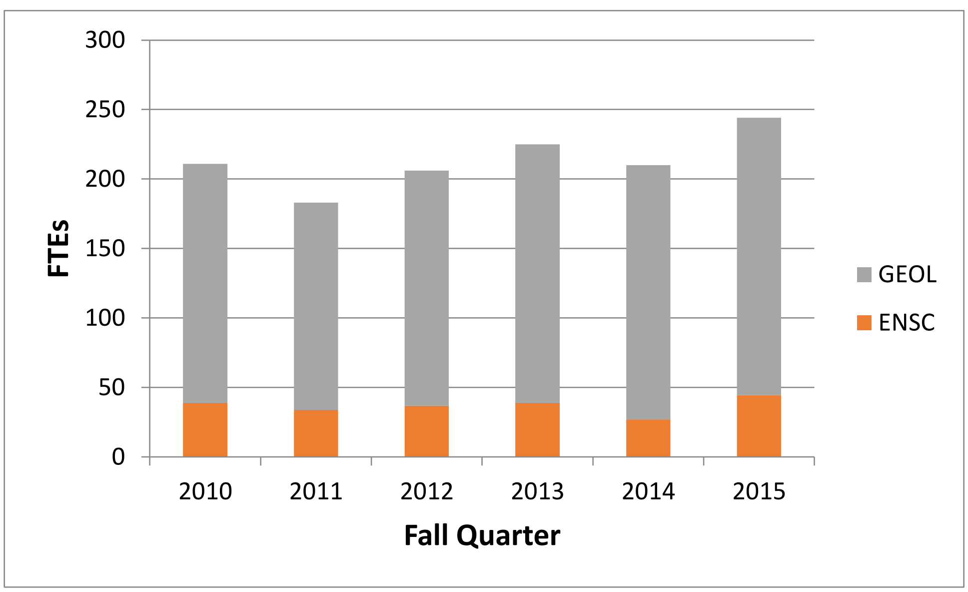
Geology MS Program Annual Report 2015-16

Department of Earth and Environmental Sciences

The Department of Earth and Environmental Sciences in the College of Science offers degrees in Geology (BS, BA, MS) and Environmental Science (BS). The scope of this report is the Geology graduate (MS) program.

Enrollment

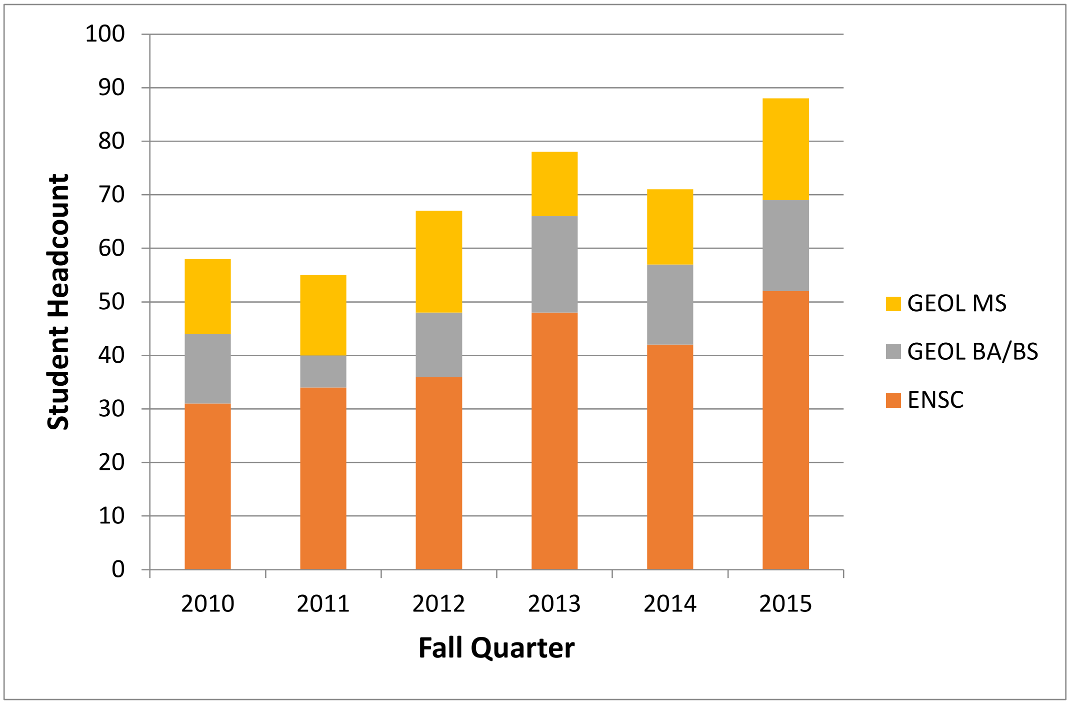
Enrollment in courses offered by the department as measured by Fall Quarter FTES was 244 for 2015 which represents a modest increase above the past few years (see figure below). The majority of the department's FTES are associated with Geology courses in the General Education (GE) Program. This includes Freshman Learning Communities (clusters) and upper-division GE. The department taught in three GE clusters during AY 2014-15. Graduate student TAs lead laboratory sections in introductory Geology courses.



FTES for courses in Geology and Environmental Science.

Number of Majors

The total number of majors, or student headcount, in the Geology MS program was 19 in Fall 2014. This is a modest increase above the average number of majors from 2010-2014 which was 14.8. The graduation rate has increased as well, with the number of degrees awarded going from 1-2 in 2010-2012 to 6-8 in 2013-15.



Number of majors in Earth and Environmental Sciences degree programs.

Student Advising

Advising for students in the Geology MS program is provided by the graduate coordinator and the project or thesis advisor.

Faculty

The department has five tenure-track or tenured faculty members; one Assistant Professor, two Associate Professors and two full Professors. A tenure-track faculty member with expertise in Environmental Science started in Fall 2013, and now serves as the Environmental Science Program Coordinator. A search was carried out for an Affinity group position in 2015-16, and a new faculty member with expertise in carbon cycling will begin in Fall 2016. A search to fill a second affinity position will take place in 2016-17.

The department contracts with ten to twelve lecturers each quarter to teach a variety of courses, including introductory courses for non-majors as well as upper-division and graduate level courses for majors. Most are part-time and have been teaching in the department for several years. All have at least an MS degree, and seven have a PhD in Geology or a related field.

Staff

The department has two staff members, an Administrative Support Assistant and Instructional Support Technician. The ASA provides office support and the technician prepares and maintains materials for labs. The technician position was filled in October, 2015.

Assessment

The department implemented its assessment plan for the current academic year, 2015-2016; report is attached.

Department of Earth and Environmental Sciences
California State University, East Bay

ASSESSMENT REPORT 2015-16

GEOLOGY M.S.

28 June 2016

Department of Earth and Environmental Sciences
California State University, East Bay

Assessment Results 2016-17
Geology M.S.

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Department of Earth and Environmental Sciences
California State University, East Bay

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)

Department of Earth and Environmental Sciences
California State University, East Bay

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.

	MS PLO 1 Geologic Materials	MS PLO 2 Data Analysis	MS PLO 3 Communication	MS PLO 4 Research	MS PLO 5 Geologic Time
ILO 1: Thinking & Reasoning	X	X	X	X	X
ILO 2: Communication			X	X	
ILO 3: Diversity			X		X
ILO 4: Collaboration		X	X	X	
ILO 5: Sustainability			X		X
ILO 6: Specialized Education	X	X	X	X	X

Curriculum Map for Program Student Learning Outcomes
CSU East Bay, Dept. of Earth & Environmental Sciences
Degree Program: M.S. in Geology

			Program Learning Outcomes				
Field	**Course**	**Title**	**1. Geologic Materials**	**2. Data Analysis**	**3. Communi-cation**	**4. Research**	**5. Geol. Time**
GEOL	6020	Seismic Exploration	P	M			
GEOL	6040	Near Surface Geophysics	P	M			
GEOL	6310	Isotope Geochemistry	I	P	P		M
GEOL	6320	Groundwater	I	M	P		P
GEOL	6411	Engineering Geology	M	M			
GEOL	6414	Earthquake Geology	P		M		M
GEOL	6430	Tectonic Geomorphology	I		P		M
GEOL	6811	Graduate Seminar			M		
GEOL	6899	Project		P	P	M	
GEOL	6910	University Thesis		M	M	M	

Proficiency Levels: I = Introduced; P = Practiced; M = Mastered

Quantitative Literacy (QL) is competency and comfort in working with numerical data. Individuals with strong QL skills possess the ability to reason and solve quantitative problems from a wide array of contexts and situations.

This rubric may be applied to student assignments that involve all or parts of any of the department's Program Learning Outcomes (PLOs).

	Capstone 3	**Milestone** 2	**Milestone** 1	**Milestone** **0**
Interpretation *Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information.	Provides accurate explanations of information presented in mathematical forms.	Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units.	Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means.
Representation *Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)*	Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.	Competently converts relevant information into an appropriate and desired mathematical portrayal.	Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.
Calculation	Calculations attempted are successful and sufficiently comprehensive to solve the problem. Calculations presented clearly and concisely.	Calculations attempted are mostly successful and sufficiently comprehensive to solve the problem.	Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.	Calculations are attempted but are both unsuccessful and are not comprehensive.
Application / Analysis *Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis*	Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.	Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.	Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.
Assumptions *Ability to make and evaluate important assumptions in estimation, modeling, and data analysis*	Explicitly describes assumptions and provides compelling rationale for each. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.	Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.	Explicitly describes assumptions.	Attempts to describe assumptions.
Communication *Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)*	Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.	Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.	Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support.

M.S. Geology Program

Assessment Summaries, 2015-2016

Overview

We evaluated student work from selected courses in the Geology MS Program 2015-2016 to assess how well Program Learning Outcomes (PLOs) were met. PLOs evaluated during this period are 2) Data & Analysis and 3) Communication.

GEOL 6320 Groundwater – Spring 2016: Data & Analysis.

Laboratory activity in which students carry out a tracer test in a column packed with sediments to graphically and analytically determine a key property of porous media for contaminant transport, dispersivity. Completion of the activity requires calibrating a UV-VIS spectrophotometer, determining concentrations of sample solutions, calculations of key physical properties of the media and writing up results and interpretation. The Quantitative Literacy rubric, which includes a Communication category, was used to evaluate student work. Out of 24 possible, overall scores ranged from 8 to 18, with an average of 11.5 and standard deviation of 3.5. Six of twelve students who completed the assignment displayed at least the basic level of competency overall; five demonstrated at least the basic level of competency in all areas of quantitative literacy. None displayed an exemplary level in more than one area of quantitative literacy. A thorough mastery of advanced algebra, calculus, and graphing is an expected pre-requisite for the course, but some students lack the basic preparation and others have the necessary preparation but their quantitative skills are quite rusty. Possible ways to improve learning outcomes for this assignment are: 1) a pre-assignment that gives students practice with advanced algebra skills, 2) recommendations for math tutoring at SCAA for students who do not perform well on a math skills pre-test given on the first day of class, 3) an additional, optional, session where students work on problems with the instructor present. In the future, similar assessment material will be assigned since calculating physical properties of porous media is a student learning outcome for this course.

GEOL6910 University Thesis - Fall 2015, Winter 2016, Spring 2016: Written Communication

Prospectus for a thesis. The department requires students on the thesis track to prepare a prospectus, which includes a literature review and proposal describing the aim, plan, and expected outcomes of the proposed research. Three committee members (at least two CSUEB faculty; one may be an outside researcher) review the prospectus, provide feedback, and approve the final version. Four students submitted prospectuses in AY 15-16. The students received initial feedback from the primary advisor on writing style, grammar, sentence structure, and word choice. The same students carried out three additional revisions, based on individual feedback from each of the committee members, on clarity of expression and accuracy of content. For two of these students, the first draft lacked organization between appropriate sub-sections. For one student, English as a second language was a significant factor in requiring many revisions of syntax and grammar. The second drafts for these three students required several grammatical/wording corrections and stylistic suggestions in *each paragraph*. On average, committee members made 35 corrections and 27 comments on the first draft (10-12 pages of text).

Students entering the M.S. program have a wide range of technical writing skills – three of four of the students assessed this year required remediation in the mechanical aspects of technical writing. Possible ways to improve outcomes for this assignment are: 1) additional reading assignments from the peer reviewed literature that are chosen to highlight quality technical writing, and 2) encouraging students to take ENGL 3025 (Technical and Professional Writing) as an elective. (One student had ENGL 3025, and submitted the highest quality first draft.) Faculty advisors and committee members will need to continue to invest a large amount of time and effort in providing corrections and other feedback on prospectuses.

Dispersion in a Sediment Column, Laboratory Assignment:

This laboratory will use a groundwater tracer to make benchtop-scale estimates of mass transport in a saturated porous medium. We will use fluorescein, a fluorescent dye approved for application in drinking water settings, as a conservative tracer. Its movement through the column should be controlled by advection and dispersion only.

A known concentration of dye will be applied to the sediment column. The solution should be applied at a constant rate and with a constant hydraulic head maintained. Small volume fractions of effluent will be collected at the column outlet and their fluorescein concentrations measured using a UV-visible spectrophotometer. From the breakthrough curve, you can make estimates of dispersivity, α, and the Dispersion Coefficient, D_L.

Results of this type of experiment are often reported in pore volumes of the fluid that are eluted.

One pore volume is equivalent to the cross sectional area, A, times the length, L, times the porosity of the medium, n. Since discharge over a time period is q*t = v*n*A*t, the number of pore volumes eluted is: vAnt/ALn = vt/L, a dimensionless number related to time.

Procedure:

1) Calibrate the spectrophotometer using the standards and blank provided. Plot a calibration curve (may not be linear, use Excel to get the best fit equation).

2) Determine the concentration of the column dye solution using your calibration curve.

3) Label several test tubes – these will be used for collection of water passing through the column.

4) Use a dh of appx. 3 cm and get a slow, smooth discharge.

5) Lower the water in the funnel until it is very nearly (but not completely!) empty.

6) Add the tracer solution to the mark on the funnel and maintain this level.

7) Open the clamp and begin draining the fluid from the column in increments into the tubes (make sure they are filled at least half way). Try to keep the flow continuous and minimize the time the outlet hose is clamped between increments.

8) Measure the transmittance of the sample as you go (pour each sample into a container to get the cumulative amount, once you have a detection of the dye). You can re-use the tubes after you've rinsed them well.

9) Continue until you have at least a C/C_0 of 0.5

10) Record time, C, and volume on a data table.

11) Plot time vs C

Calculate D, alpha, and v at $C/C_0 = 0.5$

Calculate the total mass of fluorescein recovered.

Write out equations and calculations, and write an explanation of the steps you took to determine the dispersivity of the medium. Interpret the value of the dispersivity in the context of the type of material packed in the column, and relate it to grain size and sorting.

Write another paragraph that summarizes how this experiment allows determination of dispersive characteristics of porous media. Include sources of uncertainty and your assessment of how the results would translate to the field scale.

CSUEB GEOL, M.S., Program Assessment							
Rubric:	**Quantitative Skills**						
Course:	GEOL 6320 Groundwater						
Quarter:	Sp 15						
Assignment:	Lab Activity: Dispersivity in Darcy Columns						
Student ID	Interpretation	Representation	Calculation	Application/ Analysis	Assumptions	Communication	Total
1	3	3	3	3	3	3	18
2	2	4	3	2	2	2	15
3	1	3	2	1	0	1	8
4	2	2	2	2	2	2	12
5	2	2	2	1	1	1	9
6	2	3	3	4	3	2	17
7	1	2	2	1	1	1	8
8	3	2	2	2	1	2	12
9	1	2	2	1	2	1	9
10	2	2	2	1	1	1	9
11	2	4	2	1	1	2	12
12	1	3	2	1	1	1	9
							11.5

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 <u>no thesis research can begin prior to acceptance of the prospectus.</u>**

- A prospectus must include the following parts:
  1. Title page
  2. Abstract
  3. Description of research proposed
  4. Student qualification (optional)
  5. Tentative work schedule

- The prospectus should not exceed a total of 5-15 pages.
- The following pages describe the format which must be followed for the preparation of a prospectus.

PART I - TITLE PAGE

Example of a Title Page

Prospectus for a Thesis
Master of Science Degree in Geology
California State University, East Bay

(title of the project)
e.g., **GEOLOGIC STUDY OF CONTACT METAMORPHIC ROCKS IN THE HAYWARD QUADRANGLE, ALAMEDA COUNTY, CALIFORNIA**

(name and address of the student)
e.g., **Joseph P. Dough**
11234 Grand Boulevard, Castro Valley, CA 94546
(510) 555-1212

(date of submission)
e.g., **May 10, 2011**

Proposed Advisor: Dr. XXXXX **Signature** ________________________
Other Committee Members:

Dr. xxxxxxx **Signature:** ________________________

xxxxxxx, **Signature** ________________________
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
(650) 856-1626

PART II - ABSTRACT

The abstract must highlight the salient features of the project in terms of situating the project within a context of geology, past research, significance, and feasibility.

Remember that an abstract is **not** a summary but rather a brief enumeration of the important points of the work. The abstract should be brief, not much more than a half page. **Under no circumstances should it exceed a page in length.**

You may use the attached literature as guidelines.

PART III - DESCRIPTION OF RESEARCH PROPOSED

INTRODUCTION

OVERVIEW

Outline the proposed thesis topic in terms of geographic and geologic location, type of work projected, etc. Mention briefly what other studies have been done on the same topic and why there is a need for further work. Also mention what you hope to achieve with your research.

PREVIOUS WORK DONE WHICH RELATES TO YOUR TOPIC

In this section describe in detail all you know about previous investigations which relate to your project. Be sure to support your comments with the references you were able to find and read. Use the format adopted by a standard geologic journal (e.g., GSA Bulletin) to include the references in the text and be sure to include all of them in the reference list at the end of your prospectus.

UNRESOLVED QUESTIONS

Describe the issues which remain to be resolved as described by other researchers you may have talked to or read about. Also mention the questions remaining as you perceive them from a critical evaluation of literature, application of new geologic theories, application of new techniques of study, etc.

NEED FOR PROPOSED RESEARCH

Describe what you hope to achieve through your work and how it should relate to the existing body of knowledge. Mention here why your project is important and why this is worth doing.

DESCRIPTION OF RESEARCH

PURPOSE AND OBJECTIVE

Describe in detail what you expect to do (e.g., field work, laboratory study of rocks, measurement of joint attitudes, analysis of trace elements, etc.). Explain how, with this approach, you plan to achieve your primary research goals. State a testable hypothesis or question to be answered by your project.

OUTCOME

List the results that you hope to produce such as geologic maps (scale, type, quality, etc), mineralogic or chemical data, etc. Also mention whether you plan to submit your results for publication, and if so, in what form and where (e.g., company report, open file report, geologic journal, etc.).

PROCEDURES AND SUPPORT

Itemize here the type of work you plan to carry out, e.g., field work, laboratory work, etc., and the support that you hope to receive from the department (should be checked in advance with faculty or technician), from the university, or elsewhere. If you plan to seek outside support in equipment or funds, mention it in this section and suggest how likely it is to be received and what your plans would be in case this support is not forthcoming.

REFERENCES CITED

List all the bibliographic references you cite in your prospectus using a standard journal format (e.g., the format used for G.S.A. publications).

PART IV - STUDENT'S QUALIFICATIONS

List the reasons which you feel qualify you to successfully carry out the proposed project. Include:

1. The course work you have taken which prepared you for the project.
2. Any knowledge you may have acquired on your own through reading, outside coursework.
3. Any non-academic experience which has prepared you for the project, such as work related workshops, training by non-academic specialists, etc.
4. Names of specialists who may provide you with some advice outside of the university and whom you have contacted or plan to contact.

PART V - TENTATIVE WORK SCHEDULE

In this section give an estimate of the time you plan to spend to complete your project. Your prospectus will be evaluated for its realistic time framework. Past experience shows that students nearly always underestimate the time they need to prepare and write their theses once research is completed. Also keep in mind that in its final stages thesis writing involves frequent communication between the student and committee members to improve thesis quality, scheduling of thesis defense, etc. **These matters cannot be improvised and take a lot of time.**

Finally, remember that there is a five-year time limit for completing a Master's Degree at CSUEB. This time includes all course work and the thesis approved in its final form by the University Office of Academic Programs.

Department of Earth and Environmental Sciences, CSCI

CALIFORNIA STATE UNIVERSITY EAST BAY

ASSESSMENT PLAN: M.S. in Geology

Updated Winter 2015 by Jean Moran, Luther Strayer, and Mitchell Craig

PROGRAM MISSION

CSUEB Missions, Commitments, and ILOs, 2012 version

CSUEB Geology M.S. Program Description

To serve graduate students who are employed during the day, all graduate courses in the Department of Earth and Environmental Sciences are offered in the evenings and on weekends. In addition to regular catalog courses, recent graduate seminars and advanced topics courses have dealt with such subjects as sediment transport and modern depositional environments, rock mechanics, applied geophysics, isotope hydrology, tectonics and sedimentation. Additional facilities and part-time employment may be secured through Co-op programs, the Lawrence Berkeley and Lawrence Livermore National Laboratories, and the U.S. Geological Survey in Menlo Park. Candidates for this degree must be prepared to engage in significant individual research. Lately, student research in this department has included such topics as hydrogeology, near surface geophysics, areal geology and slope stability, geochemistry, structural geology, engineering geology, and neotectonics.

PROGRAM STUDENT LEARNING OUTCOMES (PLOs)

Students graduating with a M.S. in Geology will be able to:

PLO 1 *ILO 1,6*	Attain an advanced understanding of the relationship between geologic materials and their physical and chemical properties. *(Geologic Materials)*
PLO 2 *ILO 1,4,6*	Collect, analyze, and interpret data using advanced discipline-specific methods, techniques, and equipment. *(Data & Analysis)*
PLO 3 ILO 1,2,3,4,5,6	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)*
PLO 4 *ILO 1,2,4,6*	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)*
PLO 5 *ILO 1,3, 5,6*	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)*

Year 1: 2013-2014	
1. Which PLO(s) to assess	PLO 3 *(Communication)*, PLO 4 *(Research)*
2. Assessment indicators	GEOL6320 Term Paper, GEOL6414 Precis & Oral Presentation, GEOL6910 Prospectus
3. Sample (courses/# of students)	GEOL6320/10, GEOL6414/15, GEOL6910/2.
4. Time (which quarter(s))	Fall 2013, Winter 2014, Spring 2014
5. Responsible person(s)	Luther Strayer, Jean Moran
6. Ways of reporting (how, to who)	The report was delivered to the Chair, and distributed to the faculty. It was also included within the department's annual program report.
7. Ways of closing the loop	Areas of improvement were discussed at faculty meetings, improvements and revisions to future courses are expected.

Year 2: 2014-2015	
1. Which PLO(s) to assess	PLO 1 *(Geologic Materials),* PLO 5 (*Geologic Time),*
2. Assessment indicators	Course assignments and projects, with department rubric.
3. Sample (courses/# of students)	GEOL6040/14, GEOL6310/10, GEOL6430/15
4. Time (which quarter(s))	Fall 2014, Winter 2015, Spring 2015.
5. Responsible person(s)	Mitchell Craig, Jean Moran, Luther Strayer.
6. Ways of reporting (how, to who)	Reports first to the Chair and then to the entire faculty for comment & discussion. An end-of-year meeting will be devoted to evaluating assessment results and "closing the loop."
7. Ways of closing the loop	Identified "areas for improvement" will be incorporated into modified/updated core courses for future majors

Year 3: 2015-2016	
1. Which PLO(s) to assess	PLO 2 *(Data & Analysis),* PLO 3 *(Communication)*
2. Assessment indicators	Course assignments and projects, precis & oral presentations of topical journal articles in the field, MS prospectus, MS project, MS thesis. Department rubrics will be used.
3. Sample (courses/# of students)	GEOL6320/15, GEOL6620/17, GEOL6811/12, GEOL6899/4, GEOL6910/2.
4. Time (which quarter(s))	Fall 2015, Winter 2016, Spring 2016.
5. Responsible person(s)	Luther Strayer, Jean Moran, department faculty.
6. Ways of reporting (how, to who)	Reports first to the Chair and then to the entire faculty for comment & discussion. An end-of-year meeting will be devoted to evaluating assessment results and "closing the loop."
7. Ways of closing the loop	Identified "areas for improvement" will be incorporated into modified/updated core courses for future majors. Issues with the Thesis process will be discussed and acted upon.

Year 4: 2016-2017	
1. Which PLO(s) to assess	PLO 4 *(Research),* PLO 5 *(Geologic Time).*
2. Assessment indicators	Course assignments and projects, precis & oral presentations of topical journal articles in the field, MS prospectus, MS project, MS Thesis. Department rubrics will be used.
3. Sample (courses/# of students)	GEOL6040/15, GEOL6414/15, GEOL6811/12, GEOL6899/5, GEOL6910/3.
4. Time (which quarter(s))	Fall 2016, Winter 2017, Spring 2017.
5. Responsible person(s)	Mitchell Craig, Luther Strayer, and affiliated faculty.
6. Ways of reporting (how, to who)	Reports first to the Chair and then to the entire faculty for comment & discussion. An end-of-year meeting will be devoted to evaluating assessment results and “closing the loop.”
7. Ways of closing the loop	We will assess progress made since 2015-2016, adjust strategies. Revise program requirements concurrently with quarter-to-semester conversion.

Year 5: 2017-2018	
1. Which PLO(s) to assess	PLO 1 *(Geologic Materials)*, PLO 2 *(Data & Analysis)*
2. Assessment indicators	Course assignments and projects, precis & oral presentations of topical journal articles in the field, MS prospectus, MS project, MS Thesis. Department rubrics will be used.
3. Sample (courses/# of students)	GEOL6020/15, GEOL6414/15, GEOL6899/6, GEOL6910/3.
4. Time (which quarter(s))	Fall 2017, Winter 2018, Spring 2018.
5. Responsible person(s)	Luther Strayer, Jean Moran, Mitchell Craig.
6. Ways of reporting (how, to who)	Reports first to the Chair and then to the entire faculty for comment & discussion. An end-of-year meeting will be devoted to evaluating assessment results and “closing the loop.”
7. Ways of closing the loop	Assess progress made since 2016-2017, adjust strategies.