California State University, East Bay

Five-Year Program Review for

Earth and Environmental Sciences

2012-2013

Self Study and Five-Year Plan approved by faculty on: January 29th, 2013 (4 yes, 0 no)
External Reviewer Report received by the program on: July 18th, 2013
Program’s Response to External Reviewer’s Report completed on: Oct. 27th, 2014
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1. Summary of the Program

The Department of Earth and Environmental Sciences offers degrees in Geology (B.A., B.S., M.S.) and Environmental Science (B.S.), and courses that fulfill requirements for General Education and other degree programs. The department teaches courses under two discipline listings, Geology (GEOL) and Environmental Science (ENSC). We offer upper-division and graduate coursework in geology and environmental science, including hydrology, geophysics, structural geology, petrology, and geochemistry. Many of our classes include laboratory- and field-based activities. In addition to teaching, faculty conduct research, publish, and participate in scientific meetings. Our department is involved in STEM Education activities for K-12 teachers.

Enrollments for the department (measured in FTES) quadrupled between 2005 and 2009, largely due to increased participation in the General Education program. The Geology graduate program and the Environmental Science B.S. program have experienced overall increases in the total number of majors during the past five years.

The Department has implemented most of the changes recommended in the last review, conducted in 2005. These include increasing the Department's participation in General Education and Environmental Science programs, increasing the number of students in the Geology graduate Program, and hiring a new tenure-track faculty member with expertise in hydrogeology. A tenure-track search is currently underway for a new faculty member in Environmental Science.

2. Self-Study

2.1 Summary of Previous Reviews

The last program review was conducted in 2005, prior to the merger of the Department of Geological Sciences with the Environmental Science Program. Reviews for Geology programs and the Environmental Sciences program were conducted separately. Geology Programs were reviewed by Prof. C. John Suen of CSU Fresno, and the Environmental Science Program was reviewed by Prof. Stephen Welter of UC Berkeley. The main recommendations from each of the reviews are summarized below, along with a brief statement of our progress towards their implementation. More complete explanations are given in subsequent sections.

Compliance with Dr. Suen's recommendations:

- The currently number of tenure-track faculty (four) is less than needed for a comprehensive department. Grow to 6 or 7 tenure-track faculty within 4 or 5 years.
  
  There has been no net change in the number of tenure-track Geology faculty (four) since the last review.

- Increase participation in the G.E. program, Liberal Studies, and Environmental Sciences programs.
  
  Done. We now offer five courses that are part of GE clusters, two of which are in Environmental Science. The Environmental Science program is now administered by the Department.
• The department's productivity as measured in student credit hours per FTEF, or FTES per FTEF (SFR) should be increased by maximizing the class sizes of non-lab general courses.

  Done. Overall SFR for the department has more than doubled since the last review, increasing from 13 in 2005 to 29 in 2012.

• The department’s budget needs to be augmented to counter the effect of the loss of the vehicle pool.

  Our faculty have written proposals and received A2E2 funds to help pay for transportation for class field trips.

• Review and update all catalog listings.

  We added many new classes and revised several existing ones. The new course descriptions now appear in the catalog.

• Establish linkages with UC Berkeley faculty to develop opportunities for collaborations in teaching and research.

  One of our faculty (Moran) has established a collaboration with a UCB faculty member.

• The number of students in the graduate program is too small.

  The number of graduate students has grown from 6 in 2005 to a historic high of 19 in 2012.

• The department should work with the graduate admission office to expedite the application-admission process.

  We have worked more closely with applicants and the graduate admissions office to ensure that qualified students are admitted to the program. We monitor the progress of applications and follow up on any applications that are incomplete due to lack of transcripts or other required information.

• Create a roadmap for undergraduate student advisement based on a consistent two-year cycle of course offerings. Avoid canceling classes because of low enrollments.

  Done. Roadmaps for undergraduate programs are provided in the appendix. We have switched low-enrollment classes to a two-year cycle, and have been able to avoid cancelling majors classes.

• Hire a TT faculty to cover the area of hydrogeology ASAP. Identify and recruit outstanding minority or female candidates for the TT faculty position.

  Done. We hired a female hydrogeologist as TT faculty member in Fall 2008. In addition to teaching two existing hydrogeology courses, she has developed new courses in environmental hydrology and isotope geochemistry.
• Faculty should encourage students to take calculus-based Physics. Math 2304 (third quarter of calculus) should be listed as a required course rather than implicitly in the footnote.

  *Some of our students take the calculus-based physics sequence (PHYS 1001, 1002, 1003). This is particularly useful for those who are interested in computing or modeling applications, or who wish to enter a graduate program. The non-calculus based Physics (PHYS 2701, 2702, 2703) sequence is more appropriate for other students who plan to focus on less-quantitative areas of Geology. Math 2304 may be used as an elective, but making it a requirement would increase the total number of units required above 180.*

• A data analysis and/or statistical application course is needed and should be considered for the BS curriculum.

  *Not yet implemented for the Geology curriculum but we will consider this in the future. Stat 3010 or Stat 3031 is required for the ENSC B.S.*

• A lower-division introductory Environmental Science course should be introduced for the Environmental Science Program. Ideally, this course may also be included as part of the university’s G.E. program.

  *Done. Global Environmental Problems (ENSC 2801), and Global Environmental Issues (ENSC 2802) are new courses that first appeared in the 2008-2009 catalog and are now part of G.E. clusters.*

• Develop web-based and distance-learning non-lab courses. Convert existing appropriate non-lab courses to web-based or distance learning format.

  *We implemented an online class, GEOL 3401, The Oceans, which currently has an enrollment of ~120 students per quarter (three sections with ~40 students in each). We plan to develop an additional course of this type.*

• Conduct an alumni survey to obtain long-term assessment data. Possibly, use the state registration examination results.

  *This was not completed during this period, but we hope to do it in the near future.*

• Increase student recruitment effort by working with the university’s recruitment and outreach office. Increase publicity through local public media.

  *Our faculty members regularly participate in University recruiting and outreach efforts, both on- and off-campus. Faculty have given public lectures to community organizations and schools, and been interviewed by local TV stations.*

• Ask the college to implement a more reliable and better organized information technology support service.

  *Campus information technology support has significantly improved during this period. Our faculty have worked with campus IT staff to maintain and upgrade hardware and software in student computer labs.*
• Make a contingency plan for Mr. Garbutt’s anticipated retirement.

We hired a new Instructional Support Technician in 2007 upon Mr. Garbutt's retirement. Mr. Garbutt helped to train the new technician.

Compliance with Dr. Welter's Recommendations:

In his 2005 review of the Environmental Science program, Dr. Welter provided recommendations pertaining to administration and curriculum development. Many of the administrative recommendations were addressed by the 2006 merger of the program with the Department of Geological Sciences. Prior to the merger, the Environmental Science program was not associated with a department. It is now administered by the Department of Earth and Environmental Sciences.

Administrative

1. Inclusion of Environmental Science program director in communication channels or meetings targeting department chairs.

The Environmental Science program is now part of the Department of Earth and Environmental Sciences, and is represented by the department chair.

2. Consider a more formal recognition of the program director's role with additional release time to compensate for the increased time burden.

See #1 above. The administrative duties associated with the program are now shared between the department chair and program coordinator. The program coordinator receives release time.

3. Increase the number of faculty directly involved with the administration of the program as well as with the teaching elements.

A tenure-track search is underway for a new faculty member whose primary responsibility would be Environmental Science.

4. Enhanced presence of the program on CSUEB web sites.

A search of the University home page directs users to the Environmental Science program text in the University Catalog. The catalog text for the program has undergone major revision since the last review, including the addition of many new courses.

5. Determine the desired target size of the program relative to student numbers because a larger student body will require additional resources from the administration and commitment from the faculty.

The number of majors has grown from 25 to 35 since the last review. We anticipate that with the new faculty member, the program will be able to grow further.
Curriculum Development

1. A review of the entire major relative to its core and elective courses with an eye towards development of a comprehensive, but more streamlined, set of courses independent of the four departmental affiliations.

Done. An extensive revision of the program was completed, as explained in the following section.

2. Consider reducing the number of required courses in the core to increase the number of students declaring the ES major.

Done. An extensive revision of the program was completed, as explained in the following section.

3. Review the overlap between the ES and Environmental Studies program to determine if a single major with multiple tracks can be developed.

This was taken into account during the modification of the Environmental Science program that was completed in 2009. Several new Environmental Science (ENSC) courses were created that more clearly differentiate Environmental Science from Environmental Studies. One of our associated faculty (Prof. Michael Lee), whose home department is Geography and Environmental Studies, has provided guidance in this area.

4. The students made a strong plea for continued, if not increased, "hands-on" lab courses that include field components as needed. Many of these courses were viewed as seminal to their own training as well as a source of inspiration. Perhaps additional opportunities for involvement with the private sector may provide other pathways for more direct training as opposed to lecture formatted courses.

We have added two new classes that address this need; ENSC 2401 (Environmental Biology Laboratory) and ENSC 2900 (Field Activity in Environmental Science). Their course descriptions may be found in the appendix.

5. Consider developing closer ties to outside constituencies relative to internship, employment, educational or funding opportunities.

We have begun to do this. We hope to be able to work with our numerous ES graduates who are now employed in county, state, and federal agencies, as well as in private environmental consulting firms, to develop a broad-based Advisory Committee to help us implement these suggestions.
2.2. Curriculum and Program Modifications

The Department of Geological Sciences merged with the Environmental Science B.S. program in 2007 to create the new Department of Earth and Environmental Sciences. Degree programs in Geology (B.A., B.S., M.S.) and Environmental Science (B.S.) are now administered by a single department. The courses offered and the curriculum for programs have been extensively updated since the last review, conducted in 2005. Updates include program revisions, new courses, and course modifications. Catalog descriptions of many courses were revised to reflect updated course content. The main changes since the last review are summarized below. Complete course lists, with descriptions, are provided in Appendix C, Course Lists.

Geology Undergraduate Program

The department offers several undergraduate Geology classes that qualify for General Education (GE) credit and that serve large numbers of students. These include five courses that are part of General Education clusters; How Earth Systems Work (GEOL 1003), Natural Hazards (GEOL 2301), Earth Systems and Energy (GEOL 1006), Global Environmental Problems (ENSC 2801), and Global Environmental Issues (ENSC 2802). In recent quarters, some sections of these classes have had enrollments in excess of 100 students. Other lower-division GE courses that make a significant contribution to enrollments are Introduction to Earth Science (GEOL 1000) and Environmental Geology Laboratory (GEOL 1002). We also teach several upper-division GE courses with typical enrollments of 40-50 students. These include Geology of Western National Parks (GEOL 3100) and Volcanoes and Plate Tectonics (GEOL 3050). The Oceans (GEOL 3401) is a popular online course that fulfills the upper-division GE Science requirement. We have been offering three sections of it during recent quarters, and all have been fully enrolled.

The Minor in Geology was updated effective Fall 2009 to provide more specific reference to courses in the current catalog, and to better address the needs of future science teachers. In addition, the change helps to facilitate articulation with Community College transfer students.

Undergraduate Geology courses that have been newly developed or revised since the last review are listed below:

- GEOL 1002  Earth Sciences Laboratory (1)  (REVISED)
- GEOL 1006  Earth Systems and Energy (4)  (NEW)
- GEOL 2102  Earth and Life Through Time (4)  (REVISED)
- GEOL 2210  Environmental Geology (4)  (NEW)
- GEOL 2211  Environmental Geology Lab (1)  (NEW)
- GEOL 2301  Natural Hazards (4)  (REVISED)
- GEOL 2600  Introduction to GIS (4)  (NEW)
- GEOL 3040  Weather and the Atmosphere (4)  (REVISED)
- GEOL 3060  Exploring the Solar System (4)  (NEW)
- GEOL 3500  Environmental Hydrology (4)  (NEW)
- GEOL 4010  Applied Geophysics (5)  (REVISED)
- GEOL 4200  Introduction to Planetary Science (4)  (NEW)
(Number of credit units indicated after course name)

For a complete list of courses with descriptions, see the Appendix.

*Geology Graduate Program*

All graduate courses are offered in the evening in order to allow working professionals to attend. Prior to 2005-2006, all students in the Geology M.S. program were required to complete a University Thesis (8 units). Many of our students who were working full-time while enrolled in the graduate program had difficulty completing the thesis and the program in a timely manner. We therefore revised the degree requirements by introducing a project option, which allows students to substitute additional coursework and a project in place of the University Thesis. The project is relatively limited in scope and can be completed by most students in 1-2 quarters.

Degree requirements for the Geology M.S. (from the 2011-2012 University Catalog):

Completion of the study plan outlined below (45 units):
- Two Graduate Seminars (GEOL 6811) (2, 2)
- University Thesis (GEOL 6910) (9) or Project (GEOL 6899) (1-2)
- Geology Graduate Courses (20-27)
- Upper division/graduate electives in Geology and related fields (12)

The difference between the two options is summarized in the tables below:

<table>
<thead>
<tr>
<th>Thesis Option</th>
<th>Project Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Component</td>
</tr>
<tr>
<td>Seminars</td>
<td>Seminars</td>
</tr>
<tr>
<td>Thesis</td>
<td>Project</td>
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<td>Grad Courses</td>
<td>Grad Courses</td>
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<td>Electives</td>
<td>Electives</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
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<tr>
<td>4</td>
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<td>9</td>
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<td>20</td>
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<tr>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td><strong>45</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

Students who select the project option must complete seven additional units of graduate coursework (two courses). Most new graduate students have opted for the project option.

The following new Geology graduate courses were developed since the last review:

- GEOL 6020 – Seismic Exploration
- GEOL 6030 – Earthquake Seismology
- GEOL 6040 – Near Surface Geophysics
- GEOL 6310 – Isotope Geochemistry
- GEOL 6410 – Earthquake Geology
- GEOL 6414 – Regional Tectonics
- GEOL 6430 – Tectonic Geomorphology

A complete list of graduate courses, with descriptions, is provided in Appendix C, Course Lists.
Environmental Science Program

The Environmental Science B.S. program was significantly revised effective Fall 2009 by increasing the number of required Environmental Science courses, and reducing the number of courses required in other fields. The existing four program options were replaced with three. A detailed description of the program modification is provided in Appendix D, Curriculum Modifications.

The following new Environmental Science courses were created:

- ENSC 2400 - Environmental Biology (4)
- ENSC 2401 - Environmental Biology Laboratory (1)
- ENSC 2801 - Global Environmental Problems (4)
- ENSC 2802 - Global Environmental Issues (4)
- ENSC 2900 - Field Activity in Environmental Science (3)
- ENSC 3500 - Environmental Hydrology (4)
- ENSC 4140 - Hazardous Waste Management (4)
- ENSC 4200 - Global Change (4)

Course descriptions are provided in Appendix C, Course Lists.

2.3. Other Activities

Faculty, staff, and students from the department engage in a variety of activities outside of the classroom that contribute to the broader scientific community and general populace. One example is described below.

The Third Conference on Earthquake Hazards in the East Bay was held in 2008 at CSUEB. This three-day technical conference was attended by over 200 scientists, engineers, and planners from the Bay Area and beyond. Faculty, students, and staff from the department helped to organize the event. The first and second conferences were held at CSUEB in 1985 and 1995, also organized by the department.

2.4. Curriculum and Student Learning

Our department's assessment plan consists of four parts, one for each of our three main degree programs and one for General Education courses. The goal of assessment is to evaluate student learning and determine whether or not our students are meeting course and program objectives. The individual parts of the plan are summarized in the following sections, and provided in full in Appendix E, Assessment Plan.

Assessment of Geology Undergraduate Program

Assessment of students who attain the bachelor degree in Geology is an ongoing process with the goal of maintaining the highest possible quality in our undergraduate program. Our plan takes
into account that we are a small department that produces fewer than ten graduates annually, and thus cannot rely on the statistical reliability of any sort of objective testing on an annual basis. Our plan consists of three parts: 1. Completion of specific learning activities by students; 2. Faculty review of results from Capstone Courses; and 3. Survey of the professional geological community approximately every five years. These components are described in more detail in Appendix E, Assessment Plan.

Results from our implementation of this portion of the assessment plan have been encouraging. Overall, the department appears to be headed in the right direction in terms of offering a competitive, well-rounded undergraduate degree in geology. Specific results identified in faculty discussions are as follows:

The vast majority of our students are successfully achieving our desired learning outcomes based on their accomplishments in course activities. Continual monitoring of individual students by instructors and advisors on a quarterly basis has allowed us to identify students who require additional help in achieving specific learning goals, and to either work with them on an individual basis, or direct them to appropriate resources.

Students in our capstone course, GEOL 4800, the senior seminar, produce written and oral presentations. Most of the students have produced results that demonstrate mastery of program learning outcomes. All students have demonstrated at least adequate competency.

Assessment of Geology Graduate Program

Assessment of our Geology M.S. program is a continuous process with the goal of maintaining a high-quality program. The field of geology is interdisciplinary, and involves the application of a great variety of techniques (laboratory, computer, and field based) that must be assessed on an ongoing basis in order to prepare our students for professional work in the geological sciences.

Our plan has three parts: 1) reviews of specific learning activity by students, 2) faculty evaluation of a Master's Project or Thesis (required of all graduate degree candidates) plus evaluation of a thesis defense, and 3) evaluation of a dossier compiled by graduate students, documenting their written accomplishments during their graduate study here. The plan is provided in Appendix C., Assessment Plan for Geology M.S. Program.

Department faculty will monitor these products on an ongoing basis to update and improve learning goals, and to adjust the program as necessary to reflect changes in the practice of geology. This may involve the implementation of new courses, and the modification or elimination of existing courses, and other program changes as deemed necessary.

The Graduate Seminar, Project, and University Thesis are the most important assessment tools for the M.S. Program since they require the student to utilize skills learned in several courses during the program, including data collection, analysis, interpretation, and oral and written presentation of results. If any systematic deficiencies become apparent, the graduate program will be modified accordingly.
Assessment of Environmental Science Program

Students will demonstrate interdisciplinary comprehension of environmental issues through development of an oral and written analysis of an environmental problem in the capstone course ENSC 4800, Seminar in Environmental Science. This assignment will demonstrate accomplishment of all five learning outcomes, as listed in the Appendix.

Implementation Plan:

1. Faculty Advisory Committee members will review topics, written papers, and oral presentations from ENSC 4800 each year in relation to the learning outcomes for the program.

2. Student viewpoints regarding the structure, and depth and breadth of coursework in the Environmental Science B.S. program will be assessed annually via a questionnaire given in ENSC 4800.

3. Data will be gathered from ENSC 4800 to assess learning outcomes.

Assessment of General Education Courses

We have begun to implement entrance and exit exams in selected General Education courses. The same test is given at the beginning and end of a course. The tests consist of multiple choice questions to test students' understanding of key concepts. The same test will be given to different classes over time. This type of test is relatively easy to administer and provides numerical data that can be analyzed in a straightforward manner. A sample test and results from one of our classes are provided in Appendix E, Assessment Plan.
2.5. Students, Advising, and Retention

In this section, we discuss Academic Program Review (APR) quantitative data compiled by University Institutional Research and Assessment (IRA), including student enrollment, number of majors, degrees granted, student-faculty ratio (SFR), and the percentage of courses taught by tenure-track faculty. Portions of the data are summarized below. The complete dataset is provided in Appendix F, APR Summary Data, 2008-2012.

Number of Majors

The total number of majors, or student headcount, in the department increased from 47 in 2008 to 67 in 2012, with an average of 58 majors over the five-year period. About two-thirds of the majors were undergraduates and one-third were graduate students.

<table>
<thead>
<tr>
<th>A. Student Headcount</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Undergraduate</td>
<td>43</td>
<td>45</td>
<td>43</td>
<td>40</td>
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<tr>
<td>2. Postbaccalaureate</td>
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<td>2</td>
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<tr>
<td>3. Graduate</td>
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<td>14</td>
<td>15</td>
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<tr>
<td>4. Total Number of Majors</td>
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<td>64</td>
<td>58</td>
<td>55</td>
<td>67</td>
<td>58</td>
</tr>
</tbody>
</table>

Number of majors, undergraduate, postbaccalaureate, and graduate. Department of Earth and Environmental Sciences.
As shown below, the numbers of majors in the two disciplines, Environmental Science and Geology, are similar. The number of Environmental Science majors increased from 27 in 2008 to 36 in 2012, and the number of Geology majors increased from 20 in 2008 to 31 in 2012.

During the period 2008-2012, the majority of Geology majors shifted from undergraduate to graduate students. We attribute the increase in the number of graduate students to a combination of recruiting efforts and a growing job market for geoscientists with the M.S. degree.

Number of students enrolled in Geology programs, 2008-2012. The total number of majors varied between 20 and 27. The relative percentage of graduate students increased during this period.
Five Year Program Review for Earth and Environmental Sciences

<table>
<thead>
<tr>
<th>Headcount Enrollment</th>
<th>Fall Quarter</th>
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<td>2. Postbaccalaureate</td>
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<tr>
<td>4. Total Number of Majors</td>
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<tr>
<td>Geology</td>
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<tr>
<td>1. Undergraduate</td>
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<td>2. Postbaccalaureate</td>
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</tr>
<tr>
<td>3. Graduate</td>
<td>2</td>
</tr>
<tr>
<td>4. Total Number of Majors</td>
<td>20</td>
</tr>
</tbody>
</table>

Student headcount; number of Geology and Environmental Science majors.

**Degrees Awarded**

During the period 2008-2012, the department awarded an average of 8.4 degrees per year. The majority were undergraduate degrees. The rates at which Geology and Environmental Science degrees were awarded were similar (4.6 and 3.8 per year, respectively).

![Earth and Environmental Science Degrees](chart)

<table>
<thead>
<tr>
<th>College Years</th>
<th>07-08</th>
<th>08-09</th>
<th>09-10</th>
<th>10-11</th>
<th>11-12</th>
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<td>B. Degrees Awarded</td>
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</tr>
<tr>
<td>1. Undergraduate</td>
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<td>9</td>
<td>6</td>
<td>7</td>
<td>7.8</td>
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Degrees Awarded

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<th>Ave.</th>
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<td>6</td>
<td>3</td>
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<tr>
<td>1. Undergraduate</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>2. Graduate</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>3. Total Number of Majors</td>
<td>2</td>
<td>9</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Degrees awarded, Department of Earth and Environmental Sciences.

Faculty and Academic Allocation

The department has a total of four tenure-track (TT) faculty, all of whom are full-time. During the past five years, we had between 10 and 13 lecturers, all part-time. The number of Instructional FTE Faculty increased from 4.69 to 7.15 during this period. The percentage of FTES taught by Lecturers increased from 52% to 69%.

<table>
<thead>
<tr>
<th>Fall Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>2008</td>
</tr>
<tr>
<td>Tenure/Track Headcount</td>
</tr>
<tr>
<td>1. Full-Time</td>
</tr>
<tr>
<td>2. Part-Time</td>
</tr>
<tr>
<td>3a. Total Tenure Track</td>
</tr>
<tr>
<td>3b. % Tenure Track</td>
</tr>
<tr>
<td>Lecturer Headcount</td>
</tr>
<tr>
<td>4. Full-Time</td>
</tr>
<tr>
<td>5. Part-Time</td>
</tr>
<tr>
<td>6a. Total Non-Tenure Track</td>
</tr>
<tr>
<td>6b. % Non-Tenure Track</td>
</tr>
<tr>
<td>7. Grand Total All Faculty</td>
</tr>
<tr>
<td>Instructional FTE Faculty (FTEF)</td>
</tr>
<tr>
<td>8. Tenured/Track FTEF</td>
</tr>
<tr>
<td>9. Lecturer FTEF</td>
</tr>
<tr>
<td>10. Total Instructional FTEF</td>
</tr>
<tr>
<td>Lecturer Teaching</td>
</tr>
<tr>
<td>11a. FTES Taught by Tenure/Track</td>
</tr>
<tr>
<td>11b. % of FTES Taught by Tenure/Track</td>
</tr>
<tr>
<td>12a. FTES Taught by Lecturer</td>
</tr>
<tr>
<td>12b. % of FTES Taught by Lecturer</td>
</tr>
<tr>
<td>13. Total FTES taught</td>
</tr>
<tr>
<td>14. Total SCU taught</td>
</tr>
</tbody>
</table>
Enrollment

Overall enrollment for the department grew between 2008 and 2009, and was relatively stable at approximately 200 FTES (Full Time Equivalent Students) during 2009-2012.

The data above only partially show a period of extraordinary growth in FTES that began in 2005, the year of the last program review. Data spanning a longer period show that departmental FTES quadrupled between 2005 and 2009. This increase was due to the department's increased participation in general education and service courses, as described in Section 2.2., Curriculum and Program Modifications.

Five Year Program Review for Earth and Environmental Sciences

Total FTES for Geology and Environmental Sciences, 2001-2012.

Student-Faculty Ratio

The average Student-Faculty Ratio (SFR) for the past five years was 30.7 for the department, 22.3 for tenure-track faculty, and 36.6 for lecturers. SFR is shown below in detailed form for the past five years, and in summary form for the past ten years. Overall SFR for the department has more than doubled since the last review, increasing from 13 in 2005 to 29 in 2012.

<table>
<thead>
<tr>
<th>Fall Quarter</th>
<th>FTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>62.7</td>
</tr>
<tr>
<td>2002</td>
<td>65.3</td>
</tr>
<tr>
<td>2003</td>
<td>32.5</td>
</tr>
<tr>
<td>2004</td>
<td>42.1</td>
</tr>
<tr>
<td>2005</td>
<td>55.3</td>
</tr>
<tr>
<td>2006</td>
<td>86.5</td>
</tr>
<tr>
<td>2007</td>
<td>126.4</td>
</tr>
<tr>
<td>2008</td>
<td>137.3</td>
</tr>
<tr>
<td>2009</td>
<td>213.7</td>
</tr>
<tr>
<td>2010</td>
<td>211.9</td>
</tr>
<tr>
<td>2011</td>
<td>183.5</td>
</tr>
<tr>
<td>2012</td>
<td>205.3</td>
</tr>
</tbody>
</table>

Student-Faculty Ratio for Department of Earth and Environmental Sciences.
Student-Faculty Ratio for Department of Earth and Environmental Sciences.

<table>
<thead>
<tr>
<th>Fall Qtr</th>
<th>SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>15.7</td>
</tr>
<tr>
<td>2002</td>
<td>11.1</td>
</tr>
<tr>
<td>2003</td>
<td>9.8</td>
</tr>
<tr>
<td>2004</td>
<td>13.1</td>
</tr>
<tr>
<td>2005</td>
<td>12.9</td>
</tr>
<tr>
<td>2006</td>
<td>21.0</td>
</tr>
<tr>
<td>2007</td>
<td>21.2</td>
</tr>
<tr>
<td>2008</td>
<td>29.3</td>
</tr>
<tr>
<td>2009</td>
<td>38.8</td>
</tr>
<tr>
<td>2010</td>
<td>30.5</td>
</tr>
<tr>
<td>2011</td>
<td>26.0</td>
</tr>
<tr>
<td>2012</td>
<td>28.7</td>
</tr>
</tbody>
</table>

Student-Faculty Ratio for Department of Earth and Environmental Sciences.
Section Size
The average section size was 32.1 students during this period. Tenure-track (TT) faculty on average taught 57% of the sections offered by the Department. TT faculty taught fewer upper-division courses than lecturers, about the same number of lower-division courses as lecturers, and the majority of graduate courses.

<table>
<thead>
<tr>
<th>E. Section Size</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Ave.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of Sections Offered</td>
<td>27.0</td>
<td>26.0</td>
<td>27.0</td>
<td>31.0</td>
<td>32.0</td>
<td>28.6</td>
</tr>
<tr>
<td>2. Average Section Size</td>
<td>23.9</td>
<td>35.5</td>
<td>36.2</td>
<td>30.1</td>
<td>34.9</td>
<td>32.1</td>
</tr>
<tr>
<td>3. Average Section Size for LD</td>
<td>29.6</td>
<td>40.5</td>
<td>46.1</td>
<td>34.3</td>
<td>36.1</td>
<td>37.3</td>
</tr>
<tr>
<td>4. Average Section Size for UD</td>
<td>15.8</td>
<td>30.8</td>
<td>29.9</td>
<td>26.4</td>
<td>35.3</td>
<td>27.6</td>
</tr>
<tr>
<td>5. Average Section Size for GD</td>
<td>11.0</td>
<td>17.0</td>
<td>12.0</td>
<td>14.0</td>
<td>14.0</td>
<td>13.6</td>
</tr>
<tr>
<td>6. LD Section taught by Tenured/Track</td>
<td>10</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>7.2</td>
</tr>
<tr>
<td>7. UD Section taught by Tenured/Track</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>8. GD Section taught by Tenured/Track</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>2.8</td>
</tr>
<tr>
<td>8a. N sections taught by TT</td>
<td>14</td>
<td>5</td>
<td>13</td>
<td>14</td>
<td>16</td>
<td>12.4</td>
</tr>
<tr>
<td>9. LD Section taught by Lecturer</td>
<td>6</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>6</td>
<td>7.2</td>
</tr>
<tr>
<td>10. UD Section taught by Lecturer</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>9</td>
<td>7.4</td>
</tr>
<tr>
<td>11. GD Section taught by Lecturer</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>11a. N sections taught by Lecturers</td>
<td>13</td>
<td>21</td>
<td>14</td>
<td>17</td>
<td>16</td>
<td>16.2</td>
</tr>
<tr>
<td>12. % of Sections taught by TT (#8a / #1)</td>
<td>48.1%</td>
<td>80.8%</td>
<td>51.9%</td>
<td>54.8%</td>
<td>50.0%</td>
<td>57%</td>
</tr>
</tbody>
</table>

Student Advising
Student advising for the Geology B.A. and B.S. programs is provided primarily by the Department Chair. Advising for students in the Geology M.S. program is provided by the Graduate Coordinator and the Project or Thesis Advisor. Advising for the Environmental Science program is provided by the Program Coordinator.

2.6. Faculty
During the past five years, one tenured faculty member retired and one tenure-track member was hired. We currently have four tenured faculty members, three at the Associate Professor level and one full Professor. Due to the small number of regular faculty, we utilize lecturers to teach all types of courses, including introductory courses for non-majors as well as upper-division and graduate level courses for majors. Ten lecturers have been teaching classes in our department for the past several years. Most are part-time. All have at least an M.S. degree. Seven of the ten have a Ph. D. in Geology or a related field.

The Department conducted a tenure-track search in 2007-2008 for an Environmental Hydrogeologist, which resulted in the hiring of Dr. Jean Moran, who started Fall Quarter 2008.
She teaches courses in Geology and Environmental Science, and serves as the Environmental Science Program Coordinator.

A position was requested in 2010 for an Environmental Geologist, but was not approved.

A tenure-track search is currently underway for a new tenure track faculty member in the area of Environmental Science, who will teach courses in the Environmental Science program and participate in STEM Education. The new faculty member will start in Fall 2013.

2.7. Resources

Staff
The Department has two staff members, an Administrative Support Assistant (Ms. Serena Russell) and Instructional Support Technician (Mr. James Allen). The ASA provides office support and the Technician maintains materials for labs. Ms. Russell transferred from another department in 2011. She is a long-time employee of the University and is familiar with payroll, student and employee records, and other administrative systems. Mr. Allen was hired in 2007 to replace the previous Technician, who retired after more than 30 years of service.

Equipment
Departmental equipment described below includes rock and mineral collections, microscopes, equipment for particle size analysis, analytical laboratory equipment, hydrological test equipment, and geophysical instrumentation. Much of the equipment is used for both instruction and research.

Collections
The department maintains sets of rocks and minerals that are regularly used in lower-division laboratory sections. These include over 1,000 total samples.

For Physical Geology (GEOL 2101) and Earth and Life through Time (GEOL 2102), we maintain 12 identical sets, 15-20 samples per set, for the following four categories:

- Minerals
- Igneous rocks
- Metamorphic rocks
- Sedimentary rocks

For Intro. Earth Science Lab (GEOL 1002), we maintain 12 identical sets, 20-25 samples per set, for the following two categories:

- Minerals
- Rocks

Rock and mineral collections used in upper-division petrology classes (GEOL 3601, 3701, 3801) include several hundred additional hand specimens, thin sections, and hand specimens with
matched thin sections. Our collection also includes many rock suites, each consisting of numerous samples from the same locality.

- Igneous Rock Suites: ~120 samples (approx. 8 suites, 15 samples per suite)
- Metamorphic Rock Suites: ~60 samples (4 suites, 15 samples per suite)
- Sedimentary Rock Suites: ~90 samples (6 suites, 15 samples per suite)

The department maintains a collection of over 2500 fossils, mainly marine invertebrates. The collection is used by students in laboratory sections of GEOL 2102.

**Microscopes**

The department maintains petrographic microscopes for use in upper-division petrology classes (GEOL 3601, 3701, 3801). These specialized microscopes are used for viewing thin sections of rocks and minerals with plane or polarized transmitted light. Binocular microscopes that use reflected light are used for viewing sediment and fossils in lab exercises in GEOL 2102 and 3801.

**Rock Lab**

The department maintains a workspace with rock saws and lap wheels used by the department technician to make petrographic thin sections in support of upper-division petrology classes (GEOL 3601, 3701, 3801). The equipment is also occasionally used by students for research projects and thesis work. We maintain a complete set of sieves and shakers for sediment particle size analysis, used primarily for instruction and occasionally for research.

**GPS System**

A survey-grade GPS system and 10 handheld GPS receivers were acquired to support instruction in several classes as well as research.

- Two Promark 3 GPS receivers with Real-Time Kinematic (RTK) surveying software
- 10 Garmin e-Trex GPS receivers

**Geophysical Instrumentation**

Geophysical instrumentation was significantly upgraded since the last review. This equipment is used for several classes, including Applied Geophysics (GEOL 4010), Near Surface Geophysics (GEOL 6030), and Seismic Exploration (GEOL 6020). Students use geophysical instruments to record data in the field, then process the data in the computer lab. This equipment is also used for research.
Equipment acquired or upgraded since the last review:

- Seismograph: 48-channels, with P-, S-, and surface-wave geophones
- Capacitively-coupled dipole resistivity surveying system
- Ground penetrating radar: bistatic system with 50, 100, and 200 MHz antennas

Hydrology Instrumentation

Hydrology instrumentation was upgraded since the last review. This equipment is used for several classes, including Hydrogeology (GEOL 4320), Environmental Hydrology (ENSC 3500), Environmental Field Activities (ENSC 2900) and Groundwater (GEOL 6320). Students collect samples from streams and wells, measure water quality parameters in the field and in the laboratory, and measure flow rates and water levels. This equipment is also used for research.

Equipment acquired or upgraded since the last review:

- Flow meter for low flow stream gaging
- Submersible pump and controller for monitoring wells
- YSI water quality probes, turbidity meter, field deployable radon detector
- Cavity ring-down laser isotope analyzer

Student Computer Lab

Since the last review, our student computer lab has been significantly upgraded. In 2004, there were seven computers in our departmental student computer lab, including four different models, three different operating systems, and three computers that couldn’t connect to the Internet. Our faculty wrote a Request for Program Enhancement in 2005 to upgrade the lab with 8 new computers and a file server/domain controller. The request was funded, and the computers in the lab were replaced with new ones. From 2006-2011, our faculty worked with IT staff to maintain the lab and periodically upgrade the operating system and disk image. In Spring 2011, campus Information Technology Services replaced the computers in the lab with 10 new computers. Our faculty worked with IT staff to ensure that all required software was installed and properly licensed.

2.8. Units Requirement

The Department's undergraduate programs do not exceed the University's 180-unit requirement.
3. Five-Year Plan

3.1 Curriculum

We plan to revise our curriculum during the next two years in response to the University’s plan to move from the quarter system to the semester system by Fall 2018. This will require a thorough review of all courses and program requirements. As the length of the term will increase, material from some courses will need to be combined. Some courses will be expanded, others eliminated, and some redesigned as hybrid or online courses. Degree requirements for programs will need to be revised in order to take into account changes in courses. We plan to redesign the Environmental Science BS program by combining the current options, to offer increased flexibility and choice for students in designing a program to fit their needs, and decreased time-to-degree.

General Education

Our department is currently participating in three Freshman Learning Communities (Clusters) that were approved by the General Education office in June 2014 and are currently being offered for the 2014-2015 academic year; they are Earth Crisis, Thinking Globally, and How Things Work. All three are existing clusters that have been successfully offered in the past. Cluster proposals are normally solicited and approved about every three years; we anticipate that our participation in these clusters will continue for at least this length of time. Two of the proposals are provided in Appendix I. We foresee a growing demand for General Education (GE) curriculum related to climate. We have accordingly prepared a new course proposal for a lower-division Environmental Science course on Global Change for non-majors that has been approved as a new course and for GE (area B3) credit.

Degree Programs

Continued growth of our programs and improved graduation rates would be stimulated by developing new courses in areas that provide students with practical skills in areas that are becoming increasingly important; these include spatial analysis, environmental monitoring, instrumental analysis, soil science, and engineering geology. Such courses could draw students from different programs, including Biology, Statistics, Chemistry, Geography, and Engineering.

Students need practical experience in both the field and the laboratory, including observation, data acquisition, and computer data analysis. Additional courses of this type would student engagement and improve learning. New courses could provide students with additional training in these methods, with activities both on and off campus.

The department has offered a successful online GE course, GEOL 3401 (The Oceans) for the past several years, both as a state-side and self-support course. Normally three to four sections of this course are offered each quarter. We may develop additional hybrid or online courses on topics such as pollution modeling.
Assessment

We have reviewed and updated student learning outcomes for our programs (program learning outcomes) as needed to maintain consistency with our own curriculum and the University’s new institutional learning outcomes. We have also reviewed and updated our assessment methods, and utilized them to assess academic year 2013-2014. The department's new assessment methods are designed to also measure not only the degree to which students have attained core competencies within specific courses, but also how much they learn over the duration of a degree program. Rubrics were developed based on the AACU (Association of American Colleges and Universities) templates, and are used to assess student competency for major assignments in both GE and majors courses. Our assessment plan and 2013-2014 results are included in Appendix G.

3.2 Students

Employment

Many of the companies who employ geoscientists and environmental scientists in the Bay Area are related to the construction industry. They include companies that evaluate sites for geologic or environmental hazards, and that carry out soil or groundwater remediation. As a result of the 2008 financial crisis and the downturn in construction, the number of new jobs for geoscientists was curtailed during the period of this report. Nonetheless, recent graduates have found career-track jobs as geoscientists with environmental or engineering consulting firms (URS, Fugro, ERM), government agencies (California Geological Survey), oil and gas companies, and a geophysical instrument manufacturer (Geometrics Inc.). Our students are competitive in the job market because of both their classroom training in fundamentals and their hands-on experience in the laboratory and field. During their time at CSUEB, many students gain additional experience through internships and part-time work at the U.S. Geological Survey, Lawrence Livermore National Laboratories, and private consulting firms.

Job Outlook 2010-2020

Employment of 1) geoscientists and 2) environmental scientists and specialists are projected to grow nationwide by 16% and 15%, respectively, from 2012-2022. Projected growth for both categories is faster than the 11% average rate for all occupations (Bureau of Labor Statistics, Occupational Outlook Handbook, http://www.bls.gov/ooh/life-physical-and-social-science/). Job opportunities should be excellent for both environmental scientists and geoscientists, especially geoscientists with an M.S. degree. In addition to job growth, a number of job openings are expected as employees leave the workforce due to retirement and other reasons. Ongoing demand for energy, combined with innovations in drilling and production technology, in particular horizontal drilling and hydraulic fracturing (fracking), has caused a major resurgence in domestic oil and gas exploration and extraction. The assessment of the safety and environmental impact of these operations on groundwater, and the safe use of these methods, require skilled geoscientists and environmental scientists. Major projects in California that will require environmental scientists during the coming decades include restoration of the San
Five Year Program Review for Earth and Environmental Sciences

Francisco Estuary and Delta, land use and water supply planning that takes account of future climate scenarios, and cleanup of former industrial sites and military bases. Environmental scientists will be employed by both businesses and government agencies to help monitor and regulate the impact of industry and commerce on natural resources. Many of the job openings in the Bay Area in geology and environmental science will likely be with businesses that specialize in geotechnical, environmental, and engineering consulting. Graduates with technical expertise with hazards like earthquakes, landslides, groundwater and soil contamination, and sea-level rise will be in demand. In summary, strong demand by employers for graduates in geology and environmental science should lead to an increase in the number of students in our programs.

3.3. Faculty

Our most recent tenure-track hire was a new faculty member in Environmental Science, who started at CSUEB Fall 2013. As a result, we will be able to offer more advanced classes for Environmental Science majors, decrease our reliance on lecturers, increase academic advising for majors, and improve the consistency of instruction.

We currently offer both undergraduate and graduate degree programs (Environmental Science BS, Geology BA and BS, and Geology MS) with only five tenure-track faculty. In addition, one or more faculty members typically have significant course release due to externally funded projects. The department has increased its enrollments four-fold since the last review and as a result has become increasingly reliant upon lecturers in order to teach classes of all types, including required courses for majors.

The top priority for future faculty hires is for an Environmental Scientist with a specialty in climate/global change and/or interactions between the hydrosphere, atmosphere and solid Earth. This position would provide students with an opportunity for study in a critical area that we currently cannot address and has the potential to build upon the department’s strength in hydrogeology and water quality. This position would support the department’s commitment to training students in skills that are needed to understand the interaction between humans and Earth and the sustainability of resources. Graduates with this combination of skills are highly sought after by employers in the Bay Area and beyond.

The second priority for a new faculty hire would be in the area of Environmental Geoscience with a focus on surficial processes. A new faculty member in this area would support the University's commitment to sustainability by training students in skills that are needed to a) understand the interaction between humans and Earth, and b) mitigate the environmental hazards associated with life on an active tectonic plate boundary. Priority areas for future hires will be reviewed and revised by the department in response to evolving student needs, employment trends, technological innovations, and societal needs. Our previous new faculty hire request (submitted AY 2013-14) is included as Appendix H.
4. Outside Reviewer's Report
Charge:

I was asked via e-mail by Dr. Mitchell Craig in February 2013 to serve as the external reviewer for the CSU-mandated five-year review of the curriculum and academic structure of the Department of Earth and Environmental Sciences, which was recently restructured by combining the Department of Geological Sciences and the Environmental Science program. I readily agreed and we arrived at appropriate arrangements to visit the campus and to speak formally and informally with faculty and students.

Self-Study Document:

Prior to my campus visit on April 11 and 12, 2013, I was provided by Professor Craig with a substantial self-study document: California State University, East Bay, Five-Year Program Review for Earth and Environmental Sciences 2012-2013, approved unanimously by 4 departmental faculty on January 29, 2013, 86 pages.

Previous Documents:

Following my two-day visit on April 11 and 12, 2013, I was provided with four documents by Professor Craig that concerned previous 5-year departmental and program reviews:
- Review of the Programs of the Department of Geological Sciences, California State University, East Bay, written by Dr. C. John Suen, dated April 2005, 24 pages.
- Department's Response to Outside Reviewer's Report (the report of Dr. Suen), dated April 20, 2005, authors not specified, 3 pages.
- Environmental Science Program Review, California State University, East Bay, written by Dr. Stephen C. Welter, not dated, from the 2005 external review, 5 pages.
- Response to the Reviewer's Report, Environmental Science – 2005, authored by Dr. Joy Andrews, Dr. Michael Lee, Dr. Susan Opp, and Dr. Jeffrey Seitz, not specifically dated, from the 2005 external review, 4 pages.
Personal Interactions During My Visit:

During my campus visit, I had formal interviews with the following tenure-track faculty members:
- Dr. Mitchell Craig, Department Chair, Earth and Environmental Sciences
- Dr. Danika LeDuc, Chemistry and Biochemistry
- Dr. Michael Lee, Geography and Environmental Studies
- Dr. Jean Moran, Earth and Environmental Sciences
- Dr. Jeffery Seitz, Earth and Environmental Sciences
- Dr. Luther Strayer, Earth and Environmental Sciences

Administration: I met with Dr. Michael Leung, Dean of the College of Science.

I also met informally with some of the department’s part-time faculty and primarily with students at a pizza lunch on April 11, 2013.

Lunch on April 12, 2013 was with Drs. Craig and Seitz, and dinner on April 11, 2013 was with Drs. Craig, Moran, and Strayer.

I also spoke with Administrative Support Assistant Serena Russell (mostly concerning paperwork and logistical arrangements for my campus visit), and with Instructional Support Technician Mr. James Allen (who is an alumnus of Sonoma State University, so I knew him as an undergraduate and have also interacted with him intermittently over the years as a fellow paleontologist).

Summary Impression:

My campus visit to serve as external reviewer was the first such mandated visit following the renaming of the department from the former and long-standing “Department of Geological Sciences” to the current Department of Earth & Environmental Sciences. My overall impression of the department was very positive and my time spent on campus and in Hayward was enjoyable. At this point in the department’s history it has already gone through the necessary paroxysms mandated by the previous external reviewers in 2005, and necessitated by the new identity resulting from renaming of the department. I operate under the general assumption that departments run by Ph.D.-trained scientists generally know how to conduct themselves. The department at CSU East Bay has already made substantial changes to FTES, GE offerings, and participation in the teacher preparation tracks available on campus (single-subject and multiple-subject).

Enrollments in courses offered by the department increased 4-fold between 2005 (when the previous external reviewers visited campus) and 2009. By the time of my visit in 2013, the department had healthy numbers of majors and GE enrollments. The department has a particularly impressive and well-funded STEM education program for K-12 teachers.

It is safe to say that all departments on all campuses of the CSU system have struggled with and suffered detrimental effects of budget cuts mandated by the State of California. These effects are most noticeably seen in the ability to hire new
tenure-track faculty (either to replace retired or FERP faculty, or to expand a department or program) and in administrative pressures to be “efficient” in terms of class sizes and course offerings. The faculty at CSU East Bay are managing to adjust to the changing financial situation in California. It is hoped that positive budget news announced by Governor Brown in June 2013 concerning the long-term funding of the CSU system will proportionally benefit CSU East Bay. A new tenure-track faculty member in Environmental Science will join the department in Fall 2013. The department and College Dean are to be commended for this positive change.

I was impressed by the commitment of the faculty to research and scholarship, in addition to teaching. I toured the department’s facilities on several floors of the Science North building to see not only what was possible, but also to see what was actually being done.

Specific Recommendations:

My main recommendation emerged very clearly from my discussion with students, and to a lesser extent with faculty. I recommend the department work with Dean Leung to find a way to reinstate the summer geology field camp that the department conducted for many years. My experience as a faculty member for 28 years is that the single most important factor in passing the State of California Professional Geologist Exam is whether or not the student attended summer field camp. By not offering summer field camp, the department is short-changing its undergraduate majors for short-term financial reasons. It might be possible to make the summer field camp financially viable by explicitly extending an invitation to nearby geology departments (such as my department at Sonoma State University) to bring in additional tuition-paying students. Summer field camp is a traditional part of the geological education of colleges and universities across the United States.

The American Geological Institute (AGI) has addressed changes in the number of summer field camps and the cost of attending these summer field camps in this document:


The importance of a capstone undergraduate summer field geology course is described here:


Although not all the geology faculty at CSU East Bay agree that a summer field geology course is necessary, I think that the majority of geology faculty members across the country would agree that summer field camp is both necessary and desirable for a well-rounded curriculum. The temptation to substitute several weekend or 3-5 day field trips associated with specific courses is likewise not, in my opinion, the route any department should pursue as a replacement for summer field
camp. Reinstating the summer field geology course would be consistent with the department’s Mission Statement on page 26 of their 2012-2013 self-study document: “…to provide an excellent field and laboratory based education in geologic science...” And in my opinion “excellent” should involve the capstone experience of summer field camp.

**Intra-Departmental Communication:**

I did detect a minor note of discord (but which is easily solved) concerning the physical distribution on campus of the faculty members in the Department of Earth & Environmental Sciences. The department’s faculty members are physically located on more that one floor of Science North and Science South, and in more than one building on campus. An easy fix is to ensure that all e-mail communication to “the faculty” are routinely sent to all faculty, regardless of their academic affiliation with Chemistry or Geology or Geography & Environmental Studies. If everything goes to everyone, then the individual faculty can selectively choose to read or not read, to keep or delete, the e-mail messages that necessarily must circulate within a department to conduct its business.

**Concluding Remarks:**

I feel that my role as external reviewer in 2013 was made comparatively easy by the hard work done by the two external reviewers in 2005, and then followed by the department in the form of the internal changes made that are thoroughly documented in their 2012-2013 self-study report. The merging of a department and a program into a newly-named department has gone comparatively smoothly and the department has a newly-emerged identity involving its undergraduate degree options and its graduate program. I fully anticipate continued success and growth by the department, building on the solid foundation that exists and the positive trajectory created by the 2005 review cycle.

Respectfully submitted,

Matthew J. James, External Reviewer
Professor and Department Chair
Sonoma State University
james@sonoma.edu
Campus phone: 707-528-1825
Response to External Review by Dr. Matthew James, Professor and Chair, Department of Geology, Sonoma State University

Dr. Matthew James served as the external reviewer for programs offered by the Department of Earth and Environmental Sciences. He visited our campus for two days during Spring Quarter, 2013 and met with faculty and students. The department truly appreciates his generous contribution of time and thoughtful review of our programs. Based on information provided in the department's written self-study report and observations made during his visit, the reviewer prepared the attached report, dated June 2013. He recognized several major accomplishments made by the department since the last five-year review, and stated that his overall impression of the department was "very positive".

The reviewer offered one specific recommendation, namely that a summer geologic field camp course be reinstated by the department for the Geology BS program. In order to address this recommendation, we must provide some background information. Summer field camp has traditionally been a capstone experience for Geology BS programs at many US universities during the past several decades. It continues to be a required course for many Geology BS degree programs, including our own, but is not typically required for Geology BA or Earth Science degrees. About 38% of students who have recently completed a four-year geoscience degree in the U.S. have attended summer field camp (AGI, 2014). There was a sharp decline in the number of schools offering summer field camps from 1995, when 35% of geoscience departments offered field camp, to 2006, when only 15% did so (AGI, 2006). In a recent survey, of 51 geoscience departments at four-year institutions in California, 8 (16%) offered summer field camp (AGI, 2014).

The department devotes a significant portion of its resources towards providing students in all of its programs with field experience. We provide transportation and drivers for several field trips each quarter. We train students in general geologic field methods, geophysical surveying, and hydrogeological surveying. Several of our courses include field activities that emphasize topics related to environmental issues and geologic hazards in an urban environment. The department offers two courses specifically dedicated to field activities for our two undergraduate degree programs; Geologic Field Methods (GEOL 3910) and Field Activity in Environmental Science (ENSC 2900). Each of these courses is one quarter in duration and includes six hours in the field per week. Other courses that include field activities are GEOL 2101 (Physical Geology), GEOL 2102 (Earth and Life Through Time), GEOL 3701 (Igneous and Metamorphic Petrology), GEOL 3801 (Sedimentology and Stratigraphy), GEOL 3810 (Structural Geology), ENSC 3500 (Environmental Hydrology), GEOL 4010 (Geophysics), GEOL 4320 (Hydrogeology), GEOL 6040 (Near Surface Geophysics), GEOL 6320 (Groundwater), and GEOL 6411 (Engineering Geology). In addition, many students in our Geology MS program spend a significant amount of time in the field conducting research for their Project or University Thesis.
In addition to field-based instruction, which has been the focus of this section, the department's programs also include a comprehensive suite of classroom-based and laboratory-based instruction. As explained in the section Self Study and the appendix Assessment Plan, classroom and laboratory activities are essential parts of our programs that enhance literacy and numeracy skills needed to achieve student learning outcomes and meet employer needs.

The department is relatively small, with only five tenure-track geology and environmental science faculty. Courses for the undergraduate programs are offered during the day, while courses for the graduate program are offered during the evening. Due to these scheduling constraints, combined with a large increase in total FTES, it has been necessary to rely upon lecturers to teach some of the courses that are required for majors.

Since summer geologic field camp is a requirement for our Geology BS program but we don’t offer this course, our students must take it at another university. Regardless of whether or not field camp is offered by our department, attending a 5-6 week long summer field camp may still be difficult to impossible for non-traditional students, e.g., with childcare or employment obligations. One alternative that does not require a student to take a summer field course is our BA degree in Geology.

Taking into consideration that a summer geologic field camp would serve only a small portion of the department's students, and given our relatively small number of tenure track faculty, it is not feasible for us to reinstate this resource-intensive course. However, we recognize the difficulty that fulfilling the field camp requirement presents for our Geology BS students, especially considering that many camps are offered by semester schools and begin before our spring quarter ends, and considering the cost of field camp, typically about $4,000. We offer additional advising to these students and make them aware of their options for camps and for scholarships and aid. Considering the expectations of employers and many graduate programs that students with a BS in Geology have completed field camp, we are reluctant to remove the requirement from the degree program.

On a separate note, the reviewer noted a minor difficulty in communication among department faculty, related to the fact that some of the faculty are dispersed in different buildings on campus. He recommended that we ensure that faculty in all affiliated departments be included on emails. We agree, and will strive to comply with this recommendation. In particular, since most of the courses required for the Environmental Science BS degree are taught by other departments, we recognize the importance of consulting faculty representatives or department chairs from the participating departments (Chemistry; Biology; and Anthropology, Geography, and Environmental Studies) on curricular and scheduling matters and will be sure to do so in the future.
References:
Appendix A. APR Summary Data
## Geological Sciences

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### Source and Definitions

Source and definitions available at: [http://www.csueastbay.edu/ira/apr/summary/definitions.pdf](http://www.csueastbay.edu/ira/apr/summary/definitions.pdf)
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### D. Student Faculty Ratios

#### Environmental Science

1. Tenured/Track
2. Lecturer
3. SFR By Level (All Faculty)
4. Lower Division
5. Upper Division
6. Graduate

#### Geology

1. Tenured/Track
2. Lecturer
3. SFR By Level (All Faculty)
4. Lower Division
5. Upper Division
6. Graduate

### E. Section Size

1. Number of Sections Offered
2. SCU taught
3. Average Section Size
4. Average Section Size for LD
5. Average Section Size for UD
6. Average Section Size for GD
7. LD Section taught by Tenured/Track
8. UD Section taught by Tenured/Track
9. GD Section taught by Tenured/Track
10. LD Section taught by Lecturer
11. UD Section taught by Lecturer
12. GD Section taught by Lecturer

### D. Student Faculty Ratios

#### Environmental Science

1. Tenured/Track
2. Lecturer
3. SFR By Level (All Faculty)
4. Lower Division
5. Upper Division
6. Graduate

#### Geology

1. Tenured/Track
2. Lecturer
3. SFR By Level (All Faculty)
4. Lower Division
5. Upper Division
6. Graduate

### E. Section Size

1. Number of Sections Offered
2. SCU taught
3. Average Section Size
4. Average Section Size for LD
5. Average Section Size for UD
6. Average Section Size for GD
7. LD Section taught by Tenured/Track
8. UD Section taught by Tenured/Track
9. GD Section taught by Tenured/Track
10. LD Section taught by Lecturer
11. UD Section taught by Lecturer
12. GD Section taught by Lecturer
Appendix B. Mission Statement
Department of Earth and Environmental Sciences  
California State University, East Bay

Mission Statement

Our primary mission is to provide an excellent field and laboratory based education in geologic science to prepare students for professional careers in geology, graduate study, or teaching earth science at the K-12 level.

We also support a number of complementary missions, including

- providing an MS program, taught entirely in the evening to accommodate working professionals. This component also enhances our baccalaureate degrees by allowing us to provide quality research experiences for undergraduates.

- providing General Education courses and service courses to other university programs.

- providing an Environmental Science BS, including an option in Physical Science.

- providing in-service teacher training and continuing education opportunities for professional geologists.

- community outreach and education, especially in the field of geologic hazard and earthquake awareness.
Appendix C. Course Lists
California State University, East Bay  
Department of Earth and Environmental Sciences  
Environmental Science Undergraduate Courses - 2013  
(Course prefix: ENSC)

Changes made after 2005-2006 Catalog are indicated in red.

2210 Environmental Geology (4) (NEW)  
See GEOL 2210 for course description.

2211 Environmental Geology Laboratory (1) (NEW)  
See GEOL 2211 for course description.

2400 Environmental Biology (4) (NEW)  
Introduction to living organisms focusing on organismal interactions with their environment and with other organisms, relationships between organismal structure and function, effects of humans on biological diversity and ecosystems, and conservation of species. Recommended co-requisite: ENSC 2401 (lab).

2401 Environmental Biology Laboratory (1) (NEW)  
Investigations of the interactions of living organisms with their environment and with other organisms, how organismal structure and function influence where and how they live, effects of humans on biological diversity. Prerequisite: ENSC 2400 or concurrent enrollment. Three hrs. lab.

2800 Environmental Problems of California (4)  
Human impact on the biologic and geologic environment in California. Resource needs, waste issues, species diversity, and ecosystem degradation. Not open to students with credit for ENSC 2801 or 2802.

2801 Global Environmental Problems (4) (NEW)  
Human impact on the biologic and geologic environment in California and throughout the world. Resource needs, waste issues, species diversity, and ecosystem degradation. Not open to students with credit for ENSC 2801 or 2802.

2802 Global Environmental Issues (4) (NEW)  
Biologic and geologic environment in California and throughout the world with emphasis on human impact. Resource needs, waste issues, species diversity, and ecosystem degradation. Not open to students with credit in ENSC 2800 or ENSC 2801.

2900 Field Activity in Environmental Science (3) (NEW)  
Introduction to environmental issues in the local area through weekly visits to natural sites, industrial and commercial facilities, environmental treatment and remediation sites. Recommended preparation: High school preparation in environmental science or an introductory Environmental Science course (ENSC 2800, 2801, or 2802). One hr. lect, 6 hrs. field.
3500 Environmental Hydrology (4) (NEW)
The hydrologic cycle from precipitation, evapotranspiration, infiltration and runoff, to surface and groundwater. Hydrograph analysis, effects of human activities on streamflow and the riparian environment. Surface water and groundwater contamination and remediation methods. Predicted effects of climate change on water resources in California and the Western U.S. Prerequisites: GEOL 2101 or 2210 or equivalent; ENSC 2800 or 2801 or 2802 or equivalent; and CHEM 1101 or equivalent. Cross-listed with GEOL 3500. Two hrs. lect., 6 hrs. lab.

3999 Issues in Environmental Science (4)
Readings, discussion, and research on contemporary and/or significant issues in environmental science. May be repeated for credit when content varies, for a maximum of 8 units.

4140 Hazardous Waste Management (4) (NEW)
Study of the investigation and clean-up of hazardous waste sites. Environmental regulations, hazard awareness, contaminant characterization, personal protective equipment, monitoring and sampling equipment, site characterization and control, decontamination, operational hazards and overview of emergency response. Prerequisites: CHEM 1101, 1102, 1103 or equivalent; ENSC 2800, or 2801 or 2802 or equivalent. Cross-listed with GEOL 4140.

4200 Global Change (4) (NEW)
Interaction of Earth's systems (biosphere, lithosphere, hydrosphere, cryosphere, and atmosphere) and links between life, oceans, climate, and the solid earth. This course will focus on biophysical systems, ecological responses, human activities, future scenarios, and sustainability. Prerequisite: ENSC 2800, or 2801, or 2802 or equivalent.

4800 Seminar in Environmental Science (3)
Advanced study of environmental issues based on papers presented by students. Topics to change with each course offering. Team-taught by faculty from different departments in Environmental Sciences. Prerequisites: completion of Environmental Sciences core and senior or graduate standing.

4900 Independent Study (1-4)
May be repeated for credit with consent of instructor, for a maximum of 12 units.
California State University, East Bay  
Department of Earth and Environmental Sciences

Geology Undergraduate Courses - 2013  
(Prefix: GEOL)

Changes made after 2005-2006 Catalog are indicated in red.

1000  Earth Systems Science (5)
Introduction to the nature and evolution of the solid Earth, hydrosphere, atmosphere and solar system. Emphasizes interdisciplinary thought and research. Not for credit toward Geology major. Not open to students with credit for GEOL 1001, 1002, 1003, 1005, or 1006. Four hrs. lect., 3 hrs. lab; field trip(s).

1001  Introduction to the Earth Sciences (4)
Composition, structure and evolution of the earth. Interactions of lithosphere, hydrosphere, and atmosphere. Relations of geologic systems, hazards, and resources to human environment and future. Not open to students with credit for GEOL 1000, 1003, 1005 or 1006.

1002  Earth Sciences Laboratory (1) (REVISED)
Laboratory investigation of the Earth system: solid Earth, hydrosphere, atmosphere, and solar system. Geologic materials, maps, earthquakes, landslides, weather, oceans and currents, planets. Field trip. Prerequisite: GEOL 1001 (or 1003, 1005, or 1006) or concurrent enrollment. Not open to students with credit for GEOL 1000. Not for credit in Geology major. Three hrs. lab.

1003  How Earth Systems Work (4)
How the earth's lithosphere, hydrosphere, and atmosphere work and the earth's place in the universe. Not open to students with credit for GEOL 1000, 1001, 1005 or 1006.

1005  Earth Science (4)
The earth's place in the universe with emphasis on how the earth's lithosphere, hydrosphere and atmosphere work. Not open to students with credit for GEOL 1000, 1001, 1003 or 1006.

1006  Earth Systems and Energy (4) (NEW)
Nature and evolution of solid Earth, hydrosphere, atmosphere and solar system. Emphasizes interdisciplinary thought and the role of energy in the Earth system and energy resources. Not for credit toward Geology major. Not open to students with credit for GEOL 1000, 1001, 1003 or 1006.

1201  Introduction to Oceanography (4)
Origin of ocean basins, nature of the sea floor, physical/chemical characteristics of sea water, ocean currents, marine life, relationships between humans and the sea. Not for credit toward Geology major.

1202  Oceanography Laboratory (2)
Introductory laboratory exercises in principles of oceanography, including distribution of temperature and salinity, currents, sea-floor topography, bottom sediments, waves and tides, and beach dynamics. Prerequisite: prior or concurrent enrollment in GEOL 1201. Not applicable to the Geology majors. One hr. lect., two hrs. lab activity.

2000  Introduction to the Geology of California (4)
The geologic history and development of California. Rocks, minerals and natural resources. Processes that shape California landforms. Plate tectonics, earthquakes, volcanism. Not for credit in Geology major.

2101  Physical Geology (5)
Nature and distribution of earth materials, the processes by which the materials are formed and altered, and the nature and development of the landscape. Four hrs. lect., 3 hrs. lab.; one Saturday or Sunday field trip.
Earth and Life Through Time (4) (REVISED)
Principles of interpretation of earth history. Study of plate tectonics and sea-floor spreading as related to the development of continents, ocean basins, and mountain belts. Origin, evolution and diversification of life through time. Laboratory sessions include hands-on exercises with fossils. Prerequisite: GEOL 2101 or equivalent. Not open to students with credit for GEOL 3030. Three hrs. lect., 3 hrs. lab.; field trip(s).

Environmental Geology (4) (NEW)
The interaction between geologic processes and human society. Topics include rock, mineral, water, and energy resources, volcanic hazards, earthquakes, landslides, floods, erosion, coastal processes, plate tectonics, geologic time, pollution problems and environmental management. Field trip(s). Recommended: Concurrent enrollment in GEOL/ENSC 2211 (lab). Cross-listed with ENSC 2210.

Environmental Geology Laboratory (1) (NEW)
Hands-on investigation of topics including earth materials (minerals, rocks and soils), groundwater, water chemistry, earthquakes, and landslides. Prerequisite or Co-requisite: GEOL/ENSC 2210. Cross-listed with ENSC 2211. Three hrs. lab.

Natural Disasters (4) (REVISED)
Geologic processes and their effects on human populations. Topics include earthquakes, landslides, volcanic eruptions, coastal erosion, floods, atmospheric and water pollution. Designed for Physical Science G.E. students. Not for credit in Geology major. Not open to students with credit in GEOL 2301.

Natural Hazards (4) (REVISED)
Earth and human-induced processes and their effects on human populations. Topics include earthquakes, landslides, volcanic eruptions, coastal erosion, floods, severe storms, atmospheric and water pollution. Not for credit in Geology major. Not open to students with credit in GEOL 2300.

Introduction to GIS (4) (NEW)

Weather and the Atmosphere (4) (REVISED)
Utilization of physical science principles in the study of the structure and circulation of the atmosphere; weather and weather forecasting. Emphasis on aspects of interest to the prospective or in-service teacher. Not for credit in Geology major.

Volcanoes and Plate Tectonics (4)
Relationship of volcanism to plate tectonics. Catastrophes and volcanic hazards. Processes and products at historically active volcanoes worldwide: lava flows and domes, avalanches and mudflows, air-fall tephra, and pyroclastic flows and surges. Not for credit in Geology major.

Exploring the Solar System (4) (NEW)
Comprehensive survey of the formation and structure of the solar system from the Earth Science perspective. Emphasis on results of recent planetary missions. Planets, moons, comets, asteroids, the sun, and the origin and search for extraterrestrial life in our solar system. Emphasis on the evolution, structure, and geology of planets and composition of planetary atmospheres. Not for credit in Geology Major.

Geology of the Western National Parks (4)
The geologic history of western North America (from the Pacific Coast through the Great Plains) as interpreted from the outstanding features preserved in the national parks and selected other park service areas. Not for credit in Geology major.
3110 Principles of Geomorphology (4)
Landforms as products of diastrophism, volcanism, and surficial processes; morphogenetic regions of the earth and the effect of climate on the processes that shape them; rates and stages of landscape evolution and their dependence on time, process and structure. Prerequisite: GEOL 2101 or equivalent. Three hrs. lect., 3 hrs. lab.; field trip(s).

3400 General Oceanography (4)
Biological, chemical, geological, and physical characteristics of the sea, including geology of the ocean basins, marine ecosystems, and waves and currents. Prerequisite: GEOL 2101 or equivalent. Three hrs. lect., 3 hrs. lab.; field trip(s).

3401 The Oceans (4)
Comprehensive survey of biological, chemical, and physical oceanography. Marine geology, plate tectonics, ecosystems, ocean structure, water chemistry, waves and currents. Not open to students with credit for GEOL 1201 and 3400. Not for credit in Geology major.

3500 Environmental Hydrology (4) (NEW)
(See ENSC 3500 for course description.)

3601 Mineralogy and Optical Crystallography (5)
Principles of mineralogy, crystal symmetry, structure, and chemistry. Elements of optical crystallography utilizing indicatrix theory. Laboratory emphasizes physical properties and identification of minerals in hand sample and thin section. Prerequisites: introductory chemistry and GEOL 2101 or equivalent. Three hrs. lect., 6 hrs. lab/field.

3701 Igneous and Metamorphic Petrology (5)
Characteristics, phase relations, and origin of igneous and metamorphic rocks. Plate-tectonic setting of magmatism and metamorphism. Laboratory emphasizes rock classification based upon hand-lens and microscopic examination of mineralogy and texture. Prerequisite: GEOL 3601 or equivalent. Three hrs. lect., 6 hrs. lab/field.

3800 Achievements of Women in Science (4)
(See BIOL 3800 for course description.)

3801 Sedimentology and Stratigraphy (5)
Depositional systems and sedimentary processes. Facies models, succession, age relationships, and correlation of strata. Petrology and provenance of sedimentary rocks. Prerequisites: GEOL 2102 and 3701. Three hrs. lect., 6 hrs. lab.

3810 Structural Geology (5)
Geometric, kinematic and dynamic analysis of structures of igneous, sedimentary and metamorphic rocks. Laboratory emphasis on descriptive geometry and stereographic solutions to structural problems; geologic maps and structure sections. Prerequisite: GEOL 2101 or equivalent. Three hrs. lect., 6 hrs. lab.; field trip.

3898 Cooperative Education (1-4)
Supervised work experience in which student completes academic assignments integrated with off-campus paid or volunteer activities. Prerequisites: at least 2.0 GPA and departmental approval of activity. Not for credit in Geology major. May be repeated for up to 8 units. CR/NC grading only.

3910 Geologic Field Methods (3)
Introduction to geologic field methods and instruments, use of aerial photographs and topographic maps in geologic mapping, preparation of geologic maps of local areas. Prerequisites: GEOL 3701, 3801, and 3810 (any of these courses may be taken concurrently). One hr. lect., 6 hrs. field.

3999 Issues in Geological Sciences (4)
Readings, discussion, and research on contemporary and/or significant issues in geological sciences. May be repeated for credit when content varies, for a maximum of 8 units.
4010  Applied Geophysics (5) (REVISED)
Geophysical methods for determination of subsurface geology, including seismic refraction and reflection, ground-penetrating radar, gravity, magnetism, and resistivity. Basic geophysical theory. Collection of geophysical data in the field and analysis on the computer. Prerequisites: GEOL 2101, MATH 1304, and PHYS 2702 or consent of instructor. Three hrs. lect., 6 hrs. lab.; field trip required.

4020  Seismic Exploration (4) (NEW)
Seismic exploration methods, including data acquisition, processing, modeling, and interpretation. Survey design, source and receiver types, selection of acquisition parameters. Static and gain corrections, deconvolution, velocity analysis, migration and inversion methods. Prerequisites: GEOL 2101, MATH 1304, and PHYS 2701, or consent of instructor. Not open to students with credit for GEOL 6020. Three hrs. lect., 3 hours lab.

4130  Survey of Geochemistry (4)
Chemical evolution of the universe and earth, chemistry of rock formation, hydrothermal solutions and weathering. Isotopes and trace elements. Prerequisites: GEOL 3601 (may be taken concurrently) and CHEM 1103 or equivalents.

4140  Hazardous Waste Management (4) (NEW)
(See ENSC 4140 for course description.)

4200  Introduction to Planetary Science (4) (NEW)
Introduction to the formation and origin of the solar system. Celestial mechanics, stellar evolution, meteoritics, planetary interiors, surfaces, and atmospheres, moons, asteroids, comets, extraterrestrial life. Prerequisite: GEOL 3601 or equivalent.

4320  Hydrogeology (4)
The hydrologic cycle, from precipitation, evapotranspiration, infiltration and runoff, to surface and groundwater. Hydrograph analysis, stream gaging and discharge determination. Groundwater occurrence, movement and evaluation. Hydrologic regions of U.S., emphasizing the western states. Prerequisite: GEOL 2101 or equivalent. Field trip(s). Three hrs. lect., 3 hrs. lab.

4600  GIS for Earth Sciences (5)
An introduction to applications of Geographic Information Systems (GIS) to geology and other earth sciences. Designing, automating, and analyzing a spatial database; linking data sets; creating maps; generating reports and customizing ARC/INFO software. Prerequisites: GEOL 2101 or permission of instructor. Three hrs. lect., 6 hrs. lab.

4800  Seminar (2)
Critical, in-depth study of selected topics of current and classical research in geology; topics not repeated in two-year interval. Prerequisite: senior standing or permission of instructor. May be repeated, but no more than 6 units may be applied to Geology major.

4900  Independent Study (1-4)
May be repeated for credit with consent of instructor, for a maximum of 12 units. CR/NC grading only.

4910  Senior Thesis (2)
Independent research project with a written thesis, digital map, or similar final product to be completed by students desiring to graduate with a B.S. in geology with research experience (see department for guidelines). only. Prerequisites: senior level in Geology and thesis advisor's approval. CR/NC grading only.
School of Earth and Environmental Sciences

Geology Graduate Courses – 2013
(Prefix: GEOL)

Changes made after 2005-2006 Catalog are indicated in red.

6020  Seismic Exploration (NEW)
Seismic exploration methods, including data acquisition, processing, modeling, and interpretation. Survey
design, source and receiver types, selection of acquisition parameters. Static and gain corrections,
deconvolution, velocity analysis, migration and inversion methods. Graduate research project required.
Prerequisites: GEOL 2101, MATH 1304, and PHYS 2701, or consent of instructor. Not open to students
with credit for GEOL 4020. Three hrs. lect., 3 hours lab.

6030  Earthquake Seismology (NEW)
Methods for using seismic data from earthquakes to study geologic properties. Stress and strain, seismic
raypaths, travel times, amplitude and phase, body and surface waves. Seismic source theory, including
focal mechanisms and moment tensors. Earthquake location methods. Travel-time inversion methods for
the determination of velocity structure. Seismic coda and attenuation. Array analysis. Prerequisite: GEOL
4010 or permission of instructor. A-F grading only.

6040  Near Surface Geophysics (NEW)
High-resolution seismic, ground penetrating radar (GPR), electrical resistivity, and magnetic methods.
Digital terrain data and global positioning system (GPS). Geophysical data processing methods. Field
trip(s). Prerequisite: GEOL 4010 or consent of instructor. A-F grading only. (Three hrs. lect., 3 hrs. lab)

6300  Quaternary Geology (4)
Evolution of climate and landforms of the Quaternary. Emphasis on interpretation of sedimentary deposits
and erosional landforms. Techniques for determination of age relationships. Prerequisite: graduate
standing in geology, geography, or permission of instructor.

6310  Isotope Geochemistry (4) (NEW)
The course focuses on using variations in the abundances of isotopes to understand natural processes.
Applications of radioactivity and other nuclear reactions (radioactive/radiogenic isotope geochemistry),
and chemical separation of isotopes (stable isotope geochemistry), will be covered. Prerequisite: GEOL
3701 or equivalent, GEOL 4130 or equivalent. A-F grading only.

6320  Groundwater (4)
Groundwater resource evaluation methods. Mathematical development of multi-dimensional flow
equations. Introduction to computer models and numerical simulation to predict aquifer yields. Inorganic
and/or field trips.

6410  Earthquake Geology (4) (NEW)
Aspects of earthquake geology, plate tectonic and geographic location of seismicity; the source region
and rock mechanics and deformation; seismic waves; event dating techniques and tectonic
geomorphology; fault types and behavior. Research project required. Prerequisites: GEOL 3801 and
3810, or equivalent and permission of instructor.

6411  Engineering Geology (4)
Application of geology in location and planning of engineering works. Study of case histories. Use of
gеophysical techniques to solve engineering geologic problems. Prerequisite: Graduate standing or
consent of instructor. Three hrs. lect., 3 hrs. lab. and/or field trips.
6412  Advanced Igneous and Metamorphic Petrology (4)
Chemical characteristics of igneous rocks and magmatic evolution. Petrography of igneous and metamorphic rock suites using the polarizing microscope, emphasizing thorough description of mineralogy and textures. Prerequisite: GEOL 3701. A-F grading only. Two hrs. lect.; 6 hrs. lab.

6414  Regional Tectonics (4) (NEW)
The tectonic evolution of continents, focusing on particularly important regions or a particular tectonic style that may be found in numerous regions. Students will read seminal journal articles and current literature, write summaries and make presentations on the assigned readings. Research project required. Prerequisites: GEOL 3801 and 3810, or equivalent and permission of instructor. Not open to students with credit for GEOL 4414.

6415  Advanced Sedimentary Petrology (4)
Advanced study of terrigenous-clastic and chemical sedimentary rock petrogenesis, including depositional environments and facies models, diagenesis, and basic analysis techniques. Prerequisites: GEOL 3801 or equivalent course. A-F grading only. Three hrs. lect., 3 hrs. lab. Field trip(s).

6430  Tectonic Geomorphology (4) (NEW)
Effects of earthquakes on modern landforms; types of geomorphic markers and determination of their ages; geologic structures resulting from earthquakes; geodesy and deformation rates; deformation and geomorphology at different timescales. Prerequisites: GEOL 3801 and 3810, or equivalent, or permission of instructor. A-F grading only.

6811  Graduate Seminar (2)
Investigation of a selected geologic topic. Prerequisite: graduate standing or consent of instructor. May be repeated once for credit with consent of instructor, for a maximum of 4 units. Two hrs. seminar.

6899  Project (1-2)
Development of an original product (e.g., manuscript, education module, field map, computer model) that is summarized in a written abstract. Both project and abstract are submitted to the department, which specifies their format. Supervised by a departmental committee. Oral defense may be required. Prerequisite: graduate status and 32 units of coursework applicable to the master's degree. May be repeated for credit, for a maximum of 4 units. CR/NC grading only.

6420  Internship (1-4)
Professional experience for at least one quarter with a public or private organization involved in geologic studies, summarized in a written report. Prerequisites: "Classified Graduate" status and advisor's approval. No more than 4 units can be applied toward the master's degree. CR/NC grading only.

6620  Advanced Topics in Geology (4)
Selected advanced topics in geology. Prerequisite: graduate standing or consent of instructor. May be repeated with consent of instructor. Four hrs. lect.

6910  University Thesis (1-9)
Development and writing of a formal research paper for submission to the university in the specified bound format. Supervision by a departmental committee, at least two of whom must be Cal State East Bay faculty members. Oral defense required. (See also "University Thesis Writing Guide," www.csueastbay.edu/thesiswritingguide.) Prerequisites: "Classified Graduate" status and advisor's approval. Maximum of 9 units credit per student. CR/NC grading only.
Appendix D. Curriculum Modifications
B.S. Environmental Science
Department of Earth and Environmental Sciences

Curricular Changes Effective Fall 2009

1. Lower-division core – 52-61 units (previously 62 units)
   a) One quarter of Environmental Biology lecture and lab (ENSC 2400 & 2401) may be taken in place of two quarters of majors Biology (BIOL 1402 Plant Biol & 1403 Animal Biol)
   b) One quarter of Environmental Geology lecture and lab (GEOL/ENSC 2210 & 2211) may be taken in place of two quarters of major Geology (GEOL 2101 Physical Geol & 2101 Earth & Life Through Time)
   c) No Organic Chemistry (CHEM 2301, 2302) required
   d) No Physical Geography (GEOG 2100) required
   e) Intro GIS required (GEOL/GEOG 2600)

2. Upper-division core – 23 units (no change in number of units)
   a) GEOL 4320 Hydrogeology replaced with ENSC/GEOL 3500 Environmental Hydrology

3. Electives – 8 units (no change in number of units)
   a) 4 units each to be taken from two categories instead of 8 units from one list of courses

4. Options – 4 options consolidated into 3 and units reduced from range of 26-31 units to 22 units
   a) Biology option changed to Life Science option
   b) Chemistry and Geology options consolidated into Physical Science option
   c) Environmental Systems and Resource Management option unchanged

5. Total number of units for major reduced from 119-124 to 105-114 units
REQUEST FOR APPROVAL OF MODIFICATION OF THE BACHELOR OF SCIENCE
MAJOR PROGRAM IN ENVIRONMENTAL SCIENCE

1. Definition of Proposed Change

1.1 Designation of Degree, Major
   Bachelor of Science, Environmental Science

1.2 Evidence of approval of
   1.2.1 Department
       Earth and Environmental Science
   1.2.2 College Dean
   1.2.3 College Faculty Review Body (Committee chair's name and signature)

1.3 Objectives of proposed revision
   The current Environmental Science B.S. program consists of courses drawn almost
   exclusively from other departments in the Colleges of Science and of Liberal Arts and
   Social Sciences. Only a single upper-division course, ENSC 4800 Seminar in
   Environmental Science (3 units), is an actual environmental science course designed
   exclusively for students in this major; our majors take this course as a capstone
   experience. Thus, students majoring in Environmental Science find themselves taking
   courses that, while providing excellent disciplinary content, do not focus on or integrate
   material from an environmental perspective. The Environmental Science degree, now
   close to finishing its first decade in existence at CSUEB, was one of the first
   interdisciplinary environmental science programs in the CSU. Our majors have done
   very well in the job market and in graduate programs, but they have complained about
   the lack of ENSC-focused courses during their degree. With this modification, we seek to
   remedy that situation with an enhanced focus on environmental science in lower-division
   and upper-division coursework, as well as a major that reduces the overall number of
   units to make the program more tractable.

1.4 List of all requirements, including courses by catalog number, title, and units, affected
   by change. The total required units in both old and new programs must be clearly
   indicated.
**ENVIRONMENTAL SCIENCE DEGREE**

<table>
<thead>
<tr>
<th>Current (120-124 units)</th>
<th>New (105-114 units)</th>
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<tbody>
<tr>
<td><strong>Lower Division Core</strong></td>
<td><strong>Units</strong></td>
</tr>
<tr>
<td>Biol 1402,3</td>
<td>Plant &amp; Animal Biol</td>
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<tr>
<td>Chem 1101,2,3</td>
<td>General Chem</td>
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<td>Chem 2301,2</td>
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<td>Geol 2102</td>
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<td><strong>Upper Division Core</strong></td>
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<td>Biol 3110</td>
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<td>OPTIONS</td>
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<tr>
<td><strong>BIOLOGY</strong></td>
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<tr>
<td>Biol 1402</td>
<td>Cell &amp; Molec Biol</td>
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<td>Biol 3898</td>
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<td>Biol 4351*</td>
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</table>

<table>
<thead>
<tr>
<th>ENV SYS &amp; RESOURCE MANAGE (27-31 units)</th>
<th>ENV SYS &amp; RESOURCE MANAGE (22 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Envt 4910 Internship 3-4</td>
<td>Envt 4910 Internship 2-4</td>
</tr>
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<td>Three courses from below (13-14 units)</td>
<td>Two or three courses from below (8-15 units)</td>
</tr>
<tr>
<td>Envt 3401/Geog 3401*</td>
<td>Env Resource Anal 4</td>
</tr>
<tr>
<td>Geog 3030*</td>
<td>Essentials GIS 4</td>
</tr>
<tr>
<td>Geog 3410 Air-Photo Interp 4</td>
<td>Geog 3410 Air-Photo Interp 4</td>
</tr>
<tr>
<td>Geog 3450 Comp Cartog 5</td>
<td>Geog 3450 Lit &amp; Res Methods 5</td>
</tr>
<tr>
<td>Geog 4425 Remote Sensing 4</td>
<td>Geog 4425 Remote Sensing 4</td>
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<td>Geog 4600 Intro GIS 5</td>
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<td>Geog 4605 Env Appls GIS 5</td>
<td>Geog 4605 Env Appls GIS 5</td>
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<tr>
<td>Biol/Geog 4130 Biogeography 4</td>
<td>Biol/Geog 4130 Biogeography 4</td>
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<td>Envt 4800 Sem Env Studies 3</td>
<td>Envt 4800 Sem Env Studies 3</td>
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<tr>
<td>Geog 4320*</td>
<td>Energy &amp; Society 4</td>
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<tr>
<td>Geog 3450 Lit &amp; Res Methods 5</td>
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<tr>
<td>Geog 4125 Field Course 4</td>
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<td>Geog 4350 Water Res Man 4</td>
<td>Geog 4350 Water Manage 4</td>
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<tr>
<td>Geog 4355*</td>
<td>Watershed Manage 4</td>
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<td>Geol 3110 or Geog 3115 Princ Geomorph or Phys Landscape 4</td>
<td>Geol 3110 or Geog 3115 Princ Geomorph or Phys Landscape 4</td>
</tr>
<tr>
<td>One of following: Geog 4125* or Envt/Geog 3480* or Envt 4300*</td>
<td>Field Phys-Biotic Geog, Applied Field or Environ. Field Studies 4-5</td>
</tr>
</tbody>
</table>
1.5 List of **New Course**, **Course Modification**, and **Course Discontinuance Requests**, if any, attached to this proposal. No courses being discontinued or modified. For new courses, see attached.

2. **Need** for the Proposed Change
   The proposed changes will result in an Environmental Science B.S. program that is not only more tractable for students because of the reduced number of total units, but is more environmentally focused and integrated with introductory Environmental Science courses and more skills courses (eg. GIS, hazardous waste management, sustainable development) in the core. The addition of new courses with the ENSC prefix will also enhance the visibility of the department to students interested in exploring environmental science.

3. Faculty, Library, Operating Expense, Capital Outlay, Equipment, and Facilities **Resources** for the Proposed Change
   The new courses will be taught once a year, and will require additional faculty WTUs which we plan to cover with existing department faculty and resources.

4. **Relationship of Revised Program to Teaching Credentials** or to **Accreditation Organization**

5. **Consultation.**
   Biology Department
   Chemistry and Biochemistry Department
   Geography and Environmental Studies Department
REQUEST FOR APPROVAL OF REVISION OF
THE OPTION OR MINOR IN GEOLOGY

1. Definition of Proposed Change

1.1. Designation of Option or Minor with name of major for options
Minor in Geology

1.2. Evidence of approval of

1.2.1. Department

1.2.2. College Dean

1.2.3. College Faculty Review Body

1.3. Objectives of proposed revision
This request brings the minor program in line with the courses in our current catalog and the
needs of the preparation of science teachers. In addition, the request helps to facilitate
articulation with Community College transfer students.

1.4. List of all program requirements including courses (by catalog number, title, and units) affected by the change.

<table>
<thead>
<tr>
<th>Current Minor 26-27 units</th>
<th>New Minor 28-34 units</th>
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</thead>
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<tr>
<td><strong>Core Courses</strong></td>
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<td>GEOL 2101</td>
<td>GEOL 2101</td>
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<td>5</td>
<td>5</td>
</tr>
<tr>
<td>GEOL 3030</td>
<td>GEOL 2102</td>
</tr>
<tr>
<td>Earth &amp; Life Through Time</td>
<td>Earth &amp; Life Through Time</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>One Lower Division Elective (2-4 units)</td>
<td>One Lower Division Elective (4-5 units)</td>
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<tr>
<td>GEOL 1002</td>
<td>GEOL 1000</td>
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<td>Env. Geology Lab</td>
<td>Earth Systems Science</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
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<tr>
<td>GEOL 1201</td>
<td>GEOL 1001</td>
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<tr>
<td>Intro. to Oceanography</td>
<td>Intro to Earth Sciences</td>
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<td>4</td>
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<tr>
<td>GEOL 1201</td>
<td>GEOL 1201</td>
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<tr>
<td>Intro to Oceanography</td>
<td>Intro to Oceanography</td>
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<td>4</td>
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<td>GEOL 2000</td>
<td>GEOL 2000</td>
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<tr>
<td>Intro to Geology of Cal</td>
<td>Intro to Geology of Cal</td>
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<tr>
<td>4</td>
<td>4</td>
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<tr>
<td>GEOL 2300</td>
<td>GEOL 2300</td>
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<tr>
<td>Natural Disasters</td>
<td>Natural Disasters</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Three upper division electives, chosen with assistance of minor advisor (12-15 units)</td>
<td></td>
</tr>
<tr>
<td>Four upper division electives, chosen with assistance of minor advisor (15-20 units)</td>
<td></td>
</tr>
<tr>
<td>GEOL 3040</td>
<td>GEOL 3040</td>
</tr>
<tr>
<td>Fund of Meteorology</td>
<td>Fund of Meteorology</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
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<tr>
<td>GEOL 3050</td>
<td>GEOL 3050</td>
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<tr>
<td>Volcanoes &amp; Plate Tect.</td>
<td>Volcanoes &amp; Plate Tect.</td>
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<tr>
<td>4</td>
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<tr>
<td>GEOL 3100</td>
<td>GEOL 3100</td>
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<tr>
<td>Geol of West, Nat. Parks</td>
<td>Geol of West, Nat. Parks</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
1.5. List of New Course, Course Modification (indicate nature of modification), and Course Discontinuance Requests, if any, attached to this proposal. Give prefix, number, title, and units. For modifications, indicate the nature of the change. No new courses are being requested for this program modification. GEOL 3030 has already been discontinued.

2. Need for the Proposed Change
The current Geology Minor program is out of date and has not been revised for years. The Geology major program has undergone course and program modifications in recent years. This request brings the minor program in line with the courses in our current catalog and the needs of the preparation of science teachers. In addition, the request helps to facilitate articulation with Community College transfer students.

3. Faculty, Library, Operating Expense, Capital Outlay, Equipment, and Facilities Resources needed to implement the Proposed Change and after Five Years. No new resources are required.

4. Relationship of Revised Program to Teaching Credentials or to Accreditation Organization. None

5. Consultation.
Appendix E. Degree Roadmaps
# Academic Roadmap

## Department of Earth and Environmental Sciences
### B.A. in Geology

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
<thead>
<tr>
<th>YEAR 1 (0 – 45 UNITS)</th>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>TOTAL UNITS FOR YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLC:</td>
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<td>FLC:</td>
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<td>FLC:</td>
<td></td>
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</tr>
<tr>
<td>GEOL 2101 - Physical Geology</td>
<td>(5)</td>
<td></td>
<td>GEOL 2102 - Earth &amp; Life Through Time</td>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 1101 General Chemistry I OR PHYS 2701 Intro to Physics I</td>
<td>(5) OR (4)</td>
<td></td>
<td>CHEM 1102 General Chemistry II OR PHYS 2702 Intro to Physics II</td>
<td>(5) OR (4)</td>
<td>CHEM 1103 General Chemistry III OR PHYS 2703 Intro to Physics III</td>
<td>(5) OR (4)</td>
<td></td>
</tr>
<tr>
<td>MATH 1300 Trig &amp; Analytical Geometry OR GE:</td>
<td>(4)</td>
<td></td>
<td>GE:</td>
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<td>GE:</td>
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</tbody>
</table>

**Recommended Cluster:**
- Molecules, Energy, and Living Things (Chem 1101, 1102, 1103). Fulfills both GE and major requirements.

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You should . . .

- Complete your Freshman Cluster Classes

and consider . . .

- Taking General Education courses
### YEAR 2 (46 - 90 UNITS)

<table>
<thead>
<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 3601 - Mineralogy &amp; Optical Crystallography</td>
<td>(5)</td>
<td>GEOL 3701 - Igneous &amp; Metamorphic Petrology</td>
<td>(5)</td>
<td>GEOL 3801 - Sedimentology &amp; Stratigraphy</td>
<td>(5)</td>
<td>GE: General Elective ME: Major Elective</td>
</tr>
<tr>
<td>PHYS 1700 Elementary Physics (4) and PHYS 1780 Elementary Physics Lab (1) OR CHEM 1100 Intro to College Chemistry (5)</td>
<td>(5)</td>
<td>ME:</td>
<td>(4)</td>
<td>ME:</td>
<td>(4)</td>
<td></td>
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<tr>
<td>GE:</td>
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<td>GE:</td>
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<td><strong>TOTAL UNITS</strong></td>
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<td><strong>TOTAL UNITS</strong></td>
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<td><strong>TOTAL UNITS FOR YEAR</strong></td>
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</tbody>
</table>

#### UNITS
- GE: General Elective
- ME: Major Elective

### FALL
- Complete areas A1-A4
- Complete lower division GE requirements
- Complete English 1002
- Declare a major
- Meet with your major advisor
- Meet with an AACE advisor

### WINTER
- Attend “Strictly Sophomores”
- Apply to CSSP or summer internship
- Explore student organizations
- Explore leadership opportunities

### SPRING
- 3000 and 4000 level GEOL courses (except GEOL 3040, 3050, 3051, 3100, and 3898) designed for GEOL majors (not GE courses) may be used to fulfill this requirement (a minimum of two courses must be 4000-level GEOL courses).
## Year 3 (91 – 135 Units)

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<th>NOTES</th>
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</thead>
<tbody>
<tr>
<td>ME:</td>
<td>(4)</td>
<td>GEOL 3810* Structural Geology</td>
<td>(5)</td>
<td>GEOL 3910* Geologic Field Methods</td>
<td>(3)</td>
<td>GE: General Elective</td>
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<td></td>
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<td>GEOL 4800* Seminar</td>
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<td>GE:</td>
<td></td>
<td>ME: Major Elective</td>
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<td>GE:</td>
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<td>GE:</td>
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<tr>
<td>TOTAL UNITS</td>
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<td>TOTAL UNITS FOR YEAR</td>
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</tbody>
</table>

- **3000 and 4000 level GEOL courses (except GEOL 3040, 3050, 3051, 3100, and 3898) designed for GEOL majors (not GE courses) may be used to fulfill this requirement (a minimum of two courses must be 4000-level GEOL courses).**

- **Note:** GEOL 3810, 3910, and 4800 should be taken when offered, either during the junior (3rd) or senior (4th) year.

### You should . . .
- Take the Writing Skills Test in fall quarter
- Enroll in ENGL 3000 if needed
- Complete at least one upper division GE requirement

### and consider . . .
- Meet with your major advisor
- Meet with AACE advisor
- Attend the Graduate School Fair
- Seek leadership opportunities in a club or student government
### Year 4 (136 – 180 Units)

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<th>SPRING</th>
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<th>NOTES</th>
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<tbody>
<tr>
<td>ME:</td>
<td>(4)</td>
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<td>ME:</td>
<td>(4)</td>
<td></td>
<td></td>
<td><strong>GE:</strong> General Elective</td>
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<td>GE:</td>
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<td>GE:</td>
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<td><strong>ME:</strong> Major Elective</td>
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<td>Unrestricted Elective:</td>
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<td>Unrestricted Elective:</td>
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<td><strong>UE:</strong> Unrestricted Elective</td>
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<td>TOTAL UNITS</td>
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<td>TOTAL UNITS FOR YEAR</td>
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</table>

### You should . . .
- File for graduation
- Complete upper division GE requirements
- Take Major Requirement Electives (ME)

### and consider . . .
- Meet with major advisor
- Meet with AACE advisor
- Attend a Career Fair
- Attend the Graduate School Fair
- Conduct information interviews in your field

### TOTAL UNITS ON PLAN

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<td>MAJOR UNITS</td>
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<td>FRESHMAN CLUSTER UNITS</td>
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<td>GENERAL EDUCATION UNITS</td>
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<tr>
<td>UNRESTRICTED ELECTIVE UNITS</td>
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</tbody>
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*Note: GEOL 3810, 3910, and 4800 should be taken when offered, either during the junior (3rd) or senior (4th) year. 3000 and 4000 level GEOL courses (except GEOL 3040, 3050, 3051, 3100, and 3898) designed for GEOL majors (not GE courses) may be used to fulfill this requirement (a minimum of two courses must be 4000-level GEOL courses).*
# Academic Roadmap

## Department of Earth and Environmental Sciences
### B.S. in Geology

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>GEOL 2101 - Physical Geology</td>
<td>(5)</td>
<td>GEOL 2102 - Earth &amp; Life Through Time</td>
<td>(4)</td>
<td>ME:</td>
<td>(4)</td>
<td>GE: General Elective</td>
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<tr>
<td>FLC: CHEM 1101</td>
<td>(5)</td>
<td>FLC: CHEM 1101</td>
<td>(5)</td>
<td>FLC: CHEM 1101</td>
<td>(5)</td>
<td>ME: Major Elective</td>
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<tr>
<td>GE:</td>
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<td>GE:</td>
<td></td>
<td>FLC: Freshman Learning Community (Cluster)</td>
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<td>GE</td>
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<td>Molecules, Energy, and Living Things</td>
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<td></td>
<td>(Chem 1101, 1102, 1103). Fulfills both</td>
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<td>GE and major requirements.</td>
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<td>The Math, Physics, and Chemistry</td>
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<td></td>
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<td>sequences should be taken early in</td>
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<td></td>
<td>your academic career. Each of these</td>
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<td>sequences normally starts Fall</td>
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<td>Quarter.</td>
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<td>TOTAL UNITS</td>
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<td>TOTAL UNITS</td>
<td></td>
<td>TOTAL UNITS FOR YEAR</td>
</tr>
</tbody>
</table>

You should . . .

- Complete your Freshman Cluster Classes

and consider . . .

- Taking General Education courses
<table>
<thead>
<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>GEOL 3601 - Mineralogy &amp; Optical Crystallography</td>
<td>(5)</td>
<td>GEOL 3701 - Igneous &amp; Metamorphic Petrology</td>
<td>(5)</td>
<td>GEOL 3801 - Sedimentology &amp; Stratigraphy</td>
<td>(5)</td>
<td>GE: General Elective</td>
</tr>
<tr>
<td>MATH 1304 - Calculus I</td>
<td>(4)</td>
<td>MATH 1305 - Calculus II</td>
<td>(4)</td>
<td>ME:</td>
<td>(4)</td>
<td>ME: Major Elective</td>
</tr>
<tr>
<td>ME:</td>
<td>(4)</td>
<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
<td>(27-30 units depending upon physics sequence completed):</td>
</tr>
<tr>
<td>GE:</td>
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<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
<td>At least 10 units must be in 4000-level geology courses. And up to 12 of the elective units may be satisfied with appropriate courses in Biological Sciences, Chemistry, Mathematics and Computer Science, Physics, and/or Statistics approved in advance by a faculty advisor.</td>
</tr>
</tbody>
</table>

**TOTAL UNITS** | **TOTAL UNITS** | **TOTAL UNITS**

**TOTAL UNITS FOR YEAR**

---

**You should . . .**

- Complete areas A1-A4
- Complete lower division GE requirements
- Complete English 1002
- Declare a major
- Meet with your major advisor
- Meet with an AACE advisor

**and consider . . .**

- Attend “Strictly Sophomores”
- Apply to CSSP or summer internship
- Explore student organizations
- Explore leadership opportunities

---

**CSUEB Academic Roadmap**

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*updated April 16, 2014*
<table>
<thead>
<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 1001 Gen Physics I OR PHYS 2701 Intro Physics I</td>
<td>(5) OR (4)</td>
<td>PHYS 1002 Gen Physics II OR PHYS 2702 Intro Physics II</td>
<td>(5) OR (4)</td>
<td>PHYS 1003 Gen Physics III OR PHYS 2703 Intro Physics III</td>
<td>(5) OR (4)</td>
<td>GE: General Elective ME: Major Elective</td>
</tr>
<tr>
<td>ME:</td>
<td>(4)</td>
<td>GEOL 3810* Structural Geology</td>
<td>(5)</td>
<td>GEOL 3910* Geologic Field Methods</td>
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<td>GE:</td>
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</table>

**YEAR 3 (91 – 135 UNITS)**

GEOL 4000-level course on Field Geology, with consent of advisor (8), to be taken during summer session after third or fourth year, after GEOL 3810 and 3910.

---

**You should . . .**
- Take the Writing Skills Test in fall quarter
- Enroll in ENGL 3000 if needed
- Complete at least one upper division GE requirement

**and consider . . .**
- Meet with your major advisor
- Meet with AACE advisor
- Attend the Graduate School Fair
- Seek leadership opportunities in a club or student government

---

CSUEB Academic Roadmap 63 updated April 16, 2014
<table>
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<th>UNITS</th>
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<tr>
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<td>(4)</td>
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**Year 4 (136 – 180 units)**

**Total Units for Year**

---

You should . . .
- File for graduation
- Complete upper division GE requirements
- Take Major Requirement Electives (ME)

and consider . . .
- Meet with major advisor
- Meet with AACE advisor
- Attend a Career Fair
- Attend the Graduate School Fair
- Conduct information interviews in your field

---

**Total Units on Plan**

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<thead>
<tr>
<th>MAJOR UNITS</th>
<th>FRESHMAN CLUSTER UNITS</th>
<th>GENERAL EDUCATION UNITS</th>
<th>UNRESTRICTED ELECTIVE UNITS</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

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**Notes**

GE: General Elective
ME: Major Elective
ME: Major Electives
(27-30 units depending upon physics sequence completed):
At least 10 units must be 4000-level geology courses. Up to 12 elective units may be satisfied with courses in Biological Sciences, Chemistry, Mathematics and Computer Science, Physics, and/or Statistics approved in advance by a faculty advisor.
- GEOL 3110 (4)
- GEOL 3200 (1-2, no more than 4 units)
- GEOL 3400 (4), GEOL 4010 (5), GEOL 4130 (4), GEOL 4320 (4), GEOL 4800 (2, no more than 2 units), GEOL 4850 (2), GEOL 4900 (1-4), GEOL 4910 (2) (no more than 4 units for 4900 and 4910 combined) and other appropriate GEOL courses as approved by a faculty advisor.
*Note: GEOL 3810, 3910, and 4800 should be taken when offered, either during the junior (3rd) or senior (4th) year.*
# Academic Roadmap

## Department of Earth and Environmental Sciences
### M.S. in Geology

Note: This roadmap is an example of one schedule that will enable you to graduate in two years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
<thead>
<tr>
<th></th>
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**TOTAL UNITS** 8 **TOTAL UNITS** 8 **TOTAL UNITS** 10 **TOTAL UNITS FOR YEAR** 26

### Year 1 (0 – 24 units)
- You should . . .
  - Meet with the Graduate Coordinator
  - Complete any course deficiencies
  - Take the Writing Skills Test if needed

### and consider . . .
- Participate in a student organization: Cummings Earth Science Club, AAPG, or SEG.
# Academic Roadmap

**Department of Earth and Environmental Sciences**  
**M.S. in Geology**

Note: This roadmap is an example of one schedule that will enable you to graduate in two years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
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<tr>
<th></th>
<th>UNITS</th>
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<td>GEOL 6910 - University Thesis</td>
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You should . . .  
- Meet with Graduate Advisor  
- Submit prospectus  
- Advance to candidacy  
- File for graduation

and consider . . .  
- Meet with AACE advisor  
- Attend a career fair  
- Attend a professional conference

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<td>6000-LEVEL UNITS</td>
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# Academic Roadmap

## Department of Earth and Environmental Sciences
### B.S. in Environmental Science
#### Option in Environmental Systems and Resource Management

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

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<td>GS 1011 GE Activities I</td>
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<td>ENGL 1001 College Writing I</td>
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<td>GS 1013 GE Activities III</td>
<td>(1)</td>
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<table>
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<th>TOTAL UNITS</th>
<th>TOTAL UNITS FOR YEAR</th>
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You should . . .
Complete your Freshman Cluster Classes

and consider . . .
Take General Education courses
<table>
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<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>ENSC 2800 Env. Prob. of CA</td>
<td>(4)</td>
<td>ENSC 2400 Env. Biology &amp; ENSC 2401 Env. Biology Lab</td>
<td>(4)</td>
<td>ME (year 2 or year 3):</td>
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</table>
## YEAR 3 (91 – 135 UNITS)

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<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
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</thead>
</table>
| BIOL 3110 Princ. of Ecology | (4) | ENVT 4100 Env. Impact Analysis | (4) | GEOG 3000 Resource Mgmt. | (4) | GE: General Elective  
ME: Major Elective |
| GEOL 2600 Intro. to GIS | (4) | ENSC 3500 Env. Hydrology | (5) | ME (year 2 or year 3): | ENVT 4910 Internship (2-4),  
ENVT 3400 Env. Res. Analysis (4),  
GEOG 3030 Exploring GIS (4),  
3410 Air Photo Interpretation (4),  
3450 Literature and Research Methods (5),  
3605 Computer Cartography (5),  
4425 Remote Sensing of Earth Environments (4),  
4605 Environmental Applications of GIS (5) |
| Technique Course: | | Knowledge Course: | | Technique Course: | | |
| GE: | | GE: | | GE: | | |
| TOTAL UNITS | | TOTAL UNITS | | TOTAL UNITS | | |

### TOTAL UNITS FOR YEAR

### You should . . .
- Take the Writing Skills Test in fall quarter
- Enroll in ENGL 3000 if needed
- Complete at least one upper division GE requirement

### and consider . . .
- Meet with your major advisor
- Meet with AACE advisor
- Attend the Graduate School Fair
- Seek leadership opportunities in a club or student government
**Year 4 (136 – 180 units)**

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<td>Knowledge Course</td>
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<td>GE:</td>
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</table>

**TOTAL UNITS**

<table>
<thead>
<tr>
<th>TOTAL UNITS</th>
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</thead>
</table>

**TOTAL UNITS FOR YEAR**

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**You should . . .**

- File for graduation
- Complete upper division GE requirements
- Take Major Requirement Electives (ME)

**and consider . . .**

- Meet with major advisor
- Meet with AACE advisor
- Attend a Career Fair
- Attend the Graduate School Fair
- Conduct information interviews in your field

**TOTAL UNITS ON PLAN**

<table>
<thead>
<tr>
<th>MAJOR UNITS</th>
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<tbody>
<tr>
<td>FRESHMAN CLUSTER UNITS</td>
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<tr>
<td>GENERAL EDUCATION UNITS</td>
</tr>
<tr>
<td>UNRESTRICTED ELECTIVE UNITS</td>
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</tbody>
</table>
## Academic Roadmap

Department of Earth & Environmental Sciences  
B.S. in Environmental Science  
Option in Life Science

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
<thead>
<tr>
<th>YEAR 1 (0 – 45 UNITS)</th>
<th>FALL</th>
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<tr>
<td>GE:</td>
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<td>BIOL 1402 Plant Biology</td>
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<td>BIOL 1403 Animal Biology</td>
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<td>GS 1013 GE Activities III</td>
<td>(1)</td>
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<td>TOTAL UNITS</td>
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You should . . .  
Complete your Freshman Cluster Classes

and consider . . .  
Taking General Education courses

CSUEB Academic Roadmap  
updated April 16, 2014
## Year 2 (46 - 90 Units)

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<tr>
<td>ENSC 2800 Env. Prob. of CA</td>
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<td>ME (year 2 or year 3):</td>
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<td>ENSC 2900 Field Activity</td>
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<td><strong>GE:</strong> General Elective</td>
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<tr>
<td>PHYS 2701 Intro to Physics I</td>
<td>(4)</td>
<td>PHYS 2702 Intro to Physics II</td>
<td>(4)</td>
<td>PHYS 2703 Intro to Physics III</td>
<td>(4)</td>
<td><strong>ME:</strong> Major Elective</td>
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<tr>
<td>ENSC 2210, &amp; ENSC 2211 Env. Geol. Lab</td>
<td>(5)</td>
<td>STAT 3010 Stat. Meth. in Soc. Sci. or STAT 3031 Stat. Meth. in Bio.</td>
<td>(4)</td>
<td>MATH 1304 Calculus I</td>
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<tr>
<td><strong>GE:</strong></td>
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<td><strong>GE:</strong></td>
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<td><strong>GE:</strong></td>
<td></td>
<td><strong>Note:</strong> Up to 8 units of the required core elective courses may also count for GE</td>
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</table>

**TOTAL UNITS**

**TOTAL UNITS**

**TOTAL UNITS**

**TOTAL UNITS FOR YEAR**

---

### You should . . .
- Complete areas A1-A4
- Complete lower division GE requirements
- Complete English 1002
- Declare a major
- Meet with your major advisor
- Meet with an AACE advisor

### and consider . . .
- Attend “Strictly Sophomores”
- Apply to CSSP or summer internship
- Explore student organizations
- Explore leadership opportunities
<table>
<thead>
<tr>
<th>YEAR 3 (91 – 135 UNITS)</th>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
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<tr>
<td>BIOL 3110 Princ. of Ecology</td>
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<td>ENVT 4100 Env. Impact Analysis</td>
<td>(4)</td>
<td>GEOG 3000 Resource Mgmt.</td>
<td>(4)</td>
<td>GE: General Elective</td>
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<tr>
<td>GEOL 2600 Intro. to GIS</td>
<td>(4)</td>
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<td>ENSC 3500 Env. Hydrology</td>
<td>(5)</td>
<td>ME (year 2 or year 3):</td>
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<td>BIOL 4351 Biological Conservation</td>
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<td>BIOL 3215 Marine Biology (4)</td>
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<td>or M SC 4103 Marine Ecology (6);</td>
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<td>BIOL 4517 Environmental Toxicology (4)</td>
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**TOTAL UNITS FOR YEAR**

---

**You should...**

- Take the Writing Skills Test in fall quarter
- Enroll in ENGL 3000 if needed
- Complete at least one upper division GE requirement

**and consider...**

- Meet with your major advisor
- Meet with AACE advisor
- Attend the Graduate School Fair
- Seek leadership opportunities in a club or student government

CSUEB Academic Roadmap 73

updated April 16, 2014
## Year 4 (136–180 Units)

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<th>SPRING</th>
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<tbody>
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<td>GE:</td>
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<tr>
<td><strong>TOTAL UNITS</strong></td>
<td><strong>TOTAL UNITS</strong></td>
<td><strong>TOTAL UNITS</strong></td>
<td><strong>TOTAL UNITS</strong></td>
</tr>
</tbody>
</table>

### You should . . .
- File for graduation
- Complete upper division GE requirements
- Take Major Requirement Electives (ME)

### and consider . . .
- Meet with major advisor
- Meet with AACE advisor
- Attend a Career Fair
- Attend the Graduate School Fair
- Conduct information interviews in your field

### Total Units on Plan

<table>
<thead>
<tr>
<th>MAJOR UNITS</th>
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<tbody>
<tr>
<td>FRESHMAN CLUSTER UNITS</td>
</tr>
<tr>
<td>GENERAL EDUCATION UNITS</td>
</tr>
<tr>
<td>UNRESTRICTED ELECTIVE UNITS</td>
</tr>
</tbody>
</table>
Academic Roadmap

Department of Earth and Environmental Sciences
B.S. in Environmental Science
Option in Physical Science

Note: This roadmap is an example of one schedule that will enable you to graduate in four years. There are many different ways to complete the required coursework in a timely manner. Your actual schedule will likely be different.

<table>
<thead>
<tr>
<th>YEAR 1 (0 – 45 UNITS)</th>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
</tr>
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<tbody>
<tr>
<td>Cluster</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>ENSC 2900 Field Activity</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>GS 1011 GE Activities I</td>
<td>(1)</td>
<td></td>
<td>ENGL 1001 College Writing I</td>
<td>(4)</td>
<td>GS 1013 GE Activities III</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>GE:</td>
<td></td>
<td>GE:</td>
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<td>GE:</td>
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<td>TOTAL UNITS</td>
<td></td>
<td>TOTAL UNITS</td>
<td></td>
<td>TOTAL UNITS FOR YEAR</td>
<td></td>
</tr>
</tbody>
</table>

You should . . .

Complete your Freshman Cluster Classes

and consider . . .

Taking General Education courses
<table>
<thead>
<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSC 2800 Env. Prob. of CA</td>
<td>(4)</td>
<td>ENSC 2400 Env. Biology and ENSC 2401 Env. Biology Lab</td>
<td>(4)</td>
<td>MATH 1304 Calculus I</td>
<td>(4)</td>
<td>GE: General Elective</td>
</tr>
<tr>
<td>PHYS 2701 Intro to Physics I</td>
<td>(4)</td>
<td>PHYS 2702 Intro to Physics II</td>
<td>(4)</td>
<td>PHYS 2703 Intro to Physics III</td>
<td>(4)</td>
<td>ME: Major Elective</td>
</tr>
<tr>
<td>ENSC 2211 Env. Geol. Lab</td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
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</table>

<table>
<thead>
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<th>TOTAL UNITS</th>
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</table>

<table>
<thead>
<tr>
<th>TOTAL UNITS FOR YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

You should . . .

- Complete areas A1-A4
- Complete lower division GE requirements
- Complete English 1002
- Declare a major
- Meet with your major advisor
- Meet with an AACE advisor

and consider . . .

- Attend “Strictly Sophomores”
- Apply to CSSP or summer internship
- Explore student organizations
- Explore leadership opportunities

You should . . .

- Complete areas A1-A4
- Complete lower division GE requirements
- Complete English 1002
- Declare a major
- Meet with your major advisor
- Meet with an AACE advisor

and consider . . .

- Attend “Strictly Sophomores”
- Apply to CSSP or summer internship
- Explore student organizations
- Explore leadership opportunities

**CSUEB Academic Roadmap**

updated April 16, 2014
### YEAR 3 (91 – 135 UNITS)

<table>
<thead>
<tr>
<th>FALL</th>
<th>UNITS</th>
<th>WINTER</th>
<th>UNITS</th>
<th>SPRING</th>
<th>UNITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 3110 Princ. of Ecology</td>
<td>4</td>
<td>ENVT 4100 Env. Impact Analysis</td>
<td>4</td>
<td>GEOG 3000 Resource Mgmt.</td>
<td>4</td>
<td>GE: General Elective</td>
</tr>
<tr>
<td>GEOL 2600 Intro. to GIS</td>
<td>4</td>
<td>ENSC 3500 Env. Hydrology</td>
<td>5</td>
<td>ME:</td>
<td></td>
<td>ME: Major Elective</td>
</tr>
<tr>
<td>Option Course:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
<td>GE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL UNITS</td>
<td></td>
<td>TOTAL UNITS</td>
<td></td>
<td>TOTAL UNITS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Option Courses – Must complete 22 units from the following list:**

- CHEM 2200 Quantitative Analysis (5),
- CHEM 2301 Survey of Org. Chem I (4),
- CHEM 2302 Survey of Org. Chem II (4),
- CHEM 4601 Environmental Chemistry I (5),
- CHEM 4602 Environmental Chemistry II (5),
- GEOL 3110 Principles of Geomorphology (4),
- GEOL 3601 Mineralogy (5),
- GEOL 3701 Igneous and Metamorphic Petrology (5),
- GEOL 3801 Sedimentology and Stratigraphy (5),
- GEOL 3810 Structural Geology (5),
- GEOL 3910 Geologic Field Methods (3),
- GEOL 4010 Applied Geophysics (5),
- GEOL 4130 Survey of Geochemistry (4),
- GEOL 4320 Hydrogeology (5),
- MATH 1305 Calculus II (4),
- 4900 Independent Study (2),
- 3898 Cooperative Education (Internship)

**TOTAL UNITS FOR YEAR**

---

**You should . . .**

Take the Writing Skills Test in fall quarter  
Enroll in ENGL 3000 if needed  
Complete at least one upper division GE requirement

**and consider . . .**

Meet with your major advisor  
Meet with AACE advisor  
Attend the Graduate School Fair  
Seek leadership opportunities in a club or student government
### Year 4 (136 – 180 Units)

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
<th>SPRING</th>
<th>TOTAL UNITS FOR YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option Course:</td>
<td>ENSC 4800 Env. Sci. Seminar</td>
<td>(3) Option Course:</td>
<td></td>
</tr>
<tr>
<td>ME:</td>
<td>Option Course</td>
<td>Option Course:</td>
<td></td>
</tr>
<tr>
<td>GE:</td>
<td>GE:</td>
<td>GE:</td>
<td></td>
</tr>
<tr>
<td>Unrestricted Elective:</td>
<td>Unrestricted Elective:</td>
<td>Unrestricted Elective:</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**
- GE: General Elective
- ME: Major Elective

---

**You should . . .**
- File for graduation
- Complete upper division GE requirements
- Take Major Requirement Electives (ME)

**and consider . . .**
- Meet with major advisor
- Meet with AACE advisor
- Attend a Career Fair
- Attend the Graduate School Fair
- Conduct information interviews in your field

---

**TOTAL UNITS ON PLAN**
- MAJOR UNITS
- FRESHMAN CLUSTER UNITS
- GENERAL EDUCATION UNITS
- UNRESTRICTED ELECTIVE UNITS
Appendix F. Planning for Distinction Templates
Planning for Distinction
Instructional Program Criteria and Template
Submitted Nov. 15th, 2013

College or Unit: College of Science
Report No. COS 4
Programs Included: Geology BA/BS

Total number of service courses provided to other programs: 0

Please use Tables 1-6 to prepare your write-ups for the questions in this background information section (up to 250 words in total).

I. Program History and Development
   Provide a brief overview of each program’s history and development with emphasis on the last five years.
   I. Describe the role of GE (use Table 4).
   II. Describe the role of Graduation Requirements (use Table 4).
   III. Describe the role of service courses.
   IV. Describe the course delivery method for your program(s) (use Table 5)
I. Describe the course format for your program(s) (use Table 6)

The Geology BA/BS program offered by the Department of Earth and Environmental Sciences, has been training geologists for over 30 years. During 2005-2008, the department’s participation in GE increased significantly and enrollments (FTES) quadrupled. Since 2008, the program has been served by four tenure-track faculty, two staff, and about ten lecturers. A new tenure-track faculty member was hired in Fall 2013, and though his primary teaching responsibilities will be ENSC courses, he may occasionally teach Geology courses.

Table 4 provides three years of data summarizing enrollments by course type. GE enrollments account for about half of total enrollments. Lower-division enrollments are generally higher than upper-division. Nearly all of the lower-division courses and sections are GE-certified. About two-thirds of the upper-division courses and sections are GE-certified. In summary, GE plays a major role in the program, particularly for lower-division courses. Graduation requirements drive non-GE enrollments in courses for Geology majors as well as service courses for majors in other fields. We offer a service course for Liberal Studies majors.

Three lower-division Geology courses belong to GE clusters. We offer several upper-division GE courses, including one online class.

Nearly all of courses in the program are taught in person. Students are exposed to a variety of instructional formats, including lectures, hands-on lab sessions, and seminars. The curriculum is well suited to in-person instruction. Students choose from a large number of geology electives, and are required to take a senior seminar during their program. Faculty provide digital course content delivery through Blackboard.
Criterion 1: Consistency with CSUEB Shared Strategic Commitments and Institutional Learning Outcomes (10%)

I. Institutional Learning Outcomes: (70%)
With the understanding that programs may not demonstrate alignment to every ILO, please provide a brief narrative of less than 60 words each explaining your current and/or planned alignment for each ILO (Note that Specialized Discipline is more fully evaluated within Program Quality).

Provide evidence to support current and/or planned alignment for each ILO (no more than 60 words for each ILO)

Rubrics for ILOs1(Criterion 1, Question I)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides clear and compelling evidence of alignment to the learning outcome in the current program.</td>
<td>Provides partial evidence of alignment to the learning outcome in the current program.</td>
<td>Provides evidence of alignment to the learning outcome in the near future.</td>
<td>Provides little or no evidence of alignment to the learning outcome currently or in the near future.</td>
<td></td>
</tr>
</tbody>
</table>

1Each ILO narrative is rated. Final score is average of the ratings.

1. Graduates of CSUEB will be able to think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and everyday problems

   Students taking Geology courses learn how to interpret features on the Earth in the context of the processes that formed them. In majors courses such as mineralogy and structural geology, students make careful observations, accurately record data, and apply quantitative methods to analyze spatial data. These skills equip students with the ability to address complex problems.

2. Graduates of CSUEB will be able to communicate ideas, perspectives, and values clearly and persuasively while listening openly to others

   Students learn to present their positions clearly and persuasively in written and oral form in class assignments. Course writing requirements include homework and lab reports. Courses include group- and team-based projects that encourage listening.

3. Graduates of CSUEB will be able to apply knowledge of diversity and multicultural competencies to promote equity and social justice in our communities

   The diverse student population at CSUEB, including international students, provides students with a broad perspective. Students in our courses are encouraged to consider the effects of policy and resource management decisions on everyone. Students learn that communities that are established in regions that are prone to geologic hazards often lack the resources to easily relocate.
4. Graduates of CSUEB will be able to work collaboratively and respectfully as members and leaders of diverse teams and communities

Geology is inherently interdisciplinary, requiring a collaborative approach to problem solving in field activities, the laboratory, the public sector, and private industry. Coursework prepares our students with a broad skillset and interdisciplinary perspective suitable for taking part in collaborative efforts in their workplace and career.

5. Graduates of CSUEB will be able to act responsibly and sustainably at local, national, and global levels

The ability to act responsibly and sustainably requires knowledge of the Earth sciences. In the geology program, topics include water resources, natural hazards, natural resources exploration, and global change (e.g., climate change). Courses include discussions of controversial topics such as hydraulic fracturing, urban development in seismically-vulnerable areas, and over-exploitation of water resources.

6. Graduates of CSUEB will demonstrate expertise and integration of ideas, methods, theory and practice in a specialized discipline of study.

Geology students learn to apply principles of the natural sciences to understand Earth systems, crossing disciplinary boundaries to find complex solutions. Students are required to integrate content knowledge from multiple physical and life science disciplines in their coursework. Graduates from the Geology BA/BS program demonstrate their expertise by successful completion of rigorous core curriculum and a capstone senior seminar.
II. Shared Strategic Commitments: (30%)

1. Reinforce academic quality through open-minded inquiry, innovative teaching, engaged learning, and distinguished scholarship
2. Enhance our inclusive campus, responding to the backgrounds and interests of our diverse community and promoting their academic, professional and personal development
3. Serve students first, by expanding access and enhancing each student’s educational experience and prospects for success as a graduate and life-long learner
4. Foster a vibrant community through enriched student services and student life that support student engagement and learning
5. Contribute to a sustainable planet through our academic programs, university operations, and individual behavior
6. Continuously improve our efficiency, transparency, and accountability while practicing mutual respect, responsiveness, and collaboration across the University
7. Support the civic, cultural, and economic life of all communities in the regions we serve through partnerships that promote education and social responsibility
8. Demonstrate our continuing record of leadership and innovation in higher education, focused on 21st century skills, including science, technology, engineering, and mathematics (STEM)

In addition to ILO’s, many programs may be directly aligned with one or several of the higher order Shared Strategic Commitments of the University. These connections can reinforce the program’s contribution to CSUEB standards. Please provide a narrative to describe how your program is currently aligned and/or intends to become aligned in the near future with any of the eight CSUEB Shared Strategic Commitments. (Please use a total of 120 words or less. You may use the narrative to cover one or several of the SSC’s as you see fit and as best applies to your program)

Rubrics for SSCs² (Criterion 1, Question II)

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides clear and compelling evidence of contribution toward 3 or more of the SSC’s.</td>
<td>Provides clear and compelling evidence of contribution toward 1-2 SSC’s or partial evidence of contribution toward 4 or more.</td>
<td>Provides partial evidence of contribution to 2-3 of the SSC’s.</td>
<td>Provides little or no evidence of contribution to more than 1 of the SSC’s.</td>
</tr>
</tbody>
</table>

²Evaluation is based on the single narrative response
SSC #5: The program uses scientific and data-driven methods to address sustainability issues relating to controversial topics such as climate change, hydraulic fracturing, and marine seismic exploration.

SSC #7: Faculty and students are involved in seismic hazard education and evaluation, which contributes to the safety of East Bay communities. Faculty and students used the recent Warren Hall implosion as the seismic source to study the earthquake hazard on the Hayward fault, and hosted a conference on earthquake hazards in 2008.

SSC #8: Faculty work to increase the number of STEM professionals and improve the quality of STEM education through participation in the Institute for STEM Education, Gateways, and the East Bay STEM network. Two faculty have participated in PEIL grants.

**Criterion 2: Internal and External Demand (25%)**

I. FTES, Number of Majors, and Number of Degrees Awarded

A. FTES (35%)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
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<tbody>
<tr>
<td>Top Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Middle Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Middle Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: FTES by Prefix by Remedial, Lower Division, Upper Division, and Graduate

<table>
<thead>
<tr>
<th>GEOL MS</th>
<th>5-Year Average</th>
<th>Quartile</th>
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<tbody>
<tr>
<td>Remedial</td>
<td>NA</td>
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<tr>
<td>Lower Division</td>
<td>99.79</td>
<td></td>
</tr>
<tr>
<td>Upper Division</td>
<td>84.10</td>
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</tr>
<tr>
<td>Graduate</td>
<td>5.15</td>
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</tr>
<tr>
<td>TOTAL FTES</td>
<td>189.04</td>
<td>2</td>
</tr>
</tbody>
</table>

B. Number of Majors, Options and Minors (for information only, no rubric)

Table 8: Total Number of Students by Majors, Option, and Minors

<table>
<thead>
<tr>
<th></th>
<th>Major</th>
<th>Option</th>
<th>5-Year</th>
<th>Quartile</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
C. **Number of Degrees Awarded (30%)**

**Rubrics for Degrees Awarded** *(Criterion 2, Question IC)*

<table>
<thead>
<tr>
<th>Rating</th>
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</thead>
<tbody>
<tr>
<td>Degrees Awarded</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
</tbody>
</table>

*If a program is new and no degrees have been awarded, the task group will use the quartile for majors instead of the quartile for degrees awarded.*

**Table 9: Total Number of Degrees Awarded for the College Year**

<table>
<thead>
<tr>
<th>Major</th>
<th>Option</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology BS</td>
<td>Total Students Awarded Degrees</td>
<td>2.4</td>
<td>1</td>
</tr>
<tr>
<td>Geology BA</td>
<td>Total Degrees Awarded –</td>
<td>1.6</td>
<td>1</td>
</tr>
</tbody>
</table>

D. For this criterion examine the data for quarterly FTES, number of students by major, by options and minors, and number of degrees awarded by major, options and minors. Please also examine the data for service courses offered by your program to serve other programs and any other relevant information. Please write up to 250 words describing the internal and external demand for your program. Explain any significant changes in program demand over the past 5 years.
Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

Rubrics for Narrative (Criterion 2, Question ID)

<table>
<thead>
<tr>
<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>

Score in this area (from 0-2 pts) may be added to one factor in internal demand (FTES, #majors, or #degrees awarded) to a maximum factor score of 4 pts.

The five-year average total FTES for F08-F12 is 189. As discussed above, the program experienced very rapid growth in enrollments during 2005-2008 due to an increased level of participation in GE, and has been relatively stable thereafter. Based on the sustained level of demand during the past four years, F09-F12, we anticipate a similar level of internal demand for at least the next few years.

During the past five years, there have been on average 9.4 students in the Geology BS program and 3.2 students in the Geology BA program, for a total of 12.6 students in Geology bachelor programs. The five-year averages for annual number of degrees awarded are 2.4 BS degrees per year and 1.6 BA degrees per year, for a total of 4.0 Geology Bachelors degrees per year. An average of 0.6 Geology Minor degrees per year were awarded.

II. California State Jobs Projections for Each Program (35%)

A. California Occupational Employment Projection (COEP) for 2010 to 2020 compiled by the State of California’s Employment Development Department is provided in a separate spreadsheet emailed to you with the supplemental data package for information required in criterion 2.

Chair or program director can use the suggested total jobs and transfer the total jobs for your major to line 1 of the table below.

Rubrics for Total Jobs* (Criterion 2, Question II A)

<table>
<thead>
<tr>
<th>Rating</th>
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<th>3</th>
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</thead>
<tbody>
<tr>
<td>Total Jobs</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
</tbody>
</table>

* The instructional program task group will determine the ranges for the four quartiles after all jobs data has been collected from all programs.
B. Please discuss the selections you made for the total jobs in your worksheet in Appendix 3 (no more than 125 words).

- How do the job projections relate to your program and the external demand for your program's resources and expertise?
- What other factors not represented by the COEP also indicate or explain local and regional external demands for your program?

Rubrics for Total Jobs Narrative (Criterion 2, Question II B)

<table>
<thead>
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<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
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</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>

Score in this area (from 0-2 pts) may be added to the Total Jobs category to a maximum factor score of 4 pts.

Employment of geologists is projected to grow nationwide by 19% from 2010-2020 (Bureau of Labor Statistics). Growth in California will be even stronger than the national average, and salaries of geologists compare favorably to other scientists (American Geosciences Institute, 2011). Many job openings are expected in the Bay Area with environmental and engineering consulting firms, geotechnical companies, and state and municipal agencies. As the construction industry continues to recover from the 2008 recession, the demand for geologists in the Bay Area is expected to increase. Ongoing demand for energy, combined with innovations in drilling and production technology, have caused a resurgence in domestic oil and gas exploration and has led to an increase in the demand for graduates with a degree in Geology.
Criterion 3: Program Quality (30%)

Instructional Achievement Program Faculty
I. Instructional Achievement (25%)

Rubrics for Program Faculty - Instructional Achievement (Criterion 3, Questions 1.1a, 1b, 2, 3 and 4)

<table>
<thead>
<tr>
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<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program has compelling evidence of implementing teaching</td>
<td>Program shows evidence of implementing some strategies for</td>
<td>Program has maintained effective teaching strategies without</td>
<td>Program has minimum effective teaching strategies without</td>
</tr>
<tr>
<td></td>
<td>improvement strategies based upon evaluation of outcomes;</td>
<td>teaching improvement based upon evaluation of outcomes;</td>
<td>improvement related to evaluation of outcomes; faculty</td>
<td>improvement related to evaluation of outcomes; faculty</td>
</tr>
<tr>
<td></td>
<td>faculty receive significant external teaching awards, teaching</td>
<td>faculty receives some awards, grants and recognitions for</td>
<td>receive few grants, awards or recognitions of</td>
<td>receive no awards, grants or recognitions for teaching</td>
</tr>
<tr>
<td></td>
<td>grants and recognition of instructional excellence.</td>
<td>teaching.</td>
<td>instructional excellence.</td>
<td>excellence.</td>
</tr>
</tbody>
</table>

1. Student and peer evaluations (overall for the program) (up to 100 words). Scores for on-ground course evaluations are provided in Table 11 and on-line course evaluations are provided in a separate PDF file with the supplemental data package.

1a. List average teaching evaluation scores (average for questions 1-8 of the teaching evaluation questionnaire) for all program faculty in Fall, Winter and Spring Quarters of the 2012-13 academic year.

<table>
<thead>
<tr>
<th>Input Department Name</th>
<th>On-Ground Course Evaluations Dept Mean (Q1-8)</th>
<th>Transfer Data from Table 11</th>
<th>On-line Course Evaluations Dept Mean (Q1-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2012</td>
<td>1.41</td>
<td></td>
<td>1.41</td>
</tr>
<tr>
<td>Winter 2013 Dept</td>
<td>1.32</td>
<td></td>
<td>1.31</td>
</tr>
<tr>
<td>Spring 2013 Dept</td>
<td>1.4</td>
<td></td>
<td>1.28</td>
</tr>
</tbody>
</table>
1b. System for continuous improvement of teaching (up to 100 words)
Present evidence of applying results of student and peer evaluations of tenured and tenure-track faculty, and lecturers for teaching improvement

The student evaluation scores in the table above are on a scale of 1-4, where 1 is the most favorable. Our overall evaluations range from 1.3 to 1.4. Student evaluations are used as a mechanism for providing all departmental faculty with feedback on how to improve their teaching technique. Individual faculty use student evaluations and input for continuous improvement of their courses and techniques. Student evaluations are utilized in both the RTP review of tenured/tenure-track faculty and the Department Chair's annual performance reviews of lecturers.

2. Teaching awards, teaching grants, and recognitions (up to 100 words)
List significant external and internal teaching awards, grants and recognitions

Awards:
Seitz: Outstanding Professor 2009-2010.

Grants:


Moran: NSF travel grants to attend three Geoscience teaching workshops (3); Early Career Faculty in Geosciences; The Math You Need; Teaching Hydrogeology and Geochemistry in the 21st Century.

3. Faculty-supervised student projects (up to 100 words)
Provide evidence of faculty mentoring of students. Include, for example, approaches to advising, directed study or student research, independent study, and/or clubs or student professional chapters that involve faculty mentorship.

Geology undergraduates gain research experience by participating in faculty-sponsored research projects, often as paid student assistants. One student is currently conducting a study of volcanic rocks and learning how to prepare petrographic thin sections. Others have participated in projects involving water quality monitoring, sediment particle size analysis, geophysical data acquisition. Students have been coauthors with faculty on several abstracts presented at professional meetings. The department hosts seminars with speakers on topics
related to geology. Geology majors participate in the Cummings Earth and Environmental Science Club, an ASI-supported student organization with a faculty sponsor.

4. Other evidence of quality indicators related to instruction that may not be listed elsewhere, including, for example, rigor of course syllabi and assignments, faculty diversity within the program (up to 100 words)

The core curriculum of the Geology BA/BS program includes a rigorous year-long petrology sequence taught by faculty experts. Students learn the use of specialized petrographic microscopes with polarizing filters to identify rocks and minerals in thin section.

Undergraduate geology courses are supported by excellent rock, mineral, and fossil collections.

Faculty teach students to use quantitative methods to solve geochemical, geophysical, and geometrical problems.

Courses utilize a variety of instructional settings, including lectures, seminars, and lab exercises. Outdoor activities include hydrologic sampling, well testing, and geophysical data acquisition. Computer exercises include modeling and data processing using discipline-specific software.

**Professional Achievement**

**II. Professional Achievement (25%)**

**Rubrics for Program Faculty - Professional Achievement (Criterion 3, Questions II 1a, 1b, 1c, 2, 3)**

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Professional contributions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a. TT faculty contributions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please use worksheet in the Appendix 4 and complete one worksheet for each faculty member and transfer the cumulative data to the “Total Number” column for the corresponding year. Then use the total number for the particular year divided by the number of TT faculty for that year on the third row under “Total Number” column and compute the average per tenured &amp; tenured-track faculty for that particular year under column and enter “Average per TT” in the table below.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b. Comment on contributions in professional achievement by TT and FERPs (up to 50 words)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Strayer: Oral presentation at national meeting; Geological Society of America (2013).
Seitz: presentation at international meeting; Goldschmidt Conference (2013).

1c. Comment on contributions in professional achievement by lecturers and FERPs (up to 50 words)

Pauly: article in peer-reviewed journal Geochemistry Geophysics Geosystems (2011).
Teitler: articles in peer-reviewed journals Paleoceanography (2010); Sedimentary Geology (2012).
Drumm: presentation at national meeting, Association of Environmental & Engineering Geologists (2012).

2. List significant examples for the following (up to 100 words):
   - Research grants (source and dollar amounts)
   - Professional consultancies
   - Professional awards/engagements

Research Grants:
Seitz: NASA, $178K (2011)

Professional Consultancies:

Professional awards:
Moran: President’s award, California Groundwater Resources Association (2008, 2009);
Technical advisory committee for UC Davis-led California Nitrate Assessment (2011-2012).

3. List significant professional activities (up to 100 words):
   - Leadership positions in professional societies, conferences
   - Editorial and review contributions
   - Fellowships
   - Invited (keynote, sponsored exhibitions and performances)


Strayer: Sabbatical, National Taiwan University (2009-2010).

Program Design
Curriculum, Assessment, and Student Success
III. Program Design (25%)

<table>
<thead>
<tr>
<th>Rubrics for Program Design (Criterion 3, Questions III 1 and 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
<tr>
<td>Exceptional evidence of relevance and innovation in program design.</td>
</tr>
</tbody>
</table>

1. Describe the relevancy of your program as it aligns with internal and external needs (up to 100 words). Specifically, emphasize evidence of the following:
   - Existence of advisory board, curriculum updates, etc.
   - Systematic review and update of curriculum with input from external sources
   - Alignment of needs to internal (campus) and external (local, regional, national, international) communities
   - Systematic alumni tracking and employer surveys

In order maintain the relevance of our curriculum, we utilize the Five-Year Review process, along with continuous feedback from students, alumni and employers. The employment sector in the Bay Area that hires the largest number of graduates with a bachelor's degree in Geology is environmental and engineering consulting firms.

Since our last Five-Year Review, seven new undergraduate geology classes were added and five courses were revised. The new courses include both GE and major courses. The revisions reflect updates to the curriculum and improve articulation with community colleges.
Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

2. List/describe innovations of the program curriculum (up to 100 words). Specifically emphasize the following:
   - What steps has the program taken to develop innovative and forward-looking curricula?
   - Use of technology: Computer literacy, teaching enhancements, etc.
   - Pedagogical innovations: experiential learning, online, etc.
   - Self-support programs, credential, certificate, etc.

Courses include hands-on exercises that involve interpretation, modeling, and simulation. Several courses involve collaborative projects that emphasize project and problem-based learning. Course content is delivered online through Blackboard. Courses incorporate experiential learning through fieldwork that teaches practical skills such as the acquisition of real data. An online upper-division GE course has been highly successful. We have provided additional sections in response to demand.

IV. Program Implementation and Outcomes (25%)

IV. Rubrics for Program Implementation and Outcomes (Criterion 3, Questions IV 1, 2, 3, 4 and 5)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is accredited (where relevant); provides compelling evidence of a systematic assessment process and program improvement; demonstrates high student achievement</td>
<td>Is accredited (where relevant); provides evidence of a systematic assessment process and program improvement; demonstrates good student achievement</td>
<td>Provides some evidence of an assessment process and program improvement; demonstrates satisfactory student achievement</td>
<td>Provides minimal evidence of an assessment process and program improvement; demonstrates minimal student achievement</td>
<td></td>
</tr>
</tbody>
</table>

Describe your program implementation, improvement efforts, and outcomes. Specifically, include the following (where relevant)

1. Accreditation, licensure, and external recognitions; list/describe the following (up to 100 words):
   - Accreditations (where relevant), meeting licensure requirements (where relevant), and recognitions by external bodies

   **Not applicable.**

2. Effectiveness and sufficiency of current resources; list/describe the following (up to 100 words):

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Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

- Important facilities, equipment and information/library resources, and the degree to which they affect program quality

Departmental resources includes rock, mineral, and fossil collections, petrographic microscopes, electronic balances, handheld GPS units, Brunton compasses, a handheld x-ray fluorescence analyzer, laser isotope analyzer, groundwater field equipment, high-pressure/high-temperature fluid densimeter, and geotechnical test equipment. Geophysical equipment includes a 48-channel seismic system, electrical resistivity system, ground-penetrating radar system, magnetometer, and GPS system. The equipment is used effectively for instruction and research.

A 10-seat departmental computer laboratory is essential for some of our advanced courses. The University Library contains valuable resources in both digital and print form. It provides online access to databases and online journals specific to the geosciences.

3. Student advising, experiential learning, internships, co-op, service learning; list/describe the following (up to 100 words):
   - Student degree roadmaps, faculty advisors, student centers, affiliated partners (public/private) etc.

Majors meet with the department chair or other faculty member course for advising. Geology degree roadmaps are posted on the College of Science website. Several majors have had internships at the US Geological Survey in Menlo Park. Our faculty and students participated in the USGS seismic recording of the 2013 Warren Hall implosion. They worked with USGS staff and students from other universities to deploy several hundred portable seismographs throughout the area. Students explained the experiment to local residents and helped raise the community awareness of the earthquake risk due to the Hayward fault.

4. Assessment of learning outcomes; list/describe evidence for the following (up to 150 words):
   - Modifying and improving your program based on assessment of learning outcomes

Assessment of student learning for Geology undergraduate programs will be based on 1) entrance and exit exams covering the same material, and 2) reviews of student work in specific assignments that measure student competency in key areas. These will be conducted in classes that are taught regularly by tenure-track faculty or experienced lecturers. We will assess the degree to which these outcomes have been achieved through laboratory exercises, term papers, and oral presentations. Student work for selected assignments will be submitted in digital form and retained by instructors. This will make it possible to evaluate student learning by comparing typical student work over a period of several years.

The assessment plan is currently under revision, the new plan will include a curriculum matrix that will show how program learning outcomes (PLOs) are met in individual courses. We will assess one PLO per year during the next few years.
Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

5. Student success; list/describe the following (up to 100 words):
   - Placements (major-related employment paid and unpaid, graduate school acceptance)
   - Employer evaluations (if available), alumni success
   - Student awards, presentations, recognitions, internships, etc. (at CSUEB and post-degree)
   - Data from exit interviews or alumni surveys (Tables 12-15 in the supplemental data package) may be used if available.

Several recent graduates have found employment with environmental and engineering consulting firms in the Bay Area. Several more attended or are attending graduate school, at CSUEB and elsewhere.

Criterion 4: Costs and Productivity (20%)

Cost and Productivity are often measured in ratios, trends, and comparisons. As in the case here, often only easily available data are used. Notice that programs are grouped by prefix and compared to systemwide and campus averages. Whether the tables like these imply strength, weakness, or something in between, even whether the comparisons are fair, is usually a matter of discussion with a dean or in a Five Year Review.

I. Student Faculty Ratio (FTES/FTEF) (25%)

Program prefix level SFR and comparable systemwide program SFR are provided for the last 5 years for inspection; those data appear in Table 16 of the supplemental data package. To be considered separately are lower division, upper division, and graduate level SFRs.

A. You are given “% Difference” value over a 5 year period, comparing your program SFR data with systemwide averages for your program. If your program SFR is higher than the systemwide for a given year, notice that the value is presented as a positive (“+“) percentage. If it is presented as a negative percentage (“-“), your program SFR for that year is lower than the systemwide average. The resulting four values are then averaged for you. Transfer the appropriate values to the template as specified. Transfer the average change SFR for lower division, upper division, and graduate SFR to the table below.

| Rubrics for SFR (Comparison to Systemwide SFR over 5 years) (Criterion 4, Question 1A) |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                                |                                |                                |                                |
| Average % change in SFR is equal to or greater than +20% | Average % change in SFR is greater than zero, but less than +20% | Average % change in SFR is within the range zero to -20% | Average % change in SFR is more negative than -20% |
|                                |                                |                                |                                |

Transfer Data from Table 16
Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

<table>
<thead>
<tr>
<th></th>
<th>Average Change SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>4%</td>
</tr>
<tr>
<td>Upper Division</td>
<td>39%</td>
</tr>
<tr>
<td>Graduate</td>
<td>96%</td>
</tr>
</tbody>
</table>

B. In this section you will be provided with data in Table 16 that indicate any trend of your program SFR relative to the systemwide average for your program. This is presented as the number of times in 5 years that your program SFR has exceeded the systemwide SFR for your program. Transfer the trend for lower division, upper division, and graduate SFR to the table below.

**Rubrics for SFR (Trend Comparison to Systemwide SFR over 5 years) (Criterion 4, Question IB)**

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend</td>
<td>5 of 5 years above the systemwide average SFR</td>
<td>3 or 4 years above the systemwide average SFR</td>
<td>1 or 2 years above the systemwide average SFR</td>
<td>Never above the systemwide average SFR</td>
</tr>
</tbody>
</table>

Transfer Data from Table 16

<table>
<thead>
<tr>
<th></th>
<th>Trend - Number of Years Program SFR exceeded Systemwide SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>3</td>
</tr>
<tr>
<td>Upper Division</td>
<td>4</td>
</tr>
<tr>
<td>Graduate</td>
<td>4</td>
</tr>
</tbody>
</table>

II. Instructional Costs per FTES (Department Total Annual Instructional Costs/FTES – College Year) (25%)

The departmental annual instructional costs, the FTES for college year, and the instructional cost per FTES are provided in Table 17 of the supplemental data package. In brief, instructional costs include faculty, lecturer and technical staff salaries. College year includes summer, fall, winter and spring quarters. Transfer your department’s average instructional cost per FTES and average increase/decrease in cost over 4 years to the following table.

**Rubrics for Instructional Costs per FTES (Trend over 4 Years) (Criterion 4, Question II)**

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend</td>
<td>Significant decrease in</td>
<td>Moderate decrease in</td>
<td>Moderate increase in</td>
<td>Significant increase in</td>
</tr>
</tbody>
</table>
average year to year percent change in cost | average year to year percent change in cost | average year to year percent change in cost | average year to year percent change in cost
---|---|---|---

Transfer Data from Table 17

<table>
<thead>
<tr>
<th>Earth and Environmental Sciences</th>
<th>Average Instructional cost per FTES</th>
<th>Average Increase in instructional cost per FTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$2,560.56</td>
<td>7.71%</td>
</tr>
</tbody>
</table>

III. Narrative (up to 250 Words) (50%)

Please use this opportunity to explain the meaning of the data in the tables for the programs covered by this report. In terms of Costs and Productivity, what does the data say about the programs? What subtleties might be lost? Cover trends, efficiency, and/or current resources. If significant, mention any differences between programs covered by the report. In the overall score for the Costs and Productivity criterion, your narrative will carry the same weight as the data analysis.

| Rubrics for Costs and Productivity Narrative (Criterion 4, Question III) |
|---|---|---|---|
| 4 | 3 | 2 | 1 |
| The narrative provides a clear and convincing interpretation of how the data show the program has comparatively high productivity relative to costs and it provides a compelling case for these trends to continue. | The narrative provides an adequate interpretation of how the data show the program has reasonable productivity relative to costs, and it provides a strong case for this to continue. | The narrative provides an adequate interpretation of how the data show the program has reasonable productivity relative to costs but inadequately addresses trends. | The narrative fails to provide a relevant explanation (and justification) of the program’s relative productivity and costs as reflected in the data. |

The five-year average for Student Faculty Ratio (SFR) for lower-division Geology courses was 4% higher than the systemwide value, and the SFR for upper-division Geology courses was 39% higher than systemwide. Our lower-division SFR values exceeded the systemwide values during three of the five years evaluated, and our upper-division SFR exceeded systemwide 4 of 5 years. During this period, the department's average annual increase in instructional cost per FTES was 7.71%. Both department total instructional salaries and department FTES experienced an overall increase during this period, but total salaries increased faster than FTES. The data presented in 4.I and 4.II above do not show simple trends during the reporting period. The number of tenure track faculty (4) and staff (2) remained the same during this period.
Planning for Distinction
Instructional Program Criteria and Template
Geology BA/BS Program

Based on both internal and external demand, we expect enrollments in both GE and majors classes to increase during the next five years. This should cause SFR and program productivity to also increase.

Criterion 5: Unique Issues and Future Directions (15%)

<table>
<thead>
<tr>
<th>ASSUMPTIONS and INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The prompts here allow programs to provide qualitative information. Use this space to discuss your unique issues not covered elsewhere in the template. Discuss your future direction with respect to existing resources, the impact of declining resources, and/or the potential of augmented resources. Each is equally good in support of a program. Address resource types, areas of need, and service issues that are important to the program.</td>
</tr>
</tbody>
</table>

I. Rubrics for Criterion 5: Unique Issues and Future Directions
Rubrics for Unique Issues and Future Directions (Criterion 5, Questions I, II, III and IV)

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited resources would be necessary for this program to be enhanced.</td>
<td>Additional resources would enhance the program.</td>
<td>Significant additional resources are needed to enhance the program.</td>
<td>Even considering unique features and ideas for the use of additional resources, enhancement of the program appears unlikely.</td>
</tr>
</tbody>
</table>

I. Use of Existing Resources (Up to 125 words)
- Discuss the efficiency of the way you use existing resources to meet current academic needs. Is there room to grow the program within the program’s resources?

Both tenure track faculty and lecturers teach a variety of courses. We utilize qualified lecturers to teach some of the courses that are required for the bachelor’s degree. Majors courses with small enrollments are rotated so that each course is offered only once every two years. This provides a wider variety of courses for students and shortens the time needed to graduate. It also increases enrollments and SFR. The program could potentially grow to 30 students with existing resources, though this would result in a reduction in the amount of time that faculty would be able to devote to advising student projects and theses.

II. Impact of Declining Resources (Up to 125 words)
- What would be the impact of reduced resources to your program? Identify unique issues of concern and explain how they would affect your program, CSUEB, and the local area/region.
Loss of resources would have a significant negative impact on the program. A reduction in the frequency of course offerings would lead to longer graduation times for students and decrease the ability of the program to attract high-quality applicants. Given the growing demand for geoscientists in the Bay Area and the nation as a whole in the next decade, reduced resources would render the program and the University less capable of fulfilling the needs of the 21st century.

III. Impact of Augmentation (Up to 125 words)

- If additional resources were provided to your program, how would they be used? What new services would you be able to provide to CSUEB and and/or the local community?

If additional resources were available, we would seek an additional tenure-track faculty member, which would enable us to expand our course offerings and increase the number of majors in the program. Depending on the area of expertise of the new faculty member, we would be able to offer new courses to students in other departments, and outreach and public education to the community on geologic hazards.

IV. Additional Information (Up to 250 words)

Use this space either to continue I, II, or III above -OR- to address any other unique issue and potential not covered elsewhere in this report.

The Geology BA/BS program, described in this report, is one of three programs offered by the Department of Earth and Environmental Sciences. The other programs are the Geology MS and the Environmental Science BS. Faculty, staff, equipment, and facilities are shared by the three programs.

Compared with other geoscience programs in the Bay Area, the Geology BA/BS program at CSUEB has unique strengths in applied geosciences, especially in the areas of hydrogeology, geochemistry, and earthquake hazards. This unique combination of skills is highly sought after by employers in the Bay Area and elsewhere in urban areas with geologic hazards. During the past five years, two new tenure-track faculty members have been hired and the course curriculum has been steadily updated, with many new courses implemented.

Several upper-division courses in Geology are taken by graduate students in our MS program, either as electives or to clear course deficiencies. This tends to increase the quality of the courses.
Planning for Distinction

Instructional Program Criteria and Template

Submitted Nov. 15th, 2013

College or Unit: College of Science
Report No. COS 16
Programs Included: Geology MS

Total number of service courses provided to other programs: 0

Please use Tables 1-6 to prepare your write-ups for the questions in this background information section (up to 250 words in total).

I. Program History and Development
   Provide a brief overview of each program’s history and development with emphasis on the last five years.

II. Describe the role of GE (use Table 4).

III. Describe the role of Graduation Requirements (use Table 4).

IV. Describe the role of service courses.

V. Describe the course delivery method for your program(s) (use Table 5).

VI. Describe the course format for your program(s) (use Table 6)

The Geology MS program at CSUEB has been providing advanced training in applied geology for over 30 years, and has produced highly distinguished graduates who are now practicing professionals in industry, government, and academia. All graduate courses are offered in the evening to allow working professionals to attain an advanced degree. The program was revised in 2005 by introducing a project option as an alternative to the University Thesis. Students now have the option of completing a 1-2 unit research project and additional coursework instead of the 9-unit University Thesis. The project can be completed by most students in 1-2 quarters, and is well-suited for the majority of students in the program. Both the number of students enrolled and degrees granted have recently increased, which we attribute to a combination of the program revisions and new courses that have been developed.

All courses in the program are taught in-person. Students are exposed to a variety of instructional formats, including lectures, hands-on lab sessions, and seminars. Lectures introduce basic principles, analysis methods, interpretation, and case histories. Lab sessions include analytical lab work, data acquisition in the field, and data analysis in the computer lab. The curriculum is well suited to in-person instruction. Students choose from a large number of graduate geology courses, and are required to take a graduate seminar twice during their program. This allows students to tailor the program to their learning needs. Department faculty take full advantage of digital course content delivery through the Blackboard Learning Management System.
Criterion 1: Consistency with CSUEB Shared Strategic Commitments and Institutional Learning Outcomes (10%)

I. Institutional Learning Outcomes: (70%)
With the understanding that programs may not demonstrate alignment to every ILO, please provide a brief narrative of less than 60 words each explaining your current and/or planned alignment for each ILO (Note that Specialized Discipline is more fully evaluated within Program Quality).

Provide evidence to support current and/or planned alignment for each ILO (no more than 60 words for each ILO)

Rubrics for ILOs¹(Criterion 1, Question I)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides clear and compelling evidence of alignment to the learning outcome in the current program.</td>
<td>Provides partial evidence of alignment to the learning outcome in the current program.</td>
<td>Provides evidence of alignment to the learning outcome in the near future.</td>
<td>Provides little or no evidence of alignment to the learning outcome currently or in the near future.</td>
<td></td>
</tr>
</tbody>
</table>

¹Each ILO narrative is rated. Final score is average of the ratings.

1. Graduates of CSUEB will be able to think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and everyday problems

Students are required to take two graduate seminars, in which they learn to critically analyze primary literature. In other courses such as hydrogeology and applied geophysics, they learn advanced quantitative methods. These skills, along with the required research component of the graduate program, equip students with the ability to address complex problems in the Bay Area and California.

2. Graduates of CSUEB will be able to communicate ideas, perspectives, and values clearly and persuasively while listening openly to others

Students learn to present their positions clearly and persuasively in written and oral form in class assignments. Graduate seminars and other graduate courses include writing requirements, e.g., project reports, theses, term papers, and precis. Many graduate courses have oral communication requirements and peer review of presentations. Others include group- and team-based projects that encourage listening.

3. Graduates of CSUEB will be able to apply knowledge of diversity and multicultural competencies to promote equity and social justice in our communities
The diverse student population in the Geology graduate program, including international students, provides students with a broad perspective and encourages them to consider the effects of policy and resource management decisions.

4. Graduates of CSUEB will be able to work collaboratively and respectfully as members and leaders of diverse teams and communities

Geology is inherently interdisciplinary, requiring a collaborative approach to problem solving in field activities, the laboratory, the public sector, and private industry. Coursework prepares our students with a broad skillset and interdisciplinary perspective suitable for taking part in collaborative efforts in their workplace and career.

5. Graduates of CSUEB will be able to act responsibly and sustainably at local, national, and global levels

The ability to act responsibly and sustainably requires knowledge of the Earth sciences. In the geology graduate program, topics include water resources, natural hazards, natural resources exploration, and global change (e.g., climate change). Courses include discussions of controversial topics such as hydraulic fracturing, urban development in seismically-vulnerable areas, and over-exploitation of water resources.

6. Graduates of CSUEB will demonstrate expertise and integration of ideas, methods, theory and practice in a specialized discipline of study.

Students in Geology apply principles of the natural sciences to understand Earth systems, crossing disciplinary boundaries to find complex solutions. Students in the program are required to integrate content knowledge from many physical and life science disciplines in their coursework and research. Graduates demonstrate their expertise by successful completion of a capstone Project or University Thesis.

II. Shared Strategic Commitments: (30%)

1. Reinforce academic quality through open-minded inquiry, innovative teaching, engaged learning, and distinguished scholarship

2. Enhance our inclusive campus, responding to the backgrounds and interests of our diverse community and promoting their academic, professional and personal development

3. Serve students first, by expanding access and enhancing each student’s educational experience and prospects for success as a graduate and life-long learner

4. Foster a vibrant community through enriched student services and student life that support student engagement and learning

5. Contribute to a sustainable planet through our academic programs, university operations, and individual behavior
6. Continuously improve our efficiency, transparency, and accountability while practicing mutual respect, responsiveness, and collaboration across the University

7. Support the civic, cultural, and economic life of all communities in the regions we serve through partnerships that promote education and social responsibility

8. Demonstrate our continuing record of leadership and innovation in higher education, focused on 21st century skills, including science, technology, engineering, and mathematics (STEM)

In addition to ILO’s, many programs may be directly aligned with one or several of the higher order Shared Strategic Commitments of the University. These connections can reinforce the program’s contribution to CSUEB standards. Please provide a narrative to describe how your program is currently aligned and/or intends to become aligned in the near future with any of the eight CSUEB Shared Strategic Commitments. (Please use a total of 120 words or less. You may use the narrative to cover one or several of the SSC’s as you see fit and as best applies to your program)

Rubrics for SSCs² (Criterion 1, Question II)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides clear and compelling evidence of contribution toward 3 or more of the SSC’s.</td>
<td>Provides clear and compelling evidence of contribution toward 1-2 SSC’s or partial evidence of contribution toward 4 or more.</td>
<td>Provides partial evidence of contribution to 2-3 of the SSC’s.</td>
<td>Provides little or no evidence of contribution to more than 1 of the SSC’s.</td>
<td></td>
</tr>
</tbody>
</table>

²Evaluation is based on the single narrative response

SSC #5: The program uses scientific and data-driven methods to address sustainability issues relating to controversial topics such as climate change, hydraulic fracturing, and marine seismic exploration.

SSC #7: Faculty are involved in seismic hazard education and evaluation, which contributes to the safety of our communities. Graduates work in companies and agencies critical to the economy of California. Faculty participate in community outreach events, including the biennial CSUEB Science Festival, and are featured speakers at local libraries and historical societies.

SSC #8: Faculty work to increase the number of STEM professionals and improve the quality of STEM education through participation in the Institute for STEM Education, Gateways, and the East Bay STEM network. Two faculty have participated in PEIL grants.

**Criterion 2: Internal and External Demand (25%)**
Planning for Distinction
Instructional Program Criteria and Template
Geology MS Program

I. FTES, Number of Majors, and Number of Degrees Awarded

A. FTES (35%)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Middle Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Middle Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom Quartile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total FTES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: FTES by Prefix by Remedial, Lower Division, Upper Division, and Graduate

<table>
<thead>
<tr>
<th>GEOL MS</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Lower Division</td>
<td>99.79</td>
<td></td>
</tr>
<tr>
<td>Upper Division</td>
<td>84.10</td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>5.15</td>
<td></td>
</tr>
<tr>
<td>TOTAL FTES</td>
<td>189.04</td>
<td>2</td>
</tr>
</tbody>
</table>

B. Number of Majors, Options and Minors (for information only, no rubric)

Table 8: Total Number of Students by Majors, Option, and Minors

<table>
<thead>
<tr>
<th>Major</th>
<th>Option</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Geology MS</td>
<td>Total Students in Major Degree Program -</td>
<td>12.6</td>
</tr>
</tbody>
</table>
C. Number of Degrees Awarded (30%)

Rubrics for Degrees Awarded* (Criterion 2, Question IC)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Awarded</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
</tbody>
</table>

*If a program is new and no degrees have been awarded, the task group will use the quartile for majors instead of the quartile for degrees awarded.

Table 9: Total Number of Degrees Awarded for the College Year

<table>
<thead>
<tr>
<th>Major</th>
<th>Option</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology MS</td>
<td>Total Students Awarded Degrees</td>
<td>0.8</td>
<td>1</td>
</tr>
</tbody>
</table>

D. For this criterion examine the data for quarterly FTES, number of students by major, by options and minors, and number of degrees awarded by major, options and minors. Please also examine the data for service courses offered by your program to serve other programs and any other relevant information. Please write up to 250 words describing the internal and external demand for your program. Explain any significant changes in program demand over the past 5 years.

Rubrics for Narrative (Criterion 2, Question ID)

<table>
<thead>
<tr>
<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>

Score in this area (from 0-2 pts) may be added to one factor in internal demand (FTES, #majors, or #degrees awarded) to a maximum factor score of 4 pts.

The number of Geology MS majors increased throughout the period of the data provided (F08-F12), with 18 majors enrolled in Fall 2012. An increase in the number of degrees awarded is expected to follow about 2-3 years after the increase in enrollments, with the lag corresponding to the time taken to complete the program. The number of degrees has started
to increase, with two degrees awarded in 2011-2012 (Table 8) and five degrees awarded in 2012-2013 (based on new IRA data, not included in Table 8). Based on these data, we expect the internal demand to continue to increase during the next five years.

Existing graduate courses in groundwater and isotope geochemistry are useful to graduate students in other fields, especially Biology and Chemistry, and we anticipate a continuing demand for these courses. Our new tenure track hire in Environmental Science could develop a graduate level course in soil chemistry in response to internal demand.

We offer graduate level classes in engineering geology and applied geophysics that may be useful to graduate students in Engineering.

Our existing course in earthquake seismology contains material on signal processing and time series analysis that may be useful for graduate students in statistics, engineering, and mathematics.

We foresee a growing need for graduate courses in geospatial methods and GIS (geographic information systems). A course of this type could draw graduate students from different programs, including Biology, Statistics, and Computer Science.

II. California State Jobs Projections for Each Program (35%)

A. California Occupational Employment Projection (COEP) for 2010 to 2020 compiled by the State of California’s Employment Development Department is provided in a separate spreadsheet emailed to you with the supplemental data package for information required in criterion 2. Chair or program director can use the suggested total jobs and transfer the total jobs for your major to line 1 of the table below.

Rubrics for Total Jobs* (Criterion 2, Question IIA)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>
| Total Jobs | Top Quartile | Upper Middle Quartile | Lower Middle Quartile | Bottom Quartile

* The instructional program task group will determine the ranges for the four quartiles after all jobs data has been collected from all programs.

<table>
<thead>
<tr>
<th>Programs</th>
<th>TOTAL Jobs for each program from worksheet in Appendix 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology MS</td>
<td>1950 (from Table 10)</td>
</tr>
</tbody>
</table>
B. Please discuss the selections you made for the total jobs in your worksheet in Appendix 3 (no more than 125 words).

- How do the job projections relate to your program and the external demand for your program's resources and expertise?
- What other factors not represented by the COEP also indicate or explain local and regional external demands for your program?

### Rubrics for Total Jobs Narrative (Criterion 2, Question II B)

<table>
<thead>
<tr>
<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>

Score in this area (from 0-2 pts) may be added to the Total Jobs category to a maximum factor score of 4 pts.

Employment of geologists is projected to grow nationwide by 19% from 2010-2020 (Bureau of Labor Statistics). Growth in California will be even stronger than the national average, and salaries of geologists compare favorably to other scientists (American Geosciences Institute, 2011). Many job openings are expected in the Bay Area with consulting firms, geotechnical companies, and state and municipal agencies. As the construction industry continues to recover from the 2008 recession, the demand for geologists in the Bay Area is expected to increase. Ongoing demand for energy, combined with innovations in drilling and production technology, have caused a resurgence in domestic oil and gas exploration and has led to an increase in the demand for graduates with the MS degree in Geology.
Criterion 3: Program Quality (30%)

Instructional Achievement Program Faculty

I. Instructional Achievement (25%)

Rubrics for Program Faculty - Instructional Achievement (Criterion 3, Questions 1.1a, 1b, 2, 3 and 4)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Program has compelling evidence of implementing teaching</td>
<td>Program shows evidence of implementing some strategies for</td>
<td>Program has maintained effective teaching strategies without</td>
<td>Program has minimum effective teaching strategies without</td>
</tr>
<tr>
<td></td>
<td>improvement strategies based upon evaluation of outcomes; faculty</td>
<td>teaching improvement based upon evaluation of outcomes; faculty</td>
<td>improvement related to evaluation of outcomes; faculty receive</td>
<td>improvement related to evaluation of outcomes; faculty receive</td>
</tr>
<tr>
<td></td>
<td>receive significant external teaching awards, teaching</td>
<td>receives some awards, grants and recognitions for teaching.</td>
<td>few grants, awards or recognitions of instructional excellence.</td>
<td>no awards, grants or recognitions for teaching excellence.</td>
</tr>
<tr>
<td></td>
<td>grants and recognition of instructional excellence.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Student and peer evaluations (overall for the program) (up to 100 words). Scores for on-ground course evaluations are provided in Table 11 and on-line course evaluations are provided in a separate PDF file with the supplemental data package.

1a. List average teaching evaluation scores (average for questions 1-8 of the teaching evaluation questionnaire) for all program faculty in Fall, Winter and Spring Quarters of the 2012-13 academic year.

<table>
<thead>
<tr>
<th>Input Department Name</th>
<th>On-Ground Course Evaluations Dept Mean (Q1-8)</th>
<th>Transfer Data from Table 11</th>
<th>On-line Course Evaluations Dept Mean (Q1-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2012</td>
<td>1.41</td>
<td>1.41</td>
<td>1.41</td>
</tr>
<tr>
<td>Winter 2013 Dept</td>
<td>1.32</td>
<td>1.31</td>
<td>1.31</td>
</tr>
<tr>
<td>Spring 2013 Dept</td>
<td>1.4</td>
<td>1.28</td>
<td>1.28</td>
</tr>
</tbody>
</table>

1b. System for continuous improvement of teaching (up to 100 words)
Present evidence of applying results of student and peer evaluations of tenured and tenure-track faculty, and lecturers for teaching improvement

The student evaluation scores in the table above are on a scale of 1-4, where 1 is the most favorable. Our overall evaluations range from 1.3 to 1.4. Student evaluations are used as a mechanism for providing all departmental faculty with feedback on how to improve their teaching technique. Individual faculty use student evaluations and input for continuous improvement of their courses and techniques. Student evaluations are utilized in both the RTP review of tenured/tenure-track faculty and the Department Chair’s annual performance reviews of lecturers.

2. Teaching awards, teaching grants, and recognitions (up to 100 words)

List significant external and internal teaching awards, grants and recognitions

Awards: Seitz: Outstanding Professor 2009-2010.


3. Faculty-supervised student projects (up to 100 words)

Provide evidence of faculty mentoring of students. Include, for example, approaches to advising, directed study or student research, independent study, and/or clubs or student professional chapters that involve faculty mentorship.

Each student in the Geology MS program conducts independent research by completing either a Project or Thesis. Each student is assigned a faculty advisor, who helps the student design the project. Many students also participate in faculty-sponsored research projects that include field work and laboratory analysis, and have been coauthors on publications and conference presentations. Graduate student participants are a key component of externally funded research. Students in the Geology MS program organized student chapters of two professional organizations in 2013; the American Association of Petroleum Geologists and the Society of Exploration Geophysicists. Each chapter has a faculty sponsor.
4. Other evidence of quality indicators related to instruction that may not be listed elsewhere, including, for example, rigor of course syllabi and assignments, faculty diversity within the program (up to 100 words)

In order to be admitted to the program, applicants must have completed specific courses in geology, chemistry, physics, and mathematics. Students engage in rigorous exercises and advanced quantitative methods to solve geochemical, geophysical, and geological problems. Computer exercises include modeling and data processing using discipline-specific software. Faculty and students bring diverse skills, knowledge, and abilities to bear on interdisciplinary problems and students take away experience in data integration and teamwork.

Professional Achievement
II. Professional Achievement (25%)

Rubrics for Program Faculty - Professional Achievement (Criterion 3, Questions II 1a, 1b, 1c, 2, 3)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>

1. Professional contributions

1a. TT faculty contributions
Please use worksheet in the Appendix 4 and complete one worksheet for each faculty member and transfer the cumulative data to the “Total Number” column for the corresponding year. Then use the total number for the particular year divided by the number of TT faculty for that year on the third row under “Total Number” column and compute the average per tenured & tenured-track faculty for that particular year under column and enter “Average per TT” in the table below.

1b. Comment on contributions in professional achievement by TT and FERPs (up to 50 words)
Strayer: Oral presentation at national meeting; Geological Society of America (2013).
Seitz: presentation at international meeting; Goldschmidt Conference (2013).
1c. Comment on contributions in professional achievement by lecturers and FERPs (up to 50 words)

Pauly: article in peer-reviewed journal Geochemistry Geophysics Geosystems (2011).
Drumm: presentation at national meeting, Association of Environmental & Engineering Geologists (2012).

2. List significant examples for the following (up to 100 words):
   - Research grants (source and dollar amounts)
   - Professional consultancies
   - Professional awards/engagements

**Research Grants:**
Seitz: NASA, $178K (2011)

**Professional Consultancies:**

**Professional awards:**
Moran: President’s award, California Groundwater Resources Association (2008, 2009);
Technical advisory committee for UC Davis-led California Nitrate Assessment (2011-2012).

3. List significant professional activities (up to 100 words):
   - Leadership positions in professional societies, conferences
   - Editorial and review contributions
   - Fellowships
   - Invited (keynote, sponsored exhibitions and performances)


**Craig:** Proposal review panel, US Geological Survey (2012), Organizing committee, East Bay Earthquake Conference (2008); Governing Board, Moss Landing Marine Laboratories; Program Committee, American Geophysical Union Fall Meeting (2008); Reviewer, National Science Foundation. Invited speaker: Hayward Historical Society (2012).

**Strayer:** Sabbatical, National Taiwan University (2009-2010).
Program Design
Curriculum, Assessment, and Student Success
III. Program Design (25%)

Rubrics for Program Design (Criterion 3, Questions III 1 and 2)

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptional evidence of relevance and innovation in program design.</td>
<td>Good evidence of relevance and innovation in program design.</td>
<td>Some evidence of relevance and innovation in program design.</td>
<td>Minimal evidence of relevance and innovation in program design.</td>
</tr>
</tbody>
</table>

1. Describe the relevancy of your program as it aligns with internal and external needs (up to 100 words). Specifically, emphasize evidence of the following:
   - Existence of advisory board, curriculum updates, etc.
   - Systematic review and update of curriculum with input from external sources
   - Alignment of needs to internal (campus) and external (local, regional, national, international) communities
   - Systematic alumni tracking and employer surveys

In order to provide current, relevant curricula, we utilize the Five-Year Review process, along with continuous feedback from students, alumni and employers. The main employers for geoscientists in the Bay Area are environmental and engineering consulting firms. The oil and gas sector is the main employer of geoscientists nationally.

Since our last Five-Year Review, seven new graduate geology classes were added covering topics related to tectonics, geochemistry, and seismology. These skills make our graduates competitive in the workplace whether they choose to work for an environmental or engineering consulting firm, government agency, or oil and gas company.

2. List/describe innovations of the program curriculum (up to 100 words). Specifically emphasize the following:
   - What steps has the program taken to develop innovative and forward-looking curricula?
   - Use of technology: Computer literacy, teaching enhancements, etc.
   - Pedagogical innovations: experiential learning, online, etc.
   - Self-support programs, credential, certificate, etc.

A project-based degree option was successfully implemented, resulting in increases in the number of students in the program and student graduation rate. All graduate courses are offered in the evening so that working professionals can attend. Courses include hands-on
exercises that involve interpretation, modeling, and simulation. Several courses involve collaborative projects that emphasize project and problem-based learning. Course content is delivered online through Blackboard. Courses incorporate experiential learning through field work that teaches practical skills such as the acquisition of real data.

IV. Program Implementation and Outcomes (25%)

IV. Rubrics for Program Implementation and Outcomes (Criterion 3, Questions IV 1, 2, 3, 4 and 5)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is accredited (where relevant); provides compelling evidence of a systematic assessment process and program improvement; demonstrates high student achievement</td>
<td>Is accredited (where relevant); provides evidence of an assessment process and program improvement; demonstrates good student achievement</td>
<td>Provides some evidence of an assessment process and program improvement; demonstrates satisfactory student achievement</td>
<td>Provides minimal evidence of an assessment process and program improvement; demonstrates minimal student achievement</td>
<td></td>
</tr>
</tbody>
</table>

Describe your program implementation, improvement efforts, and outcomes. Specifically, include the following (where relevant)

1. Accreditation, licensure, and external recognitions; list/describe the following (up to 100 words):
   - Accreditations (where relevant), meeting licensure requirements (where relevant), and recognitions by external bodies

   Not applicable.

2. Effectiveness and sufficiency of current resources; list/describe the following (up to 100 words):
   - Important facilities, equipment and information/library resources, and the degree to which they affect program quality

Modern equipment that is used effectively for instruction and research includes a handheld x-ray fluorescence analyzer, laser isotope analyzer, groundwater field equipment, and high-pressure/high-temperature fluid densimeter. Geophysical equipment includes a 48-channel seismic system, resistivity system, ground-penetrating radar system, magnetometer, and GPS system.

A 10-seat departmental computer laboratory is well maintained by campus IT services. The hardware is less than two years old. Software and licenses are kept up-to-date.
The University Library contains valuable resources for graduate students in both digital and print form. It provides online access to databases and online journals specific to the geosciences.

3. Student advising, experiential learning, internships, co-op, service learning; list/describe the following (up to 100 words):
   - Student degree roadmaps, faculty advisors, student centers, affiliated partners (public/private) etc.

New students meet with the Graduate Coordinator for orientation and initial course advising. Each student is assigned a faculty advisor who serves as the student’s project or thesis supervisor. Due to the modest size of the program, students receive individualized attention. Some graduate students participate in faculty-supervised research that is supported by research grants. Others have had internships at the U.S. Geological Survey, Lawrence Livermore National Laboratory, and consulting firms. Some students in the graduate program are employed by local geoscience-related firms and agencies while in the program, and apply the knowledge they gain in class directly to their careers.

4. Assessment of learning outcomes; list/describe evidence for the following (up to 150 words):
   - Modifying and improving your program based on assessment of learning outcomes

The Geology MS assessment plan includes reviews of specific learning activities by students, and faculty evaluation of a Master's Project or Thesis (required from all graduate degree candidates), plus evaluation at a thesis defense. All students are required to complete specific learning activities in Geology coursework. Faculty review of the M.S. project or thesis is probably the most effective assessment tool we have to measure the overall achievement of the student and the overall effectiveness of our graduate program. The graduate seminar allows assessment of students’ ability to combine methods from multiple disciplines to solve complex interdisciplinary problems.

The assessment plan is currently under revision. The updated plan will include a curriculum matrix that will show how program learning outcomes (PLOs) are met in individual courses. We will assess one PLO per year during the next few years.

5. Student success; list/describe the following (up to 100 words):
   - Placements (major-related employment paid and unpaid, graduate school acceptance)
   - Employer evaluations (if available), alumni success
   - Student awards, presentations, recognitions, internships, etc. (at CSUEB and post-degree)
   - Data from exit interviews or alumni surveys (Tables 12-15 in the supplemental data package) may be used if available.
Recent graduates have found career-track jobs as geoscientists with environmental & engineering consulting firms (URS, Fugro, ERM), an instrument manufacturer (Geometrics), oil and gas companies (Chevron, Horizon Drilling, Geosan Mongolia), and government agencies (East Bay Regional Parks, Lawrence Livermore National Laboratory, US Geological Survey, California Geological Survey, San Francisco Public Utilities Commission).

One recent graduate is in a PhD program at Arizona State University.

Students have given presentations at professional meetings including AAPG, AGU, and GRA. Four students have completed internships at LLNL since 2009.

Since 1999, eight geology graduate students have won the Harrington Award for Outstanding University Thesis.

**Criterion 4: Costs and Productivity (20%)**

Cost and Productivity are often measured in ratios, trends, and comparisons. As in the case here, often only easily available data are used. Notice that programs are grouped by prefix and compared to systemwide and campus averages. Whether the tables like these imply strength, weakness, or something in between, even whether the comparisons are fair, is usually a matter of discussion with a dean or in a Five Year Review.

1. **Student Faculty Ratio (FTES/FTEF) (25%)**

Program prefix level SFR and comparable systemwide program SFR are provided for the last 5 years for inspection; those data appear in Table 16 of the supplemental data package. To be considered separately are lower division, upper division, and graduate level SFRs.

A. You are given “% Difference” value over a 5 year period, comparing your program SFR data with systemwide averages for your program. If your program SFR is higher than the systemwide for a given year, notice that the value is presented as a positive (“+”) percentage. If it is presented as a negative percentage (“−”), your program SFR for that year is lower than the systemwide average. The resulting four values are then averaged for you. Transfer the appropriate values to the template as specified.

**Rubrics for SFR (Comparison to Systemwide SFR over 5 years) (Criterion 4, Question IA)**

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average % change in SFR is equal to or greater than +20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average % change in SFR is greater than zero, but less than +20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average % change in SFR is within the range zero to -20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average % change in SFR is more negative than -20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Planning for Distinction
Instructional Program Criteria and Template
Geology MS Program

Data from Table 16:

<table>
<thead>
<tr>
<th></th>
<th>Average Change SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>4%</td>
</tr>
<tr>
<td>Upper Division</td>
<td>39%</td>
</tr>
<tr>
<td>Graduate</td>
<td>96%</td>
</tr>
</tbody>
</table>

B. In this section you will be provided with data in Table 16 that indicate any trend of your program SFR relative to the systemwide average for your program. This is presented as the number of times in 5 years that your program SFR has exceeded the systemwide SFR for your program. Transfer the trend for lower division, upper division, and graduate SFR to the table below.

**Rubrics for SFR (Trend Comparison to Systemwide SFR over 5 years) (Criterion 4, Question IB)**

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 of 5 years above the systemwide average SFR</td>
<td>3 or 4 years above the systemwide average SFR</td>
<td>1 or 2 years above the systemwide average SFR</td>
<td>Never above the systemwide average SFR</td>
<td></td>
</tr>
</tbody>
</table>

Data from Table 16

<table>
<thead>
<tr>
<th></th>
<th>Trend - Number of Years Program SFR exceeded Systemwide SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>3</td>
</tr>
<tr>
<td>Upper Division</td>
<td>4</td>
</tr>
<tr>
<td>Graduate</td>
<td>4</td>
</tr>
</tbody>
</table>

II. **Instructional Costs per FTES (Department Total Annual Instructional Costs/FTES – College Year) (25%)**

The departmental annual instructional costs, the FTES for college year, and the instructional cost per FTES are provided in Table 17 of the supplemental data package. In brief, instructional costs include faculty, lecturer and technical staff salaries. College year includes summer, fall, winter and spring quarters. Transfer your department’s average instructional cost per FTES and average increase/decrease in cost over 4 years to the following table.

**Rubrics for Instructional Costs per FTES (Trend over 4 Years) (Criterion 4, Question II)**
III. Narrative (up to 250 Words) (50%)

Please use this opportunity to explain the meaning of the data in the tables for the programs covered by this report. In terms of Costs and Productivity, what does the data say about the programs? What subtleties might be lost? Cover trends, efficiency, and/or current resources. If significant, mention any differences between programs covered by the report. In the overall score for the Costs and Productivity criterion, your narrative will carry the same weight as the data analysis.

<table>
<thead>
<tr>
<th>Rubrics for Costs and Productivity Narrative (Criterion 4, Question III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
</tr>
<tr>
<td>The narrative provides a clear and convincing interpretation of how the data show the program has comparatively high productivity relative to costs and it provides a compelling case for these trends to continue.</td>
</tr>
</tbody>
</table>

The five-year average for Student Faculty Ratio (SFR) for Geology graduate courses was 96% higher than the systemwide value. The program’s annual SFR values exceeded the systemwide values during four of the five years evaluated. During this period, the department’s average annual increase in instructional cost per FTES was 7.71%. Both department total instructional salaries and department FTES experienced an overall increase during this period, but total salaries increased faster than FTES. The data presented in 4.I and 4.II above do not show simple trends during the reporting period. Fluctuations in our program’s SFR data may arise due to the relatively small number of sections taught per year. The number of tenure track faculty (4) and staff (2) remained the same during this period. Evaluation criteria of the broader impacts of external research funding is weighted heavily toward educational benefits, which depend on an active graduate program with student workers and student participants in research projects.
We expect SFR and program productivity to increase during the next five years based on the growth in the number of majors during the reporting period, as described above under Criterion 2, Question ID.

Criterion 5: Unique Issues and Future Directions (15%)

ASSUMPTIONS and INSTRUCTIONS
The prompts here allow programs to provide qualitative information. Use this space to discuss your unique issues not covered elsewhere in the template. Discuss your future direction with respect to existing resources, the impact of declining resources, and/or the potential of augmented resources. Each is equally good in support of a program. Address resource types, areas of need, and service issues that are important to the program.

I. Rubrics for Criterion 5: Unique Issues and Future Directions

Rubrics for Unique Issues and Future Directions (Criterion 5, Questions I, II, III and IV)

<table>
<thead>
<tr>
<th>Rubrics for Unique Issues and Future Directions (Criterion 5, Questions I, II, III and IV)</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited resources would be necessary for this program to be enhanced.</td>
<td>Additional resources would enhance the program.</td>
<td>Significant additional resources are needed to enhance the program.</td>
<td>Even considering unique features and ideas for the use of additional resources, enhancement of the program appears unlikely.</td>
<td></td>
</tr>
</tbody>
</table>

I. Use of Existing Resources (Up to 125 words)
- Discuss the efficiency of the way you use existing resources to meet current academic needs. Is there room to grow the program within the program’s resources?

Tenure track faculty in the department teach as many as three different graduate courses, and lecturers also occasionally teach graduate courses. Graduate courses are rotated so that each course is offered only once every 2-3 years. This provides a wider variety of courses for students and shortens the time needed to graduate. It also increases enrollments and SFR. Currently the factor that limits the size of the program is the number of project or thesis students that each faculty member can adequately advise. The graduate program could potentially grow to 30 students with existing resources, though this would result in a reduction in the amount of time that faculty would be able to devote to advising student projects and theses.
II. Impact of Declining Resources (Up to 125 words)
   - What would be the impact of reduced resources to your program? Identify unique issues of concern and explain how they would affect your program, CSUEB, and the local area/region.

Loss of resources would have a significant negative impact on the program. A reduction in the frequency of course offerings would lead to longer graduation times for students and decrease the ability of the program to attract high-quality applicants. Given the growing demand for geoscientists in the Bay Area and the nation as a whole in the next decade, reduced resources would render the program and the University less capable of fulfilling the needs of the 21st century workforce. Externally-funded research is greatly enhanced by the existence of the graduate program. A significant portion of the department’s external research funds would not have been obtained without the educational component of the project justification.

III. Impact of Augmentation (Up to 125 words)
   - If additional resources were provided to your program, how would they be used? What new services would you be able to provide to CSUEB and and/or the local community?

If a limited amount of additional resources were available, we would recommend that faculty be given course release for serving as project and thesis adviser for graduate students. This would allow us to increase the size of the program without decreasing the quality of the independent research experience for students. If a larger amount of resources were available, we would seek an additional tenure-track faculty member, which would enable us to expand our course offerings and increase the number of majors in the program. Depending on the area of expertise of the new faculty member, we would be able to offer new courses to graduate students in other departments, and outreach and public education to the community on geologic hazards.

IV. Additional Information (Up to 250 words)
   Use this space either to continue I, II, or III above -OR- to address any other unique issue and potential not covered elsewhere in this report.

The Geology MS program, described in this report, is one of three programs offered by the Department of Earth and Environmental Sciences. The other programs are the Geology BA/BS and the Environmental Science BS. Faculty, staff, equipment, and facilities are shared by the three programs. Total enrollments for the department (measured in FTES) quadrupled between 2005 and 2009.

Compared with other geoscience graduate programs in the Bay Area, the Geology MS program at CSUEB has unique strengths in applied geosciences, especially in the areas of hydrogeology, geochemistry, and earthquake hazards. This unique combination of skills is highly sought after
by employers in the Bay Area and elsewhere in urban areas with geologic hazards. During the past five years, two new tenure-track faculty members have been hired and the graduate course curriculum has been steadily updated, with many new courses implemented.

The program has attracted several excellent students with degrees in Earth Science or other fields having course deficiencies in Geology. These students typically take several core classes in our Geology BS program during their first year in the program.

Because the demographic of geoscience disciplines is dominated by Caucasian males, our small program has the potential to significantly impact the gender and ethnic diversity of practicing professionals in the Bay Area and elsewhere. The program has also started to attract international students from Asia and Africa. During the past few years, we have had majors from India, China, Mongolia, Egypt, Nigeria, and Iran.
The Environmental Science (ENSC) program began in 1998 as an interdisciplinary program with four departments; Biological Sciences, Chemistry, Geology, and Geography and Environmental Studies. ENSC courses were taught by faculty from these departments. In 2006 the Environmental Science program merged with the Department of Geological Science, forming what is today the Department of Earth and Environmental Sciences. In response to external reviewer comments from the last Five Year review, The Environmental Science BS degree requirements were revised Fall 2009 by increasing the number of required ENSC courses and reducing the number of courses required in other disciplines. The existing four program options were replaced with three. A new faculty member specializing in Environmental Science was hired in Fall 2013, and will teach primarily ENSC courses.

All lower-division ENSC courses have been approved for GE credit, and two are part of freshman GE clusters. As a result, GE has made up a significant portion (about 50%) of total ENSC enrollments during the past three years. In 2011-12, nine ENSC courses were offered, with total enrollments of 540 and total GE enrollments of 270.

The majority of the courses in this program are taught in person. To date, one hybrid course has been offered. Lab sections focus on hands-on skills, practical knowledge, and field work (with occasional field trips) and are well suited to in-person instruction.

The majority of the enrollments are in the lecture sections. Lab and seminar sections are designed for majors and have smaller enrollments.
Criterion 1: Consistency with CSUEB Shared Strategic Commitments and Institutional Learning Outcomes (10%)

I. Institutional Learning Outcomes: (70%)
With the understanding that programs may not demonstrate alignment to every ILO, please provide a brief narrative of less than 60 words each explaining your current and/or planned alignment for each ILO (Note that Specialized Discipline is more fully evaluated within Program Quality).

Provide evidence to support current and/or planned alignment for each ILO (no more than 60 words for each ILO)

Rubrics for ILOs1(Criterion 1, Question I)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides clear and compelling evidence of alignment to the learning outcome in the current program.</td>
<td>Provides partial evidence of alignment to the learning outcome in the current program.</td>
<td>Provides evidence of alignment to the learning outcome in the near future.</td>
<td>Provides little or no evidence of alignment to the learning outcome currently or in the near future.</td>
<td></td>
</tr>
</tbody>
</table>

1 Each ILO narrative is rated. Final score is average of the ratings.

1. Graduates of CSUEB will be able to think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and everyday problems

Environmental problems are among the most complex issues facing humanity in the 21st century. A rigorous, quantitative understanding of the physical, chemical, and biological processes underpinning environmental systems is necessary to synthesize solutions. Environmental Science courses require students to think critically and creatively through experimental design, lab work, and field work, and apply their knowledge to complex problems.

2. Graduates of CSUEB will be able to communicate ideas, perspectives, and values clearly and persuasively while listening openly to others

Communication of scientific concepts to broader audiences is crucial to improving societal understanding of local and global environmental issues. Environmental science students learn to critically analyze environmental issues by evaluating scientific literature and critically reading popular media. They consider multiple stakeholder perspectives, and learn to present their positions clearly and persuasively in written and oral form in class assignments.

3. Graduates of CSUEB will be able to apply knowledge of diversity and multicultural competencies to promote equity and social justice in our communities

The diverse student population in ENSC courses provides students with a broad perspective and encourages them to consider the effects of policy and resource management decisions on the
entire community. Content in ENSC courses also addresses issues related to environmental equity, justice, and ethics.

4. Graduates of CSUEB will be able to work collaboratively and respectfully as members and leaders of diverse teams and communities

Environmental science is inherently interdisciplinary, requiring a collaborative approach to problem solving in field activities, the laboratory, the public sector, and private industry. Students develop collaborative skills through organized group projects, including organized discussion projects and field work. Coursework prepares our students with a broad skillset and interdisciplinary perspective suitable for participating in collaborative efforts in their workplace and career.

5. Graduates of CSUEB will be able to act responsibly and sustainably at local, national, and global levels

The ability to act responsibly and sustainably requires knowledge of environmental issues. Environmental science is motivated by questions of the sustainability of human impacts on the Earth. Topics encompassing local, national and global sustainability are woven throughout the ENSC curriculum and comprise an overarching theme of the major. Scientific and quantitative approaches to sustainability are highlighted in several courses.

6. Graduates of CSUEB will demonstrate expertise and integration of ideas, methods, theory and practice in a specialized discipline of study.

Students in Environmental Science apply principles of the natural sciences to understand environmental systems, crossing disciplinary boundaries to synthesize knowledge and create solutions to the complex environmental issues of the 21st century. Students apply different research methodologies, integrating quantitative and qualitative data in the study of the environment. Students are required to choose from one of three specialized degree options.

II. Shared Strategic Commitments: (30%)

1. Reinforce academic quality through open-minded inquiry, innovative teaching, engaged learning, and distinguished scholarship

2. Enhance our inclusive campus, responding to the backgrounds and interests of our diverse community and promoting their academic, professional and personal development

3. Serve students first, by expanding access and enhancing each student’s educational experience and prospects for success as a graduate and life-long learner

4. Foster a vibrant community through enriched student services and student life that support student engagement and learning

5. Contribute to a sustainable planet through our academic programs, university operations, and individual behavior
6. Continuously improve our efficiency, transparency, and accountability while practicing mutual respect, responsiveness, and collaboration across the University.

7. Support the civic, cultural, and economic life of all communities in the regions we serve through partnerships that promote education and social responsibility.

8. Demonstrate our continuing record of leadership and innovation in higher education, focused on 21st century skills, including science, technology, engineering, and mathematics (STEM).

In addition to ILO’s, many programs may be directly aligned with one or several of the higher order Shared Strategic Commitments of the University. These connections can reinforce the program’s contribution to CSUEB standards. Please provide a narrative to describe how your program is currently aligned and/or intends to become aligned in the near future with any of the eight CSUEB Shared Strategic Commitments. (Please use a total of 120 words or less. You may use the narrative to cover one or several of the SSC’s as you see fit and as best applies to your program)

Rubrics for SSCs\(^2\) (Criterion 1, Question II)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Provides clear and compelling evidence of contribution toward 3 or more of the SSC’s.</td>
<td>Provides clear and compelling evidence of contribution toward 1-2 SSC’s or partial evidence of contribution toward 4 or more.</td>
<td>Provides partial evidence of contribution to 2-3 of the SSC’s.</td>
<td>Provides little or no evidence of contribution to more than 1 of the SSC’s.</td>
</tr>
</tbody>
</table>

\(^2\)Evaluation is based on the single narrative response

The Environmental Science program uses scientific and data-driven methods to address sustainability issues such as ecological responses to human activities. Courses challenge students to consider issues of environmental justice. (SSC #5)

Faculty are working to increase the number of STEM professionals and improving the quality of STEM education through their participation in the Institute for STEM Education, Gateways, and the East Bay STEM network. We have developed K-12 partnerships in 4 counties and 10 school districts to improve the STEM pipeline. Faculty have participated in PEIL grants to improve instruction. (SSC #8)

Courses incorporate inquiry-based activities, flipped classes, and other student-centered pedagogies. (SSC#1)

Faculty participate in community outreach events, including the biennial CSUEB Science Festival, and are featured speakers at local libraries and historical societies. (SSC #7)
Criterion 2: Internal and External Demand (25%)

I. FTES, Number of Majors, and Number of Degrees Awarded

A. FTES (35%)

Rubrics for Total FTES (Criterion 2, Question IA)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FTES</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
</tbody>
</table>

Table 7: FTES by Prefix by Remedial, Lower Division, Upper Division, and Graduate

<table>
<thead>
<tr>
<th>ENSC</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Lower Division</td>
<td>36.08</td>
<td></td>
</tr>
<tr>
<td>Upper Division</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TOTAL FTES</td>
<td>36.08</td>
<td>1</td>
</tr>
</tbody>
</table>

B. Number of Majors, Options and Minors (for information only, no rubric)

Table 8: Total Number of Students by Majors, Option, and Minors

<table>
<thead>
<tr>
<th>Major</th>
<th>Option</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Science BS</td>
<td>Total Students in Major Degree Program - DEGREE PROGRAM TOTAL (Unduplicated)</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>Environmental Science BS</td>
<td>Total Major Program Enrollments - PROGRAMS TOTAL (Duplicated)</td>
<td>36</td>
</tr>
</tbody>
</table>
### C. Number of Degrees Awarded (30%)

**Rubrics for Degrees Awarded* (Criterion 2, Question IC)**

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Awarded</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
</tbody>
</table>

*If a program is new and no degrees have been awarded, the task group will use the quartile for majors instead of the quartile for degrees awarded.

### Table 9: Total Number of Degrees Awarded for the College Year

<table>
<thead>
<tr>
<th>Major</th>
<th>Option</th>
<th>5-Year Average</th>
<th>Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Science BS</td>
<td>Total Students Awarded Degrees – Deg.Tot (unduplicated)</td>
<td>3.8</td>
<td>1</td>
</tr>
<tr>
<td>Environmental Science BS</td>
<td>Total Degrees Awarded – Deg.Opt.Tot (duplicated)</td>
<td>3.8</td>
<td>1</td>
</tr>
</tbody>
</table>
D. For this criterion examine the data for quarterly FTES, number of students by major, by options and minors, and number of degrees awarded by major, options and minors. Please also examine the data for service courses offered by your program to serve other programs and any other relevant information. Please write up to 250 words describing the internal and external demand for your program. Explain any significant changes in program demand over the past 5 years.

**Rubrics for Narrative (Criterion 2, Question ID)**

<table>
<thead>
<tr>
<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of internal demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>

Score in this area (from 0-2 pts) may be added to one factor in internal demand (FTES, #majors, or #degrees awarded) to a maximum factor score of 4 pts.

The number of Environmental Science majors grew from 26 to 37 during the period evaluated, with an average of 33. An average of 3.8 degrees per year were awarded. Based on the growth of the program over the past five years, and because the urgency of environmental problems will only increase in the next decade, we anticipate that both the number of majors and degrees awarded will continue to increase for the foreseeable future. The recent arrival of our first dedicated Environmental Science faculty member in the Fall of 2013 is also expected to positively impact the number of majors in the Environmental Science program. Increased ENSC course offerings, increased program visibility, and increased availability of student mentoring by faculty will encourage students with an interest in Environmental Science to choose the major. Program visibility will be enhanced by continued and expanding involvement in clusters, and GE courses focusing on climate change and other popular issues. The program was revised in 2009, and the degree options were changed. In order to include all students that were in the program during the period evaluated, both the old and new options are included in the tables above, which are based on revised versions of Tables 8 and 9 of the supplemental data package. The program offers both lower-division and upper-division courses. The FTES data that are listed in the table above for question IA are based solely on fall quarter FTES and do not accurately indicate the program's upper-division FTES.
II. California State Jobs Projections for Each Program (35%)

A. California Occupational Employment Projection (COEP) for 2010 to 2020 compiled by the State of California’s Employment Development Department is provided in a separate spreadsheet emailed to you with the supplemental data package for information required in criterion 2. Chair or program director can use the suggested total jobs and transfer the total jobs for your major to line 1 of the table below.

Rubrics for Total Jobs* (Criterion 2, Question IIA)

<table>
<thead>
<tr>
<th>Rating</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Jobs</td>
<td>Top Quartile</td>
<td>Upper Middle Quartile</td>
<td>Lower Middle Quartile</td>
<td>Bottom Quartile</td>
</tr>
<tr>
<td>Programs</td>
<td>Environmental Science</td>
<td>1380 (from Table 10)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The instructional program task group will determine the ranges for the four quartiles after all jobs data has been collected from all programs.

B. Please discuss the selections you made for the total jobs in your worksheet in Appendix 3 (no more than 125 words).
- How do the job projections relate to your program and the external demand for your program's resources and expertise?
- What other factors not represented by the COEP also indicate or explain local and regional external demands for your program?

Rubrics for Total Jobs Narrative (Criterion 2, Question II B)

<table>
<thead>
<tr>
<th>2 Points</th>
<th>1 Point</th>
<th>0 Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides more than 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides 1 clear example of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
<td>Provides no examples of established or emergent /growing sources of external demand for the expertise and resources of the program</td>
</tr>
</tbody>
</table>
Planning for Distinction
Instructional Program Criteria and Template
Environmental Science BS Program

Score in this area (from 0-2 pts) may be added to the Total Jobs category to a maximum factor score of 4 pts.

Employment of environmental scientists is projected to grow nationwide by 19% from 2010-2020 (BLS). Growth in California will be even stronger than the national average, and salaries of environmental scientists compare favorably to other scientists (AGI, 2011). Within the Bay Area, job openings are expected with consulting firms and state and municipal agencies. Ongoing projects in California that will require environmental scientists for the coming decades include restoration in the San Francisco Bay-Delta, land use and water supply planning that takes account of future climate scenarios, and cleanup of former industrial sites and military bases. Strong external demand should lead to an increase in the number of students in our program. Growth in green technology and sustainability should result in additional job opportunities.

Criterion 3: Program Quality (30%)

Instructional Achievement Program Faculty

I. Instructional Achievement (25%)

Rubrics for Program Faculty - Instructional Achievement (Criterion 3, Questions I.1a, 1b, 2, 3 and 4)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Program has compelling evidence of implementing teaching improvement strategies based upon evaluation of outcomes; faculty receive significant external teaching awards, teaching grants and recognition of instructional excellence.</td>
<td>Program shows evidence of implementing some strategies for teaching improvement based upon evaluation of outcomes; faculty receives some awards, grants and recognitions for teaching.</td>
<td>Program has maintained effective teaching strategies without improvement related to evaluation of outcomes; faculty receive few grants, awards or recognitions of instructional excellence.</td>
<td>Program has minimum effective teaching strategies without improvement related to evaluation of outcomes; faculty receive no awards, grants or recognitions for teaching excellence.</td>
</tr>
</tbody>
</table>

1. Student and peer evaluations (overall for the program) (up to 100 words). Scores for on-ground course evaluations are provided in Table 11 and on-line course evaluations are provided in a separate PDF file with the supplemental data package.
1a. List average teaching evaluation scores (average for questions 1-8 of the teaching evaluation questionnaire) for all program faculty in Fall, Winter and Spring Quarters of the 2012-13 academic year.

<table>
<thead>
<tr>
<th>Input Department Name</th>
<th>On-Ground Course Evaluations Dept Mean (Q1-8)</th>
<th>On-line Course Evaluations Dept Mean (Q1-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2012</td>
<td>1.41</td>
<td>1.41</td>
</tr>
<tr>
<td>Winter 2013 Dept</td>
<td>1.32</td>
<td>1.31</td>
</tr>
<tr>
<td>Spring 2013 Dept</td>
<td>1.4</td>
<td>1.28</td>
</tr>
</tbody>
</table>

1b. System for continuous improvement of teaching (up to 100 words)

Present evidence of applying results of student and peer evaluations of tenured and tenure-track faculty, and lecturers for teaching improvement

The student evaluation scores in the table above are on a scale of 1-4, where 1 is the most favorable. Our overall evaluations range from 1.3 to 1.4. Student evaluations are used as a mechanism for providing all departmental faculty with feedback on how to improve their teaching technique. Individual faculty use student evaluations and input for continuous improvement of their courses and techniques. Student evaluations are utilized in both the RTP review of tenured/tenure-track faculty and the Department Chair's annual performance reviews of lecturers.

2. Teaching awards, teaching grants, and recognitions (up to 100 words)

List significant external and internal teaching awards, grants and recognitions

Awards:
Seitz: Outstanding Professor 2009-2010.

Grants:
Moran: NSF travel grants to attend three Geoscience teaching workshops (3); Early Career Faculty in Geosciences; The Math You Need; Teaching Hydrogeology and Geochemistry in the 21st Century.
Planning for Distinction
Instructional Program Criteria and Template
Environmental Science BS Program

3. Faculty-supervised student projects (up to 100 words)
Provide evidence of faculty mentoring of students. Include, for example, approaches to advising, directed study or student research, independent study, and/or clubs or student professional chapters that involve faculty mentorship.

A major advantage of the CSUEB Environmental Science program over competing local institutions is the availability of individualized faculty mentoring and advising of students. At CSUEB, Environmental Science majors are involved in faculty-sponsored research projects, including both field work and laboratory analysis, and have been coauthors on publications and conference presentations. Faculty advise individual students on independent study and research projects, and mentor McNair Scholars and NSF LSAMP students. The department hosts seminars with speakers on topics related to environmental science. Majors participate in the Cummings Earth and Environmental Science Club, an ASI-supported student organization with a faculty sponsor.

4. Other evidence of quality indicators related to instruction that may not be listed elsewhere, including, for example, rigor of course syllabi and assignments, faculty diversity within the program (up to 100 words)
Environmental Science is an interdisciplinary program, and courses are taught by specialists in a wide array of scientific disciplines. As a result, students are exposed to many different faculty who are experts in their respective fields. Students in the program are exposed to a variety of instructional settings, including lectures, seminars, laboratory and field education. Required courses include year-long sequences in biology, chemistry and physics, and additional lower and upper division core requirements are uniformly quantitative and rigorous. The program’s scientific focus distinguishes it from the Environmental Studies B.A. program, and the interdisciplinary focus distinguishes it from other physical/biological sciences.
Professional Achievement
II. Professional Achievement (25%)

Rubrics for Program Faculty - Professional Achievement (Criterion 3, Questions II 1a, 1b, 1c, 2, 3)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Professional contributions
   1a. TT faculty contributions Please use worksheet in the Appendix 4 and complete one worksheet for each faculty member and transfer the cumulative data to the “Total Number” column for the corresponding year. Then use the total number for the particular year divided by the number of TT faculty for that year on the third row under “Total Number” column and compute the average per tenured & tenured-track faculty for that particular year under column and enter “Average per TT” in the table below.

   1b. Comment on contributions in professional achievement by TT and FERPs (up to 50 words)


   Strayer: oral presentation at national meeting; Geological Society of America (2013).
   Seitz: presentation at international meeting; Goldschmidt Conference (2013).

   1c. Comment on contributions in professional achievement by lecturers and FERPs (up to 50 words)

   Pauly: article in peer-reviewed journal Geochemistry Geophysics Geosystems (2011).
   Teitler: articles in peer-reviewed journals Paleoceanography (2010); Sedimentary Geology (2012).
   Drumm: presentation at national meeting, Association of Environmental & Engineering Geologists (2012).
2. List significant examples for the following (up to 100 words):
   - Research grants (source and dollar amounts)
   - Professional consultancies
   - Professional awards/engagements

**Research Grants:**

**Professional Consultancies:**

**Professional awards:**
Moran: President’s award, California Groundwater Resources Association (2008, 2009); Technical advisory committee for UC Davis-led California Nitrate Assessment (2011-2012).

3. List significant professional activities (up to 100 words):
   - Leadership positions in professional societies, conferences
   - Editorial and review contributions
   - Fellowships
   - Invited (keynote, sponsored exhibitions and performances)


Strayer: Sabbatical, National Taiwan University (2009-2010).
Program Design
Curriculum, Assessment, and Student Success

III. Program Design (25%)

Rubrics for Program Design (Criterion 3, Questions III 1 and 2)

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceptional evidence of relevance and innovation in program design.</td>
<td>Good evidence of relevance and innovation in program design.</td>
<td>Some evidence of relevance and innovation in program design.</td>
<td>Minimal evidence of relevance and innovation in program design.</td>
</tr>
</tbody>
</table>

1. Describe the relevancy of your program as it aligns with internal and external needs (up to 100 words). Specifically, emphasize evidence of the following:
   - Existence of advisory board, curriculum updates, etc.
   - Systematic review and update of curriculum with input from external sources
   - Alignment of needs to internal (campus) and external (local, regional, national, international ) communities
   - Systematic alumni tracking and employer surveys

The Environmental Science BS program was revised in 2009 in response to external reviewer recommendations. Several new courses were introduced, including the lower-division classes Global Environmental Problems (ENSC 2801) and Global Environmental Issues (ENSC 2802), which belong to GE clusters. Environmental Biology Laboratory (ENSC 2401) and Field Activity in Environmental Science (ENSC 2900) were created to provide more hands-on experience in the lab and field. Hazardous Waste Management (ENSC 4140) was added to address needs of local and regional employers. New TT faculty hired since 2008 have expertise in environmental hydrology, contaminants, and soil science, areas of employer demand.

2. List/describe innovations of the program curriculum (up to 100 words). Specifically emphasize the following:
   - What steps has the program taken to develop innovative and forward-looking curricula?
   - Use of technology: Computer literacy, teaching enhancements, etc.
   - Pedagogical innovations: experiential learning, online, etc.
   - Self-support programs, credential, certificate, etc.

We foresee a growing demand for curriculum related to climate, and in response have developed Global Change: Planet in Crisis (ENSC 2300). Hydrology and Hydrogeology courses are tailored toward critical evaluation of California’s water quality and quantity challenges. Through in-service training and connections with the NSF-sponsored workshops and materials, faculty employ active learning approaches geared specifically to environmental science. Faculty take advantage of CSUEB training on teaching enhancements and the online interactive capabilities of Blackboard. Students are exposed to diverse pedagogical methods including
testing claims with data, jigsaw cooperative learning, physical and numerical models, problem-solving-focused computer simulations, and meta-cognitive reflection.

IV. Program Implementation and Outcomes (25%)

IV. Rubrics for Program Implementation and Outcomes (Criterion 3, Questions IV 1, 2, 3, 4 and 5)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is accredited (where relevant); provides compelling evidence of a systematic assessment process and program improvement; demonstrates high student achievement</td>
<td>Is accredited (where relevant); provides evidence of a systematic assessment process and program improvement; demonstrates good student achievement</td>
<td>Provides some evidence of an assessment process and program improvement; demonstrates satisfactory student achievement</td>
<td>Provides minimal evidence of an assessment process and program improvement; demonstrates minimal student achievement</td>
</tr>
</tbody>
</table>

Describe your program implementation, improvement efforts, and outcomes. Specifically, include the following (where relevant)

1. Accreditation, licensure, and external recognitions; list/describe the following (up to 100 words):
   - Accreditations (where relevant), meeting licensure requirements (where relevant), and recognitions by external bodies

   Not applicable.

2. Effectiveness and sufficiency of current resources; list/describe the following (up to 100 words):
   - Important facilities, equipment and information/library resources, and the degree to which they affect program quality

Departmental GPS units, hydrologic measurement equipment, microscopes, and balances are effective and of sufficient quality, but more units are needed for lab classes. Larger, stand-alone equipment that is supported by individual faculty includes a handheld x-ray fluorescence analyzer, groundwater pump, laser isotope analyzer, and electrical resistivity surveying equipment. These items are used for both instruction and research. A departmental computer laboratory (10 seats) is used by students as a collaborative workspace and for completing homework assignments and lab exercises. Larger (24-seat) computer classrooms are important for classroom instruction. University Library journal subscriptions and books support student projects and research.
3. Student advising, experiential learning, internships, co-op, service learning; list/describe the following (up to 100 words):
   - Student degree roadmaps, faculty advisors, student centers, affiliated partners (public/private) etc.

Degree roadmaps have been prepared for each of the three options in the Environmental Science BS, and are available on the College of Science website. Undergraduate students perform faculty-supervised research that is supported by research grants and work study. Student internships are an option for the ENSC major, and students have worked for the City of Hayward and other agencies. Due to the individualized nature of our program, departmental faculty are able to actively advise undergraduate students. Service learning and experiential learning are key to increasing program impact and visibility in the future, and are areas of active development.

4. Assessment of learning outcomes; list/describe evidence for the following (up to 150 words):
   - Modifying and improving your program based on assessment of learning outcomes

The capstone seminar course (ENSC 4800) is a key element of the assessment of student learning outcomes. The major is interdisciplinary, and the capstone seminar allows assessment of students’ ability to combine methods from multiple disciplines to solve complex interdisciplinary problems. The course is taught yearly, and student reports will be used to assess the attainment of each learning outcome.

Assessment of student achievement in the capstone course and other ENSC courses will be used to modify course and program content in response to areas demonstrating a need for improvement. The arrival of a new faculty member in the Fall of 2013 will allow for an expansion of course offerings in order to further strengthen the program.

5. Student success; list/describe the following (up to 100 words):
   - Placements (major-related employment paid and unpaid, graduate school acceptance)
   - Employer evaluations (if available), alumni success
   - Student awards, presentations, recognitions, internships, etc. (at CSUEB and post-degree)
   - Data from exit interviews or alumni surveys (Tables 12-15 in the supplemental data package) may be used if available.

Graduates from our program have obtained positions at environmental consulting firms, state and federal agencies, city and county agencies. Recent positions include lab manager at a national laboratory (supporting the research of hundreds of scientists, and supervising multiple laboratory facilities), fish & game warden, water district technician, project analyst in remediation, insect control technician, environmental education outreach specialist, and wastewater treatment plant technician. Recent ENSC alumni have entered graduate programs at Johns Hopkins University, UC Santa Barbara, and at Northern Arizona University.
Criterion 4: Costs and Productivity (20%)

Cost and Productivity are often measured in ratios, trends, and comparisons. As in the case here, often only easily available data are used. Notice that programs are grouped by prefix and compared to systemwide and campus averages. Whether the tables like these imply strength, weakness, or something in between, even whether the comparisons are fair, is usually a matter of discussion with a dean or in a Five Year Review.

I. Student Faculty Ratio (FTES/FTEF) (25%)

Program prefix level SFR and comparable systemwide program SFR are provided for the last 5 years for inspection; those data appear in Table 16 of the supplemental data package. To be considered separately are lower division, upper division, and graduate level SFRs.

A. You are given “% Difference” value over a 5 year period, comparing your program SFR data with systemwide averages for your program. If your program SFR is higher than the systemwide for a given year, notice that the value is presented as a positive (“+”) percentage. If it is presented as a negative percentage (“−”), your program SFR for that year is lower than the systemwide average. The resulting four values are then averaged for you. Transfer the appropriate values to the template as specified. Transfer the average change SFR for lower division, upper division, and graduate SFR to the table below.

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average % change in SFR is equal to or greater than +20%</td>
<td>Average % change in SFR is greater than zero, but less than +20%</td>
<td>Average % change in SFR is within the range zero to -20%</td>
<td>Average % change in SFR is more negative than -20%</td>
</tr>
</tbody>
</table>

Rubrics for SFR (Comparison to Systemwide SFR over 5 years) (Criterion 4, Question IA)

Transfer Data from Table 16

<table>
<thead>
<tr>
<th>Division</th>
<th>Average Change SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>85%</td>
</tr>
<tr>
<td>Upper Division</td>
<td>0%</td>
</tr>
<tr>
<td>Graduate</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

B. In this section you will be provided with data in Table 16 that indicate any trend of your program SFR relative to the systemwide average for your program. This is presented as the number of times in 5 years that your program SFR has exceeded the systemwide SFR for your program. Transfer the trend for lower division, upper division, and graduate SFR to the table below.
Rubrics for SFR (Trend Comparison to Systemwide SFR over 5 years) (Criterion 4, Question IB)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 of 5 years above the systemwide average SFR</td>
<td>3 or 4 years above the systemwide average SFR</td>
<td>1 or 2 years above the systemwide average SFR</td>
<td>Never above the systemwide average SFR</td>
</tr>
</tbody>
</table>

Transfer Data from Table 16

<table>
<thead>
<tr>
<th></th>
<th>Trend - Number of Years Program SFR exceeded Systemwide SFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Division</td>
<td>5</td>
</tr>
<tr>
<td>Upper Division</td>
<td>0</td>
</tr>
<tr>
<td>Graduate</td>
<td>not applicable</td>
</tr>
</tbody>
</table>

II. Instructional Costs per FTES (Department Total Annual Instructional Costs/FTES – College Year) (25%)

The departmental annual instructional costs, the FTES for college year, and the instructional cost per FTES are provided in Table 17 of the supplemental data package. In brief, instructional costs include faculty, lecturer and technical staff salaries. College year includes summer, fall, winter and spring quarters. Transfer your department’s average instructional cost per FTES and average increase/decrease in cost over 4 years to the following table.

Rubrics for Instructional Costs per FTES (Trend over 4 Years) (Criterion 4, Question II)

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Significant decrease in average year to year percent change in cost</td>
<td>Moderate decrease in average year to year percent change in cost</td>
<td>Moderate increase in average year to year percent change in cost</td>
<td>Significant increase in average year to year percent change in cost</td>
</tr>
</tbody>
</table>

Transfer Data from Table 17

<table>
<thead>
<tr>
<th></th>
<th>Average Instructional cost per FTES</th>
<th>Average Increase in instructional cost per FTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth and Environmental Sciences</td>
<td>$2,560.56</td>
<td>7.71%</td>
</tr>
</tbody>
</table>
III. **Narrative** (up to 250 Words) (50%)

Please use this opportunity to explain the meaning of the data in the tables for the programs covered by this report. In terms of Costs and Productivity, what does the data say about the programs? What subtleties might be lost? Cover trends, efficiency, and/or current resources. If significant, mention any differences between programs covered by the report. In the overall score for the Costs and Productivity criterion, your narrative will carry the same weight as the data analysis.

| Rubrics for Costs and Productivity Narrative (Criterion 4, Question III) |
|---|---|---|---|
| 4 | 3 | 2 | 1 |
| The narrative provides a clear and convincing interpretation of how the data show the program has comparatively high productivity relative to costs and it provides a compelling case for these trends to continue. | The narrative provides an adequate interpretation of how the data show the program has reasonable productivity relative to costs, and it provides a strong case for this to continue. | The narrative provides an adequate interpretation of how the data show the program has reasonable productivity relative to costs but inadequately addresses trends. | The narrative fails to provide a relevant explanation (and justification) of the program's relative productivity and costs as reflected in the data. |

The Student Faculty Ratio (SFR), measured as FTES/FTEF, in the Environmental Science program was significantly (85%) higher than the systemwide average, and exceeded the systemwide average for each of the five years evaluated. The program's SFR values reflect high course enrollments due to our increased participation in the General Education program. In addition, the Environmental Science BS program experienced an overall increase in the total number of majors during the past five years. Total enrollments for the department (measured in FTES), including both ENSC and GEOL course offerings, quadrupled between 2005 and 2009, largely due to increased participation in the General Education program.

The period evaluated represents a period of growth for the Environmental Science program following the incorporation of the program in the Department of Earth and Environmental Sciences (2006), the hiring of a new tenure-track hydrogeologist in 2008, and program revisions in 2009. We have hired a new tenure-track Environmental Scientist, who started in Fall 2013. We expect the new faculty member will help to sustain this high productivity while maintaining our high quality of instruction. Our new faculty member will continue to grow the program through participation in General Education clusters and the creation of new courses related to environmental science and sustainability.
Criterion 5: Unique Issues and Future Directions (15%)

ASSUMPTIONS and INSTRUCTIONS
The prompts here allow programs to provide qualitative information. Use this space to discuss your unique issues not covered elsewhere in the template. Discuss your future direction with respect to existing resources, the impact of declining resources, and/or the potential of augmented resources. Each is equally good in support of a program. Address resource types, areas of need, and service issues that are important to the program.

I. Rubrics for Criterion 5: Unique Issues and Future Directions
Rubrics for Unique Issues and Future Directions (Criterion 5, Questions I, II, III and IV)

<table>
<thead>
<tr>
<th>4</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Limited resources would be necessary for this program to be enhanced.</td>
<td>Additional resources would enhance the program.</td>
<td>Significant additional resources are needed to enhance the program.</td>
<td>Even considering unique features and ideas for the use of additional resources, enhancement of the program appears unlikely.</td>
</tr>
</tbody>
</table>

I. Use of Existing Resources (Up to 125 words)
- Discuss the efficiency of the way you use existing resources to meet current academic needs. Is there room to grow the program within the program’s resources?

During the past five years, we have relied significantly on lecturers to teach both ENSC courses and GEOL courses that are part of the Environmental Science curriculum. Existing tenure-track (TT) faculty within the department teach mainly GEOL courses. We have developed some new courses (e.g., ENSC 3500 – Environmental Hydrology) that are taught by existing departmental TT faculty. With the arrival of a new TT hire in Environmental Science in Fall 2013, we expect the reliance on lecturers to diminish and the consistency of instruction to improve. Nonetheless, we still only have one TT faculty member whose primary area expertise is Environmental Science, so it will be difficult for the program to significantly grow with existing resources.

II. Impact of Declining Resources (Up to 125 words)
- What would be the impact of reduced resources to your program? Identify unique issues of concern and explain how they would affect your program, CSUEB, and the local area/region.

Loss of resources would have significant negative impact on the program. As of Fall 2013, after a new hire, there is one full-time, tenure-track faculty member dedicated to ENSC courses, with other faculty members offering ENSC courses on an occasional basis. The balance of courses are taught by lecturers. Loss of resources would hamper the program’s ability to offer existing courses, let alone expand course offerings in response to pressing local and global environmental issues. Given the increasing demand for environmental scientists in the Bay Area
Planning for Distinction
Instructional Program Criteria and Template
Environmental Science BS Program

and the nation as a whole, reduced resources would render the program and the University less capable of fulfilling the needs of the 21st century workforce.

III. Impact of Augmentation (Up to 125 words)
- If additional resources were provided to your program, how would they be used? What new services would you be able to provide to CSUEB and and/or the local community?

With a relatively modest augmentation, we could establish on-campus outdoor learning tools, such as a centrally-located California native plant garden, an instructional garden for laboratory experiments and student-led projects, groundwater monitoring wells, and other environmental monitoring equipment. These resources would improve the visibility of program, help to attract new majors, and provide majors with important hands-on experience. Additionally, they would provide “testing areas” for incorporating on-campus activities into STEM education in local schools. With even more resources, a new faculty member specializing in urban ecology or the physical science applications of remote sensing (measurement of plant cover, soil types, and land-use change using airborne or ground-based methods) would provide the program with expertise complementary to our current specialties of environmental geology, hydrology, and pollution/contaminant remediation.

IV. Additional Information (Up to 250 words)
- Use this space either to continue I, II, or III above -OR- to address any other unique issue and potential not covered elsewhere in this report.

In the view of the department faculty, continued growth of the Environmental Science program and improved graduation rates would be stimulated by developing new courses in areas like advanced instrumental analysis, data analysis (environmental monitoring statistics), soil science, and water chemistry. New courses would provide students with training in field methods, with both on-campus and off-campus activities, increasing student engagement, improving learning, and ultimately leading to higher retention/graduation rates. Increases could also be achieved by developing suitable hybrid/online courses, such as pollution modeling.

A key to improving learning outcomes and growing the program is to focus on the strengths of environmental science: practical, hands-on, “real world” learning. This will require on-campus outdoor learning tools, as outlined in III above. Some of the benefits of these tools could be attained through field trips to local facilities or parks, but the transportation and time requirements could be prohibitive. In contrast, on-campus outdoor learning tools are easily and inexpensively available for ongoing class projects and teaching. Their use could be aligned with the needs of other departments/colleges. Increased program visibility from the outdoor learning tools would help to grow the program, and increased hands-on learning would help improve both student learning and the employability of graduates. Hands-on learning and field education are “high-impact practices” that improve student learning, retention, and graduation rates.
Appendix G. Assessment Plan
Department of Earth and Environmental Sciences
California State University, East Bay

ASSESSMENT PLAN 2013-14
GEOLGY B.S., B.A.

25 August 2014
Assessment Plan 2013-14
Geology B.S., B.A.

Contents
Program Learning Outcomes
PLO-ILO Alignment Matrix
Curriculum Map
Rubrics
  Critical Thinking
  Lab Project
Assessment Results, 2013-2014
  Overview
  Summary Sheets
    GEOL 3701 – Igneous and Metamorphic Petrology
    GEOL 3801 - Sedimentology and Stratigraphy
    GEOL 3810 - Structural Geology
    GEOL 3910 - Geologic Field Methods
Sample Assignments
  GEOL 3701 – Igneous and Metamorphic Petrology
  GEOL 3801 - Sedimentology and Stratigraphy
  GEOL 3810 - Structural Geology
  GEOL 3910 - Geologic Field Methods
Program Learning Outcomes
Geology B.S., B.A.

Students graduating with a B.S. or B.A. in Geology from Cal State East Bay will be able to:

1. identify and classify geologic materials, including minerals, rocks, and fossils, and know their material and/or biological properties or characteristics. (Geologic Materials)

2. collect, organize, and analyze qualitative and quantitative data from both field and laboratory investigations such as lithostratigraphic and biostratigraphic correlations, geologic maps, geophysical surveys, cross-sections, soil tests, and geochemical and groundwater quality analyses. (Data Analysis)

3. synthesize, interpret and critically analyze geologic datasets (2D and 3D) and reports using discipline-specific methods, techniques, and equipment. (Interpretation)

4. critically analyze geological and environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form. (Communication)

5. understand geologic time, evolution, Earth’s place in the Universe, and global-scale processes such as plate tectonics, earth systems interactions, and climate change. (Geologic Time)
ILO Alignment Matrix for Geology B.S., B.A. Programs

The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs).

<table>
<thead>
<tr>
<th>ILO 1: Thinking &amp; Reasoning</th>
<th>BSBA PLO 1 Geologic Materials</th>
<th>BSBA PLO 2 Data Analysis</th>
<th>BSBA PLO 3 Interpretation</th>
<th>BSBA PLO 4 Communication</th>
<th>BSBA PLO 5 Geologic Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILO 2: Communication</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ILO 3: Diversity*</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ILO 4: Collaboration</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ILO 5: Sustainability</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>ILO 6: Specialized Education</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*diversity in the natural world, including evolutionary diversity, and ranging from microscopic to astronomic scales.
## CSU East Bay, Dept. of Earth & Environmental Sciences

**Degree:** B.S. and B.A. in Geology

Levels: I = Introduced; P = Practiced; M = Mastered

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</thead>
<tbody>
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<td></td>
<td>GEOL 2101</td>
<td>Physical Geology</td>
<td>I*</td>
<td>I*</td>
<td>I*</td>
<td>I</td>
<td>I</td>
<td>I</td>
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<tr>
<td>*</td>
<td>GEOL 2102</td>
<td>Earth and Life Through Time</td>
<td>I*</td>
<td>P*</td>
<td>I</td>
<td>P*</td>
<td>P*</td>
<td>P*</td>
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<tr>
<td></td>
<td>GEOL 2600</td>
<td>Introduction to GIS</td>
<td>I</td>
<td>P</td>
<td>P</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>GEOL 3110</td>
<td>Principles of Geomorphology</td>
<td>P</td>
<td>P</td>
<td>I</td>
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<td>GEOL 3400</td>
<td>General Oceanography</td>
<td>P</td>
<td>P</td>
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<td>GEOL 3500</td>
<td>Environmental Hydrology</td>
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<td>P</td>
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<td></td>
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<tr>
<td>*</td>
<td>GEOL 3601</td>
<td>Mineralogy and Optical Crystallography</td>
<td>P*</td>
<td>P</td>
<td>P*</td>
<td></td>
<td>P*</td>
<td>P*</td>
</tr>
<tr>
<td>*</td>
<td>GEOL 3701</td>
<td>Igneous and Metamorphic Petrology</td>
<td>P*</td>
<td>P</td>
<td>P*</td>
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<td>P*</td>
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<tr>
<td>*</td>
<td>GEOL 3801</td>
<td>Sedimentology and Stratigraphy</td>
<td>P</td>
<td>P</td>
<td>P*</td>
<td>I</td>
<td>I*</td>
<td>I*</td>
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<tr>
<td>*</td>
<td>GEOL 3810</td>
<td>Structural Geology</td>
<td>P</td>
<td>P</td>
<td>I*</td>
<td>P*</td>
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</tr>
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<td>*</td>
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<td>Geologic Field Methods</td>
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<tr>
<td></td>
<td>GEOL 3999</td>
<td>Issues in Geological Sciences</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td>P</td>
<td>M</td>
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<tr>
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<td>GEOL 4010</td>
<td>Applied Geophysics</td>
<td>P*</td>
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<td></td>
<td>GEOL 4130</td>
<td>Survey of Geochemistry</td>
<td>P</td>
<td>P</td>
<td>I</td>
<td>P</td>
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<td>M</td>
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<tr>
<td></td>
<td>GEOL 4140</td>
<td>Hazardous Waste Management</td>
<td>P</td>
<td>P</td>
<td>P</td>
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<td>M</td>
<td>I</td>
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<td>Introduction to Planetary Science</td>
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<td>Hydrogeology</td>
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<td>GEOL 4600</td>
<td>GIS for Earth Sciences</td>
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</table>

**Proficiency Levels:** I = Introduced; P = Practiced; M = Mastered

* This course used to assess program learning outcomes

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This course used for 2013-2014 assessment
Creative thinking is both the capacity to combine or synthesize existing ideas, images, or expertise in original ways and the experience of thinking, reacting, and working in an imaginative way characterized by a high degree of innovation, divergent thinking, and risk taking.

This rubric may be applied to student **writing assignments** and **projects** in order to assess how well the Geology B.S., B.A. Program Learning Outcomes have been achieved.

<table>
<thead>
<tr>
<th>Exemplary</th>
<th>Accomplished</th>
<th>Competent</th>
<th>Insufficient Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Competencies</strong>&lt;br&gt;Strategies and skills that apply to geological problem solving (i.e. discipline-specific lab &amp; field exercises).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearly understands purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield. Proposes/develops new means methods to address the problem.</td>
<td>Strong understanding of purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield. Uses discipline-appropriate means to address the problem.</td>
<td>Understanding of the purpose and role of the exercise and some insight into its importance and context within the Earth Sciences and/or related subfield. Follows instructions and understands the steps.</td>
<td>Poor understanding of the purpose and role of the exercise with little/no insight into its importance and context within the Earth Sciences and/or related subfield. Unable to follow instructions.</td>
</tr>
<tr>
<td><strong>2. Problem Solving</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Develops a logical, consistent plan to solve problem, and recognizes consequences of solution and can articulate reason for choosing solution.</td>
<td>Develops a plan to solve the problem. Has some insight into consequences and some ability to articulate reason for choosing solution.</td>
<td>Considers and rejects less acceptable approaches to solving problem.</td>
<td>Only a single approach is considered and used to solve the problem.</td>
</tr>
<tr>
<td><strong>3. Embracing Contradictions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrates alternate, divergent, or contradictory perspectives or ideas fully. Proposes/uses multiple working hypotheses.</td>
<td>Incorporates alternate, divergent, or contradictory perspectives or ideas in a exploratory way. Applies multiple working hypotheses</td>
<td>Includes (recognizes value) alternate, divergent, or contradictory perspectives or ideas in a limited way. Has difficulty creating multiple working hypotheses</td>
<td>Fails to Acknowledge alternate, divergent, or contradictory perspectives or ideas. No use of multiple working hypotheses</td>
</tr>
<tr>
<td><strong>4. Innovative Thinking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creates a novel/unique idea, method, hypothesis, format, or product.</td>
<td>Imagines/conceives a novel/unique idea, method, hypothesis, format, or product.</td>
<td>Reformulates a collection of available ideas.</td>
<td>No new ideas</td>
</tr>
<tr>
<td><strong>5. Connections, Synthesis, Transformation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthesizes ideas or solutions into a coherent whole.</td>
<td>Connects ideas or solutions in novel ways.</td>
<td>Recognizes existing connections among ideas or solutions.</td>
<td>No recognition of significance of exercise to discipline or global context.</td>
</tr>
</tbody>
</table>

CSUEB Geology B.S., B.A. Program – LABORATORY SKILLS / COURSE PROJECT RUBRIC

Laboratory skills and course projects and assignments are where the discipline-specific skills, methods, techniques and processes that are fundamental to the Earth Sciences are acquired and utilized.

This rubric or portions of it may be applied to student laboratory and course assignments and projects in order to assess how well the Geology B.S., B.A. Program Learning Outcomes have been achieved.

<table>
<thead>
<tr>
<th>1. Organization</th>
<th>Exemplary 3</th>
<th>Accomplished 2</th>
<th>Competent 1</th>
<th>Insufficient Evidence 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization is clear, consistent, observable and skillful and content is cohesive.</td>
<td>Organization is clear, consistent &amp; observable.</td>
<td>Organization is intermittently observable.</td>
<td>Organization is poor or not observable.</td>
<td></td>
</tr>
</tbody>
</table>

| 2. Presentation | Work is attractive, clean, clear, accurate, visually strong | Work is well produced, clear, mostly-accurate, visually effective | Work is adequate with minor errors, visually inert | Work is unclear, informal, minimally conveys intent and error prone |


| 4. Execution | Work is complete to levels above expectation and turned in early or on time | Work is strong, complete and turned in on time | Work is adequate, complete and turned in on time | Work is incomplete or not turned in on time |

| 5. Connection, Synthesis, Transformation | Synthesizes ideas or solutions into a coherent whole. Creates connections to higher-level discipline-specific concepts and practices. | Connects ideas or solutions in novel ways. Recognizes connections to higher-level discipline-specific concepts and practices. | Acknowledges existing connections among ideas or solutions. | No recognition of significance of exercise to discipline or global context. |

Modified from: AAC&U
Overview
We present four assessments from the B.A and B.S. Program in Geology that evaluate a full range of Program Learning Outcomes. Not surprisingly, all of the assessments presented here are derived from laboratory-based assignments. Capstone and other milestone experiences in geology typically and necessarily integrate the traditional ‘lecture hall’ experiences of reading, critical analysis, and subsequent written communication (our PLOs 2 & 3), but also the very applied experience of working with geologic materials, maps and techniques in the laboratory and the field. As such, the Laboratory Skills / Course Project rubric is applied in all cases.

These four assessments analyze 30 separate pieces of student work derived from four sequential courses that progress in complexity.

In the two ‘lower-level’ classes (GEOL 3701 and 3801) overall class results are strong and there are no students that fall below the minimum competence level. In fact results indicate that our students are operating at or above the ‘accomplished’ level.

The two ‘upper-level’ classes (GEOL 3810 and 3910) are difficult courses, where students are introduced to the complications of three-dimensional geometry and thinking. These difficult-to-grasp concepts are applied in both the laboratory and in the field. Here we see the both the rigor of the courses and difficulty that some students have with 3D thinking, spatial relationships, their comfort working in the field, and applying mathematical analysis to natural systems. In these courses there are four instances where students perform below the level of basic competence, and two instances of work that is at, or just above, minimum competence level. The large standard deviation for the Field Methods (GEOL3910) is evidence of this.

Course assessments are briefly summarized below. Assessments were performed using the departmental rubrics, modified as needed to take into account the requirements of the assignment.

GEOL 3710 – Igneous and Metamorphic Petrology: Term Project

Term-long comprehensive study of a suite of rocks. A course average of 10.7/15, where 5/15 indicates “competence” and 10/15 indicates “accomplishment”. The large standard deviation (2.66) indicates that there is a wide range of abilities. The lowest average scores in the area of ‘Organization’ is consistent with difficulties students encounter when needing to track numerous aspects of the project and integrate them into a coherent piece of work.

This project provides an excellent introduction to the methods used by and skills required of a professional geologist. It incorporates all of the Geology BS/BA PLOs, and the students highly value the experience.

GEOL 3801 – Sedimentology and Stratigraphy: Cull Canyon Stratigraphic Section

Field data collection, laboratory analysis and discipline-specific write-up. Course average is 9.8/12, where 4/12 indicates competence and 9/12 indicates accomplishment. The lowest scores indicate that execution is a weak area relative to others. Future efforts to demonstrate methods, provide examples and make clear the expectations for the final product may help in this area, but overall the class results are very strong.

We would be wise to continue and ideally increase the number of field experiences in order to
produce students with strong field skills. There is no substitute for field experience and no question that the more time in the field that students accumulate, the more insight they will have in other aspects of geology.

**GEOL 3810 – Structural Geology: Term Project**

*A term-long, semi-cumulative analysis of a complexly deformed area in Montana. Course average is 8.6/15, where 5/15 is ‘competent’ and 10/15 is ‘accomplished’. With the exception of one student who barely met the competence threshold (5/12), the results are solid.

These types of term-long, highly integrative projects that simulate professional duties are an important part of a modern education in geology. The difficult nature of this type of assignment is visible in the low scores in the areas of "Quantitative Skills and Synthesis". This is not surprising considering that many students have poor math and critical analysis skills. Both of these are likely issues prior to attending CSUEB, and thus it is incumbent upon us to maintain and even increase the number of assignments that require our students to apply mathematical methods to geologic problems, and to read challenging scientific literature for content and analysis.

**GEOL 3910 – Geologic Field Methods: Geologic Map**

*Produce from direct field investigation a geologic map and report. Course average is 8/15, where 5/15 is ‘competent’ and 10/15 is ‘accomplished’. Two students failed to meet the competence threshold (5/12), and one was just above it (6/12). There is a relatively large range of scores, as indicated by the standard deviation of 4.65.

This serves as a capstone course and may be, in many ways, the most difficult course for many students: it is a field class, where ideally all of the methods from previous courses are applied. Issues range from discomfort from being in the field, difficulty recognizing rock types and structures, and inability to visualize in 3D. This assessment area does not necessarily measure how good a geologist a student may be, but rather reflects more on their ability to operate comfortably in a field environment (hills, wildlife, 3D, etc.), which is not necessary for all geologists, as some may prefer to work in laboratory or less rugged field environments.
CSUEB Geology B.S., B.A. Program Assessment

Rubric: Lab Project
Course: GEOL-3801: Sedimentology and Stratigraphy
Quarter: Spring 2014
Assignment: Cull Canyon Stratigraphic Column

<table>
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<th>Student ID</th>
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<th>Execution</th>
<th>Connection, Synthesis, Transformation</th>
<th>Total</th>
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</tbody>
</table>

Notes: Quantitative skills are not assessed by this project; they are assessed using other lab assignments in the course
CSUEB Geology B.S. Program - LAB SKILL COURSE PROJECT RUBRIC
APPLIED TO: GEOL3810 Winter 2014

GEOL3810 Quarter Lab Project: BS_PLO's 2 & 4  Class Average =  8.6

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CSUEB Geology B.S., B.A. Program Assessment
Rubric: Lab Project
Course: GEOL 3910
Quarter: Spring 2014
Assignment: Geologic Map

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<th>Student ID</th>
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<th>Connection, Synthesis, Transformation</th>
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</table>
SYNOPSIS: You will carry out a petrological research project for the rock suite of your choice from our outstanding collection. Then, similar to Mineralogy class last quarter, you will create and submit a manuscript suitable for publication in a petrological journal. However, this quarter, your manuscript will be based upon your own research, data collection, observations, discussion-synthesis, and conclusions. The rock suite project will be worth 20% of your overall course grade; do not take the project lightly! I recommend that you begin early in the quarter, as significant out-of-class lab time will be required.

TOPIC:

Choose a rock suite from our extensive collection. I suggest that you first look at the rock suites to learn which are available, then do some research on localities of interest before making your choice. I can help you decide if you want, just ask!

RESEARCH:

Your paper should include the general geology of your samples (geologic setting, location, previous work by others, etc.). The bulk of research, however, will be complete hand sample and thin section descriptions, following the same procedures as used in the class lab exercises. Collect data systematically - prepare tables and figures as appropriate. Labeled photographs, photomicrographs, and sketches are an excellent way to convey information. When you have completed the research, integrate what you observe about your samples with the bigger regional geologic picture. This is the quantum leap - you must synthesize your observations to come up with a petrogenesis for your rock suite that is supported by your observations. This requires a lot of thought.

MANUSCRIPT FORMAT:

Following examples from the journal Geochemica, Cosmochemica Acta (posted on Blackboard).

Organize your paper as follows:

Title

Abstract: 200 to 300 words; what did you do, how did you do it, what did you find out

Introduction – Geologic History – Setting etc. (you will have to research this…)
Methods – how did you carry out your study of your rock suite samples

Results – your hand sample and thin section descriptions, etc. (can be an Appendix…)

Discussion – how do your hand sample results fit into the context of the geologic setting and characteristics of your field area? Synthesize your results into a story…

Conclusions – what did you find?

Reference List

GUIDELINES:

In your paper you are expected to reference your sources -- class readings, any published source (books or articles) or the Internet (however, as the quality of materials on the Internet can vary drastically, you should use some discretion here). For a paper of this size, 10 cited references is a good average. YOUR PAPER MUST BE YOUR OWN WORK. Do not lift sentences directly from a text; this is plagiarism and is subject to academic punishment. Your must express the ideas and concepts in your own words. But you MUST cite/reference the source of your information -- give credit where credit is due. If you do not cite the source of your information, this is also plagiarism. Feel free to use illustrations – plots – diagrams, etc. (remember a picture says a thousand words…), just be sure to include Figure Numbers, Figure Captions, and Figure References.

Do not use quotes unless it is necessary to illustrate your point or you are critiquing someone else. For this paper, you should be able to express your ideas in your own words. Do not use terms or jargon that you are not familiar with. If I do not understand what you are writing about, I will come to you and ask and you must be able to explain what you mean.

Remember that petrology is a science concerned with phenomena at a wide variety of scales - from mappable units, to hand samples, to microscopic examination. Your paper should reflect this breadth of scale. Your paper should include a map of the geology and sample locations if available.

I will help you every step of the way - research, petrography, paper organization, etc. Just ask! The best way to get my help is to turn in a draft!!

REQUIREMENTS:

Length: 7-8 pages of double-spaced text (excluding title page, abstract, references, tables and figures).

1 inch margins all around with 12 pt font.
Follow the format for the journal Geochimica et Cosmochimica Acta for style (references, figure captions, organization, etc.). The instructions for contributors are found in each January issue of that journal (copy on our bookshelf; also scanned and posted on Blackboard).

**DUE DATES:**

**Rock Suite Selection Deadline:** see syllabus

**Manuscript first draft deadline:** see syllabus. This deadline is optional. You may turn in your paper on this date and I will grade it. If you are satisfied with your paper and grade, you have completed the assignment. If you are dissatisfied with your grade, you may edit/rewrite your paper and turn it in at the final deadline for a revised final grade.

**Manuscript final version deadline:** see syllabus. This deadline is mandatory. If you did not submit a first draft at the first deadline, you must submit a manuscript on or before this date.
(100 Points Possible)

(5) Title

(15) Abstract

(10) Introduction and Geologic Setting

(5) Methods

(15) Hand sample descriptions and observations

(15) Thin section descriptions and observations

(15) Discussion (Synthesis)

(15) Conclusions

(5) References: usage and list

Overall
Purpose: The following pages contain suggestions concerning how and what you should observe in the field, what to record and how to record it. In addition this exercise will acquaint you with some standard techniques for creating a stratigraphic section, collection of samples, and utilizing data gathered in the field.

Method: You will measure and describe the stratigraphic section of an exposure in Cull Canyon. A brief report, including graphic presentation of the section will be prepared. You will work in concert with a partner(s).

THE STRATIGRAPHIC SECTION
Measuring Section
In areas where the geology is not known, measuring and describing the stratigraphic section is one of the most important initial steps of a geological investigation. The obvious purpose behind measuring section is to familiarize the geologist with the local stratigraphy. Measuring a section also aids the geologist in recognizing structural complexities (duplication or omission of strata), interpreting the region’s tectonic history, and recognizing stratigraphic similarities (as well as differences) in other locales. The purpose behind having you measure section is two-fold. Number one, it is intended to familiarize you with the local stratigraphy, so that you can learn to recognize a formation or unit based on its lithologic character. Number two, while measuring the section, you are to observe and record specific information concerning the lithologic content of all units. Doing so will aid you in the interpretation of the region’s geologic history.

Lithologic Field Descriptions
1. Before commencing measurement, examine the section and decide on the subdivisions that are to be described. Normally, each measured unit will constitute a homogeneous bed (or group of beds) which has (have) uniform composition, texture, structure, and fabric.

2. Describe each unit in detail. Assigning rock names is to be done in accordance with the classification scheme of McBride which is appended on a later page in this handout. Individual, distinct rock types should be treated separately. Where units are thin, repetitive (either rhythmic or cyclic) and of similar rock type, it is appropriate and simplest to treat these units as one interbedded unit (e.g., see sample description below). You may find it more practical to take samples back to the lab in order to determine some of these descriptive features. If you bring samples back to the lab make sure you mark/note where they were collected and make sure the samples are labeled.
An example description is given below. For each lithologic unit, you are to determine, record and present (in your stratigraphic column), each of the following lithologic features, and in the following order:

1. Rock name
2. Mineralogy
3. Fresh color
4. Weathered color
5. Dominant grain size
6. Degree of sorting
7. Degree of rounding
8. Degree of induration (see below)
9. Bedding thickness (see below)
10. Bedding shape (planar parallel, wedge, lens)
11. Type of cement
12. Fossil content (non-, moderately-, or richly fossiliferous; identify major phyla)
13. Sedimentary structures
14. Basal contact relationships (gradational, sharp, erosive, unconformable)
15. Weatherability (slope-forming (erodable), cliff-forming (resistant))
16. Other pertinent features

Example

0-.3m  Limestone, (Calcite and minimal if any Dolomite), Light-gray organized into medium thickness beds consisting of rippled, coarse, well-sorted, well-rounded/abraded grains (dominantly skeletal fragments) at bottom, and thickly laminated mud at the top (Mud approx. 50%, Coarse sand approx. 30%, and gradational mix of the two approx. 20%, fossils include fragments of brachiopods, echinoderms, bivalves, and other unrecognizable skeletal fragments, a few distinguishable Archimedes, Fenestrellina, and Rhynchotreta.

.3-.8m  Sandstone (quartz (40%), feldspar (30%), rock fragments (10%) clay (10%, calcite cement (10%)), Reddish-orange, Medium-sand: poorly sorted, sub-angular grains, Medium-bedded, Cross-bedded, ripple marks and tool marks on bedding surfaces, Fossils consist of Atroya, assorted shell fragments, several individual vertical burrows (including Skolithos), and a few undefinable plant fragments.

Be sure to include the nature of unit contacts and any paleocurrent indicators in your description.

Do not omit items, e.g., if there are no fossils, don’t ignore it, call it non-fossiliferous.

Constructing the Stratigraphic Column

Graph paper will be provided upon which you can record your field observations as shown in the example (Figure 2.1), using the appropriate symbols (Figure 2.2). The final drafted stratigraphic section must exactly follow the format shown in figure 2.3, and include a detailed lithologic description (discussed above)

Report: The laboratory report will be in three parts.
1. Description of the measured section. Uppermost unit will be at top of the page, and lowermost unit at bottom of written description.
2. Graphic section which is a carefully prepared drawing that depicts basic features of the section to scale. See attached example. Section should include a scale, a title, and a legend, explaining symbols used in the graphic section.

3. Interpretation of depositional environments. This will begin with a statement of the evidence and will be followed by environmental interpretation. Vertical changes in lithology, structure, texture, etc. reflect changes of environment. Be certain that your interpretation accounts for such changes.

Use the following charts and diagrams for their respective features:

**Bedding**

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>thinly laminated</td>
<td>less than 3 mm</td>
</tr>
<tr>
<td>thickly laminated</td>
<td>3 mm to 1 cm</td>
</tr>
<tr>
<td>very thin-bedded</td>
<td>1 cm to 3 cm</td>
</tr>
<tr>
<td>thin-bedded</td>
<td>3 cm to 10 cm</td>
</tr>
<tr>
<td>medium-bedded</td>
<td>10 cm to 30 cm</td>
</tr>
<tr>
<td>thick-bedded</td>
<td>30 cm to 1 m</td>
</tr>
<tr>
<td>very thick-bedded</td>
<td>1-2 m</td>
</tr>
<tr>
<td>massive</td>
<td>&gt;2 m</td>
</tr>
</tbody>
</table>

**Degree of Sorting:**

- **Very well sorted**
- **Well sorted**
- **Moderately sorted**
- **Poorly sorted**

**Rounding:**

<table>
<thead>
<tr>
<th>Sphericity</th>
<th>Angularity</th>
</tr>
</thead>
</table>
| **High Sphericity**
|                 |
| **Low Sphericity**
|                 |
| 0                | VERY ANGULAR |
| 1                | ANGULAR     |
| 2                | SUB-ANGULAR |
| 3                | SUB-ROUNDED |
| 4                | ROUNDED     |
| 5                | WELL-ROUNDED |
Small Hand-Draw Structure Section

For your assigned map area, choose any 6-inch long segment of any of the cross-sections on your map (labeled A-A’ & B-B’, etc.) to:

1) Create a topographic profile of your chosen section, labeled after your map section in, i.e. a subsection of line A-A’ will be labeled a-a’.
- confirm your section choice with Strayer before beginning.
- you will be supplied a cross-section template (and online) on which you will construct your topographic profile.
- When the profile is perfect (check with Strayer), then make multiple copies. You will construct your Structure Sections on these.

2) Create a geologic cross-section that takes into account the contacts, faults and structure data that are within 2000 feet (1 inch) on either side of the cross-section.
- project data perpendicularly to the section line.
- make apparent dip corrections (use hand stereonet) for structure-section dips.

3) Using stereonet software, plot the S/D of bedding and fault dips (planes & poles for bedding; planes for faults – mark the faults, in 2 plots). Make a -diagram and interpret it.

Turn In (with your final Montana Map Project):
A) Completed colored & inked Structure Section;
B) Stereonets of bedding and faults, with faults plotted with bedding, and an interpreted -diagram of poles to bedding (3 total), and;
C) Brief, <1 page summary interpretation of the structure section and stereonets.
GEOL3810 Structural Geology      Winter 2014
Montana Map & 3D Model Project

Turn-In (in binder/folder, etc. format, appropriately labeled with separate sections A-C) - below):

A) Major Faults Three-Point Problems & Stereonets
- All materials (see [A] attached)

B) Small-Scale Structure Section
- All materials (see [B] attached)

C) Three-Dimensional Model of a Quadrangle in the Montana Disturbed (Thrust) Belt

(1a) Completed model in Move ‘.mve’ format with the following filename format (for example Strayer_SR.mve for a Sawtooth Ridge model) that includes the map surface and at least 2 constructed cross-sections and appropriate faults within the map volume.
(1b) Submit it to the class Wiki in a space created under your last name

(2a) Stereonet Analysis of the major folding in your area. Produce at least 1 b- or p-diagram for each important fold system in your area (min 2, max 5. CHECK WITH ME IF ANY QUESTIONS ON WHAT CONSTITUTES A FOLD OR SYSTEM PLEASE.
(2a) One paragraph description of fold/folding per stereonet and;
(2b) One paragraph on how they (the folds) are related to the local deformation there.

(3a) Brief description (1 page 1.5 spaced) of the stratigraphy in the map area, and relate the lithology to possible sedimentary environments of deformation. Ponder… which of these (if any) were being deposited syn-tectonically, and what was that environment?

(4b) Brief description (1-2 page 1.5 spaced) of the structural geology and geologic history of your specific map area and the larger region. Refer to Mudge72.pdf in the ‘MudgeMaps’ Dropbox site.

DUE March 11, 12 midnight. No Exceptions or Late Assignments.
Montana Map Project – 3Point Problems

You have an 8.5”x11” greyscale copy of your Montana map area. I have circled 6 locations – mostly on faults, but in some cases on formation contacts or igneous contacts – that you will do 3-point solutions for the attitude of the features that are circles. [COME SEE ME IF YOU ARE NOT CLEAR ON THE SPECIFIC FEATURES THAT ARE OUTLINED!]

1) Do the solutions using a combined graphical and mathematical technique on sheets of velum or white paper (6 solutions). See below – thousand words... (you use care and accurate technique!):

2) Plot your 6 fault planes as great circles on a paper stereonet, as well as 3-4 strike and dip values from the map that are nearby – ideally on both sides of the fault.

3) Answer: a) Do you see any patterns in the fault dip data? Anything that may relate to the lithologies involved or the E-W or N-S location in the system? b) how do the S/D’s from the adjacent sediments compare to the fault? Any observations there?
Hi Students,

Regarding the final report, it is time to start writing and drafting now. Below, I outline what is to be turned in on Friday 6/6/14 (no late reports accepted):

1) 5-7 pgs. written text; use the journal articles I have provided as templates (use Compton handouts as well),

2) all Mt. Diablo maps that you have used during your field work (these do not have to be inked),

3) final copy map (the two 11" x 17" sheets, taped together, rolled or folded), showing all your data inked and colored, with the cross-section location also shown, and

4) geologic cross-section, inked and colored as well; use only the bold 200 foot contours when drafting the topographic profile; show the shape of the fold where it has been removed by erosion (i.e. extrapolate the bedding above the topographic profile), and draw the section down to sea level.

I will place a map showing the cross-section line in the classroom tomorrow.

See you all Friday,

Dr. Kriens
Department of Earth and Environmental Sciences
California State University, East Bay

ASSESSMENT PLAN 2013-14

GEOLOGY M.S.

27 August 2014
Contents
Program Learning Outcomes
PLO-ILO Alignment Matrix
Curriculum Map
Rubrics
  Critical Thinking and Writing
  Oral Communication
  Quantitative Literacy
Assessment Results, 2013-2014
  Overview
  Summary Sheets
    GEOL 6320 – Groundwater (Critical Thinking and Writing)
    GEOL 6414 - Earthquake Geology (Critical Thinking & Writing)
    GEOL 6414 - Earthquake Geology (Oral Communication)
    GEOL 6910 – University Thesis (Critical Thinking and Writing)
Sample Assignments
  GEOL 6320 – Term Paper
  GEOL 6414 - Precis
  GEOL 6910 – MS Prospectus Writing Guide
Geology M.S. Program Learning Outcomes

Students graduating with an M.S. in Geology from Cal State East Bay will be able to:

1. attain an advanced understanding of the relationship between geologic materials and their physical and chemical properties. (Geologic Materials)

2. collect, analyze, and interpret data using advanced discipline-specific methods, techniques, and equipment. (Data Analysis)

3. critically analyze geological and environmental issues through the evaluation of current scientific literature, and present an argument clearly and persuasively in written and oral form. (Communication)

4. conduct geologic research, including preparation of a project or thesis; the result should be of high enough quality to be presented at a professional meeting. (Research)

5. understand geologic time, evolution, Earth’s place in the Universe, and global-scale processes such as plate tectonics, earth systems interactions, and climate change. (Geologic Time)
Geology M.S. Program ILO Alignment Matrix

The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs) listed above.

<table>
<thead>
<tr>
<th></th>
<th>MS PLO 1 Geologic Materials</th>
<th>MS PLO 2 Data Analysis</th>
<th>MS PLO 3 Communication</th>
<th>MS PLO 4 Research</th>
<th>MS PLO 5 Geologic Time</th>
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<td>ILO 1: Thinking &amp; Reasoning</td>
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<td>ILO 3: Diversity</td>
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<td>ILO 5: Sustainability</td>
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<td>ILO 6: Specialized Education</td>
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## Curriculum Map for Program Student Learning Outcomes

**CSU East Bay, Dept. of Earth & Environmental Sciences**

**Degree Program: M.S. in Geology**

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<td>M*</td>
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<tr>
<td>* GEOL 6910</td>
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<td>University Thesis</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M*</td>
<td></td>
</tr>
</tbody>
</table>

**Proficiency Levels:**
- I = Introduced; P = Practiced; M = Mastered
- *This course used to assess program learning outcomes

**This course used for 2013-2014 assessment**
**CSUEB Geology M.S. Program - CRITICAL THINKING & WRITING RUBRIC**

**Definition:** *Critical thinking* is a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion. *Written communication* is the development and expression of ideas in writing. It can involve working with many different writing technologies, and mixing texts, data, and images. This rubric may be applied to student writing assignments that involve all or parts of any of the M.S. in Geology Program Learning Outcomes (PLOs).

<table>
<thead>
<tr>
<th>1. Context and Purpose</th>
<th>Demonstrates thorough understanding of context, audience &amp; purpose.</th>
<th>Demonstrates adequate understanding of context, audience &amp; purpose.</th>
<th>Demonstrates awareness of context, audience &amp; purpose.</th>
<th>Demonstrates minimal or no attention of context, audience &amp; purpose. Barely completes or does not complete assigned task(s) and focus all elements of the work.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consideration of audience, purpose (i.e précis, term papers &amp; reports).</strong></td>
<td>Assigns and focuses all elements of the work.</td>
<td>Assigns and focuses all elements of the work.</td>
<td>Assigns and focuses all elements of the work.</td>
<td>Assigns and focuses all elements of the work.</td>
</tr>
<tr>
<td>2. Disciplinary Conventions</td>
<td>Demonstrates detailed attention to, and successful execution of, writing task(s) including organization, content, presentation, formatting, and style.</td>
<td>Demonstrates consistent attention to, and successful execution of, writing task(s) including organization, content, presentation, formatting, and style.</td>
<td>Demonstrates some attention to, and successful execution of, writing task(s) including organization, content, presentation, formatting, and style.</td>
<td>Demonstrates poor attention to, and execution of, writing task(s) including organization, content, presentation, formatting, and style.</td>
</tr>
<tr>
<td><strong>Formal and informal rules for writing in particular forms and academic fields.</strong></td>
<td>Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.</td>
<td>Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.</td>
<td>Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.</td>
<td>Uses poor or inappropriate language choices that sometimes impede meaning because of errors in usage.</td>
</tr>
<tr>
<td>3. Syntax and Mechanics</td>
<td>Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.</td>
<td>Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.</td>
<td>Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.</td>
<td>Uses poor or inappropriate language choices that sometimes impede meaning because of errors in usage.</td>
</tr>
<tr>
<td>4. Explanation of Issues</td>
<td>Issue is stated clearly and described comprehensively, delivering all information necessary for full understanding.</td>
<td>Issue is stated, described, and clarified so that understanding is not seriously impeded by omissions.</td>
<td>Issue is stated but leaves some terms undefined, ambiguities unexplored.</td>
<td>Issue is stated without clarification or description.</td>
</tr>
<tr>
<td><strong>Selecting and using information to investigate a point of view or conclusion.</strong></td>
<td>Information is taken from appropriate source(s); allows comprehensive analysis. Viewpoints of experts are questioned thoroughly.</td>
<td>Information is taken from appropriate source(s); allows coherent analysis or synthesis. Viewpoints of experts are subject to questioning.</td>
<td>Information is taken from mostly appropriate source(s) without coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little questioning.</td>
<td>Information is taken from source(s) without any interpretation or evaluation. Viewpoints of experts are taken as fact, without question.</td>
</tr>
</tbody>
</table>

**CSUEB Geology M.S. Program - ORAL COMMUNICATION VALUE RUBRIC**

**Definition:** Oral communication is a prepared, purposeful presentation designed to increase knowledge, to foster understanding, or to promote change in the listeners' attitudes, values, beliefs, or behaviors. This rubric may be applied to student oral presentation assignments that involve all or parts of the M.S. in Geology Program Learning Outcomes (PLOs) 2 (Data Analysis), 3 (Communication), 4 (Research), and 5 (Geologic Time).

<table>
<thead>
<tr>
<th>Exemplary</th>
<th>Accomplished</th>
<th>Competent</th>
<th>Insufficient Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
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</tbody>
</table>

1. **Organization**
   - **Exemplary:** Organization is clear, consistent, observable and skillful and content is cohesive.
   - **Accomplished:** Organization is clear, consistent & observable.
   - **Competent:** Organization is intermittently observable.
   - **Insufficient Evidence:** Organization is poor or not observable.

2. **Language**
   - **Exemplary:** Language is clear, accurate, compelling, and enhances the effectiveness of the presentation, and audience appropriate.
   - **Accomplished:** Language is clear, thoughtful and supports the effectiveness of the presentation, and audience appropriate.
   - **Competent:** Language is mundane, commonplace and partially supports the effectiveness of the presentation, and audience appropriate.
   - **Insufficient Evidence:** Language choice is unclear, informal and minimally supports effectiveness of presentation. Language in presentation is not appropriate to audience.

3. **Delivery**
   - **Exemplary:** Delivery techniques make presentation compelling. Speaker appears polished and confident.
   - **Accomplished:** Delivery techniques make presentation interesting. Speaker appears comfortable.
   - **Competent:** Delivery techniques make the presentation understandable. Speaker appears tentative.
   - **Insufficient Evidence:** Delivery techniques detract from the understandability of the presentation. Speaker is uncomfortable.

4. **Supporting Material**
   - **Exemplary:** Appropriate type(s) of supporting materials make reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/authority on the topic.
   - **Accomplished:** Appropriate type(s) of supporting materials make reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/authority on the topic.
   - **Competent:** Appropriate type(s) of supporting materials make reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/authority on the topic.
   - **Insufficient Evidence:** Insufficient supporting materials

5. **Central Message**
   - **Exemplary:** Message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.)
   - **Accomplished:** Central message is clear and consistent with the supporting material.
   - **Competent:** Central message is basically understandable but is not often repeated and is not memorable.
   - **Insufficient Evidence:** Central message can be deduced, but is not explicitly stated in the presentation.

Assessment Results, 2013-2014

Overview

We present four assessments from the M.S. program in Geology that span a range of learning outcomes, but here we focus on our PLO #3 (Communication), both written and oral, based on traditional term papers, précis of journal articles, oral presentations of timely and topical subjects, and University theses and their associated prospecti. These four assessments analyze 38 separate pieces of student work, and in only one case did a student not meet the competency standard set forth in the pertinent grading rubric. Furthermore, there was only one case where a student failed to achieve basic competence (minimum score), otherwise students scored above the level "competence".

GEOL 6310 – Groundwater: Term Paper

Graduate-level term paper. A course average of 8.5/15, where 5/15 indicates “competence” and 10/15 indicates “accomplishment”. The large standard deviation (3.87) indicates that there is a wide range of abilities, and the lowest average scores in the area of ‘Syntax & Mechanics’ is consistent with difficulties in writing for many of our students.

We would be wise to continue and in fact increase the number of writing assignments in order to produce students with stronger writing and analysis skills.

GEOL 6414 – Earthquake Geology: Complex Journal Article Précis - Mid-Term

Précis of a difficult and complex journal article. Used a modified rubric that takes into account the requirements of the précis. Course average is 6.1/9, where 3/9 indicates competence and 6/9 indicates accomplishment. The lowest scores indicate that the rigorous nature of the précis style is difficult to apply.

Again, we would be wise to continue and in fact increase the number of writing assignments in order to produce students with stronger writing and analysis skills. The précis is a writing form that encourages the student to focus on reading, critical analysis and written communication. Students are well served by these exercises in that they easily transfer to the writing of critical or executive summaries, journal abstracts, and articles.

GEOL 6414 – Earthquake Geology: Oral Presentation on Earthquake or Region

A 30-45 minute oral presentation on an important earthquake or earthquake-producing region. Students are asked to focus on substance rather than style and use discipline-specific language in a formal presentation. Course average is 7.8/12, where 4/12 is ‘competent’ and 8/12 is ‘accomplished’. One student barely met the competence threshold (5/12), but otherwise the results are strong.

Oral presentations are an important aspect to our M.S. students training, however focus should remain on organization and presentation, projecting a comfort with the material, and using discipline-specific terminology and a professional rather than informal speaking style.
GEOL 6910 – University Thesis: Prospectus and Thesis

Approved thesis and associated prospectus. The department is one of the few in which students produce University Theses. With a sample size, n=2, the statistics are not important relative to the accomplishment of proposing, producing and bringing to successful completion a proper thesis that passes not only 3 member faculty review, but often outside advisors from industry and government agencies. Students from the M.S. Program in Geology have been awarded the Harrington Award for Outstanding University Thesis in 2013 (Daniel Segal) and 2014 (Pamela Beitz).
CSUEB Geology M.S Program Assessment

Rubric: Written Comm. Class Average: 8.5/15
Course: GEOL 6320 Std. Dev. 3.87
Quarter: Winter 2014 Min. Competance 5.0/15
Assignment: Term Paper

<table>
<thead>
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<th>Context &amp; Purpose</th>
<th>Disciplinary Conventions</th>
<th>Syntax and Mechanics</th>
<th>Explanation of Issues</th>
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Course: GEOL 6414/4414 Std. Dev. 1.24
Quarter: Winter 2014 Min. Competence 3.0/9
Assignment: Midterm Journal Article Precis

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Rubric: Crit. Think/Writing Class Average: 12.0/15
Course: GEOL 6910 Std. Dev. 1.41
Quarter: Winter 2014 Min. Competence 5.0/15
Assignment: University Thesis & Prospectus

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GEOL6320 Assignment:
A key assignment for the course is a research paper about one of the well-studied groundwater contamination sites listed below. The papers should be about 10-12 pages of text (1.5 spaced, 11 point font), not including references. Draw mainly from journal articles and please be certain to cite your references within the paper as well as at the end in the reference section. Use a citation manager such as EndNote or Zotero to keep track of and store citations. Get started with your search at: http://library.csueastbay.edu/online-resources/databases/?sub=69. Beginning your search on the site name/location should give you a good start.

The sites listed have been examined extensively by academics, government agencies, and consultants, and are thoroughly described in the scientific literature. Your paper should describe the basic hydrogeologic setting and the contamination issue(s) at the site, but should focus on what new information was learned about contaminant transport through studies carried out at the site. Be sure to discuss how the hydrogeologic setting affected transport (advection and dispersion) of contaminants, and how the contaminant(s) at the site behaved with respect to retardation, natural attenuation, biodegradation, abiotic degradation, etc. If there was active remediation at the site, discuss the method(s) used and how effective they were. It’s okay to focus on one contaminant or one biogeochemical process once you’ve described the basic hydrogeologic setting and overall contamination issue(s). I will discuss how the paper should be organized during class but keep in mind that you should follow technical writing conventions as exemplified by peer-reviewed scientific literature. Draft versions of the paper are due on Nov. 20th. Submit your paper on Blackboard using Turn-It-In. You will have an opportunity to improve upon the draft, based on my comments, and turn in the final version on Dec. 4th.

Choose one of these sites – there will be 2 or 3 other students working on the same site:
Borden Aquifer – Ontario, Canada (landfill – multiple)
Bemidji, MN (hydrocarbons)
Nevada Test Site/Yucca Mountain, NV (radionuclides)
Cape Cod, MA (sewage)

During the last class meeting on December 4, you will present a poster showing the results of your literature research, as a team (with the other students working on the same site). The poster should mainly display figures with captions, and have sections on hydrogeologic setting, contaminants and contaminant transport, and major findings that advanced the understanding of contaminant transport. The team will talk us through the poster as a way of presenting the material to the rest of the class.
Please find either Yue, Suppe & Hung, 2011 or Sylvester, 1988 on the course Blackboard site; chose one to read and write a précis in the strict style we have been following in class for textbook chapter.

Please refer to the Precis Writing Guide that is also posted in the course Bb space or see me if you have any questions.

Due at the end of week 6.
Writing a Précis
As Graduate students you are ideally expected to do many critical readings, to assess arguments, hypotheses or models, and then to present an informed argument of an article and to reproduce the logical development of the argument in as cogent a form as possible in your own words. In order to demonstrate that you have assimilated the central argument and proof of another scholar's critical interpretation, you must be able to compose a précis of an argument. Another way to think of a précis is that it is an executive summary in the academic world.

A summary or a précis is NOT a personal interpretation of a work or an expression of your opinion of the idea (you will never use the first-person I in a précis); it is, rather, an exact replica in miniature of the work, often reduced to one-quarter to one-fifth of its size, in which you express the complete argument! You will not write such things as: “the authors conclude...”, but will rather simply state the conclusion of the paper. You are to write this as though YOU are the author, but you are even better in that you will be even more focused and briefer!

What actually happens when you write a précis? First, you must understand the complete work so that you can abstract the central argument and express it cogently and completely. Next, you must develop the argument exactly as the writer has presented it AND reduce the work by 75-80% (and for this class with some of these 30-40 page papers - 90%) of its original size.

The key word here is assimilation. When you read the material, it is probable that you will understand only those parts that have associations within your own experience. Don’t get bogged down by mathematics if things are not initially clear: look at the terms and their arrangement – try to recognize fundamental relationships and try to verify them with your reading of the text.
- How you actually go about writing a précis depends largely on your ability to restate the writer's central ideas after you have assimilated them in your own mind.

Steps to writing an effective précis:
1. Read the article many times most carefully.
2. Write a précis of the article in which you state the entire argument and also to present the logical progression (the development) of the argument.
3. Reduce the article to around one-fifth to one-quarter of its original length and omit nothing from the essential argument. This is, in reality, the key to the whole enterprise!
4. Type the précis and begin with your abstraction of the central, informing idea of the article. Having understood and written the central idea, present the essential argument(s) in as cogent manner as possible.
5. Here is a central rule: Do not copy a single sentence from the article! You may use key words and phrases only when you are expressing ideas which are technically precise or when you feel comfortable using the writer's
own words, i.e., you understand exactly he or she means, and there is really no better way to express the concept.

Finally, in order to complete this assignment, you will have to read the work most carefully, ask questions about the work repeatedly, and reach into your own geologic background so that you can best shape the writer's concepts!

These kinds of assignments are not easy! When you have completed it well, you will likely never forget the argument, the examples, and the development of the article. More than likely you will also be learning that, when you write research papers and other critical papers, you ability to write the précis is central to the basics of analysis, synthesis, comparison, and other key, higher order thinking skills absolutely required for your success in college and in the profession or career you have chosen when you graduate.
California State University, East Bay
Department of Earth and Environmental Sciences

SUGGESTIONS FOR THE PREPARATION OF A PROSPECTUS FOR A
MASTER'S THESIS

GENERALITIES

A thesis prospectus is a document which is required from all graduate students who plan to
complete a Master's thesis in Geology. It is one of the requirements which must be fulfilled in
order to be advanced to candidacy, a step necessary to begin work on a thesis project.

The prospectus must present convincing evidence that the student is able to complete
independent research; specifically, there must be evidence that:

- The student is familiar with the proposed thesis topic:
  1. by his/her ability to state clearly the research objectives and to demonstrate
     mastery in the methods to be used in carrying out these objectives.
  2. by his/her academic background.
  3. by his/her knowledge of pertinent geologic literature.

- The student will be able to carry out the proposed research within a realistic
  framework of:
  1. reasonable project scope and size.
  2. available time.
  3. available equipment.
  4. other available resources.

- The student is able to write in clear and grammatically correct English.

Prior to beginning work on a prospectus, a student must first make sure that he/she has achieved
classified status. One of the university requirements to reach this status is the completion of the
Writing Skills Test; normally this test is completed during the first quarter of attendance at
CSUEB. The other major requirement is that all undergraduate course deficiencies have been
removed. Once these requirements are satisfied, a student must consult with faculty members
and the Graduate Coordinator to select a Thesis Adviser. The Thesis Adviser will be appointed
by the Department Chair to act as Chair of the student's Thesis Committee. Students are
encouraged not to wait until the completion of all course work before beginning thesis research.
As soon as they have reached classified status, they should begin to think about areas in which
they may wish to specialize. They will be helped in their search by the Graduate Coordinator
who will also advise them on their status in the program. The Department Chair will also
appoint other colleagues who will act as thesis committee members of whom at least one (in
addition to the Adviser) must be a regular member of the faculty of the Department of Earth and
Environmental Sciences, the other can be from outside the Department or University. Please
keep in mind that no thesis research can begin prior to acceptance of the prospectus.
Department of Earth and Environmental Sciences
California State University, East Bay

ASSESSMENT PLAN 2013-14

ENVIRONMENTAL SCIENCE B.S.

27 September 2014
Department of Earth and Environmental Sciences
California State University, East Bay

Assessment Plan 2013-14
Environmental Science B.S.

Contents
1. Program Learning Outcomes
2. PLO-ILO Alignment Matrix
3. Draft Revision of PLOs and Alignment Matrix
4. Curriculum Map
5. Assessment Results, 2013-2014
   a. ENSC 4800 - Seminar in Environmental Science
   b. ENSC 4140 - Hazardous Waste Management
6. Sample Assignment
   a. ENSC 4800 - Seminar in Environmental Science
Program Learning Outcomes
Environmental Science B.S.

Students graduating with a B.S. in Environmental Science from Cal State East Bay will be able to:

1. demonstrate knowledge of the principles of form, function and organization of organisms at the levels of molecules, cells, tissues, organs, organisms, populations, and communities. (Biology)

2. demonstrate knowledge of the fundamental principles of chemistry, chemical structure, bonding, equilibrium, dynamics, and reactions, as well as classes of organic compounds and reactions. (Chemistry)

3. characterize the nature and distribution of earth materials, the processes by which the materials are formed and altered, and the nature and development of the landscape. (Earth Science)

4. synthesize knowledge of the major components of the physical environment, including landforms, climate, vegetation, and soils. (Synthesis)

5. critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form. (Communication)
ILO Alignment Matrix. The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs) listed above.

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Department of Earth and Environmental Sciences
California State University, East Bay

Program Learning Outcomes
Environmental Science B.S.

Students graduating with a B.S. in Environmental Science from Cal State East Bay will be able to:

1. demonstrate practical skills and theoretical knowledge of the biology, chemistry, geology, and physics relevant to the Earth system, in both laboratory and field settings;
2. collect, analyze, and interpret quantitative and qualitative data in order to characterize and address environmental issues;
3. critically consider scientific findings within the context of the social, cultural, economic, ethical, and human dimensions of contentious environmental issues;
4. synthesize knowledge of the major components of the Earth system, including physical, biological, and human systems, as well as human impacts;
5. critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form.

ILO Alignment Matrix. The table below shows which Institutional Learning Outcomes (ILOs) are addressed by each of the Program Learning Outcomes (PLOs) listed above.

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## Curriculum Map for Program Learning Outcomes

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**Degree:** B.S. in Environmental Science

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<td>Principles of Geomorphology</td>
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<td>3801</td>
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<td>Sedimentology and Stratigraphy</td>
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<td>Hydrogeology</td>
<td>M</td>
<td>P</td>
<td>P</td>
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</table>

### Notes:

- **See attached Program Learning Outcomes (PLOs)**
- + This course cross listed, appears under both ENSC and GEOL
- This course used for 2013-2014 assessment
- Levels: I = Introduced; P = Practiced; M = Mastered
CSUEB Environmental Science B.S. Program Learning Outcome Evaluation

Course evaluated: ENSC 4800 Seminar in Environmental Science, Winter 2014

Assignment evaluated: “Brownfield Action” capstone project

PLO evaluated: PLO #4 (pre-revision), “synthesize knowledge of the major components of the physical environment, including landforms, climate, vegetation, and soils” (“synthesis” objective), PLO #5 (pre-revision), “critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form” (“communication” objective).

Rubric(s) used: Critical Thinking Rubric (“synthesis” PLO), Laboratory Skills/Course Project Rubric (“communication” PLO)

“Synthesis” objective evaluation (ENSC 4800 Seminar in Environmental Science)
14 students evaluated, 14 students in class
Class total average: (6.50 out of 15, 5 is meeting PLO), class total standard deviation: 1.45

<table>
<thead>
<tr>
<th>Student</th>
<th>Competencies</th>
<th>Problem Solving</th>
<th>Embracing Contradictions</th>
<th>Innovative Thinking</th>
<th>Connecting, Synthesizing</th>
<th>Total</th>
</tr>
</thead>
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<td>0.27</td>
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<td>1.45</td>
</tr>
</tbody>
</table>

(Interpretation on next page.)
**Interpretation:** Students scored particularly high on the “connecting and synthesizing” portion of the rubric, which fits the nature of this assignment as an integrated capstone project simulating a real-world situation. Students scored low in the areas of problem solving and embracing contradictions, two areas that are very important for environmental science since “real world” scenarios deal with incomplete data, and many unknown factors. That said, low student scores in these areas could also be attributable to the non-standard and open-ended nature of the assignment, which several students reported “not really getting” until about six weeks into the quarter. Low scores in “innovative thinking” are also likely due to the nature of the assignment (which takes the form of a contract prescribing specific deliverables—there is not a great deal of room for innovation). **Attached are two student papers (Students 5 and 11) as examples.**
“Communication” objective evaluation (ENSC 4800 Seminar in Environmental Science)

14 students evaluated, 14 students in class

Class total average: (6.79 out of 15, 5 is meeting PLO), class total standard deviation: 1.85

<table>
<thead>
<tr>
<th>Student</th>
<th>Organization</th>
<th>Presentation</th>
<th>Quantitative Skills</th>
<th>Execution</th>
<th>Connecting, Synthesizing</th>
<th>Total</th>
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<td>0.55</td>
<td>0.73</td>
<td>0.51</td>
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</table>

**Interpretation:** For the level to truly approach that of a “professional” most students need to work on details such as organization and execution, but overall students rated well in these areas. Most students were able to reasonably approach the quantitative portion of the assignment (which has no exact “correct” answer, but has a correct approach), but a few students chose not to attempt the calculation. One student who attempted the calculation came up with a nonsensical answer, but the student’s report was otherwise reasonable and well-presented. Quality, on-time execution is an issue with some students. Overall, the students met the PLO for “communication” of discipline-specific information, but there is significant room for improvement. **Attached are two student papers (Students 5 and 11) as examples.**
“Communication” objective evaluation (ENSC 4140 Hazardous Waste Management)

**Assignment evaluated:** Hazardous waste capstone presentation (based on research paper)

**PLO evaluated:** PLO #5 (pre-revision), “critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form” (“communication” objective).

**Rubric(s) used:** Laboratory Skills/Course Project Rubric

12 students evaluated, 12 students in class

Class total average: 4.75 (out of 12, 4 is meeting PLO), class total standard deviation: 1.96

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<th>Organization</th>
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<th>Quantitative Skills*</th>
<th>Execution</th>
<th>Connecting, Synthesizing</th>
<th>Total</th>
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<td>0.43</td>
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<td>1.96</td>
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</table>

* Quantitative skills not evaluated in this assignment

**Interpretation:** Students in this class did a good job of synthesizing their understanding from the class and applying it to their individual projects. Execution was an area where the students were particularly weak—though their work for the final project was for the most part on-time and adequate. Overall, the program is meeting its communication objective for most students, but there is substantial room for improvement in student performance. Attached is one student’s presentation (Student 11) as an example.
### “Synthesis” objective criteria

<table>
<thead>
<tr>
<th></th>
<th>Exemplary</th>
<th>Accomplished</th>
<th>Competent</th>
<th>Insufficient Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Competencies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies and skills</td>
<td>Clear</td>
<td>Strong</td>
<td>Under</td>
<td>Poor</td>
</tr>
<tr>
<td>that apply to Earth</td>
<td>understands</td>
<td>understanding</td>
<td>standing</td>
<td>understanding</td>
</tr>
<tr>
<td>Science problem solving</td>
<td>purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield.</td>
<td>purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield.</td>
<td>purpose and role of the exercise and its importance and context within the Earth Sciences and/or related subfield.</td>
<td>purpose and role of the exercise with little/no insight into its importance and context within the Earth Sciences and/or related subfield.</td>
</tr>
<tr>
<td>(i.e. discipline-specific lab &amp; field exercises)</td>
<td>Uses discipline-appropriate means to address the problem.</td>
<td>Uses discipline-appropriate means to address the problem.</td>
<td>Follows instructions and understands the steps.</td>
<td>Unable to follow instructions.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>2. Problem Solving</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Develops a logical,</td>
<td>Develops a plan to solve the problem. Has some insight into consequences and some ability to articulate reason for choosing solution.</td>
<td>Considers and rejects less acceptable approaches to solving problem.</td>
<td>Only a single approach is considered and used to solve the problem.</td>
<td></td>
</tr>
<tr>
<td>consistent plan to solve</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>problem, recognizes</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>consequences of solution</td>
<td></td>
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<tr>
<td>and can articulate</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>reason for choosing</td>
<td></td>
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<tr>
<td>solution.</td>
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<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**3. Embracing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contradictions**</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Integrates alternate,</td>
<td>Incorporates alternate, divergent, or contradictory perspectives or ideas in an exploratory way.</td>
<td>Includes (recognizes value) alternate, divergent, or contradictory perspectives or ideas in a limited way.</td>
<td>Fails to acknowledge alternate, divergent, or contradictory perspectives or ideas.</td>
<td></td>
</tr>
<tr>
<td>divergent, or</td>
<td>Applies multiple working hypotheses.</td>
<td>Has difficulty creating multiple working hypotheses.</td>
<td>No use of multiple working hypotheses.</td>
<td></td>
</tr>
<tr>
<td>contradictory perspectives or ideas fully.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposes/uses multiple</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>working hypotheses.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Innovative Thinking</strong></td>
<td>Creates a novel/unique idea, method, hypothesis, format, or product.</td>
<td>Imagines/conceives a novel/unique idea, method, hypothesis, format, or product.</td>
<td>Reformulates a collection of available ideas.</td>
<td>No new ideas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**5. Connecting,</td>
<td>Synthesizes ideas or solutions into a coherent whole.</td>
<td>Connects ideas or solutions in novel ways.</td>
<td>Recognizes existing connections among ideas or solutions.</td>
<td>No recognition of significance of exercise to discipline or global context.</td>
</tr>
<tr>
<td>Synthesizing**</td>
<td>Creates connections to higher-level discipline-specific concepts and practices.</td>
<td>Recognizes connections to higher-level discipline-specific concepts and practices.</td>
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</tbody>
</table>

*Spring 2014 (based on Winter 2014 courses)*
### “Communication” objective criteria

<table>
<thead>
<tr>
<th>Exemplary 3</th>
<th>Accomplished 2</th>
<th>Competent 1</th>
<th>Insufficient Evidence 0</th>
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<tbody>
<tr>
<td><strong>1. Organization</strong></td>
<td>Organization is clear, consistent, observable, and skillful; content is cohesive.</td>
<td>Organization is clear, consistent &amp; observable.</td>
<td>Organization is intermittently observable.</td>
</tr>
<tr>
<td><strong>2. Presentation</strong></td>
<td>Work is attractive, clean, clear, accurate, visually strong.</td>
<td>Work is well-produced, clear, mostly-accurate, visually effective.</td>
<td>Work is adequate with minor errors, visually inert.</td>
</tr>
<tr>
<td><strong>4. Execution</strong></td>
<td>Work is complete to levels above expectation, and turned in early or on time.</td>
<td>Work is strong, complete, and turned in on time.</td>
<td>Work is adequate, complete, and turned in on time.</td>
</tr>
<tr>
<td><strong>5. Connecting, Synthesizing</strong></td>
<td>Synthesizes ideas or solutions into a coherent whole. Creates connections to higher-level discipline-specific concepts and practices.</td>
<td>Connects ideas or solutions in novel ways. Recognizes connections to higher-level discipline-specific concepts and practices.</td>
<td>Acknowledges existing connections among ideas or solutions.</td>
</tr>
</tbody>
</table>
Guidelines for Phase One ESA Project
ENSC 4800 Seminar, Winter 2014

The following guidelines apply for the Brownfield Action ESA Project. The project is worth 50% of your grade in this course (per the syllabus). All submissions must be digital and in PDF format, with the exception of maps (unless you would like to digitize your maps, which would be excellent).

Student deliverables
Each student must submit their own 8-10 page (plus Table of Contents for the body of the report) ESA report (double-spaced, 12-point font, one-inch margins). Requirements for the report are outlined below.

ESA report
The report should include the following, in addition to a Table of Contents:

• Physical Description: Describe the surface topography of Self-Lume (SL) property and the entire “site.” Include the shape of “site” and the dimensions, and acreage of both the “site” and SL property. Put dimensions, areas, and acreages in a chart. Give specific values for relief of the entire “site” and slope between SL septic tank to town well.

• Subsurface: Physical description of subsurface beneath SL property and entire “site” including sediment type, sediment size analysis (that is, range of particle sizes), % porosity, permeability, and surface bedrock topography.

• Aquifer: Physical description of aquifer under SL property and entire “site.” Include: (1) the nature of the aquifer (What kind of aquifer is it?), (2) calculations of aquifer thicknesses (between water table elevations and bedrock elevations) at each well on “site.” Put these calculations into a table. (3) direction of water flow from SL to town well, and (4) the velocity and time it would take for water to travel from SL to town well.

• Self-Lume Property Concerns: Itemize any findings at the SL property that are probable sources of contamination and warrant a Phase Two ESA.

• “Site” Concerns: Itemize any findings at the “site” that are probable sources of contamination and warrant a Phase Two ESA.

A note on grading
Grades will be assigned on an individual basis, so the ESA report will be the primary means of determining your project grade. However, high quality supporting documents are the basis for your ESA, so it is in your interest to do a good job on the maps, appendix, budget, etc.

I expect you to do a good job on this assignment – it is half of the course grade, two-thirds of the class time, and represents a great opportunity for you to apply the skills you have learned. Excellent work will receive an excellent grade (a grading rubric will be distributed as we get further into the project).
Team deliverables
Each team must submit:

1) A cover letter to Seymour Buckmeister (see below)
2) One set of four maps (site map, topographical map, bedrock map, water table map)
3) Appendix of supporting documents
4) One-page, categorized budget (as the first page of the Appendix)

Cover Letter
The cover letter to Mr. Seymour Buckmeister should include:

1) Purpose for writing the report
2) Brief summary stating issues of concern at Self-Lume property
3) Summary of any solid evidence of contamination in Moraine Township (the “site”)
4) State whether a Phase Two is recommended and provide rationale
5) Provide an itemized list of requirements for a Phase One ESA stated under the “Provisions and Specifications” found in the contract, which your company completed (items 15 a-k)

Appendix
The appendix should include:

1) A Table of Contents
2) A one-page, categorized budget (first page)
3) All supporting documents gathered throughout the investigation

Acknowledgements
The Brownfield Action simulation was created by Dr. Peter Bower of Barnard College and Columbia University. It is supported by the Columbia Center for New Media Teaching and Learning, and the National Science Foundation of the United States. This assignment is slightly adapted from Dr. Bower’s, and many of the documents used in this part of the class were originally created as a result of Dr. Bower’s work. I am eternally grateful for Dr. Bower’s work and for the use of his shared materials. – M.M., January 2014
Appendix H. New Faculty Request
REQUEST FOR TENURE-TRACK FACULTY
Department of Earth and Environmental Sciences
ENVIRONMENTAL GEOSCIENTIST

Justification:

1. Brief overview of the position.

The Department of Earth and Environmental Science requests a new tenure track faculty member in the area of environmental geoscience with expertise in environmental hazards and geotechnical methods. Other desirable areas of expertise include site characterization, subsurface modeling, and geographic information systems (GIS). The new position will complement existing areas of specialty within the department in hydrogeology, tectonics, geochemistry, and geophysics. The person filling the position will teach courses in environmental science and geology for general education and major programs, and will support the department’s commitment to STEM education. Courses to be taught by the new faculty member include Natural Hazards, Environmental Geology, Introduction to Environmental Science, Environmental Problems of California, and graduate level Engineering Geology. Additional courses will be assigned according to the area of expertise of the new faculty member.

2. How does this position help the department meet its strategic goals, those of the College, and those of the University?

This position would enable the department to expand its course offerings, to better serve existing programs, and to increase the number of majors in the Environmental Science program. The new position would also support the goals of the department, college, and university by providing students with the skills and knowledge needed to achieve their career goals, become contributing members of society, and improve the environmental quality of the region and state. The new faculty member would likely contribute to outreach and public education on environmental hazards. This position will also help the university in its institutional goals regarding sustainability.

3. What are the three most pressing needs to be filled by this position? Curricular gaps? Student Demand? Accreditation requirements? Other?

The most pressing needs to be filled by this position are:

a. to provide students with current skills in environmental geoscience that are essential for employment and informed decision making as either a professional or responsible citizen,

b. to teach popular courses that are regularly taught by lecturers, e.g., Environmental Geology, Environmental Science, and Engineering Geology. These include both non-majors courses and majors courses, and courses at both the undergraduate and graduate levels.

c. to fill gaps in the Geology and Environmental Science curricula that are not currently covered by existing faculty. The new faculty member would enable us to offer courses that are needed by students in order to be competitive in the workplace and deal with challenging and complex environmental problems.
4. If student demand is a key driver of this position, please analyze student demand over the past 5 years and how this position will help meet that need. Additionally, please describe how this position will impact the availability of part-time funds? Can the department afford a full-time hire, while maintaining a sufficient number of part-time lecturers to meet demand?

In 2013 the total SCU taught by the department reached a new high, 3377 SCU. This growth in enrollment has been achieved through greater reliance on part-time lecturers. A new tenure-track faculty member with expertise in environmental geoscience would help to maintain the quality of instruction for both general education classes and departmental programs.

The total number of majors in the department’s programs (Geology and Environmental Science) reached a new high in 2013. Employment for environmental scientists and specialists is projected to increase 15% from 2012 to 2022, and employment for geoscientists is expected to increase 16%. The average growth rate for all occupations is 11% (Bureau of Labor Statistics, 2014). Growth in California will be even stronger than the national average, and salaries of geoscientists compare favorably to other scientists (American Geosciences Institute, 2011). Many job openings are expected in the Bay Area with environmental and engineering consulting firms, geotechnical companies, and state and municipal agencies. As the construction industry continues to recover from the 2008 recession, the demand for environmental geoscientists who can address issues slope stability, water availability, and contaminated site closure in the Bay Area is expected to increase.

5. Does the department/school have a strong reputation and can it be made one of the strongest in the region/country by the addition/replacement of one or more faculty members?

The department has a 30-year reputation for producing reliable students with a solid background in applied geoscience. Graduates from our programs work in both industry and government agencies nationwide. Employers include engineering, environmental, and geotechnical consulting firms; oil and gas companies; and state and federal agencies. The department currently has five regular faculty, smaller than the national average of eight faculty for geoscience departments at four-year universities in the U.S. (American Geological Institute, 2011, p. 50, http://www.agiweb.org/workforce/reports/StatusoftheWorkforce2011overview.pdf ).

Among universities in the Bay Area, the department has unique strength in the area of environmental geoscience due to its faculty expertise in hydrology, geochemistry, tectonics, environmental science, and geophysics. Graduates with this combination of skills are highly sought after by employers in the Bay Area and beyond. With the addition of an environmental geoscientist with expertise in environmental hazards and geotechnical methods, the department would become a leading institution in Northern California in environmental geoscience.

The department currently has two faculty members with professional activity in STEM education. An additional faculty member who contributes to STEM education would support the department’s national leadership in this area.
Please describe briefly;

6. Faculty Composition.
   a. The number of faculty in your department who have left, retired, or are in the FERP program over the last five years; and the dates of those events (a retirement does not automatically justify a replacement.)
      None.
   b. The ratio of tenured/tenure-track faculty to total FTEF in your department
      In Fall 2013, the ratio of TT faculty (5) to total FTEF (8.85) was 0.56, or 56%. This does not take into account assigned time for research, which significantly reduces the availability of TT faculty for teaching. Only 30.0% of FTES were taught by TT faculty during Fall 2013.
   c. Why a tenured/tenure-track faculty position is needed over a full or part-time instructor.
      A tenured/tenure-track position is needed in order to recruit and retain a qualified faculty member who will be able to develop courses, maintain and upgrade laboratory test equipment, supervise student research, and make our program competitive with others in the region and beyond.
   d. The number of majors and the ratio of majors to tenured/tenure-track faculty in your department (Fall 2013).
      Number of majors: 78  (48 Env. Sci. and 30 Geol.)
      Ratio of majors to tenured/tenure-track faculty
      Geology: 6.0
      Environmental Science: 9.6
   e. Department/School SFR as compared to the College SFR.
      Department SFR - Fall 2013: 25.4
      Department SFR – 5 Yr Ave.: 29.9
      College of Science SFR: 23.2
      System Ave. (EESC): 25.2
      The department's SFR for Fall 2013 (25.4) is comparable to the CSU System average for similar departments, and slightly higher than the College average. The department's five-year average SFR (29.9) is substantially higher.
   f. The need in the context of your five-year hiring plan. (Each Department must have a 5-year hiring plan in place before a new faculty request will be considered. The 5-year plan must emphasize which sub-disciplines within the department are designated as distinctive, and necessitate a T/TT faculty).
The department’s five-year plan includes the following positions:

- Fall 2013 - Completed: Environmental Scientist (Massey)
- Fall 2015 - This request: Environmental Geoscientist
- Fall 2017 - Future request: Surficial Processes and Paleoclimate

These positions build upon the department's strengths in the area of environmental geology, and support its commitment to training students in skills that are needed to understand the interaction between humans and Earth, and to mitigate the environmental hazards associated with life on an active plate boundary.

7. Curriculum

   a. The percentage of teaching in your department which satisfies general education requirements

   Approximately two-thirds (65%) of the sections offered in AY 2011-2012 were GE sections.

   b. Will online teaching and/or teaching at another campus site (i.e. Oakland/Concord) be a requirement of this position?

   Yes, teaching at the Concord campus, as needed, will be a requirement of this position.

   c. Does the position represent a central component of a CSU, East Bay’s student’s education? How?

   Yes. The person filling this position will teach science GE courses for non-science majors, as well as specialized courses for Geology and Environmental Science majors. Sustainability and environmental stewardship will be a primary component of courses taught by the new faculty member.

8. Scholarship/New Sources of Revenue

   a. Address the potential for scholarly success.

   We anticipate that the applicant pool will include strong candidates with a high potential for scholarly success as the Bay Area is a center for research in environmental geoscience. Institutions conducting research in this area include the U.S. Geological Survey, Lawrence Berkeley and Lawrence Livermore National Laboratories, and U.C. Berkeley.

   b. Address the potential for external/internal support for scholarship.

   The potential for external support is very high due to the consistent demand for expertise in hazards research and the large number of institutions conducting research in this field in the Bay Area (see above).

   c. Is a replacement critical to the scholarly/research/creative efforts of units both inside and outside of the department or college? Does the position have the support of other colleges?

   This position provides expertise that is not currently available within other units of the University and will encourage interdisciplinary cooperation with other departments, in particular the Engineering Department.
d. What has the unit done to maximize its current resources (i.e., to help itself?) over the past five years?

Faculty, staff, equipment, and facilities are shared by three programs; Environmental Science BS, Geology BA/BS, and Geology MS. The department has applied for and received internal funds to upgrade equipment for instruction and student research. Majors courses with small enrollments are rotated so that each course is offered only once every two years.

e. Has the department raised funds effectively from external sources? Has it worked effectively with external agencies and constituencies?

During the past five years, faculty have been very active in externally funded research and programs and has obtained over $13 million in funding and support from external sources, including the NSF, NASA, NOAA, USGS, and California State Water Resources Control Board. This has provided funding for students and equipment, but has also reduced the availability of TT faculty for instruction.

9. Recruitment:

a. How will your department ensure that hiring is performed with the diversity goals of the University in mind?

We will prepare a recruitment plan in consultation with the CSUEB Office of Human Resources, CSUEB Faculty Diversity and Equity Committee (FDEC) and Diversity and Equity Liaison Officer (DELO). After we have completed our recruitment plan, we will ensure the widest possible circulation of the position announcement in the publications of scientific/professional organizations including those with special emphases on increasing the diversity of the science workforce such as the National Association of Black Geologists and Geophysicists, the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science and the Association of Women Geoscientists.

We will attempt to increase the diversity of the pool of candidates by recruiting at major conferences such as the annual meetings of the Geological Society of America and the American Geophysical Union.

b. Is there a pressing need for a senior hire (tenured), either to ensure excellence or fill a leadership role?

No, the position can be filled by a tenure-track Assistant Professor.

c. Can you collaborate with another department on advertising or other costs of recruitment?

No.

References:

Appendix I

Freshman Learning Community (Cluster) Proposals
Proposal for a General Education Learning Community (Cluster)

Earth Crisis!
April, 2014

1. Theme and Relevance

The theme of this mixed cluster covering GE areas B1 (Physical Science), D (Social Science), and B5 (Science Elective) is the critical analysis of environmental issues and problems, from scientific and social perspectives, and from global to local scales. The name of the cluster is "Earth Crisis!". We believe this theme will speak to our freshmen because of the pervasiveness of environmental issues in popular media including blogs on the internet, movies, music, radio, and television. Environmental problems are increasingly affecting all aspects of life, including all aspects of human society. Global warming and sea-level rise have become topics of everyday discussion. The lack of understanding by the American public of the social and scientific implications of environmental crises is alarming. By the middle of the century, sea level rise is projected to have a major impact on infrastructure along the margins of San Francisco Bay, including both the San Francisco and Oakland airports. We explore this and other topics that have the potential to directly affect people living in the Bay Area, especially earthquakes, tsunamis, floods, and landslides. Students will have an opportunity to examine the potential effects of earth crises on our everyday lives.

2. Courses

- GEOL 2301 - Natural Hazards (Physical Science - B1)
- ENVT 2001 - Environmental Perspectives (Social Science - D)
- ENSC 2802 - California Environmental Crises (Science Elective - B5)

3. Integration of Course Content

During Fall quarter, students will learn about the science behind natural disasters in GEOL 2301. In this Physical Science GE course, students will learn about the earth processes that lead to catastrophic events such as earthquakes, volcanoes, hurricanes, floods, landslides, tsunamis. They will also learn how certain human activities may exacerbate the impact of natural physical events. In ENVT 2001 during Winter Quarter, students will apply social science methodologies to further investigate the natural phenomena that they explored during Fall quarter, and will explore their effects on humans, societies, and social structures.

One example of how the content of GEOL 2301 and ENVT 2001 may be integrated is in the physical causes and human impact of earthquakes. Students will learn in GEOL 2301 about the geological processes that result in an earthquake, and then in ENVT 2001 why a major earthquake would tend to cause a much higher level of casualties in a developing nation like Haiti than in a more developed nation like Chile. Students will also learn that the impact of a natural disaster in a developing nation is generally measured in terms of loss of human lives, whereas in a developed nation it is measured in terms of economic and environmental impact.
During Spring quarter, in ENSC 2802, the students will integrate aspects of the science and social science they explored earlier in the year, explore the life science aspects of environmental science, and apply the integrated knowledge to investigations of major California environmental problems.

4. Learning Outcomes and General Education Requirements

GEOL 2301, ENVT 2001, and ENSC 2802 have already been approved for GE credit. GE area learning outcomes for each of these areas are attached, along with an explanation of how they are met by each of these courses.

5. Course Outlines and Integrative Activities

The first course in this cluster, GEOL 2301 (Natural Hazards), will introduce the students to physical earth processes and how the scientific method is applied to studying such processes. In the second course, ENVT 2001 (Environmental Perspectives), students will continue to examine the environmental phenomena introduced during Fall Quarter, but with an emphasis on the sociological and societal effects of these natural disasters. In the third course, ENSC 2802 (Global Environmental Issues), students will apply the general social science and science knowledge gained in the first two classes to investigations of environmental issues specific to California. Course syllabi are attached.
Fulfillment of Learning Outcomes for Lower Division Physical Science (B1)  
by GEOL 2301 - Natural Hazards

Note: This course has already been approved for GE credit as a Physical Science Course (B1). Included below are the B1 learning outcomes (in italics), with an explanation of how each is met by this course.

1. Students should be able to demonstrate broad science content knowledge in the physical sciences such as the nature and structure of matter, Earth’s place in the Universe, or the conservation of energy and matter.

This course examines content in Physical Geology and students will gain knowledge in the following areas:

- Plate tectonics
- Volcanology
- Earthquakes and seismology
- Mass wasting
- Climate change
- Severe storms
- Extraterrestrial impacts

Students will demonstrate their understanding of the content of the course through examinations, homework exercises, and the use of the Internet.

2. Students should be able to demonstrate the application of quantitative skills (such as statistics, mathematics, and the interpretation of numerical graphical data) to (physical) science problems.

Students in this course will have the opportunity, in both the lecture and laboratory sections, to interpret graphical data and perform simple numerical calculations. In this course, we will stress the connection between mathematics and science. It is important that students understand that science is a way of describing the physical world and that we can achieve a deeper understanding through quantitative skills.

Example:

If an isotope has a half-life of 100 years, what percentage of it will remain after 300 years?

This problem may be solved iteratively:

After 100 years, \((0.5)(100\%) = 50\% \) remaining.
After another 100 years (200 years total), \((0.5)(50\%) = 25\% \) remaining.
After another 100 years (300 years total), \((0.5)(25\%) = 12.5\% \) remaining

Alternatively, the problem can be solved simply when the time period is a simple multiple of the half-life:

\((100\%)(0.5)^3 = 0.125 = 12.5\% \)
This simple example gives us the ability to gain a deeper appreciation of the nature of radioactive decay through a very simple calculation. In addition, this problem reinforces mathematical skills (e.g., iteration, percentages) and science content such as geochronology.

Students in this class will also have the opportunity to interpret graphical data that describe the physical world. For example, they will learn the basic principle of earthquake location by triangulation. In addition, students will learn how to determine the Richter magnitude of an earthquake based on simple measurements from a seismogram. Students will demonstrate their understanding of this learning outcome through examinations, homework exercises, and internet activities.

3. Students should be able to demonstrate a general understanding of the nature of science, the methods applied to scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

The content of this course includes the analysis of a large amount of scientific observations and data. Examples in class are used to demonstrate the nature of science, empiricism and experimentation. Through this course, students will begin to evaluate scientific data and claims. For example, Wegener's hypothesis known as Continental Drift will be contrasted with the modern theory of plate tectonics as an example of the scientific method and modern definitions of science. Through these examples, students will gain an appreciation of the methods of science and how science differs from other fields of knowledge and pseudoscience.

Students will demonstrate their understanding of this learning outcome through examinations, homework exercises, and/or web activities.
Fulfillment of Learning Outcomes for Lower Division Social Science (Area D1-3), by ENVT 2001 - Environmental Perspectives

Note: This course has already been approved for General Education Area D credit. ENVT 2001 specifically addresses Area D learning outcomes 1, 2, 3, and 5, as detailed below.

1. Students will demonstrate, orally and in writing, recognition of the application of disciplinary concepts derived from at least three social or behavioral sciences in the study of human behavior, individually and in society.

ENVT 2001 introduces how behaviors of human beings and human society make changes to our living environment consequently how such changes of environment influences our own well being, our economic development, and our society's sustainable future. Students learn theories of ecosystem conservation, models of sustainable ecosystems. They learn, through their exams and essays, to use these theories and models to compare with human society and economic system. They also learn the practical applications of environmental conservation to urban development, forest and rangeland management, aquatic ecosystem protection.

2. Students will demonstrate, orally and in writing, recognition of the inquiry methods used by at least one of the social or behavioral science disciplines.

ENVT 2001 introduces how behaviors of human beings and human society make changes to our living environment consequently how such changes of environment influences our own well being, our economic development, and our society's sustainable future. Students learn theories of ecosystem conservation, models of sustainable ecosystems. They learn, through their exams and essays, to use these theories and models to compare with human society and economic system. They also learn the practical applications of environmental conservation to urban development, forest and rangeland management, aquatic ecosystem protection.

3. Students will demonstrate, orally and in writing, the ability to describe how human diversity and the diversity of human societies influence our understanding of human behavior, individually and in societies, both local and global.

ENVT 2001 demonstrates that human beings had become the super-power in natural, surpassing all other agents in the natural in shaping our living environment. Students learn that individual behavior plays an important role in environment protection and natural resource conservation. Through their essay pages, these concept will be engraved in their minds which will serve as an important principal in guiding their person behavior in their future lives.
5. Students will demonstrate, orally and in writing, the ability to describe major positions and contrasting arguments made on one or more significant contemporary issue area confronting US society as applied to human behavior. (Possible areas include: biomedical and health issues, class, crime, discrimination, education, energy, environment, gender, global economy, immigration, military intervention abroad, poverty, race, technology.)

ENVT 2001 spends a good portion of time in discussing our energy and environment issues. Air pollution, water pollution, and global warming derived from fossil fuels consumption have given serious challenges to human being's development. Whether the technology can solve these problems in the short or long run remains to be discussed. Students learn that the U.S. can play a pivotal role in dealing with environmental changes that the world is facing.
Fulfillment of Learning Outcomes for Lower Division Science Elective (B5) by ENSC 2802 - California Environmental Crises

Note: This course has already been approved for GE credit as a Science Elective (B5). Included below are the B5 learning outcomes, with an explanation of how each is met by this course.

1. Students will demonstrate a broad science content knowledge in the physical, life, or interdisciplinary sciences.

This course is designed to be a vehicle for integrating a range of science skills and knowledge into an examination of critical science-based issues that affect the lives of CSUEB students as well as all Californians. Students are given an opportunity to apply the knowledge they have gained and further the interests they have and will acquire in other science classes by studying, evaluating and communicating to their professor and peers the nature, significance and potential solutions to ongoing or predicted environmental problems in the state. Through class instruction and through individual guided research, each student will develop a more profound knowledge of the natural sciences and how the physical and biological components interact with other non-science areas to create the multifaceted environmental problems faced by this increasingly populated state. This class will provide a broad based education in the natural sciences as well as a balanced exposure to the application of both the life and physical sciences through the examination of environmental problems. Environmental issues will form the backdrop for an interdisciplinary examination of science topics.

2. Students will demonstrate the application of quantitative skills (such as statistics, mathematics, the interpretation of graphical data, etc.) to scientific problems.

Students will be required to apply quantitative skills to the analysis of such diverse topics as population growth, nuclear energy, background extinction rates, and water quality. They will be asked to examine relationships between different facets of information, for example, the comparison between increase in atmospheric carbon dioxide levels and changes in climate. As another example, students will learn about the First and Second Laws of Thermodynamics and learn to apply these laws in their interpretations of how energy is used efficiently and inefficiently (e.g., Did you know that only about 20% of the high-quality energy in gasoline is transformed into usable mechanical and electrical energy by the typical automobile?). Quantitative analysis of graphical, statistical, and mathematical information will be stressed throughout the class, both in class instruction and in the student analysis and presentation of research topics. Students must clearly demonstrate the application of quantitative skills including the ability to understand and perform statistical and mathematical procedures and interpret tabular and graphical data ranging from histograms and scatter plots to maps and Venn diagrams.

3. Students should be able to demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

Students will develop a clearer understanding of the complex nature of a range of important environmental issues through the examination of scientific methods of investigation and discussions of topics that constitute science vs. pseudoscience. As an example, topics to be
discussed will include evolution, the scientific evidence in support of evolution, and scientific methods for studying evolution. We will also examine physical earth processes such as plate tectonics, and will discuss evidence for continental drift with its effects on the biogeography of different groups of organisms. We will require students to conduct thematic research projects to evaluate the information available about the scientific basis and implications of different California environmental problems. Students will learn to identify, assess and synthesize a wide array of information from different sources and data types to arrive at a clear understanding of a topic about which they had only limited prior knowledge.
1. Theme and Relevance

The theme of this proposed General Education Learning Community (Cluster) is an interdisciplinary investigation of environmental problems, politics, and ethics. Environmental problems such as global warming, water quality and biodiversity represent some of the most pressing issues faced by society today. Students who make up the incoming freshman class at Cal State East Bay may belong to the first generation that will face large scale loss of human habitat due to rising seas, shifting climate zones, and environmental disasters involving radioactive contamination. This cluster investigates scientific, ethical and political issues related to the environment and prepares students to make informed choices as citizens and professionals.

2. Courses

- ENSC 2801 - Global Environmental Problems
- PHIL 1104 - The Philosophy of Environmental Science and Policy
- POSC 1171 - Environmental Politics

3. Integration of Course Content

This cluster is an interdisciplinary examination of environmental issues- the three content courses represent courses from the three major GE learning areas: Area B - Natural Sciences (ENSC 2801), Area C - Humanities (PHIL 1104), and Area D - Social Sciences (POSC 1171). During Fall Quarter, students investigate the science behind important environmental issues affecting California and the entire Earth in ENSC 2801. This course integrates physical and life science content and provides the background for students to have meaningful discussions about environmental ethics and policy in subsequent quarters. In PHIL 1104, students learn about social issues related to the environment (e.g., environmental racism) and learn to construct logical arguments based upon various ethical frameworks (e.g., precautionary theory). In POSC 1171, students gain an understanding of the history, ideologies and institutions of modern environmental politics and policy. The approach of this cluster is interdisciplinary and comprehensive - it provides students with the scientific background of environmental issues, enables them to create ethical arguments, and challenges them to consider the social and political implications of environmental policies.

4. Fulfillment of General Education Learning Outcomes

ENSC 2801 (Science Elective - B5), PHIL 1104 (C2, C3), and POSC 1171 (D) have already been approved for lower division General Education. GE area learning outcomes for each of these areas are attached, along with an explanation of how they are met by each of these courses.
5. Course Outlines and Integrative Activities

The focus on environmental issues from a variety of disciplinary perspectives will unify the proposed cluster. Although faculty have not decided on specific assignments, we will use the summer meeting on cluster integration to develop assignments and/or readings that will span the freshman year. For example, one proposed assignment consists of students writing a series of papers during each quarter - each student would choose a specific environmental issue. During each course in the cluster, students would write papers on the science, ethical issues, social implications and a summary of the political issues for their chosen environmental issue for a portfolio. Alternatively, students may work in groups to develop mini-conferences on a limited number of environmental issues.

Course syllabi are attached.
Fulfillment of Learning Outcomes for Lower Division Science Elective (B5) by ENSC 2801 - Global Environmental Issues

Note: This course has already been approved for GE credit as a Science Elective (B5). Included below are the B5 learning outcomes, with an explanation of how each is met by this course.

1. Students will demonstrate a broad science content knowledge in the physical, life, or interdisciplinary sciences.

This course is designed to be a vehicle for integrating a range of science skills and knowledge into an examination of critical science-based issues that affect the lives of CSUEB students as well as all Californians. Students are given an opportunity to apply the knowledge they have gained and further the interests they have and will acquire in other science classes by studying, evaluating and communicating to their professor and peers the nature, significance and potential solutions to ongoing or predicted environmental problems in the state. Through class instruction and through individual guided research, each student will develop a more profound knowledge of the natural sciences and how the physical and biological components interact with other non-science areas to create the multifaceted environmental problems faced by this increasingly populated state. This class will provide a broad based education in the natural sciences as well as a balanced exposure to the application of both the life and physical sciences through the examination of environmental problems. Environmental issues will form the backdrop for an interdisciplinary examination of science topics.

2. Students will demonstrate the application of quantitative skills (such as statistics, mathematics, the interpretation of graphical data, etc.) to scientific problems.

Students will be required to apply quantitative skills to the analysis of such diverse topics as population growth, nuclear energy, background extinction rates, and water quality. They will be asked to examine relationships between different facets of information, for example, the comparison between increase in atmospheric carbon dioxide levels and changes in climate. As another example, students will learn about the First and Second Laws of Thermodynamics and learn to apply these laws in their interpretations of how energy is used efficiently and inefficiently (e.g., Did you know that only about 20% of the high-quality energy in gasoline is transformed into usable mechanical and electrical energy by the typical automobile?). Quantitative analysis of graphical, statistical, and mathematical information will be stressed throughout the class, both in class instruction and in the student analysis and presentation of research topics. Students must clearly demonstrate the application of quantitative skills including the ability to understand and perform statistical and mathematical procedures and interpret tabular and graphical data ranging from histograms and scatter plots to maps and Venn diagrams.

3. Students should be able to demonstrate a general understanding of the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world. Students should be able to identify the difference between science and other fields of knowledge. Students should be able to distinguish science from pseudoscience.

Students will develop a clearer understanding of the complex nature of a range of important environmental issues through the examination of scientific methods of investigation and discussions of topics that constitute science vs. pseudoscience. As an example, topics to be
discussed will include evolution, the scientific evidence in support of evolution, and scientific methods for studying evolution. We will also examine physical earth processes such as plate tectonics, and will discuss evidence for continental drift with its effects on the biogeography of different groups of organisms. We will require students to conduct thematic research projects to evaluate the information available about the scientific basis and implications of different California environmental problems. Students will learn to identify, assess and synthesize a wide array of information from different sources and data types to arrive at a clear understanding of a topic about which they had only limited prior knowledge.
Fulfillment of Learning Outcomes for Lower Division Humanities (Area C2 or C3) by PHIL 1104 - The Philosophy of Environmental Science and Policy

Note: This course has already been approved for General Education Area C credit. Included below are the Area C learning outcomes, with an explanation of how each is met by this course.

1. Students will demonstrate through oral and written work how foundational works in the humanities illuminate enduring human concerns and the intellectual and cultural traditions within which these concerns arise, including both classical and contemporary artists and/or theorists.

The body of literature that relates to human interaction with the environment is vast and diverse. It covers both developments in science as well as social issues such as attitudes toward our environment. Students will be required to address a variety of works across a variety of fields.

2. Students will demonstrate a developing understanding of the interaction among historical and cultural contexts, individual works, and the development of humanities over time.

Students will be required to study writing and ideas about the environment both historical and modern. Students will realize how certain concerns are persistent (like the difference between intrinsic and instrumental value) while other concerns are contemporary (like concerns based on recent science).

3. Through oral and written work, students will demonstrate their ability to critically employ concepts, theories, and methods of analysis used in the humanities to interpret and evaluate enduring human concerns.

Critical reflection is the theme of the class. Students will be required to develop a detailed understanding of the arguments, but they will also be required to evaluate the arguments in such a way so that they are aware of their strengths and weaknesses and can identify what would qualify as support or criticisms of those arguments.

4. Students will critically reflect on the formation of human goals and values, and will articulate an understanding of the creativity reflected in works of the humanities that influenced the formation of those values.

Students will discover that the obvious arguments are rarely the best because they fail to demonstrate a thorough understanding or relevant skills related to the detailed study of environmental ethics. Students will come to appreciate the value of interesting thoughtful studies and arguments.
Fulfillment of Learning Outcomes for Lower Division Social Science (Area D1-3),
by POSC 1171- Environmental Politics

Note: This course has already been approved for General Education Area D credit. Included below is an edited version of the Area D application for GE credit to show how GE learning outcomes are met by this course.

1. Students will demonstrate, orally and in writing, recognition of the application of disciplinary concepts derived from at least three social or behavioral sciences in the study of human behavior, individually and in society.

   State at least two standard or basic theories and models.
   

   Define key disciplinary terms.
   
   Governments, NGOs, IGOs. Activist, equity, blocking coalitions. Power relations.

   Identify professional applications of disciplinary concepts.
   
   Environmental policy-making, environmental advocacy, international diplomacy & negotiation.

2. Students will demonstrate, orally and in writing, recognition of the inquiry methods used by at least one of the social or behavioral science disciplines.

   Identify key research issues
   
   Environmental & health impacts of pollution, levels of compliance with environmental laws, policies & treaties.

   Describe how hypotheses or research questions are formed

   List examples of data that are examined
   
   UN data on government compliance with environmental treaties (Carbon emissions, ozone depleting substance emissions, air & water quality data, loss of biodiversity records.

   Describe how data are analyzed
   
   Example: students examine GHG emissions compared on a country-by-country basis & correlate them with energy use & GDP. They are responsible for discussing in class & in writing what implications can be drawn from this data about relationships between economic development, energy use & carbon pollution.

3. Students will demonstrate, orally and in writing, the ability to describe how human diversity and the diversity of human societies influence our understanding of human behavior, individually and in societies, both local and global.

   The impact of domestic & international environmental problems upon classes, races, genders & countries at different levels of development are highlighted in this course. Lectures, group discussions, films & short student essay exams focus on these topics. The issue of environmental justice is given special attention, as it applies to impoverished communities (urban & rural),
hazardous occupations & poor nations. In addition, the uneven capacities of affected communities to use the political system to defend their interests & advance their well-being is given particular attention. This course looks at environmental justice issues from the Bay Area to the global South.

4. Students will demonstrate, orally and in writing, some knowledge of the political, social, and/or economic institutions of a country other than the United States.

The first half of this course is focused the American political system's capacity to protect the domestic environment--through its laws & regulations; its regulatory agencies; and its judicial rulings. The last half of the course compares the American system's environmental protection process with other developed countries as well as the developing nations of the global South. In addition, the capacity of the international community to forge cooperative agreements & treaties to respond to global environmental threats is analyzed in great detail. Lectures, group discussions, films & short student essay exams all focus on these topics.

5. Students will demonstrate, orally and in writing, the ability to describe major positions and contrasting arguments made on one or more significant contemporary issue area confronting US society as applied to human behavior. (Possible areas include: biomedical and health issues, class, crime, discrimination, education, energy, environment, gender, global economy, immigration, military intervention abroad, poverty, race, technology.)

This course devotes special attention to the contending eco-political philosophies that shape contemporary thinking around environmental policy. Students are exposed to several rival schools of thought regarding the proper relationship between the humans & nature. In addition, ample attention is given to the ongoing debates around what constitutes sustainability in terms of energy use, global trade, agriculture, population, consumption, transportation and living arrangements.
Appendix J. Faculty C.V.s
MITCHELL S. CRAIG  
Department of Earth and Environmental Sciences  
California State University, East Bay  
25800 Carlos Bee Blvd., Hayward, CA 94542  
Phone: 510-885-3425  Fax: 510-885-2526  
Email: mitchell.craig@csueastbay.edu

Education  
Ph. D., Geophysics, Georgia Institute of Technology (1990)  
M. S., Geophysics, Georgia Institute of Technology (1987)  
B. A., Geology, Humboldt State University (1982)

Research Interests  
Near surface geophysics, applied seismology, ground penetrating radar, coastal sedimentary environments.

Appointments  
California State University, East Bay (2002-present), Department of Earth and Environmental Sciences  
2013-present: Professor (promoted Fall 2013).  
2012-present: Department Chair  
2009-2014: Graduate Coordinator  
2006-2013: Associate Professor (awarded tenure Fall 2006).  
2002-2006: Assistant Professor  


University of Papua New Guinea (1998-2000), Department of Geosciences  
1998-2000: Senior Lecturer  
Courses taught: Geophysics, Structural Geology, Data Analysis.

Chevron Corporation (nine years total)  

1990-1995: Geophysicist. Chevron Exploration and Production Services, Houston, Midland, San Ramon. Seismic data processing, data management, and computer system configuration. 2D and 3D prestack and poststack processing, data acquisition, geometry assignment, phase picking, gain and trace equalization, deconvolution, refraction statics, velocity analysis, migration, wavelet inversion.
Temporary Appointments


Articles


Selected Abstracts


Selected Grants


- 2004-2007: *Center for Integrative Coastal Observation, Research and Education (CICORE) – Continuous In Situ Monitoring of South San Francisco Bay*, M. Craig, J. Andrews, and D. Yang. Awarded by National Oceanographic and Atmospheric Administration, subcontract through San Jose State University Foundation.

Recent Students

Aql, Rania. Site Characterization Using Multichannel Analysis of Surface waves in the East San Francisco Bay Area, California (M.S. project, completed 2014).


Fay, Ryan: M.S. Project: Geology of a Portion of the Western East Bay Hills, Niles and Newark Quadrangles, Alameda County, California (M.S. project, completed 2013).

Rhett, Garret. Near Surface Seismic Reflection Surveying in the San Francisco Bay Area (M.S. Project, completed 2012). Employed by Geometrics, Inc., San Jose CA.


Memberships

- Environmental and Engineering Geophysical Society
- American Geophysical Union (Near Surface Section)
- Society of Exploration Geophysicists (and Near-Surface Geophysics Section)
- Seismological Society of America
- Australian Society of Exploration Geophysicists
Michael Stanley Massey  
*Assistant Professor, Department of Earth & Environmental Sciences*  
California State University, East Bay  
Hayward, California 94542 United States  
E-mail: mike.massey@csueastbay.edu

**EDUCATION**

**Ph.D.,** Environmental Earth System Science, Stanford University, September 2013  
- *Advisor:* Dr. Scott Fendorf  
- *Dissertation:* Long-term stable sinks of uranium in soils and sediments

**M.S.,** Soil Science, Colorado State University, May 2008  
- *Advisor:* Dr. Jessica Davis  
- *Thesis:* Dairy farm phosphorus recovery and re-use to reduce water quality risk and improve phosphorus cycling in agriculture

**B.A.,** Japanese with a minor in Computer Science, Stanford University, June 2003

**RESEARCH EXPERIENCE**

**Uranium retention in iron oxides and amorphous silicates**  
Stanford University, Stanford, California, USA  
*Research Assistant, Department of Environmental & Earth System Science*  
September 2008–September 2013  
- Researched uranium retention in iron oxides and silicates to understand uranium environmental fate  
- Analyzed solid phases using synchrotron x-ray absorption, x-ray diffraction, and x-ray fluorescence mapping  
- Developed a mechanistic understanding of uranium incorporation into iron oxides  
- Elucidated the molecular structure of uranium in synthetic amorphous silicates and natural opals

**Phosphorus recovery and re-use from dairy wastewater**  
Colorado State University, Fort Collins, Colorado, USA  
*Research Assistant, Department of Soil and Crop Sciences*  
March 2006–May 2008  
- Researched the removal and beneficial reuse of phosphorus from dairy waste treatment systems  
- Successfully removed excess phosphorus from dairy waste and demonstrated the usefulness of the product as a fertilizer in high-pH, calcium-rich soils

**Biogas production from wastewater treatment plants and livestock agriculture**  
USEPA Region 8, Denver, Colorado, USA  
*Environmental Scientist Intern, Office of Partnerships and Regulatory Assistance (Water)*  
Summer 2007  
- Researched anaerobic digestion and biogas production at wastewater treatment plants and farms  
- Collected, standardized, and analyzed responses from regional treatment plant operators  
- Estimated current and potential biogas production in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)

**ADDITIONAL RESEARCH/EDUCATIONAL EXPERIENCE**

**Jasper Ridge Biological Preserve Docent**  
- Experiential nature education and research in a field setting  
- Field ecology, native flora and fauna of Stanford’s Jasper Ridge Biological Preserve (JRBP)  
- Lead JRBP tours, nature walks (for community members, local schools, etc.)
HONORS AND AWARDS

2012: Stanford University School of Earth Sciences Certificate of Achievement in Mentoring
2012: Stanford Synchrotron Radiation Lightsource Graduate Student Poster Competition winner
2011: Stanford University “Diversifying Academia, Recruiting Excellence” Fellowship Alternate
2010: Soil Science Society of America Graduate Student Poster Competition winner
2010: Stanford Synchrotron Radiation Lightsource Graduate Student Poster Competition winner
2009: Robert and Marvel Kirby Stanford Graduate Fellowship
2008: Great Plains Soil Fertility Conference Student Poster Contest, first place; Travel Award
2007: Hunter S. Follett Graduate Student Award
2007: Elected to Phi Kappa Phi national all-discipline honor society
2002: Stanford University Center for East Asian Studies Fellowship

PROFESSIONAL AFFILIATIONS

2007–present: Member, Soil Science Society of America
2007–present: Member, Agronomy Society of America
2007–present: Member, American Society of Agricultural and Biological Engineers
2007–present: Member, American Association for the Advancement of Science
2009–present: Member, American Chemical Society
2010–present: Member, Mineralogical Society of America
2007–2013: Member, Water Environment Federation
2011–2012: Member, American Geophysical Union

TEACHING EXPERIENCE

California State University, East Bay, Hayward, California, USA
Assistant Professor, Earth & Environmental Sciences
Fall 2013–present
Courses taught: Environmental Biology, Environmental Biology Laboratory, Environmental Problems of California, Hazardous Waste Management, Seminar in Environmental Science

Stanford University, Stanford, California, USA
Teaching Assistant, Soil and Environmental Chemistry
Winter 2010 and Winter 2012

Stanford University, Stanford, California, USA
Program Assistant, Summer Undergraduate Research in Geoscience and Engineering (SURGE)
Summer 2011 and Summer 2012

Colorado State University, Fort Collins, Colorado, USA
Teaching Assistant, Environmental Issues in Agriculture
Fall 2007

Yokosuka Sogo High School, Yokosuka, Japan
English Teacher, Foreign Language Department
August 2003–August 2005
PUBLICATIONS

PEER-REVIEWED JOURNAL ARTICLES (5):


PEER-REVIEWED CONFERENCE PROCEEDINGS (3):


ABSTRACTS (12):

Invited Conference Presentations (1):


Conference Oral Presentations: 4

Conference Poster Presentations: 7

OTHER CONFERENCE PRESENTATIONS (1):


NEWSLETTER/EXTENSION ARTICLES (1):

Jean E. Moran

EMPLOYMENT
Associate Professor, Department of Earth & Environmental Science
California State University East Bay  2012-present
Assistant Professor, CSUEB  2008-2012
Collaborating Scientist, Lawrence Livermore National Laboratory  2008-present
Research Scientist, Project Leader, Lawrence Livermore National Laboratory  1997-2008

EDUCATION
1994, University of Rochester, Rochester, NY, Ph.D. Geochemistry
1986, University of Washington, Seattle, WA, M.S. Geophysics
1983, University of Rochester, Rochester, NY, B.S. Geology, cum laude  B.A. Physics, cum laude

RESEARCH EXPERIENCE
Research grants and contracts  2008-present
Sources of nitrate in drinking water, analysis of groundwater ages, examination of water quality in tritum-dead groundwater, identification of paleowater, extrinsic tracers in managed aquifer recharge settings
Primary advisor for nine M.Sc. students
Research Scientist, Lawrence Livermore National Laboratory  1997-2008
Project Leader Groundwater Ambient Monitoring and Assessment Program, Director noble gas mass spectrometry laboratory; water quality, surface water/groundwater interaction, groundwater age-dating, GIS
Post-Doctoral Scientist, Texas A&M University  1994-1997
hydrology and radiochemistry, trace element analysis
Research Assistant, University of Rochester  1991-1994
isotope geochemistry, accelerator mass spectrometry, basin brine chemistry and dating
Research Assistant, University of Washington  1984-1986
marine heat flow and marine seismology, introductory oceanography

GENERAL RESEARCH INTERESTS
groundwater dating and groundwater contamination vulnerability, mass spectrometric methods for environmental geochemistry, chemical evolution of fluids in the earth's crust, applications of isotopes in hydrogeology and environmental geology, artificial recharge, public health and drinking water quality

TEACHING EXPERIENCE
California State University East Bay  2008-present
Courses taught: Groundwater Chemistry (graduate), Hydrogeology, Oceanography, Natural Disasters, Environmental Hydrology, Physical Geology, Contaminant Transport (graduate), Isotope Geochemistry (graduate)
Lawrence Livermore National Laboratory  1997-2007
Mentor/Advisor to high school students, undergraduate students, graduate students, and post-doctoral scientists
J. E. Moran and C. Kendall (Instructors), Isotope Methods for Groundwater Investigations Course  2007
University of Rochester  1990-1991
laboratory methods in environmental science
Teaching Assistantships: computer applications in geological sciences, environmental geophysics, geochemistry, energy and mineral resources
U.S. Peace Corps, Fiji Islands, public high school  1986-1990
Chemistry, Physics and Mathematics teacher
Technical coordinator for Peace Corps teacher training  1989-1990
PROFESSIONAL MEMBERSHIPS
American Geophysical Union
Geological Society of America
Groundwater Resources Association of California
Board of Directors 2006-2011

HONORS, AWARDS, RECOGNITION
Hitchon Award - International Association of Geochemistry 2007
Groundwater Resources Association President’s Award 2007, 2008, 2009
Regeant’s Graduate Fellowship 1990-1993
Merle Spurrier Award for Leadership in Athletics 1983
Lattimore Prize for Geology Field Camp 1983
Chairman’s Award, Geology Department 1983
NYS Regent’s Scholarship 1979-1983
Rochester National Scholarship 1979-1983

REVIEWER

Recent Publications (*peer-reviewed; ± student or post-doctoral researcher)


Jeffery C. Seitz  
Department of Earth & Environmental Sciences  
California State University, East Bay  
Hayward, CA 94542-3088  
(510) 885-3438; (510) 885-2526 FAX  
jeff.seitz@csueastbay.edu  
www.sci.csueastbay.edu/~jseitz

Education:
A.M. Earth and Planetary Sciences (December 1989) Washington University, St. Louis, MO  
A.B. Earth and Planetary Sciences (May 1986) Washington University, St. Louis, MO

Recent Positions Held:
2008-present: Professor of Geology. California State University, East Bay.  
2010-present: Principal Investigator, Integrated Middle School Science (IMSS) Partnership  
2008-present: Faculty Advisor, East Bay Science Project at the California State University, East Bay. California Science Project.  
2006-12: Chair, Department of Earth and Environmental Sciences (formerly Geological Sciences).  
2003-08: Associate Professor of Geology. California State University, East Bay.  
2000-08: Director, East Bay Science Project (formerly the BEST Institute) at the California State University, East Bay. California Science Project.  
1997-2003: Assistant Professor of Geology. California State University, East Bay (formerly California State University, Hayward).

Recent Awards and Professional Recognition:
George and Miriam Phillips Outstanding Professor of the Year (California State University East Bay, 2010).  
Stanford University-ASEE Faculty Research Fellowship. (NASA Ames Research Center, 1998 and 1999).  

Recent Funding History:
2012 **Principal Investigator**, East Bay Science Project (2012-13) Funder: California Science Project, University of California ($50,000).  
2011 **Principal Investigator**, California Science Project ($50,362) CSMP and NCLB8 funding for the East Bay Science Project (2011-12).  
**Principal Investigator**, NASA: Exobiology and Evolutionary Biology Program ($178,360) Experimental determination of the partial molal volumes of aqueous organic compounds.
2010 **Principal Investigator**, National Science Foundation, Math Science Partnership ($11.96 million) SF Bay-Integrated Middle School Science Project (IMSS).

**Principal Investigator**, California Science Project ($50,000) CSMP Funding for East Bay Science Project (2009-10).


**Principal Investigator**, California Science Project ($50,000) NCLB X Funding for the East Bay Science Project.

2007 **Co-Investigator**, NASA: Exobiology and Evolutionary Biology Program ($512,417) Experimental determination of the partial molal heat capacities and volumes of aqueous organic compounds.

**Recent University and Administrative Service:**
- 2013-15: Elected member, Academic Senate, California State University East Bay
- 2013-15, Elected member, University Committee on Research, California State University East Bay
- 2011-12: Elected member, Executive Committee, Academic Senate, California State University, East Bay.
- 2011-12 Ad Hoc Information Technology (IT) Advisory Committee
- 2010-11: Elected Vice Chair, Academic Senate, California State University, East Bay
- 2010-12: University Layoff Committee, California State University, East Bay
- 2010-11: Research Strategic Planning Task Force, California State University, East Bay
- 2010-12: Elected member, Academic Senate, California State University, East Bay, representing the College of Science
- 2006-present: Department Chair, Department of Earth and Environmental Sciences, California State University, East Bay
- 2008-present: Elected at-large member, Academic Senate, California State University, East Bay
- 2008-09: Elected member, Executive Committee, Academic Senate, California State University, East Bay.

**Recent Refereed Articles** (student authors in *bold italics*):
Hall A. S. and Seitz J. C. (in prep) Determination of the Volumetric Properties of Dilute Sodium 2-Mercaptobenzenesulfonate · H₂O Solutions at Temperatures from (293.15 to 353.15 K) and Pressures from (0.1 To 0.8 MPa). *Journal of Chemical Thermodynamics*. October 2014 expected submission.
Seitz J. C. and Blencoe J. G. (1996) Volumetric properties for \{(1-x)\text{CO}_2 + x\text{CH}_4\}, \{(1-x)\text{CO}_2 + xN_2\}, and \{(1-x)\text{CH}_4 + xN_2\} at the pressures (19.94, 29.94, 39.94, 59.93, 79.93, and 99.93) MPa and the temperature 673.15 K. *Journal of Chemical Thermodynamics*, 28, 1207-1213.


Seitz J. C., Schulte M. D., Hall A. S., and Rhett G. W. (in prep) Volumetric properties of dilute D-glucose \cdot \text{H}_2\text{O} solutions at temperatures from (293.15 to 433.15) K and pressures from (0.10 to 50.00) MPa. *Journal of Chemical Thermodynamics*. October 2014 expected submission.

**Recent Published Abstracts and Presentations** (student authors in *bold italics*):


*Hall A. S.* and Seitz J. C. (in prep) Determination of the Volumetric Properties of Dilute Sodium 2-Mercaptoethanesulfonate \cdot \text{H}_2\text{O} Solutions at Temperatures from (293.15 to 353.15) K and Pressures from (0.1 To 0.8 MPa). *Journal of Chemical Thermodynamics*. October 2014 expected submission.


Seitz J. C., Schulte M. D., *Hall A. S.*, and Rhett G. W. (in prep) Volumetric properties of dilute D-glucose \cdot \text{H}_2\text{O} solutions at temperatures from (293.15 to 433.15) K and pressures from (0.10 to 50.00) MPa. *Journal of Chemical Thermodynamics*. October 2014 expected submission.


Curriculum Vitae - Luther Milton Strayer

Assistant Professor, Structure & Tectonics  Dept. of Earth & Environmental Sci.
Ph.D. Structural Geology, University of Minnesota California State University, East Bay
Peter J. Hudleston, Thesis Advisor 25800 Carlos Bee Blvd.
luther.strayer@csueastbay.edu Hayward, CA 94542
home: (510) 582-4400 office: (510) 885-3083

Education
Project, Dr. John Suppe Supervisor
Ph.D. 1998 University of Minnesota (Structural Geology - Thrust Deformation and
Fluid Flow)
1990 - 1992 University of Connecticut (Doctoral study, left when advisor quit
academics)
M.S. 1989 University of Montana (Structural Geology - Kinematics of Arc-Continent
Suture)
B.A. 1985 Macalester College (Studio Arts & Geology double major)

Positions (Academic)
2010 – present Associate Professor of Geology, Dept. of Earth & Env. Sciences, CSU,
East Bay
2009 – 2010 Visiting Scholar, National Taiwan University, Taipei, NSC funded.
2006 – 2009 Associate Professor of Geology, Dept. of Geological Sciences, CSU, East
Bay
2000 – 2006 Assistant Professor of Geology, Dept. of Geological Sciences, CSU, East
Bay
1998 - 2000 Research Associate, Princeton 3D Structure Project. (Developing Cross-
Section Restoration Techniques and Forward Numerical Modeling).
1997 - 1998 Research Assistant, University of Minnesota (Brittle-Plastic Deformation
& Fluid Flow).
1996 - 1997 GeoFluids Fellow, University of Minnesota (Brittle-Plastic Deformation &
Fluid Flow).
1995 - 1996 GeoFluids Fellow, University of Minnesota (Brittle-Plastic Deformation &
Fluid Flow).
1993 Research Assistant (Rio Grande Rift Project).

Positions (Industry)
Summer 1992 BioMyne Inc. Project Manager, Supervised grass-roots gold
exploration program, Ketchum & Challis, Idaho USA.
Protection Division (paid internship), Municipal aquifer protection plan analysis & river quality surveys.
Summer 1989  Gradient Geophysical Inc. Missoula, Montana USA, Geophysical surveys for gold industry, SW Montana.

Summer - Fall 1988  NERCO Minerals, Reno, Nevada USA, Field/Project Geologist, gold exploration, Roberts Mountains, Nevada.

Spring 1988  Atlanta Gold Corporation, Atlanta, Idaho USA, Drill-site geologist.

Honors and Awards
April 2012  Visiting Research Scholar – National Taiwan University
1996 - 1997  GeoFluids Fellowship (NSF Funded), University of Minnesota.
1995 - 1996  GeoFluids Fellowship (NSF Funded), University of Minnesota.

Grants
- Programmatic Excellence and Innovation in Learning (PEIL) Grants 2012: Assessing Community Engagement and its Impact on Student Learning Outcomes at CSUEB (co-PI); $10,000.
- ChevronTexaco, CSU East Bay Field Camp Support Grant. In aid of GEOL4820 Summer 2006. $15,000. Award went to student scholarships, field vehicle rental, student room & board, and camp infrastructure.

Relevant Publications/Abstracts
Earthquake Conference, California State University, East Bay.


