

Geoscience

Geology:

Date: 09-07-2022

- Physical Sciences (Geoscience) 2020-21 PUR Self-Study

Sorted by: Section

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1.A. Program or Unit Description

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Briefly describe the program/unit, including but not limited to the following: academic division that the program/unit belongs to, the academic area(s) represented, degrees/certificates offered, average student enrollment, number of full-time faculty, type of curriculum or pedagogical approaches, and any other pertinent aspect of the program/unit.

The Geoscience Program is part of the Department of Physical Sciences in the Division of Math and Physical Sciences. The program offers an Associate of Science degree in Geosciences that allows seamless transfer to the Geology baccalaureate degree at UNR. The program offers five courses: Geology 100 (Earth Hazards), Geology 101 (Physical Geology—Exploring Planet Earth), Geology 102 (History of Life Through Time), Geology 206 (Geologic Fundamentals of Geothermal Energy Resources), and Geology 260 (Introduction to Geological Field (Mapping) Techniques). The latter 4 courses are required for the A.S. degree and are required for the baccalaureate degree

in Geology at UNR. Although Geology 100 (Earth Hazards) is not part of the Associate of Science Degree in Geoscience, it is a required course for several programs as well as a general education. Approximately 90 students enroll in geosciences courses each semester, many of them fulfilling their general education requirements. Currently, the program employs one tenure-track faculty, David Boden, who will be retiring at the end of the spring 2021 semester.

1.B. Program or Unit Mission

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State the department's or unit's mission. Describe how it aligns to the College's Mission, and how program learning outcomes (PLOs) for degrees and certificates offered, or for the unit, align to the department/unit mission. If your department or unit does not currently have a mission statement, please discuss among your colleagues and develop one.

The Geosciences program falls under the mission of the Physical Sciences department:

The mission of the Physical Sciences Department is to provide students the basic principles of modern astronomy, physics, chemistry, environmental sciences, geology, geography, and engineering in order to establish a foundation for those pursuing degrees in the natural sciences and engineering fields, as well as the pre-requisite courses for students seeking degrees in biology and the allied health professions. As such, the Physical Sciences Department supports student success and academic excellence by offering college transfer courses in all areas, providing pre-requisite classes for allied health and pre-professional programs, and supporting TMCC's general education requirements in the natural sciences.

Both the department's goals and TMCC's mission statement align well and the same applies for the Geology discipline, which is one of eight disciplines housed in the Department of Physical Sciences. One of the innovative learning opportunities in Geology courses are the field studies where the outdoors is used as a natural laboratory allowing students to extend and apply what they learn in class to the better understand Earth processes, geologic history, and Earth hazards. In classes taught by David Boden, students use an electronic

response system that allows them to check their understanding of taught concepts in real time and provide alerts when students need remediation in particular concepts.

1.C. Program Learning Outcomes

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Program Learning Outcomes (PSLOs or PLOs)
Geology
PSLO
Associate of Science, Geoscience
PSLO1: Relate how the various earth systems, consisting of the geosphere, hydrosphere, cryosphere, atmosphere, and biosphere, interact with each other so as to affect surface landforms, climate and weather, oceanic circulation patterns, and well being of life forms including the human condition. (Active from Spring 2020)
PSLO2: Utilize the theory of plate tectonics to explain the distribution of volcanoes, earthquakes, energy and mineral resources, and formation of different types of rocks and minerals. (Active from Spring 2020)
PSLO3: Demonstrate an ability to identify and classify rocks and minerals and relate their origin to both internal and external forces and processes. Much like words in a book tell a story, students will "read" rocks to interpret their history as written by nature. (Active from Spring 2020)
PSLO4: Recognize that changes in life over time involve feedbacks between life forms and the physical environment—that changes in our physical environment, driven by both internal and external forces, govern the explosions and extinctions of life forms with time and will continue to do so. (Active from Spring 2020)
PSLO5: Apply the scientific method and geologic knowledge gained in a capstone course to interpret the geologic history of select areas of the Reno region through field studies, involving rock and structure identification and plotting their distribution to make basic but informative geologic maps also useful in assessments of geological hazards. (Active from Spring 2020)

2.A. Progress on Previous Findings and Recommendations

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Describe your progress on the major findings and recommendations for the program/unit from the last PUR, any annual progress reports (APRs), and if applicable, external reviews, (e.g. advisory boards, articulation committees, and program accreditors).

- **Which findings and recommendations have the program/unit addressed?**

- **Which have yet to be accomplished? Which are no longer relevant, and why?**
- **Has the program/unit undergone any major changes as a result or that would impact the findings and recommendations since the last PUR?**

The last Department of Physical Sciences PUR was completed in 2012 and was completed for the department as a whole rather than for the individual areas. At that time, Geology and Geography were combined under Geosciences with two lead faculty, Bronwen Owen in Geography/Environmental Science and David Boden in Geology. Only two items were put forth in the departmental PUR:

- 1) Find more storage space for the geology rock samples and maps in or near RDMT 307,
- 2) Hire additional faculty in Geography to address the issue that 14% of all sections were taught by a tenure-track faculty member.

The issue of storage space has only partially been addressed. RDMT 306, which had been a storage area, was reallocated to the Biology department for their student research program. The rock samples and other equipment were moved to RDMT 300 and additional cabinet space was purchased.

At the end of 2014, Bronwen Own left TMCC, and for two years immediately following Bronwen Owen's departure a full-time non-tenure track faculty headed the program. As a result, the Geography program floundered, enrollment dropped, the Geography AS was deactivated, and many of the courses were deactivated, revised, or are in the progress of revision. GEOG 121 (The Science of Climate Change) was deactivated, GEOG 103 (Physical Geography of Earth's Environment) and GEOG 104 (Physical Geography Lab) were revised to match the offerings of UNR and combined into a single course with four labs, and GEOG 106 (Cultural Geography) and GEOG 200 (World Regional Geography) are in the revision process.

To reflect these changes, GEOG 103, which was a required component for the A. S. degree in Geoscience, was placed as an elective in the curriculum sequence, and GEOG 121 on Climate Change was dropped from the elective list. Consequently, the A. S. degree in Geoscience is now basically a Geology degree.

In an effort to improve awareness of geoscience and to increase enrollment in offered courses, a video about geoscience was made with the help Media Services and placed on the TMCC website. The video was posted in the fall before the pandemic, so the effectiveness of the video for raising awareness and increasing enrollment in geoscience courses remains unclear at this time.

Dave Boden retires at the end of the spring 2021 semester. This will leave the Geosciences program without a lead faculty in Geology as well. The fear of the department is that without a lead faculty member to, at the minimum, coordinate the general education courses that this program will flounder as well.

3.A. Technical Programs (AAS degrees and Certificates; Allied Health Programs only)

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Describe how your program(s) are meeting labor market demands and industry curriculum needs by answering the accompanying questions. The following are potential resources for labor market data, though other sources may be referenced.

Nevada Department of Employment Training and Rehabilitation (DETR) (<https://detr.nv.gov/>)

Economic Development Authority of Western Nevada (EDAWN) (<http://edawn.org/>)

U.S. Bureau of Labor Statistics (<http://www.bls.gov/>)

- **What is the evidence for the regional need for the program (DETR and EDawn data)?**
- **What is the evidence that program curriculum meets the latest industry trends or workforce needs?**

Not applicable.

3.B. Transferability

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- **Which Bachelor's degrees(s), especially within the Nevada System of Higher Education, does the program's AA or AS degree(s) align?**

- **Does the AA or AS transfer seamlessly in a 2+2 agreement without a loss of credits or a substantial amount of courses counting only as general electives? Please reference the appropriate transfer agreement in the receiving institution's catalog and explain.**

The A. S. degree in Geoscience aligns well with the B. S. degree in Geology at UNR. The Geology Department at UNR requires more geology courses in the first two years, six classes altogether, than many other institutions. Three of the six classes are typically taught at the junior level at most other colleges and universities. Currently, the Physical Sciences department only offers three of the six classes: GEOL 101, GEOL 102, and GEOL 260. GEOL 102 (Historical Geology) has not been taught at TMCC since 2016 due to low enrollment, but students are able to back-transfer the course from UNR in order to complete the A.S. degree. In addition, TMCC students in the Geoscience program are encouraged to complete their math, physics, and chemistry courses before transferring to UNR, which frees up time in their junior and senior years at UNR to complete the required geology courses. As stated in the transfer agreement with UNR, TMCC students who have taken GEOL 206 (Geology of Geothermal Energy Resources), can apply it toward an upper division geology elective. As such, TMCC transfer graduates can graduate in four years with a B. S. degree in Geology if their life circumstances allow.

3.C. Student-centered Offerings

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- **Is the program Information In the catalog up-to-date?**
- **Does the program's suggested course sequence in the catalog allow for completion of degrees within 2 years and/or certificates within 2 semesters for full-time students? Is there a recommended sequence for part-time students?**
 - **Describe how courses are scheduled and faculty teaching schedules are assigned. How does the department/unit schedule its course offerings in a student-centered manner that meets student demand and allows for efficient**

completion? How are teaching assignments determined so that they are equitable for faculty?

The program information is current in the catalog and allows for completion of the degree within two years for a full-time student, provided they enter TMCC without academic deficiencies. As for part-time students, the program will take longer but the course sequence as outlined in the catalog is clear and can be followed as their life circumstances permit.

3.D. Accessibility of Instructional Materials

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What is the department/unit currently doing or planning to help ensure that instructional materials are accessible to students with disabilities? For example, have all full-time faculty attended accessibility workshops? Have full-time faculty used the accessibility purchase checker when purchasing new curricular materials? Has the department/unit taken steps to ensure part-time faculty are using accessible instructional materials?

All instructional materials utilized for courses have disability access as typically provided by the publisher. For those courses taught online, e.g., GEOL 100 (section 3001), TMCC's WebCollege provides audio and written transcripts as needed for students with disabilities. Also instructors work with the Disability Resource Center on campus to make sure student accommodations are satisfied as needed and specified, such as where to sit in the classroom or offering extra time for taking an exam.

4.A. Curriculum Mapping

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As instructed the curriculum map has been created in eLumen.

Truckee Meadows					
ISLO/PSLO Summary Map by Course/Context					
Map Origin: Associate of Science, Geoscience					
Map Target: Associate of Science, Geoscience					
Associate of Science, Geoscience					
ISLO	PSLO1	PSLO2	PSLO3	PSLO4	PSLO5
<p>ECOM201</p> <p>1. Students will apply economic indicators to assess the state of a product market and analyze changes in the market in order to measure the amount of the good to be produced and price to be charged.</p> <p>2. Students will apply graphic analysis in order to determine the effect of changes in price, wages and interest on GDP, employment and investment for an economy.</p> <p>3. Students will know the basic differences among the major industrial organizations in a market context including companies, monopoly and monopolistic firms.</p>	<p>PSLO1: Explain how the various earth systems, considering the geosphere, lithosphere, cryosphere, atmosphere, and hydrosphere, interact with each other as well as affect surface conditions, climate and weather. Discuss the circulation patterns, and weathering of the earth including the human condition.</p> <p>PSLO2: Utilize the theory of plate tectonics to explain the distribution of volcanoes, earthquakes, energy and mineral resources, and formation of different types of rocks and minerals.</p>	<p>PSLO3: Demonstrate an ability to identify and classify rocks and minerals and relate their origin to both internal and external forces and processes such as the earth's crust and a variety of students will "read" rocks to interpret their history as written by nature.</p>	<p>PSLO4: Recognize that changes in the crust have created the landscape we live in and the physical environment—that changes driven by both internal and external forces, govern the formation of geologic hazards that threaten the geologic maps that are useful in assessments of geological hazards.</p>	<p>PSLO5: Apply the scientific method and geologic knowledge gained in a classroom setting to interpret the geologic history of areas across the Reno region through field studies, involving rock and structure identification and paying their attention to map scales and interpret geologic maps that are useful in assessments of geological hazards.</p>	
<p>ECOM202</p> <p>1. Students will apply economic indicators to assess the state of a product market and analyze changes in the market in order to measure the amount of the good to be produced and price to be charged.</p> <p>2. Students will apply graphic analysis in order to determine the effect of changes in price, wages and interest on GDP, employment and investment for an economy.</p> <p>3. Students will know the basic differences among the major industrial organizations in a market context including companies, monopoly and monopolistic firms.</p>					
<p>ECOM203</p> <p>1. Students will apply economic indicators to assess the state of a product market and analyze changes in the market in order to measure the amount of the good to be produced and price to be charged.</p> <p>2. Students will apply graphic analysis in order to determine the effect of changes in price, wages and interest on GDP, employment and investment for an economy.</p> <p>3. Students will know the basic differences among the major industrial organizations in a market context including companies, monopoly and monopolistic firms.</p>					
<p>GEOL101</p> <p>1. The student will analyze and apply how the classification of minerals and rocks helps describe the processes of their formation.</p> <p>2. The student will apply appropriate field study techniques to interpret the geological history of an instructor-specified region.</p> <p>3. The student will explain how internal processes and forces within the Earth along with weathering and erosion shape the surface of our planet.</p>			X (P)		X (P)
<p>GEOL102</p> <p>1. The student will define and analyze the relationship between biological and physical processes associated with Earth's evolution.</p> <p>2. The student will explain how physical processes, such as climate change, tectonic activity, and sea level rise, can affect the evolution of life on Earth.</p> <p>3. The student will interpret the geological history of a location using appropriate field observation and measurement techniques.</p>	X (P)	X (P)		X (P)	X (P)
<p>GEOL201</p> <p>1. The student will compare and contrast advantages and problems and create solutions to problems associated with developing types of geothermal resources.</p> <p>2. The student will describe and compare how different geologic environments affect the distribution and types of geothermal systems.</p> <p>3. The student will observe and describe components of an actively producing geothermal power plant.</p>	X (P)		X (P)		X (P)
<p>GEOL202</p> <p>1. Students will gain the ability to apply basic geologic concepts to rock and structural identification to produce geologic maps of a variety of different geologic environments.</p> <p>2. Students will gain the ability to synthesize data collected in production of geologic maps to describe continuity for near-surface rock structures, and develop a coherent geologic history of the area mapped.</p>			X (P)		X (P)
<p>MATH101</p> <p>1. The student will apply the fundamental theorem of calculus.</p> <p>2. The student will compute and interpret average rate of change and instantaneous rate of change for functions.</p> <p>3. The student will interpret the derivative of a function graphically, numerically and analytically.</p>	X (O)	X (O)		X (O)	
<p>MATH102</p> <p>1. Students will develop an appropriate integral form to solve a specific applied problem in geometry, physics, or probability.</p> <p>2. Students will evaluate indefinite and definite integrals by selecting and correctly applying appropriate integration techniques (u).</p> <p>3. Students will utilize appropriate theory and computational techniques to compare Taylor series with its interval of convergence for use in a variety of applications such as approximating values of a function, finding normals for new functions, and density.</p>					
<p>PHYS101</p> <p>1. Students will choose which conceptual and quantitative techniques are relevant when presented with different applications of classical dynamics.</p> <p>2. Students will construct graphs and diagrams to represent phenomena of classical dynamics.</p> <p>3. Students will quantitatively solve introductory level problems of classical dynamics.</p>	X (O)	X (O)			
<p>PHYS102</p> <p>1. Students will choose which conceptual and quantitative techniques are relevant when presented with different applications of electrostatics.</p> <p>2. Students will construct graphs and diagrams to represent phenomena of electrostatics.</p> <p>3. Students will quantitatively solve introductory level problems of electrostatics.</p>	X (O)	X (O)			
<p>PHYS103</p> <p>1. Students will choose which conceptual and quantitative techniques are relevant when presented with different applications of classical dynamics.</p> <p>2. Students will construct graphs and diagrams to represent phenomena of classical dynamics.</p> <p>3. Students will quantitatively solve introductory level problems in classical dynamics.</p>	X (O)	X (O)	X (O)		
<p>PHYS104</p> <p>1. Students will do experiments requiring them to choose which conceptual and quantitative techniques are relevant when presented with different applications of classical dynamics.</p> <p>2. Students will do experiments requiring them to construct graphs and diagrams to represent phenomena of classical dynamics.</p> <p>3. Students will do experiments requiring them to quantitatively analyze introductory level problems of classical dynamics.</p>					
<p>Attachment Levels</p> <p>M: Mastered NR: Not Reached/Not Started IR: Introduced/Introduced DM: Demonstrated/Mastery PR: Practiced/Practiced IRD: Introduced/Reached/Demonstrated PPD: Practiced/Practiced/Demonstrated DP: Demonstrated/Demonstrated D: Demonstrated IP: Introduced/Practiced IP: Practiced R: Reached/Reached I: Introduced</p>					

Once your map is complete, please analyze the following:

- **PLOs: Do all PLOs still reflect what you want students to demonstrate once they complete the program? Are there any PLOs that need to be updated?**
 - **Potential gaps and redundancies: Are there any PLOs that are not addressed in the curriculum? Are there any unwanted redundancies of PLOs in the curriculum?**
 - **CLO alignment: Is there a need to modify any course learning outcomes so that courses better support PLOs?**
 - **Course sequencing: Is there a need to modify the course sequencing, so students have a more seamless learning experience?**
 - **Curriculum and learning opportunities: Is it necessary to introduce new learning opportunities to reinforce learning? These could be modules or assignments in courses, additional courses, and/or co-curricular opportunities that would be required of all students in the program.**
 - **Other?**

The PLOs adequately reflect the desired outcomes intended for students who pursue the program and require no updating at this time.

For the present there are no gaps or redundancies in the PLOs.

As shown in the curriculum map, the CLOs and PLOs have good alignment.

Course sequencing allows students to progress in a logical order from establishing fundamentals to learning more advanced concepts and applications through the sequence. As noted above, the course sequencing places emphasis on completing breadth requirements in humanities, sciences, and math so upon transfer to UNR, a TMCC student can be on par with a UNR counterpart.

Students are encouraged to review video animations posted on website and Canvas to reinforce learning of concepts. Students are then asked to apply taught concepts to real world situations, such as using a chemical reaction to explain the deposition of calcite in a hot spring due to pressure loss or temperature increase.

For some reason the curriculum map does not include Chemistry 121 and 122 which are required in the program. These courses should be there in addition to Physics because Geology is the application of chemistry and physics toward understanding Earth processes. For example, the origin of Earth's magnetic

field is created by motion of liquid metal in the Earth's outer core creating a geodynamo (physics), or explaining the physical and chemical characteristics of different minerals based on their bond types and internal arrangement of atoms (chemistry).

4.B. Evidence of Program Learning Outcomes Assessment

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Now that you have completed your curriculum map, summarize the most significant *program* assessment results since your last PUR. These will come from any data we have available in eLumen as well as past assessment reports. Please discuss these findings as they relate to the program and program learning outcomes, not just individual courses.

As shown on the curriculum map, there is good alignment between individual course learning outcomes and program learning outcomes. Courses and ultimately program outcomes were measured using Hake gain on pre- and post-course content inventories taken by students. The Hake gain is ratio defined by $\text{post test score (\%)} - \text{pretest score (\%)} / 100\% - \text{pretest score (\%)}$. Ratios of >0.5 are exemplary, 0.5 to 0.3 are proficient, 0.3 to 0.1 are marginal, and 0.1 are unsatisfactory. Ratios of 0.1 to 0.3 are typical for lecture-based or passive learning, where ratios >0.3 are indicative of active learning techniques, such as using think-pair-share or lecture tutorials, and reflect superior student learning gains.

For classes taught by David Boden, learning gains are routinely above 0.3 and not uncommonly above 0.5 . To achieve these superior results, active learning techniques are utilized during class, mandating full student participation. These techniques include using an electronic response system where students answer questions and response results are posted as a histogram. This tells both the students and the instructor how well the class is understanding presented concepts. Another technique employed is using lecture tutorial exercises where students work in pairs solving higher order thinking problems, usually at the application and analysis level.

Describe how plans were implemented to try and improve teaching and learning. What changes did you make to the program based on assessment results and improvement plans?

The program is evolving as Hake gain scores are usually not as good with classes taught by part-time faculty, routinely in the marginal range (0.1 to 0.3). As such, an effort is underway to encourage these instructors to use more active learning techniques in class and minimize lecture-style (passive learning) instruction.

4.C. General Education Outcomes Assessment

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- **Identify which general education learning outcomes (GELOs) you assessed and summarize the most significant assessment results.**
- **Describe how plans were implemented to try and improve teaching and learning in general education (GE). What changes did you make assessment results and improvement plans? Do any CLOs need to be changed to meet GE assessment requirements?**

The GELOs are embraced within the program learning outcomes and individual course learning outcomes. General education courses in the program consist of GEOL 100, GEOL 101, and GEOL 206. As noted above, assessment results range from proficient to exemplary in courses taught using active learning techniques.

Efforts are underway to encourage applying active learning strategies with the adjunct faculty to improve Hake gains and student learning. No CLOs are believed needed to change at this time to meet GE assessment requirements.

4.D. Five-year Course Assessment Cycle

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The course assessment cycle has been submitted by our department (Physical Sciences) and no changes for Geology courses are recommended at this time.

This question has not been answered yet

5.A. FTE, Section Count, Course Fill Rate, and Unsuccessful Enrollment Attempts

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Please analyze and discuss the trends you see in FTE and section counts, including how they compare to those of the division and College. Discuss any factors that could have led to significant trends or shifts in enrollment and sections offered.

Please analyze the default settings first. Then, you may use the drop-down menus to examine more disaggregated data sets. If you describe any trends in these more specific data, please include a screen shot of the data to accompany your discussion.

In the last five years, FTE enrollment in Geology courses has declined by 13% and 14%, for fall and spring semesters, respectively. By comparison, FTE for the Department of Physical Sciences has been approximately steady over the same period of time.

As for section count in Geology, there has been a 20% section increase overall. This is driven by a new online version of GEOL 100 which is required for the B. S. Emergency Management degree at TMCC. Otherwise, the number of sections has remained stable or in the case of Geology 101 was reduced to one section beginning in the fall 2019 due to reduced enrollment.

Similar to declining overall FTE, the fill rates for Geology courses have declined from 70-75% to 55-59% depending on the semester. Prior to about 2010 fill rates for Geology courses were typically above 80%.

Please analyze and discuss the trends or shifts you see. Discuss any factors that could have led to significant trends or shifts in course fill rate and unsuccessful enrollment attempts.

Please analyze the default settings first. Then, you may use the drop-down menus to examine more disaggregated data sets. If you describe any trends in these more specific data, please include a screen shot of the data to accompany your discussion.

The decline in FTE for Geology, mainly GEOL 101, is not well understood. Prior to about 2015, GEOL 101 had both a day and evening section, with enrollment generally in the low to mid-twenties for the day section and mid to upper teens in the evening section. Enrollment declined rather abruptly beginning in Fall 2018 for reasons not entirely clear. It could be due to a changing demographic with students less interested in learning about Earth processes and energy and mineral resources and more focused on job training and applied health sciences.

5.B. Student Demographics: Ethnicity, Gender, Credit Load, Student Status, and Age Range

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Briefly describe the typical student profile in terms of ethnicity, gender, credit load, student status, and age in your program/unit. Please note and discuss any reasons why the demographics of students in your program noticeably differ from TMCC's student demographics. Please note any potentially underserved student populations and the reasons why they may exist.

For the Geoscience program, looking at ethnicity, data are really only available for two ethnicities: Caucasian and Hispanic. The Caucasian enrollment has varied from a high of 92% to a low of 59%, with an average of 77%. Over the same period, Hispanic enrollment has varied from a high of 18% to a low of 6%. In both cases, trends are difficult to discern as enrollment can vary widely from term to term.

Because of the wide variability from term to term, it is hard to compare results for the Geoscience program to those of the College. For the College, the Caucasian enrollment has decreased by about 8% and Hispanic enrollment has increased by about 7% over the same 5 year period. Black enrollment for the school has remained relatively steady with a slight increase of about 0.5%. These trends are not unlike those for the Department of Physical Sciences as a whole, except for Black enrollment which has declined slightly.

As for gender, except for fall 2015, which had a low of 36% female, for the subsequent terms has fluctuated from 46% to 41% female averaging about 43%. As for male students, except for fall 2015 that had a high of 64% the male enrollment has vacillated between 54% to 59% averaging 56%. Compared to the College, there is a higher percentage of male students taking courses in the Geoscience program. In the college the demographic proportions of female to male students has remained relatively constant over the last 5 years, with 54% being female and 46% being male.

Regarding student credit load, full time student status has increased from a low of 15% in fall 2015 to a high of 44% in fall 2019, the last year of reported data. Correspondingly, part-time student status has decreased from a high of 85% in fall 2016 to a low of 56% in fall 2019. Compared to the College, the full-time student status is higher for the Geoscience program with only about 28% of enrolled students being full time and the rest being part time. The higher amount of full-time students in the program could reflect the overall higher percentage of students in the younger age group of 18-24 taking Geoscience courses. These students are less likely to be working compared to those students in the older age bracket of 25-34 (see age discussion below).

As for student status, the bulk of students in Geoscience program are continuing, with results varying from a low of 69% to a high of 94%. The results seem to fluctuate from semester to semester without really any clear trend. These values are higher than for the College as a whole, where continuing student percentage has declined consistently from a high of 72% in fall 2015 to 62% in fall 2019.

Looking at student age, about 55% of students are in the 18-24 age bracket, and about 30% are in the 25-34 age bracket for fall 2015 to fall 2018. Fall 2019 seems to be anomalous compared to the preceding four years with the 18-24 and 25-34 age brackets evenly divided at 37.5%. These results are not dissimilar to that of the college as a whole, where a little more than 50% of the students are in the 18-24 age bracket and about 22% of students are in the 25-34 age bracket. The main change with age for the College has been the increase in young students (18) from just over 3% in fall 2015 to nearly 14% in fall 2019.

6.A. Course Completion

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Please describe any substantial trends or shifts that you see in overall course completion rates and successful completion (C or better). What might these trends or shifts mean? Discuss any factors that could have led to these trends or shifts in the data. Next, disaggregate the data by student demographics and describe any substantial trends. An educational equity gap is where there is a significant and persistent disparity in educational attainment between different groups of students. Are there any equity gaps in course completion or successful completion rates?

For Geology, the five-year average for completion is 87% with a successful completion of 70% (C or better). This compares favorably with other disciplines in the Department of Physical Sciences. These values are above the average for the Math and Physical Sciences Division as a whole, whose results are 69% completion rate and 54% successful completion.

As for gender in Geology, there is no gender gap as both male and female performed comparably, 87%-71% and 87% and 69%, respectively for completion and successful completion.

For ethnicity, Caucasians have performed better than Hispanics and Blacks for completion and successful completion. The results are 90% and 74% (Caucasian), 83% and 63% (Hispanic), and 75% and 58% (Black). Again these results are comparable to other disciplines in the department where ethnic minorities do not do as well as their Caucasian counterparts. These disparities probably reflect complicated contrasting social-economic issues that compete with educational development. To encourage improved completion and successful completion, instructors probably need to work more closely with students belonging to ethnic minorities and make clear to them that we are here to help you succeed.

6.B. Graduation and Transfer

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Please discuss any trends or shifts that you see in overall graduation and transfer. Next, disaggregate the data by student demographics and describe any substantial trends. An educational equity gap is where there is a significant and persistent disparity in educational attainment between different groups of students. Are there any equity gaps in graduation or transfer?

Regarding graduation and transfer, one degree was awarded in Geoscience in each academic year beginning in 14-15 and ending in 18-19, for a total of 4 degrees over the time period. Of the four, two transferred to a NSHE school and the other two did not transfer after earning their degrees. Two of the Geoscience degrees were earned by women and the other two by men. Neither of the women who earned degrees transferred, whereas the two men who graduated did transfer. All four degree earners are Caucasian. All degree earners were full-time students, and three were in the 18-24 age bracket and one in the 25-34 age bracket.

7.A. Faculty Achievement

Geology

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Describe the program/unit's full-time (FT) faculty credentials, experience, and highlights of significant activities and/or contributions to TMCC. Please use the format below for each FT faculty member.

- **Faculty Name, FTE**
- **Degree(s) or professional certification(s) awarded, discipline, awarding institution**
- **Substantial accomplishments or contributions to the community, especially those related to education or your discipline (e.g. mentoring, community service) (please limit to 3)**
- **Number of years teaching at TMCC**
- **Total number of years in academia**
- **Primary courses taught**
- **Significant activities or contributions made to TMCC (Please limit to 3)**

Dave Boden is the lead program coordinator for Geology and the only full-time faculty member teaching courses in Geology. He is currently in phase-in retirement working at 60% FTE and will retire at the end of the 20-21 academic year. He earned a Ph.D from Stanford University in 1987 and a Master's of Science in Geological Engineering from Colorado School of Mines in 1980.

For four years he was a member of the Board of Directors of the international Geothermal Resources Council and was successful in securing funding to support students to attend the annual meeting when held here in Reno (alternate years). During his sabbatical year, he wrote a reference book on the Geology of Geothermal Energy Resources that was published by Taylor-Francis. The book is used as a reference at some colleges where geothermal energy is taught as part of the Geology and/or Engineering curriculum, including UNR and Western Washington University. He also served on the Executive Committee for the Geological Society of Nevada as Publications Chair for 3 years. As part of his duties, he reviewed applications for scholarships to help students at UNR pay for field camp, which is the capstone course for the baccalaureate degree in Geology. He also wrote and was awarded a grant to the Geological Society of Nevada Foundation to purchase a drone the purpose of making geological base maps for students taking Geology 260. Due to the pandemic and his impending retirement, unfortunately, the drone has yet to be utilized but will be donated to the Physical Sciences Department so it may be hopefully used in fortifying in geology or environmental science courses.

Dave Boden has taught at TMCC for nearly 18 years and before that he taught chemistry and earth science at Reno High School for 5 years, for a total of 23 years in academia. Prior to embarking on academia, he worked in minerals exploration looking for base and precious metal deposits in many parts of the world for about a dozen years after completing my graduate studies.

While at TMCC, he has served two terms as faculty senator, and has been a long-standing member of the Professional Standards Committee. With the help of Jim Nichols, he developed the TMCC

geothermal plant operator program which was very successful in placing graduates into jobs with the industry. The program is now dormant as job opportunities declined coinciding with a downturn in the industry beginning in 2012. Also for several years, he taught or co-taught a workshop during Professional Development week at TMCC on the benefits of using electronic response systems to improve student engagement and learning. Because of this system and using other active learning strategies, student learning in courses I teach is routinely in the proficient and exemplary range on the basis of Hake gains of pre- and post-course content inventories assessing course student learning outcomes.

While at TMCC, Dave Boden has taught courses in physical geography (GEOG 103, 104), physical geology (GEOL 101), Earth hazards (GEOL 100), geothermal energy (GEOL 206), and introductory geological field mapping (GEOL 260).

7.B. FT/PT Faculty and Student Credit Hours Taught

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

Describe the trends or shifts in the number of full-time (FT) and part-time (PT) faculty, and the number of student credit hours (SCH) taught by FT and PT faculty since the last program/unit review. What Impact, if any, have these trends or shifts had on the program/unit?

The workload dashboard only shows results for the Physical Sciences Department and not individual disciplines within the department. According to the dashboard for the past 5 years, about 53% of course sections in the fall (on average) were taught by full time faculty. Results are similar for spring term. In one academic year, 2018-19, 55% of course sections for fall term and 52% for spring term were taught by part-time faculty.

7.C. Support Staff

Geology

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Describe the program/unit's support staff, including their FTE, major duties, and any specialized credentials necessary to carry out their duties. Is the number of staff adequate to support the program/unit? Explain.

For the Physical Sciences Department, the support staff consists of Lee Anderson, full-time administrative assistant, and Sydnee Franzwa, part-time laboratory facilitator. Both do a fine job supporting the Department and the Geology program.

7.D. Facilities and Technology

Geology

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Describe the facilities and technology used by the program/unit, and discuss any unique requirements. These may include labs, studios, off-campus sites, computer classrooms, specialized equipment, etc. Are program/unit facilities and technology adequate to support the program? Explain.

Current facilities adequately support the program in general. Lab and classroom instruction are delivered in RDMT 307 and a sample storage/prep is shared with biology equipment in RDMT 300. The storage/prep room is cramped and additional shelving and storage space would allow improved organization and retrieval of mineral and rock specimens.

With the upcoming renovation of RDMT 303/300 in the fall 2021 semester, the geology samples are temporarily being relocated to an empty office in RDMT 321. Once the renovation is complete, new cabinets and storage space will be allocated in RDMT 303.

8.A. Five Year Plan

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

Using the most significant curriculum and assessment-driven findings, and considering any internal or external factors anticipated to impact your program, discuss strategies to sustain or improve student learning. This may also include deactivating existing or introducing new courses or programs to meet student and/or Industry demand.

The department recommends that a program for part-time faculty on incorporating active learning strategies be developed, such as use of electronic response systems and lecture tutorial activities, to foster student engagement and learning. On the basis of past results of course learning assessments using Hake gains, a notable gap is evident between courses taught using active learning strategies and those that are mainly lecture based.

After considering the most significant enrollment findings, and any internal or external factors anticipated to impact future enrollment, discuss strategies, if needed, to improve enrollment or address these factors. These may include, more efficient scheduling, streamlining pathways to completion, outreach to underserved students, etc.

To improve enrollment in the Geoscience program and select geology courses, Dave Boden suggests active recruitment in other related courses such as environmental science and engineering courses. The video David Boden created with the help of Media Services regarding the Geoscience program needs to be prominently displayed not only on the College Website but also on the Physical Sciences Department website. If GEOL 260 is continued after Dave Boden retires, it is recommend that recruitment continue at UNR in the Geology, Hydrogeology, and Geological Engineering programs. Generally about half the students that participate in the fall course come from UNR based on active recruiting.

With respect to course pass rate, graduation, and transfer, discuss strategies to enhance student success. These may include curriculum changes, streamlining pathways to completion, Improving advising, mentoring, and retention efforts, etc. Address any equity gaps. How does the department or unit plan to improve degree/certificate

completion and/or course completion if the department or unit does not offer any degrees/certificates?

Course completion and successful completion in Geology courses is pretty good at present. Further improvement can be probably achieved, as discussed previously, by having part-time faculty implement active learning strategies as part of their teaching that effectively mandate student engagement. It is also recommend adding additional field activities as part of course instruction. Feedback indicates that the field studies are key highlights from the course and students also note that field education is unique in their college learning experiences.

Considering the above strategies, what are the major goals that the department/unit hopes to accomplish in the next 5 years? How does the department or unit plan align with the Academic Affairs Strategic Plan or the College's Strategic Master Plan? Include an estimated timeline of goal completion.

A major goal is to increase enrollment in the Geoscience program through increased recruitment and promotion. Many students are not aware of the unique educational opportunities afforded in the Geoscience program including how the outdoors is a natural laboratory to better understand the workings of the Earth and their impact on people. Also students who are interested in managing energy and mineral resources, used by society, need to be made aware of the many employment opportunities in the Geosciences.

These goals are consistent with College's strategic plan to provide a quality education to its students and prepare them to be contributing members of society.

9.A. Resource Requests

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

For each request, please indicate whether the request is for an additional faculty and/or staff position, capital improvements (facilities), technology or specialized instructional resources, or professional development and address the following items:

- **Request (Additional faculty/staff, capital improvements,**

technology or other specialized instructional resources, or professional development)

- **Estimated time to hire or time the request will be made**
- **Projected measurable outcomes: What does the program hope to introduce, develop, improve, enhance, accomplish, etc. as a result of the request? Which PLOs and/or student success metrics does the department hope to improve as a result of the request?**
- **Alignment to the Academic Affairs and College's Strategic Plan**
- **Institutional Funding Priority: Indicate which of the following institutional funding priorities your request addresses:**

1. **Compliance with mandates and requirements.**
2. **Address and/or mitigate issues of liability.**
3. **Address compensation equity.**
4. **Improve efficiency and/or effectiveness.**
5. **Leverage resources, investments with returns.**
6. **Promote professional development.**

Having seen the decline of the Geography program with the departure of the tenure-track faculty member and with the impending retirement of David Boden, the department needs a new Geosciences tenure-track faculty member. This faculty member would not only oversee the Geology courses, but would also teach and help coordinate part-time faculty in the Geography program. While the Geosciences A.S. is a low enrollment program, even the general education courses in this area (GEOL 100, GEOL 101, GEOG 106, GEOG 200), and the courses that supplement programs in Environmental Science, Education, and Engineering (GEOG 103, GEOG 210, GEOL 206) need the attention of a full-time tenure track faculty member to coordinate curriculum and assessment. The replacement of David Boden needs to take place as soon as possible, as other members of the Physical Sciences department are not qualified to take over course management in these areas.

This request complies with the goals and objectives as stated in the strategic plans of Academic Affairs and the College. A full-time

faculty member would be much more disposed to investing time in seeking resources to fortify the program and benefit students. A full-time faculty member would likely engage in professional development forums or conferences where information learned can be brought back into the classroom for the benefit of students. Furthermore, a full-time faculty member is more inclined to lead professional development workshops at TMCC perhaps on effective strategies he or she has learned for improving success in student learning, retention, and completion of programs.

Academic Standards and Assessment Committee Findings and Recommendations

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

Academic Standards and Assessment Committee's Findings:

This question has not been answered yet

Program Strengths:

- PLOs align well with the Physical Sciences Division mission statement.
- Program curriculum includes field work (experiential learning), which is a high-impact practice, and which students report enjoying.
 - Overall course completion and successful course completion is higher compared to the department.
 - The FT faculty member (now retired) has made use of Hake gains in assessment as overall measures of learning gains, though analysis by PLO should be completed.
- Partial progress has been made towards recommendation to secure additional storage space.

Areas of Concern or Improvement:

- Catalog information is inaccurate regarding when courses are offered. Most of the GEOL courses are listed as offered in fall, but course offerings in past semesters do not seem to match.
 - It is being communicated that GEOL 206 - Geology of Geothermal Energy Resources satisfies upper division Geology electives at UNR, but there is no documentation of this, and the transfer agreement does not support this.
 - Faculty have not participated in accessibility workshops or used accessibility checkers on course materials.

- There is no PLO assessment analysis beyond overall Hake gains to suggest which PLOs students were achieving or not achieving.
 - There is no planned use of assessment data. The PUR only notes an action plan of “an effort” to encourage part-time instructors to use active learning strategies in their sections (e.g. incorporation of electronic response systems).
 - The PUR presents no assessment data for Gen Ed.
 - Program enrollment is low and has continued to decline since 2015. The program has appeared on the Low Yield list for over 3 years. The only course experiencing demand is the general education GEOL 100 course, which is not required of program majors.
 - There is no discussion of student-centered scheduling presented.
 - Fill rates have declined 15% over the last 5 years in GEOL courses (with the exception of GEOL 100) and there is no discussion of unsuccessful enrolment attempts.
 - There are noticeable gaps in course completion among ethnic minority and female students but no discussion of how to try and mitigate those gaps other than letting students know we care or to increase field experiences.
 - The number of graduates is declining (4 students over the last 5 years) with only half of students completing the degree transferring to a 4-year institution.
 - The recent retirement of the only FT faculty member leaves no one over the AS GeoScience, geology, or geography disciplines in the Physical Sciences Department. Combined with low enrolment trends, this begs the question of whether the AS GeoScience program should continue.
- The 5-year plan includes only the hiring of new faculty with no clear goals or timelines presented. The need for storage space, despite being noted as lacking, was not addressed.

Recommendations:

- We recommend making the mission statement more forward facing on the department website and/or other suitable locations.
- We recommend updating catalog information to accurately reflect when courses are offered and schedule courses according to student demand.
- We recommend encouraging PT faculty to attend accessibility training and review all course materials for accessibility.
 - The Committee recommends review and possible revision of CSLOs to include action verbs based on Blooms’s taxonomy so that CLOs are more measurable.
 - We recommend using curriculum mapping to assess PLOs beyond reporting overall Hake gains, which do not indicate specific PLO achievement.
 - We recommend implementation of the proposed assessment action plan for improving assessment collection and active learning techniques for PT faculty, but include more specific actions.
 - The Committee recommends assessing GEOL 100 for General Education in the next year.
 - We recommend incorporation of additional field activities if feasible based on student feedback and as a high impact practice.
 - We recommend the development of mitigation strategies towards notable enrollment, course completion, and graduation equity gaps among ethnic minorities and females.
 - We recommend that given the declining enrollment, which precedes the pandemic, and lack of graduates, consideration of deactivating or deleting the AS GeoScience and refocusing resources on GEOL and GEOG courses that satisfy general education.
 - The Committee concurs with the need to hire a new FT faculty member to oversee GEOL and GEOG courses even if the AS GeoScience is deactivated or deleted.
 - We recommend development of a 5-year plan with timelines and goals that determines whether the AS GeoScience will continue, restructures GEOL and GEOG course offerings, address equity gaps in access and student success, and outlines a clear and prompt schedule

of general education assessment.

Other comments:

This question has not been answered yet

Dean's Findings and Recommendations

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

Academic Dean's Findings:

The Geoscience Program has suffered some setbacks since the last PUR, such as declining enrollment and the loss of both tenured faculty. This leaves the program in a very vulnerable place. Overall, the program struggles both in enrollment and graduation/transfer rates. This may be due to the program requiring Math 127 in the first semester, as this can be problematic for the majority of our incoming students. The high math course requirement may also deter many students from pursuing this degree path upon enrollment at TMCC, and declare a general AS instead. While I agree with the comments in the report that students may not be aware of this useful degree path, but with exceptionally low graduation totals, it seems that the program should have graduated more than 2 in the past 3 years. The number of declared majors has been steady at 20. In 5 years, the program only saw 4 graduates. Although students are encouraged to take upper division classes at UNR and back transfer, with only 4 graduates of the program in the last 5 years, this is not a viable way to improve graduation rates in the program. My overall findings are in support of replacing a full-time tenure track as soon as possible, given the reasons outlined in the report, but to deactivate this as a program, and students can complete a general Associates in Science with an emphasis in Geology to transfer to a 4-year institution.

Strengths:

The program aligns with UNR and most 4-year transfer institutions. Although some of the first two-year classes are not offered due to low enrollment, students are encouraged to back transfer course to complete the associate degree.

The program has well defined CSLOs that map clearly to the PSLOs.

The program employed a long-time faculty member, that kept this program afloat, even while on a 60% FTE, phase-in the past 4 years.

The program has seen high completion rates in its classes, 87% over 5 years, with a 70% successful completion rate over 5 years. So, while there may not be many declared majors, the course completion rates are above that of the department, on average.

Areas for Improvement:

The program had a 27% decline in majors, a decline in fill rates, and the demographics by ethnic groups is not comparable to TMCC overall.

The program needs to increase the number of Hispanic student to align with the department percent.

The program has now lost its only full-time faculty member, and needs to backfill this position

as soon as possible. While the program itself may not be a sustainable degree, given its continual low yield, decline FTE, and declining fill rates, a full-time faculty member is essential because the courses are strong feeders of the general education program as well as other degrees. GEOL 100 is required for the AS in Environmental Science and GEOL 100 is required for the BS in Emergency Management and Homeland Security. A full time faculty member is essential for curriculum development, coordination, assessment, part-time coordination, overseeing any revisions and additions of essential field activities, as well as a be generally invested in the college and department. Without a full-time faculty member at the helm, these classes will flounder. As part of a department with faculty in multiple disciplines, no one is qualified to oversee the program, the courses, or inventory the materials.

With the upcoming CHEM lab renovations, I recommend finding an improved space for all the rocks and materials needed in these courses. Since the departure of Dave Boden, the department has no full-time faculty equipped to sort and organize the rocks, minerals, and other materials.

Also, with the noticeable gap in Hake gains in courses taught by full-time and part-time faculty, it is imperative we have a dedicated full-time faculty to oversee assessment and curriculum and coordinate part-time faculty teaching these and the geography courses.

Summary Action Recommended (Continue program(s), significantly revise, discontinue, etc. followed by explanation):

I recommend the following:

1. Deactivate the program, but continue all classes that are required for other degrees and general education classes.
2. Backfill the tenure track full-time faculty position as soon as possible
3. Create an improved storage space, useful for all faculty teaching the courses to access and use the rock, minerals and other materials
4. Promote the classes to underrepresented student to balance the gap in ethnic groups to a more comparable level with that of the department

Recommendations and Implementation Timeline:

1. Recommend deactivation after this PUR is fully reviewed
2. Submit a position requisition in September to hire on the normal academic hiring cycle
3. Create an improved storage space after the CHEM lab renovation is complete
4. Take opportunities such as student success fairs to encourage more Hispanic students to take GEOL 101 as a GE science

Resources Necessary for Implementation of Recommendations:

Utilize Professional Salaries from position line P0003554 to fund a replacement Geology or Geography faculty position. The position could be qualified in either area but also be responsible for overseeing the courses as a whole for the department.

If needed, storage shelves and cabinets for Geology material to be stored

Impact of Recommendations on Division Planning:

If the program is deactivated, these courses may be assessed under a more robust general education PUR in the physical sciences department. These seems an appropriate avenue of a broader assessment of all courses that are general education feeders, but not sustainable as individual programs. These general education courses in the Physical Science fulfill a demand and satisfy many general education outcomes for students.

Impact of Recommendations on Program/Unit Faculty:

Same as above.

Vice President of Academic Affairs' Findings and Recommendations

Geology

Physical Sciences (Geoscience) 2020-21 PUR Self-Study

VPAA's Findings:

This PUR was written before Boden's retirement in Spring 2021, and already by that time, this program had been neglected for some time and its momentum lost. The time for reviving a named AS degree has passed, but the core GEOL courses could be offered as an AS with emphasis area in Geology. It was a mistake not to build the program's momentum upon its star course, GEOL 100: Earth Hazards.

Strengths:

The program's main strength was GEOL 100: Earth Hazards, which could have been a significant recruiting tool, particularly if offered by a dynamic instructor and taught using innovative approaches that engage students. This course should continue to be promoted and marketed, as it is the principal means of recruiting students to an AS with an emphasis in Geology.

Areas for Improvement:

Another 100-level recruiting course on the Geology of Nevada is desperately needed. Like GEOL 100, a focused course with local field trips could excite students and convince more of them to pursue Geology as an emphasis area.

The following recommendations made by the Academic Standards and Assessment Committee and Dean are upheld, and/or additional recommendations include the following: (Please include an implementation timeline, and indicate how these recommendations align to the Academic Affairs Strategic Plan and/or the College's Strategic Master Plan.)

I agree with the ASA Committee and the Dean -- this program should be deactivated. It should continue as an AS with an emphasis in Geology, enabling students to transfer to UNR to pursue

a B.S. in Geology. However, if the enrollments beyond GEOL 100 are weak, they should be discontinued.

The following recommendations made by the Academic Standards and Assessment Committee and Dean are not upheld: (Please provide an explanation.)

I do not support the ASA Committee's proposal for a 5-year plan to study the AS Geoscience degree. That program is a dead letter.

A FT faculty hire should be able to stand up a course on Geology of Nevada, as a recruiting vehicle to the emphasis.

In order to implement recommendations towards program improvement, the following resource requests are upheld, and/or additional recommended resources include the following:

Yes, order storage cabinets/shelves to store our specimens securely.

Again, a FT faculty hire in Geology must be able to generate the enrollments necessary to deliver students to and through an AS with an emphasis in Geology. Perhaps if the hire can also teach Geography, we would be able to build upon their ability to teach 100-level courses.

The following resource requests are not upheld: (Please provide an explanation.)

See above about the prospects for a FT hire.

Summary Action Recommended (Continue program, significantly revise, or discontinue, followed by explanation):

Discontinue the AS Geosciences. Pursue a generic AS with emphasis in Geology, but discontinue it if enrollments remain weak and completers do not begin to rise within 3-5 years.