EARTH AND ENVIRONMENTAL SCIENCE SYLLABUS CONSULTATION REPORT

INTRODUCTION
During April 1999 the Board of Studies conducted extensive consultation on new Science syllabuses for stage 6 of the school curriculum. This report is concerned with the feedback for the proposed 2 unit draft Earth and Environmental Science course. The consultations consisted of a series of Key Group meetings with representatives of various interested parties, seven Focus Group meetings, each with a cross-section of teachers, and a paper survey that was sent to all secondary schools.

The Evaluation committee consisted of Bruce McAdam, Geoff Alexander, Charlie Cochrane, Sue Ezzy, Brian McInnes (Chair), assisted by Board of Studies Officer, Sandy Dufficy. This committee conducted the Key Group meetings and produced a summary report on each meeting. The input from the eight Key Group meetings, the Focus Groups and the Surveys is the basis for this report.

The eight Key Groups represented were the Board Curriculum Committee for Science (BCC), the Science Teachers’ Association of NSW (STANSW), Interest Groups (Royal Botanical Gardens, Geological Society of NSW, Earth Resources Foundation, NSW National Parks and Wildlife Service), School Principals, the Education Systems, Unions, Tertiary Educators and Tertiary Specialists.

Focus Group meetings were held (sometimes with the aid of telecommunication) at St Agnes Campus, Rooty Hill, Goulburn High School, Bega High School, Inaburra School, St John's College, Woodlawn, The Scots School Albury, and Wee Waa High School. Sixteen teachers took part in four of the meetings and an unknown number in the other three meetings. Written reports from these meetings can be found in Appendix XX.

Eighty respondents completed the Survey documents during April 1999. A Report on the findings from the Survey was drawn up and made available to the Chair of the Evaluation Team.

It is probably inevitable that an evaluation of this kind will concentrate on those aspects of a course that could be improved and those which need to be discarded or replaced; the good news looks like no news. It is important, therefore, to start by saying that the evaluation team found a lot of goodwill and support for the major new initiatives and educational approaches embodied in the draft syllabus.

The response to the Draft Syllabus was principally in three directions:
- content of the Syllabus;
- need for continuing support in the introduction and delivery of the Syllabus;
- timing of the introduction of the Syllabus;

Points reported here on these and other matters are illustrated by quotes from various of the evaluation streams. The illustrations are not exhaustive.

STRENGTHS OF THE DRAFT SYLLABUS
As mentioned above, respondents to exercises like this tend to concentrate on negative aspects and sometimes forget to point out the things that they like. Identification of the strengths in the syllabus depends to some extent on identifying aspects which were not criticised. Putting those aspects together with explicit positive comments yields the following list of strengths, some of which will be qualified later in this report.
- The new structures which build on the innovations of the new junior science course are supported.
- The innovative and exciting nature of much of the course content is welcomed.
- Teachers recognise the value of learning in suitable contexts.
- The potential of Student Research Projects to foster independent learning and the development of skills is overwhelmingly supported.
MAJOR ISSUES FOR IMPROVEMENT

1. The Content of the Syllabus

There is no doubt that the amount of content, judged largely by statements of content in both knowledge and skills is far too great. A number of teachers and organisations reported analyses to back up this conclusion.

There is a strong perception that the draft syllabi contain too much content for the allocated time and this is exacerbated with the fact that the course depends to a large extent on ‘assumed knowledge’ from Stages 4 and 5.

Concerns are expressed that there is no time allocated to revise the ‘vital’ material covered in the earlier years. The educational philosophy underpinning this concern rests with teachers’ belief that students ‘forget’ learning from earlier years and revision, in part, is necessary to ensure students have the appropriate and recently revised framework on which to build.

The link between earth and environmental sciences has disappeared. This course misses the point of the Symposium, which was to maintain earth science but with an environmental slant. The focus should have been using earth resources and the cost to the earth of doing this.

The list of Objectives and Outcomes (pp. 20-21) is good, but has not been used to structure the syllabus. Apply this model to the syllabus content as a cutting tool: retain material that relates to these Objectives and remove other material.

There was concern that the listed Objectives and Outcomes need to be revised to better reflect the directions that the course should take. The principal focus areas appearing as objectives 6-10 must be realistic before using them to organise the Syllabus.

There is little mention of fieldwork in the draft Syllabus and none in the HSC Course. It was suggested that: the Writing Team should look at Stage 6 Geography draft Syllabus for statements about fieldwork (p.15) and the Senior Geography Project (pp.22-3) as a possible way of clarifying expectations about the Science Student Research Project.

Key Issue: In order to encourage quality of learning, the specific content of the course (skills, understanding and declarative knowledge) should be severely pruned.

Key Issue: The modules should be reduced in content and areas of consolidation be highlighted in each module.

Key Issue: The overall syllabus should be reviewed to include more obvious geology content.

Key Issue: Cull the syllabus content using direct relationship to the revised Objectives 6-10 as an essential factor for retention in the Syllabus document.

Key Issue: Revise Objectives 6-10 to fit a course that reflects the use of earth resources and the cost to the earth of this use.

Key Issue: The Syllabus should be reviewed to make clear the need for all students in this course to spend some of the indicative teaching hours doing field work.

2. Level of Difficulty and Target Group

Discussions as to what students are likely to do the Earth and Environmental Science course ran along 4 paths:

- students who would have done 2-unit Geology cohort: would they remain (and/or, would those presently teaching 2-unit Geology transfer to the new Course?);
- students who would have done 2-unit Biology;
• students who would have done Science for Life or General Science;
• students who would not have done any science course.

The Review of the Survey responses showed a general perception that the course may appeal to students. The course was described as relevant, topical, and current and possibly the only course in the new Stage 6 group to encourage students not to drop science at the end of Year 10. Others saw the course as useful and embraceable for many more students and teachers. Earth and Environmental Science will appeal to a wide range of students, but suitability will depend on how content is reduced and how the exam is set out.

However, there was some disagreement on the audience for the course because although the name will be attractive to many students, the content was seen to be too difficult for those students who do not have substantial achievement in Science Stages 4 and 5. The course is designed for middle to upper level students and will not cater well for the less able students. The demands of this course are above those students as anyone wishing to do well is going to have to be more academic, more literate, and with greater numeracy skills. For others, the concern is not the level of content, but the amount of it. It is possible to take many students (in bands 2-3) through the valleys of content without climbing the peaks.

Some believed that the present course is aimed at some few high level students who do not need physics or chemistry for university courses with the bulk from the middle of the range. The new course seems to be aimed at the top end of the candidature. If we are to pick up the General Science students, the new course needs to be broad. Science for Life students would have a lot of trouble with this course.

**Key Issue:** The course should be reviewed to reduce the amount and level of difficulty of the content to accommodate a broader band of students.

### 3. Student Research Project

There is considerable support and some enthusiasm for the introduction of the Project but this support is not unanimous and there is general concern about many of the managerial issues associated with the Project. Although the value of active engagement of students in project work is acknowledged by all, there are substantial worries about the mandatory implementation of the Student Research Project (SRP) as described in the draft syllabus. It will be very difficult to implement before students have completed a Stage 4 and 5 project.

Although there is already a lot of information about the SRP in the draft syllabus, there is clearly a widespread perception that more concrete guidance is needed. Issues of depth, plagiarism and assessment may need to be addressed more explicitly in the syllabus. Teachers feel that they may not have the time or resources to deal adequately with those problems.

The Open Training & Education Network have a real problem with the time needed for contact back and forth with the distance education students meant that there would be a 5-8 weeks time lapse in inspecting which would lead to major problems with the authentication of student's work. It could work only if the Project were spread over the year.

Others pointed to serious Occupational Health and Safety issues with regard to some of the practical activities, in particular soil testing (some wet chemical tests are dangerous eg phosphate), and also deep concern about the overall increase in Teacher work-load with Stage 4 and 5 Projects.

There are so many investigations in the HSC Core Modules already so a Student Research Project becomes redundant. DET notes the unexplained use of the word “research” many times in the body of the Syllabus. They suggest making the Project optional for the first few years. It is essential that the teacher is equipped to manage and assess the methodology of the project.

The assessment of the Student Research Projects is also a problem, given the range of possible projects, and it will be necessary and difficult to equate them. There are great difficulties in valid and fair marking if included in assessment; there is a problem in supervising that the Student Research
Project is the student's own work. Authentication of individual work is not viable if required for HSC assessment.

Finally, there are equity concerns with the resources available to students across the State; country schools may be greatly disadvantaged especially with smaller community support on which to draw.

Key Issues: Student Research Project

- **Review the introduction of a Student Research Project, given the level of concern over many aspects of the project.**

- **The concerns of teachers about plagiarism and assessment should be considered. Syllabus writers are urged to explore ways of providing more concrete guidance and reassurance.**

- **In the light of the feedback received in this Evaluation, reconsider the timing, the time allocated and the assessment procedures for the Student Research Project.**

- **Rewrite material in syllabus to clearly and concisely set out the purpose and place of the Student Research Project in a much simpler way than at present. There needs to be consistency about the scope of the Project internally (pp.51 and 56) and across all five Stage 6 Syllabuses.**

- **Develop a Support Document with clear, detailed and realistic advice to teachers on how to implement the Student Research Project including: elaboration and clarification of material on p.59; replacing “statistics” with “handling numerical data”; provision of marking criteria for the Student Research Project.**

- **Examine all occurrences of the word “research” in the skills content and, in general, replace by a more appropriate and meaningful phrase.**
4. USE OF LANGUAGE IN THE SYLLABUS

The headings "will learn about" and "will learn to" over the columns of content and skills were not liked. All "musts"/"wills" need to be replaced by "should"/"could" to remove litigation possibilities.

The use of ill-defined words such as "research" in the skills lists. The depth of study required by syllabus not clear: meaning of words "research", "investigate".

A general looseness or non-specificity of language is perceived in the draft Syllabus. There is poor indication of the depth required. Most of this stems from the non-specific language and poor links to outcomes in the layout of the syllabus. The language demands of the Earth and Environmental Science Syllabus need to be adjusted so that they can assist in the development of scientific literacy of students.

KEY ISSUE: Adjust the language demands of the syllabus so that they assist in the development of scientific literacy of the student and promote elucidation rather than confusion for teachers.

7. DRAFT PERFORMANCE SCALES

The Board's Curriculum Committee noted that the Performance Scale will be a public document which students, parents and employers will need to be able to interpret, as well as education workers. It therefore made a set of recommendations which are presented here as follows:

Key Issues:
1. The Performance Scale should relate to the Objectives (pp.20-1); it does not in this draft.
2. Provide discrete, independent descriptions of each band, including a description for Band
3. Remove negative language from band descriptors (e.g. "... but displays lack of ..."; Band 2: "displays limited skill" - omit references to particular skills until they can be positive)
4. Remove relative language: it is impossible for users to consistently differentiate between descriptions such as "good" and "very good" or "extensive and detailed" and "sound"

8. OVERLAP WITH GEOGRAPHY

The Board Officers have a Draft Report of a Geography Teachers Working Party on the Earth and Environmental Science Syllabus. This Report indicates a small area of unacceptable overlap between this syllabus and the geography syllabus, areas that are complementary and areas of partial overlap. Some of the Groups interviewed in the Evaluation exercise believed that the overlap was more serious than was indicated in this Report.

Key Issue: The perception that there is much overlap between the draft Syllabuses in Earth and Environmental Science and Geography has to be addressed.

9. TIMETABLE FOR IMPLEMENTATION

Assumed knowledge is based on the new Stages 4 and 5 Science Syllabuses, which themselves are not to be introduced until 2000. There is almost unanimous agreement that the implementation of the new syllabus must be deferred until the year 2002 at the earliest. There are two main classes of argument for that: preparation for students and preparation of teachers.

The draft syllabus itself highlights the importance of student preparation in the way that it builds on the new structures, approaches and content of the new Science Stages 4-5 course, including PFAs and student project work, as well as substantial lists of "assumed knowledge". The focus questions provided by the Board also highlighted the importance of building on the new junior course and an overwhelming majority of respondents agreed that the draft syllabus does just that. Students will not have assumed knowledge from Stage 5 syllabus until Year 11 2002, so there needs to be an interim syllabus for 2000-2001 in any case.
The purpose of a delay would be to carry out development activities. There is no point in delaying implementation at all unless this development work is undertaken:

- resources development,

- teacher in-service training: The preparation of teachers is crucial to the successful implementation of new syllabuses. This is a particular need for the Earth and Environmental Science Syllabus where, if the Course has the anticipated up-take of schools and students, there will be a marked shortage of 'trained' and experienced teachers. There is a great deal of enthusiasm for the package of new science courses, especially those which will cater for a wide range of students. However, the very newness leads teachers to say that they will not be able to cope unless they are given adequate time and help to learn the new material and approaches. In-service training and professional development will be crucial.

- building links between schools/teachers and organisations able to provide resources and skills: National Parks and Wildlife Service, Botanic Gardens, Soil Conservation Service, etc.

Key Issue: Trials and a continuing review of the revised syllabus should commence in 2000, with the aim of having it ready for full implementation for the first cohort of students who have completed the new Stage 5 Science course. Consideration to staged implementation of the course needs to be reviewed.

10. SUPPORT DOCUMENT

Every Group emphases the need for support. Most schools are unlikely to have the resources to teach the draft course; many teachers would need to be trained to increase their skill level. This is particularly so for this course because it is so different to existing courses and does not line up with per-service training of science teachers.

Key Issue: The Board prepare generic support materials and alert all systems to the need to provide extensive (and probably expensive) support.

Key Issue: The Board of Studies acknowledge the need for regular updating of support materials.
DETAILED COMMENTS ON MODULES

B. General Comments

They agreed that the concept of 4 modules was OK but there was no agreement on the placement of modules. It was suggested there was an earth science bias in the Preliminary Course and the HSC course was mostly biological. Geological time is not mentioned in the Preliminary Course and could perhaps provide a thread to link the two Courses. Science Teachers' Association

There are too many Principal Focus Areas in any one module (shouldn't be more than one or two). Systems

This Stage 6 perpetuates the negative anti-mining and anti-natural resource use attitude of the Stage 4/5 Syllabus. Unions

The issue of mineral resources is missing from the core. It is important to Australia and contains good science. Principals

There is not enough on the lithosphere (especially mineralogy and mapping). In all there must be a change of emphasis from the old geology course; the emphasis on water should remain with some addition of earth science issues such as the appropriate inclusion of some environmental issues around use of rock and mineral resources. DET teleconference

The 4 module concept is appropriate but again there is too much content. Soil study was removed from previous syllabus as students did not like it; it is now back in exactly the same form. It could be included but in better form Science Teachers' Association

There was much discussion on the place of mineralogy in the Syllabus. It was agreed that there needs to be some mineral development as modules Systems

Non-renewable, non-organic resources should be included in the modules: they are not in this draft syllabus at all. Unions

There was a desire for a stronger presence of Earth science. Key Points from Survey

Concern was expressed over the absence of mapping skills. Key Points from Survey
A. Detailed comments on Modules in Preliminary Course

BCC expresses strong support for "Local Area" and "Water Issues" Preliminary modules as bases from which Science Research Project subjects (could) arise; therefore these modules should be retained or strengthened (that is, kept as at least 2/4 of Preliminary Course). Board's Curriculum Committee

"Dynamic Earth" is very important and underpins most of geology, basic concepts are in the Preliminary Course but the importance should be stressed in the HSC Course. Science Teachers' Association

The topics in the core modules are not appropriate: there are no landscapes and nothing on geological disasters. Evolution and the fossil record is now in the Biology Syllabus; it should be brought back into Earth and Environmental Science. There is scope here for mapping. The balance is wrong: a unit on the whole history of earth and the universe, and one on water. Tertiary Specialists

"Planetary Earth" and "Dynamic Earth" could perhaps be combined into a single module. Whether the 4 modules are appropriate in number and content depends on whether one is looking at the syllabus from the geology or environmental perspective. It was suggested that "Dynamic Earth" should be in the HSC Course so that knowledge of it can be tested in the examination. The Option "Mining and the Australian Environment" should be shifted into the Preliminary Year and made Core. Systems

This Stage 6 perpetuates the negative anti-mining and anti-natural resource use attitude of the Stage 4/5 Syllabus. The module "Dynamic Earth" could provide a unifying theme. It is the only acceptable Earth Science module and could have two parts, one in the Preliminary Course and the other in the HSC Course, with the emphasis on the HSC module. The module "Water Issues" should be removed. The module "The Local Environment" will present problems for students in Metropolitan Sydney. Unions

The issue of mineral resources is missing from the core. It is important to Australia and contains good science. Principals

Some thought "Water Issues" has too much biology/environment and not enough geology; it could have more on Environmental Impact Statements, farming issues, exploration, mining and environment. The module "Local Environment" should be renamed "Regional Environment" to allow a sufficient choice in resources. DET teleconference

The 4 module concept is appropriate but again there is too much content. Soil study was removed from previous syllabus as students did not like it; it is now back in exactly the same form. It could be included but in better form. The module "Environments through Time" should be moved to the Preliminary Course. Science Teachers' Association

It was suggested that "Dynamic Earth" should be in the HSC Course so that knowledge of it can be tested in the examination. Systems

ISSUE: In the light of the comments received in the Evaluation Process, modules and options be recast so that more geology be included in the modules and in the options. Useful submissions have been made as to what parts of geological science are appropriate. KEY ISSUE: Some economic geology, probably based on mineral resources, should be included in the Preliminary Course.
B. Detailed comments on Modules in Higher School Certificate Course

The module "Environments through Time" should be moved into the Preliminary Course
Science Teachers' Association

The module "Environments Through Time" has too much emphasis on the biological aspects of palaeontology. It should be revised and put into the Preliminary Course
Unions

The 4 module concept is appropriate but again there is too much content. The module "Environments through Time" should be moved to the Preliminary Course. Science Teachers' Association

"Mining and the Australian Environment" could become a module and "Caring for the Country" an option. It was suggested that "Dynamic Earth" should be in the HSC Course so that knowledge of it can be tested in the examination. Systems

The module "Environments Through Time" has too much emphasis on the biological aspects of palaeontology. It should be revised and put into the Preliminary Course.
The module "Caring for the Country" has some good material but it is not suitable for this course: it overlaps with geography and agricultural science. Unions

The module "Caring for Country " should have an indigenous element; it need not to be all doom and gloom eg what has happened, etc.
The module "Environments Through Time" is good; resources are needed. Interest Groups

KEY ISSUE: Modules should be rewritten or rearranged so that there are unmistakable earth science based modules in the HSC course.
C. Detailed comments on options

All Groups, without exemption, want to be involved in further consultation process when the options are fully detailed.

Some material from the modules could be moved to options

Additional options: “Geological History of Australia”; “Environmental Management ”.

There needs to be a balance between geological and environmental matters in option topics. Board’s Curriculum Committee

It was suggested that option 4 has no place in an earth science course, it is a biology topic. Option 5 is better suited to geography. The applicability of option 2 is limited to students near coal deposits and it would be better to widen it so metalliferous resources could be studied in an either/or situation. At least some of option 3 should be placed in a module. Science Teachers’ Association

The 5 options have very little geology. “Environmental Geology”, “Planning Issues”, “Geoheritage” would be good options. “Organic Geology” should be called “Fossil Fuels”. Tertiary Specialists

Options are the big chance to expand core material. “Organic Geology” seems mundane. We need more options with various flavours. “Natural Disasters” would be a good option: some chemistry and physics could be bought in here.

Could there be a changing "elective 9" (the one-time Physics Elective) option here? The option "Mining and the Australian Environment" should be shifted into the Preliminary Course and made into a module. Systems

Option 1 is well received by students and could be a Preliminary module or remain as an Option. Option 2 is good but should be as a module.

Option 3 has no background in the modules: it should become an HSC module with its appropriate background or be a module in both the Preliminary Course and the HSC course.

Option 5 is OK but should not be in an earth and environmental science course. Unions

Concern is expressed about: the "Local Environment" option and its fieldwork component:

need guidelines, clarification as to the expectation of treatment;

equity issues expressed about getting access to an appropriate field site.

Key Points from Survey

All options are too ‘hefty’, too broad.

Option 4 - biological option - could well be renamed "Animals through Time". Interest Groups

Whereas it is appropriate to offer options, their treatment may well end up too superficial if teachers become bogged down due to the difficulty of the modules. Focus Group Meeting, St John's College, Woodlawn

The options are too heavily biased towards the environmental sciences. There is a lot of overlap with the content in the modules. Options on palaeogeology and mapping and exploration could be included. Focus Group Meeting, Goulburn High School

KEY ISSUE: One or more options based on geology should be written.

KEY ISSUE: That when the details of the options are written, all Reference Groups that took part in the Evaluation Process be asked for their comments.