-appointed faculty member for the duration of his term as Director. The current Director and the previous Director appear to be responsible for the teaching of all Environmental Science labeled courses. Since few students are enrolled in the Honours program, which requires thesis research, few other faculty are directly involved in teaching Environmental Science students.

A Steering Committee, composed of one representative from each participating department (Biological Sciences, Chemistry, Earth Sciences, Geography, Physics, Statistics and Actuarial Sciences) provide guidance to the Director on curriculum issues, and provide advice to students within their respective streams. The Steering Committee members are responsible first to their home departments and therefore act on behalf of their home departments for the benefit of their home departments, rather than for the Environmental Science program. It is this territorial attitude that has led to the development of a highly rigid, over-regulated curriculum, with little room for maneuverability due to long lists of required pre-requisite courses. Several Steering Committee members saw membership on the Committee as a relatively unimportant task and were unaware of the requirements and intended scope of the Program as a whole.

3.2 Budget

The Program was created with zero cost and currently operates with a limited budget that is targeted primarily for the hiring of sessional lecturers to replace the teaching of the Director by their home department. Funding for other initiatives is at the discretion of the Dean of Science, who is supportive of the program. However, budget limitations (real or perceived) clearly have affected the level of activity for program enhancement and student recruitment.

3.3 Support Staff

The support staff for the Environmental Science program consists of a portion of the time (<25%) of Rosemary Hotell, a Faculty Assistant based in the office of the Dean of Science. We understand from all program participants that her role is

vital to the operation of the Program. In addition to providing office support to the Director, Ms. Hotell provides student counseling and is a point of contact for enquiries regarding the Program.

3.4 Space

At present the Environmental Science program lacks any identifiable space and is dependent on the good will of participating departments for some limited storage space. The students have no place at the University to call their own, which together with the lack of a sequence of definitive Environmental Science courses prevents any degree of bonding between students, faculty, or their program of study.

3.5 Library Resources

The review committee received a report from the SFU Library concerning library resources specifically for the Environmental Science program. As noted in their report, the Library is aware of the Environmental Science program and is attempting to address the program needs through acquisitions in related subject areas and by providing a library research class session for the Environmental Science students. The Library report also notes that the Environmental Science program does not have a dedicated allocation in the collections budget or a library representative to inform the liaison librarian of program issues. As a result, the Environmental Science program has little if any direct input over acquisitions (or deletions) that could affect the Program. This is apparent in that the report makes a direct link between library acquisition expenditures for Biological Sciences and Environmental Science. Although there is overlap between the two subject areas, they are distinct.

Recommendations relating to Section 3 are as follows:

- *The resources provided for the Program are totally inadequate. Even if the Program were to remain in its current form increased resources must be made available to support an adequate level of faculty involvement and administrative support.*
- *Participating departments should ensure that faculty appointed to the Steering Committee play a positive role as both a departmental representative and as an active participant in an interdisciplinary program.*
- *A dedicated area within the University must be made available to students in the Program.*

4. The External Context for Environmental Science.

It is not uncommon for a university's academic programs to develop entirely within the framework of the home institution. Increasingly, however, off-campus initiatives can provide considerable benefit and direction for program development. This is particularly so in the case of applied programs and where a connection can be made to a professional body or bodies. This can be of mutual benefit to all concerned. It is increasingly the case in the field of the environment. Over the past few years heads of university environmental science programs have formed a national council to organize and promote programs and to give some external recognition to the meaning of 'environmental science'. This organization is the Canadian Council of University Environmental Science Program Heads (CCUESPH).

On the professional side the Environmental Careers Organization of Canada (ECOCanada), formerly CCHREI (Canadian Council for Human Resources in the Environment Industry), was established by the federal government as a Sector Council of Human Resources and Skills Development, Canada (HRSDC). Its major achievements have been to define the scope for employment in the environmental sector, to develop a system of national occupational standards, and based on these has developed a system of professional certification.

CCUESPH works closely with ECOCanada and in particular is developing a system for environmental science program accreditation. CCUESPH has produced a description of the field of environmental science and has outlined the characteristics of an environmental science degree program. This is very much for external recognition. Several universities are now restructuring their curricula to provide their undergraduates with the necessary academic background to support their passage to professional certification as Certified Canadian Environmental Practitioners (CCEP). Such a credential is increasingly becoming an optional requirement in the allocation of government contracts and for employment in industry and the consulting field. Many of the faculty at SFU who are involved in the environmental field seemed to be unaware of these developments or of their growing professional significance and potential importance to their students.

Whereas the statements developed by CCUESPH are by no means prescriptive, it is quite evident that the SFU environmental science program meets very few of the criteria outlined. Since the issue of program accreditation will become important in the near future and this is likely to contain many elements as requirements from both the academic and professional sides, much greater attention should be paid by SFU to these ongoing initiatives.

CCUESPH has reached consensus on outlining environmental science. Its definition is:

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Environmental Science is the interdisciplinary study of the environment, its functioning and its relationship to human activity. It extends beyond the traditional science disciplines to terrestrial, aquatic and atmospheric systems and their interactions. An environmental science graduate will have an in-depth knowledge of environmental systems and of the breadth and context in which these systems operate. Students will develop a diversity of expertise necessary to address present, future and unanticipated environmental problems.

In terms of the “normal” content of an environmental science program, CCUESPH has outlined the following:

- *Introductory basic science courses: mathematics, physics, chemistry, biology*
- *Foundation courses for environmental science related to atmospheric, terrestrial and aquatic systems (e.g. earth sciences, physical geography, ecology)*
- *Courses relating socio-economic and political factors to environmental policy and decision-making (e.g. environmental economics, environmental law, environmental policy, compliance, environmental ethics, management)*
- *An in-depth concentration on an environmentally-focused scientific discipline or interdisciplinary field to an upper level that emphasizes theoretical concepts and practical skills (field and laboratory)*
- *Exposure to another environmentally relevant discipline or field at an upper level*
- *Written and oral communication skills, quantitative literacy and computer skills*
- *Statistics, spatial and temporal analyses: analysis and prediction using computational methods*
- *Experience in environmental research and problem solving as part of an interdisciplinary team approach and/or on an individual basis, to gain exposure to environmental issues. This may be attained through a thesis, fieldwork, co-op experience, internships, seminars, or community-based research.*

It is quite evident from the above descriptions that the SFU Environmental Science program needs to meet more of these criteria.

- *Whether the existing program is moderately restructured, or whether there is a major restructuring of environmental programming at SFU, there is considerable benefit to its students, and a responsibility of its administrators to develop a program that recognizes national initiatives in terms of curriculum goals, and which prepares its students with the*

resources to become effective environmental problem-solvers and employable professionals.

5. Restructuring the Environmental Science Program

This section examines the restructuring of the undergraduate Environmental Science program, while Section 6 looks at the position of Environmental Science within the University as a whole.

5.1 Current Deficiencies

Although the Environmental Science program has some strong points, such as the co-op placements, the program suffers in four major ways. Despite these problems, the program continues to attract some students.

1. The current program is handcuffed by rigidity, which is primarily the result of too many pre-requisites for various courses at the University and the territorial nature of other Science departments and their representatives on the Steering Committee. This is most evident in the Chemistry stream, which requires more than 120 semester hours for graduation.
2. Rigidity in the program prevents students from accessing courses which address environmental issues outside the Faculty of Science. Two examples of these are SA371-4 (Environment and Society) and GEOG389-4 (Human Ecology). Such broadly-focused offerings need to be balanced by courses directly relevant to an Environmental Science degree. Examples of such courses would be in environmental policy and law and environmental impact assessment. Such courses could be the responsibility of new faculty hired by a new structure. They should be courses needed by a revised program structure. They could very effectively serve a need in a range of other University programs thus adding to the resource base of Environmental Science, strengthening the interdisciplinary profile of a restructured unit whilst providing students with very relevant employment and career-related knowledge.
3. Each of the departments participating in the Environmental Science program has developed their own "environmental stream". This in turn has led to a view by some faculty that the Environmental Science program is not unique and is simply duplicating efforts and therefore taking students away from the departmental environmental streams. However, these environmental streams do not provide the multi-disciplinary view that is required for truly comprehending, understanding and dealing with complex Environmental Science issues.

4. The Environmental Science program has very few courses to call its own. Students do not enroll in an Environmental Science course until second year with EVSC 200-3. As a group, the Environmental Science students only get together again in 4th year with the seminar course (EVSC 401-1). The only other Environmental Science course (EVSC 491-3) is an optional 4th year field course. This does not permit the students to develop any identity with their program or with one another and thus there is no sense of belonging.
5. The Environmental Science program exists in a vacuum, with no department and no space to call home. Throughout our visit, the Review Committee heard comments about attaching the Environmental Science program to various existing departments and then heard reasons why these various potential unions would not work. The one common theme heard was that the status quo was not acceptable and that the Environmental Science program needed a home.

5.2 A Proposal for Restructuring

It is clear that the status quo is not an option. At this point in time, the University has two choices with regard to the Environmental Science program. It can either decide to scrap it altogether and delete the program, or, it can commit to the expenditure of the necessary resources (financial, human, and space) to revitalize and build on the vast potential that this program has to offer. The remainder of this section, and its recommendations, deals only with the second option.

1. The Environmental Science program needs a home. Placing the Program within an existing department is not considered to be viable and does not take into account the multi-disciplinary nature of the program. At the same time we see no reason to split existing departments, particularly, as in the case of Geography, for whom a realignment of its physical geography courses with Earth Science has been proposed. (The value of Geography lies in it retaining the link between both the physical and the human environments. It is a strong department with well-recognized programs at all levels).
2. The new Department of Environmental Science should contain faculty members who are primarily interested in environmental issues. They can come from new hires or through transfers from other departments. The potential for cross-appointments should also be available in some instances.
3. The new department will require space for offices, teaching, research, and students.

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4. The program curriculum needs to be completely overhauled and the current six streams need to be scrapped. Furthermore, the development of any new thematic streams (not duplicates of departmental streams as is currently the norm) should be based on a common core curriculum. In the second year of the program, a field-based course should be established that will provide students in the program with an opportunity to gain hands-on experience as to the complexity of issues that face environmental scientists.
5. It is recognized that many of the non-core courses will still be taught by other departments, especially in Science Faculty. However, in the development of the new curriculum, special attention must be paid to the pre-requisite requirements and sufficient flexibility must be maintained in the program structure. Where required, new courses (using EVSC or other department codes) should be developed with the environment as the major focus.
6. Since students are the only group that actually participates in every course contained in the curriculum, they often bring a unique perspective to the discussion table (see Section 2.2).
7. Some resources for a major restructuring of the Environmental Science program into a department could be from transfers from those now expended in the "environmental streams" of existing departments.

We recommend that:

- *A separate Department of Environmental Science be created*
- *Existing faculty members at the University be given the opportunity to consider transferring to the new Department of Environmental Science, and that priority be given to new hires as required.*
- *There must be the allocation of an identifiable space for the new Department of Environmental Science that will permit its faculty, staff, and students to function as a coherent unit. As a department, Environmental Science should also obtain a library representative and a separate allocation budget to ensure adequate material and resources are available.*
- *The new curriculum should contain an identifiable core, which includes at least one or two courses per year with an EVSC label, beginning in the first year*

- *Student participation should be included in the formulation of a curriculum committee. This committee should involve also the new faculty members of the new Department of Environmental Science whether they be full time or cross-appointed.*

6. Strengthening the SFU Environmental Profile.

When the current condition of the Environmental Science program, as discussed above, is viewed within the context of other activities and initiatives currently underway at SFU, it is evident that any proposals for the enhancement of Environmental Science will be greatly improved if some broad thinking about the profile of SFU environmental programs overall takes place. Two critical initiatives that should provide a positive context for such environmental programming are (1) the Task Force on Faculty Restructuring and (2) the support being given to an environmental focus in the University's 'Strategic Research Plan, 2005-2010'. Outlined below is a rationale for establishing a Faculty of the Environment at SFU. The University clearly has an academic strength in the environmental field but this strength is dispersed across several faculties and many departments. There is also a significant external opportunity. West of the University of Manitoba no Canadian university has a focused strength in the environment. East of Manitoba there would be few rivals to match the scale of a Faculty of the Environment that could be established at SFU.

The proposal outlined here is for a new Faculty to be established with three founding departments. One department would be the new Department of Environmental Science (as outlined in section 5). The School of Resource and Environmental Management would move to the new Faculty and assume a responsibility for initiating undergraduate programs. These should build from the existing strength and (inter)national profile of its existing, highly-regarded Master's program. The Department of Geography would move to the new Faculty in its entirety bringing all its existing undergraduate and graduate degree programs and certificates.

Several of the existing, and proposed, environmental research centres, in particular those which are evidently interdisciplinary in focus should be housed administratively within the new Faculty thus enhancing their respective profiles both on and off campus.

As such, the breadth of the new Faculty could provide a teaching and research focus, central to the University's mission, with REM and the socio-economic side of Geography developing courses and programs at both the undergraduate and graduate levels that promote further the University's strength in environmental resource management and in sustainability. Such a broad theme would be consistent with two of the three employment sectors outlined by ECO Canada (i.e. 'Environmental Sustainability' and 'Conservation and Preservation of Natural Resources').

The Geography Department's existing strengths in bridging the gap between the social and physical sciences would be pivotal to the new Faculty.

The new Department of Environmental Science, with its new status and faculty complement (see 5.2 above), will be in a unique position to develop up-to-date, interdisciplinary programs at both the undergraduate and graduate levels. For example, a potential focus for interdisciplinary options in the Department could relate to two of the three major employment sectors; these are 'Environmental Protection' and 'Conservation and Preservation of Natural Resources'. In the case of the latter, the conservation/management theme could incorporate several of the environmental and quantitative technique objectives, poorly taken up in the existing program. Such an emphasis would be supported by a breadth of discussion of the ecological and scientific bases of resource management. There is a tremendous potential for professionally-oriented, coursework-based Master's degree programs to be offered by this new Department, particularly if these were built upon collaboration with the more environmentally-focused faculty in related science departments.

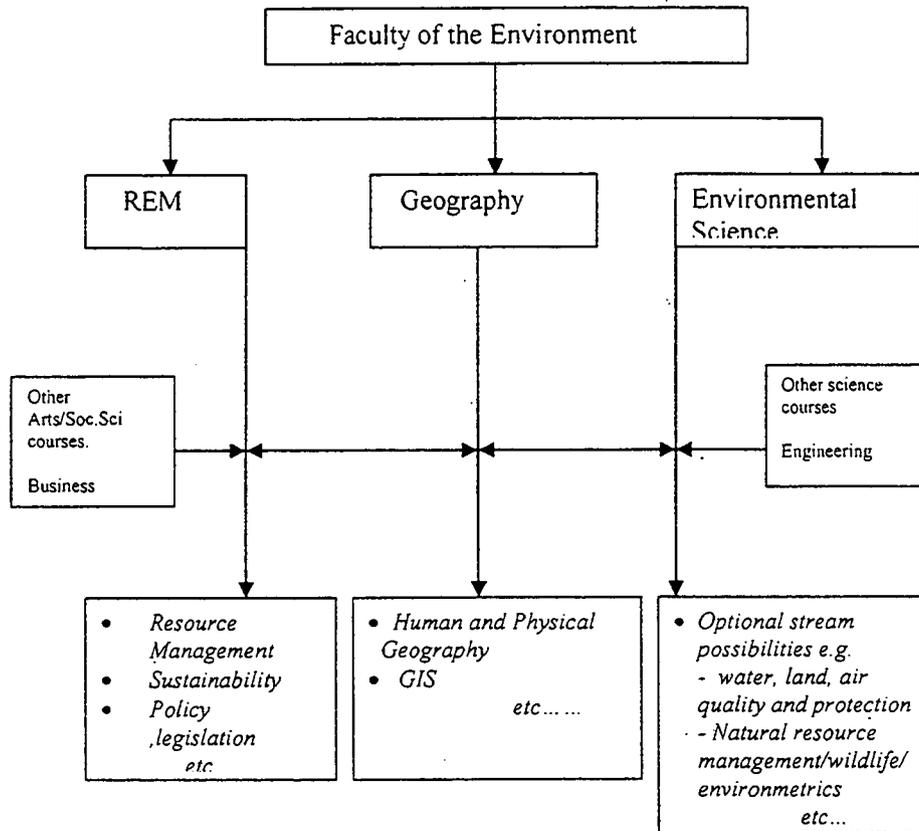
Given the full support of the SFU Administration and the willingness of faculty members in REM, Geography, and a new Environmental Science department to cooperate in innovative program development, Simon Fraser University is in the position of staking out a position as a national leader in the environmental field. There is a fully documented need of employment opportunities for both baccalaureate and Masters graduates, particularly from interdisciplinary programs. This need exists both nationally and internationally.

Outlined in the diagram below is this proposed structure for a Faculty of the Environment.

Our recommendation is:

- *That Simon Fraser University seek to achieve its potential as a national leader in environmental education and research at the university level by establishing a Faculty of the Environment based initially on three departments – REM, Geography, and a new Department of Environmental Science.*

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7. Summary of Recommendations

Given the decline in the numbers of students and their concentration into only two of the six streams, despite an increasing awareness and emphasis on Environmental Science in society at large (and in intermediate/secondary schools), it is clearly time for a change to the current program in Environmental Science at SFU.

The program needs to be marketed more aggressively at the high school level, e.g. by contacting high school science heads and school counselors directly with pertinent and easily understood information on the attractiveness of environmental science as an alternative for science students. Marketing as an “applied” science has proven to be very successful alternative to the more common “hard” sciences. The career potential for program graduates should be emphasized.

The web page needs to be redesigned and the profile of the program given far greater prominence as a major academic offering at SFU

That the SFU Administration should enhance the support given to students in the Program by supporting their calls for more flexibility within the Program, increased options for both independent study and field experience, more Program cohesion, and more control over required course scheduling by the Program Director.

That SFU provide both a visible administrative centre for Environmental Science with work space and meeting areas for its students.

The Program should immediately find the means whereby information on the breadth of innovative and interdisciplinary graduate programs in the environmental field, both domestic and international, can be made available.

The Program should bring to the attention of its students the increasing requirements by the profession for certification as environmental practitioners.

The resources provided for the Program are totally inadequate. Even if the Program were to remain in its current form increased resources must be made available to support an adequate level of faculty involvement and administrative support.

Participating departments should ensure that faculty appointed to the Steering Committee play a positive role as both a departmental representative and as an active participant in an interdisciplinary program.

A dedicated area within the University must be made available to students in the Program.

Whether the existing program is moderately restructured, or whether there is a major restructuring of environmental programming at SFU, there is considerable benefit to its students, and a responsibility of its administrators to develop a program that recognizes national initiatives in terms of curriculum goals, and which prepares its students with the resources to become effective environmental problem-solvers and employable professionals.

A separate Department of Environmental Science be created

Existing faculty members at the University be given the opportunity to consider transferring to the new Department of Environmental Science, and that priority be given to new hires as required.

There must be the allocation of an identifiable space for the new Department of Environmental Science that will permit its faculty, staff, and students to function as a coherent unit. As a department, Environmental Science should also obtain a library representative and a separate allocation budget to ensure adequate material and resources are available.

The new curriculum should contain an identifiable core, which includes at least one or two courses per year with an EVSC label, beginning in the first year

Student participation should be included in the formulation of a curriculum committee. This committee should involve also the new faculty members of the new Department of Environmental Science whether they be full time or cross-appointed.

That Simon Fraser University seek to achieve its potential as a national leader in environmental education and research at the university level by establishing a Faculty of the Environment based initially on three departments – REM, Geography, and a new Department of Environmental Science.

**Response to the External Review Report
of the Environmental Science Program
at Simon Fraser University**

**Alton Harestad, Director
Environmental Science Program
Simon Fraser University**

October 22, 2006.

The External Review Team provided a summary that listed their major recommendations for the Environmental Science Program at Simon Fraser University. In their report, there are also more minor, but frequently important recommendations that have to do with specific curriculum issues. I have not responded individually to these minor recommendations because they would be largely addressed through broad changes to the curriculum.

I present the major recommendations in bold italics followed by my responses in regular text. At times, there is some duplication in specific responses, but this occurs to ensure all recommendations are addressed directly.

There are several recommendations that deal with administrative level and university restructuring. I respond to these recommendations collectively because they are interdependent and rely on major re-alignments of related environmental science and management units at SFU.

Recommendation: Given the decline in the numbers of students and their concentration into only two of the six streams, despite an increasing awareness and emphasis on Environmental Science in society at large (and in intermediate/secondary schools), it is clearly time for a change to the current program in Environmental Science at SFU.

Enrollment may not have declined as the review committee thinks (72 in fall 1999 to 35 (sic) in fall 2005). As explained on page 5 of the self study report, the high number of majors in 1999 and 2000 may be an artifact because at that time "intended majors" may have formed the database used by Analytical Studies. If there were high numbers of majors in 1999-2000 and 2000-2001, then 2-4 years later when these majors finished their degrees, there should be a pulse of graduates. Our statistics do not reveal this expected pulse of graduates. This fall 2006, there are 64 declared majors in the program. This apparent recent increase in majors is partly due to increased numbers of students joining the program after being at SFU for several semesters (like has happened in the past), but also likely partly due to direct entry. There is variation in numbers of majors and graduates since Fall 1999, but not a substantial decline.

There is strong public concern about environmental issues. As well, both Federal and Provincial agencies with environmental mandates are facing loss of capacity because of earlier staff cuts and hiring freezes combined with current retirements. There is increasing demand for environmental scientists. Our students are poised to help fill this demand and are competitive for entry level positions. The Environmental Science program can be redesigned to provide students with the skills they need, while distinguishing it from technical institutions. However, it also must maintain a high quality academic curriculum that promotes the professional standards sought by employers and prepares students for graduate level research.

Recommendation: The program needs to be marketed more aggressively at the high school level, e.g. by contacting high school science heads and school counselors directly with pertinent and easily understood information on the attractiveness of environmental science as an alternative for science students. Marketing as an "applied" science has proven to be very successful alternative to the more common "hard" sciences. The career potential for program graduates should be emphasized.

Marketing at high school level is helpful but it is not clear if this needs to be direct effort by the Environmental Science program or whether awareness about the program could be achieved by existing recruitment initiatives. Students do not always know what they are going to do for a career when they enter university and many have not even declared their majors by third year. Some change programs after several semesters at university. Although some contact is merited at high schools, it can not be our whole effort to attract students to Environmental Science. Students who have already come to Simon Fraser University should be included in recruitment efforts and be informed about the program. The Environmental Science Program could create better promotional material that recruiters could distribute during school visits. Also, given the proficient web skills of most high school students, a redesigned web site for the Environmental Science Program could help raise awareness and interest in the Program.

Guidance from the professional recruiters at Simon Fraser University could help design an efficient approach that targets students most likely to be attracted to Environmental Science.

Recommendation: The web page needs to be redesigned and the profile of the program given far greater prominence as a major academic offering at SFU.

The web page needs to be redesigned and a new site could be created at a modest cost. The Master of Pest Management Program has a web page format and content that could be used as a model for the Environmental Science Program. When I was acting director of that program in Biological Sciences it cost about \$500 to design and construct that web site.

Recommendation: That the SFU Administration should enhance the support given to students in the Program by supporting their calls for more flexibility within the Program, increased options for both independent study and field experience, more Program cohesion, and more control over required course scheduling by the Program Director.

Students expressed to the review committee that a big strength of the Environmental Science program is the broad background that it provided them. This is echoed by the co-op coordinator, Paul Degrace. This breadth includes disciplines in science but also courses in resource management and economics. The students face challenges in meeting program requirements and suggested changes to the curricula for the various streams in

Environmental Science. Greater flexibility is required, but we must not introduce so much flexibility that the assuredness of breadth is compromised.

The lack of flexibility is due to the high number of prescribed courses and scheduling. Departments make efforts to accommodate needs of all students when scheduling courses but they also must meet the needs of their own majors. The rigidity of the Environmental Science program likely exacerbates scheduling issues. The scheduling conflicts become most strongly expressed when the number of prescribed courses form the bulk of a student's program. Adding even a modest amount of flexibility to the program would reduce a substantial number of scheduling problems faced by students.

The concern from some students that some upper level courses lacked the advanced level that they sought is a difficult issue to address within the context of an Environmental Science program where breadth is a guiding principle and a recognized strength. This is a B.Sc. requiring 120 credits of which 44 must be upper division. In the Environmental Science program, there will always be tension between breadth and depth outside of the student's specialization (i.e., stream). If we ensure there is breadth then there will be less depth in some portions of their individual programs. The stream approach is a one way that students can get breadth but also achieve depth within a particular discipline of interest. Providing flexibility (e.g., reducing the number of prescribed courses) with or without streams would allow students to seek depth without extending their B.Sc. program beyond the standards within the Faculty of Science.

The current stream approach for Environmental Science at Simon Fraser University helps provide the depth required by graduate from our program, but it is rigid. The prescribed approaches to streams could be dropped and in their place students could build their own area(s) of strength. Students would be guided by a written set of principles that form the basis upon which to maintain breath and ensure sufficient specialization. As well, students could be directed to the Canadian Certified Environmental Professionals and College of Applied Biology of British Columbia so they can ensure their course choices contribute towards requirements for professional certification. Current curricula for streams could be modified to give more choices and provided as examples of courses that could be taken to fulfill the requirements for the B.Sc. in Environmental Science.

The Review Team thought our students should have greater experience in environmental research and problem solving. They suggested that this may be attained through a thesis, fieldwork, co-op experience, internships, seminars, or community-based research. Several courses could be developed to provide this experience. A field course at the end of second year or beginning of 3rd year could be designed that would provide field experience use opportunities in the Lower Mainland. For example, the Lower Seymour Conservation Reserve is within ½ hour of the Burnaby Campus and we have established a relationship with the LSCR through the EVSC 491 field course. This second/third year field course could be 1-3 credit hours depending on its content. The convenience and proximity to the Burnaby campus would mean that all Environmental Science students could participate. Activities for the course should be concentrated so benefits of field studies are achieved.

25.

The Review Team noted that the co-op program extended the duration of the Environmental Science student's degree. This is a voluntary program and students are fully aware of the costs and benefits of joining co-op. The co-op program, should students choose this option, provides experiential education and it means that students spend several semesters beyond those needed to simply meet the course requirements for their degree. Students benefit in a number of ways and they choose to take extra time to obtain not only the skills, but also the personal and professional growth that the co-op program offers.

If flexibility was provided in the Environmental Science program then students could take the opportunities for research courses that exist in participation departments. As well the Environmental Science program could add two research courses to its curriculum perhaps one at 300 level and one at 400 level. If these course were added then there would have to be Faculty available to offer them.

The Review Team thought the Environmental Science Program needs more cohesion and that the Director should have more control over required course scheduling. Although more program cohesion, and more control over required course scheduling by the Program Director would be desirable. Greater cohesion can be achieved by working closely with students and modest reorganization of the curriculum. Environmental Science at Simon Fraser University is an interdisciplinary program; hence, a substantial portion of its curriculum is drawn from other disciplines in Science as well as other Faculties and Departments. These courses serve more than Environmental Science students and although more control is desirable, it is not possible given the mandates of the departments upon which Environmental Science draws. An active steering committee whose mandate is the interests of the Environmental Science program could bring scheduling concerns to the respective departments. Departments are typically helpful with regards to curricula where they can, but the complexity of interdepartmental scheduling means there will always be some conflicts and issues with scheduling. Program flexibility regarding required courses taken by Environmental Science students would achieve greater success faster and would provide students with the on-going capacity to seek solutions as the various departmental curricula change over time.

Recommendation: That SFU provide both a visible administrative centre for Environmental Science with work space and meeting areas for its students.

An administrative centre would be welcomed by the students and go a long way to help promote identity and cohesiveness to the Environmental Science program. Space is an on going issue across Simon Fraser University including the Faculty of Science. When resources are in short supply allocation of space is a matter of priority. Initially the space requirements for the Environmental Science program are small but still significant to the Faculty of Science. Should the program grow and become a department then its need for space will increase commensurate with that growth.

Recommendation: The Program should immediately find the means whereby information on the breadth of innovative and interdisciplinary graduate programs in the environmental field, both domestic and international, can be made available.

The Directory of Canadian Graduate Programs in Environmental Studies (CGPES) was acquired shortly after the visit by the Review Team and is available for loan from the program assistant's office of the Environmental Science program. The Directory is published by the School of Environmental Studies at Queen's University in Kingston and is a not-for-profit publication that aims to ease the search for graduate schools and graduate programs. It provides a comprehensive overview of the many programs offered by Canadian universities and colleges in the multidisciplinary field of Environmental Studies. The CGPES Directory contains:

- Over 400 listings from more than 150 Canadian universities and colleges
- Comprehensive indexes
- 35 subject headings over the disciplines of Engineering, Health Sciences, Natural Sciences, Social Sciences and Law
- College diploma program information
- French program listings
- Research stations affiliated with Canadian universities.

Each listing includes the name of university, school, department and program; degrees offered and years to complete the programs; program contact information including web and email addresses; and research areas of faculty.

Information and advice about graduate studies is provided on an individual basis by the Director as well as other professors among the Departments that participate in the Environmental Science program. To support these efforts an annual workshop could be developed that gives students advice about graduate studies, scholarships and other research opportunities. This workshop would have to be given in the latter part of third year so students could have time to consider graduate studies and apply for NSERC scholarships in the fall semester of their fourth year.

Recommendation: The Program should bring to the attention of its students the increasing requirements by the profession for certification as environmental practitioners.

The Director is Member #60 of the 1500+ member College of Applied Biology of British Columbia (CAB). As an active member who has served as Chair of the Board of Examiners and on the Disciplinary Committee, I am fully aware of the requirements and benefits of professional certification. Simon Fraser University's Environmental Science graduates, with a biology stream, meet the eligibility requirements of the College Applied Biologists of British Columbia if they choose biology courses in their upper levels optional courses and if they take an English course. With the writing required for many science lecture and lab courses, as well as the work reports for the co-op terms, I think

our students would be able to demonstrate their writing abilities to the Board of Examiners and thus meet the requirements of the College of Applied Biologists.

In June, the Director attended a 3-day meeting of Canadian Environmental Science Program Heads at Royal Roads University where they discussed the certification program for Canadian Certified Environmental Professionals (CCEP). Unlike the CAB which has matured and is mandated through a provincial act in British Columbia, the CCEP program is still developing. I examined the requirements for the CCEP and our Environmental Science Program does not seem too far from providing our students with the curriculum that would let them meet certification. A particular deficiency is a course in Environmental Ethics. Such a course could be developed at Simon Fraser University with cooperation of other departments but if it was added to our current curriculum then an existing required course would have to be dropped. When the EVSC curriculum is reviewed, changes should include courses that would accommodate CCEP certification for those students that wish to pursue that option.

Information about the CCEP program is available on the ECO Canada web site. Links to this web site and specifically to the CCEP web site will be provided when the Environmental Science web page is redesigned.

Recommendation: The resources provided for the Program are totally inadequate. Even if the Program were to remain in its current form increased resources must be made available to support an adequate level of faculty involvement and administrative support.

While more resources are desirable and could be used to assist the program, more resources without a clear vision and plan would not be prudent. The curriculum needs to be reviewed and modified. This modification could be relatively small and achieved by increasing flexibility and giving students greater choice in courses pertinent to environmental science. Alternatively, the modification could be a major overhaul. However, I do not know if this major overhaul is needed. Environmental Science students are easily placed into coop work terms and some go on to graduate research. This indicates that the basic curriculum is consistent with professional needs. As well, students like the program, but they find it constraining and difficult to schedule the required courses.

Initially, flexibility can be added to the program by reducing required courses and by providing more options to required components of the program. This could be done immediately, and then a comprehensive curriculum review conducted. This curriculum review would also include specific reviews of content and overlap among of REM 100, GEOG 100, and EVSC 200.

Recommendation: Participating departments should ensure that faculty appointed to the Steering Committee play a positive role as both a departmental representative and as an active participant in an interdisciplinary program.

I agree. Perhaps clear terms of reference could be prepared that would help the steering committee provide the appropriate advice needed by the program. There is always some risk that people will be concerned with the implications of the Environmental Science Program to their home departments.

Recommendation: A dedicated area within the University must be made available to students in the Program.

It would be very helpful and positive for the university to provide space to students in the program. Several benefits would be realized: camaraderie, peer support, and cohort development. This allocation of space can be made whether Environmental Science remains a program or developed into a department.

Recommendation: Whether the existing program is moderately restructured, or whether there is a major restructuring of environmental programming at SFU, there is considerable benefit to its students, and a responsibility of its administrators to develop a program that recognizes national initiatives in terms of curriculum goals, and which prepares its students with the resources to become effective environmental problem-solvers and employable professionals.

Recommendation: A separate Department of Environmental Science be created

Recommendation: Existing faculty members at the University be given the opportunity to consider transferring to the new Department of Environmental Science, and that priority be given to new hires as required.

Recommendation: There must be the allocation of an identifiable space for the new Department of Environmental Science that will permit its faculty, staff, and students to function as a coherent unit. As a department, Environmental Science should also obtain a library representative and a separate allocation budget to ensure adequate material and resources are available.

Recommendation: The new curriculum should contain an identifiable core, which includes at least one or two courses per year with an Environmental Science label, beginning in the first year.

Recommendation: Student participation should be included in the formulation of a curriculum committee. This committee should involve also the new faculty members of the new Department of Environmental Science whether they be full time or cross-appointed.

Recommendation: That Simon Fraser University seek to achieve its potential as a national leader in environmental education and research at the university level by establishing a Faculty of the Environment based initially on three departments – REM, Geography, and a new Department of Environmental Science.

The Environmental Science program at SFU currently has an identifiable core but is deficient in designated EVSC courses. Although there are 6 streams, these streams have a similar suite of required courses especially at the lower levels. For example in the 2 dominate streams, biology and physical geography, 74% of the credit hours are the same during the first 2 years and 52% are the same during the 3rd and 4th years. Required courses taken by Environmental Science students in the biology and physical geography streams overlap by 50% (60/120 credit hours) for their whole program. In comparison, streams within the Department of Biological Sciences overlap by 44% (53/120 credit hours).

There is merit in having an identifiable core but if the core becomes too large it would unduly restrict student's individual choices and lead to the sorts of scheduling issues students currently face in the program. It is appropriate that students be given some opportunity to specialize and tailor their program to meet their particular interests. If there were greater prescription of an "identifiable core", likely there would be greater difficulties in course scheduling and flexibility in the program would be even more constrained.

Students will be included in assessing the current curriculum and identifying options for changes to the curriculum. Students bring unique and relevant perspectives to discussions on curriculum and also would help ensure changes do not create further problems with the program.

There are short term and long term responses to address the issues raised by the External Review. The short term response does not depend on whether the Environmental Science Program remains a program, develops into a department within the Faculty of Science, or becomes a central unit in a Faculty of Environment. The long term response depends greatly on whether there are structural changes and the role that the Environmental Science program plays in the resulting institutional arrangement.

In the short term, flexibility can be inserted immediately into the program by reducing the number of required courses and providing more options within areas of specialization (i.e., streams). Initially, this means that approximately 18 credit hours (6 courses) that are now required should be made optional. For the more heavily prescribed streams (e.g., environmental chemistry) even more courses should be made optional. After a curriculum review, the stream design could be modified or dropped. If it was dropped then it could be replaced with a more individually driven curriculum (in terms of optional courses) that is bounded by a core and course selection principles that ensure academic quality.

Over the long term, there are several potential futures for the Environmental Science Program. Some depend on large-scale changes to university structure. Whatever the organizational level, success of Environmental Science at Simon Fraser University will need research, teaching and governance cultures that respect different disciplines and embrace the strengths that science and social science faculty bring to interdisciplinary programs. The challenge will be to ensure different disciplines can accept and value each other's contributions. Although there is merit in restructuring to form a Faculty of the Environment, it is well beyond the scope of a program to initiate such a substantive change. Also, many of the benefits used by the Review Team to support the formation of a Faculty of the Environment could be achieved by other institutional models. Should the university make changes, then the Environmental Science program can adapt and fit within a fairly wide range of structures.

SIMON FRASER UNIVERSITY

Office of the Dean of Science

MEMORANDUM

TO: Bill Krane, Associate VP
Academic

FROM: Dr. Michael Plischke, Dean
Faculty of Science

RE: External Review of
Environmental Science Program

DATE: October 25, 2006

I write with regard to the report of the External Review Committee (ERC) on the Environmental Science Program and the response of its Director, Dr. Alton Harestad. I requested a review of this program because I was concerned about the apparent drop in demand for the program and because it seemed to me that the structure of the program reflected departmental priorities at the time of its creation more than it did a coherent view of environmental science. As Dr. Harestad points out in his response, the drop in demand may have been a fluctuation but the lack of growth in this program is nevertheless disappointing especially since there will be strong demand for graduates for the foreseeable future.

The main recommendation of the ERC is the creation of a new Faculty of the Environment, which would become the home of a new Department of Environmental Science that would take ownership of the EVSC Program. I find this recommendation very attractive. However, this new Faculty can only be successful if there is, at a minimum, strong support from the School of Resource and Environmental Management (REM) and the Department of Geography. I am quite confident that a number of current faculty in Science would find it attractive to transfer to a Department of Environmental Science.

Other recommendations concern revisions to the curriculum of the program. In essence, what is recommended is a complete overhaul of the program. I support this and have asked the current Director to chair a committee to initiate this process. This committee will be different from the current Steering Committee and will have membership from REM. If the new Faculty and Department come into existence, the work of this committee will, hopefully, provide a point of departure for the Department's Curriculum Committee.

A third important point that the ERC makes is the lack of visibility of the Program on campus and the lack of space for the students enrolled in it. Thanks to the completion of TASC II, the Faculty of Science has a bit of flexible space. I have decided to assign an office in TASC II to the Director of the Program and a nearby office to the EVSC Undergraduate Student Society. This is a modest first step but it should serve to make the Program more visible and to improve the *esprit de corps* of the students.

In summary, this review was a most valuable exercise, no matter what the eventual outcome of the Faculty Restructuring Process turns out to be. I am confident that we are now in a position to create an attractive and effective EVSC Program in either a new Faculty or in the Faculty of Science.

Michael Plischke

c: Alton Harestad