Idaho State Board of Education
Proposal for Undergraduate/Graduate Degree Program

<table>
<thead>
<tr>
<th>Date of Proposal Submission:</th>
<th>10/11/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution Submitting Proposal:</td>
<td>University of Idaho</td>
</tr>
<tr>
<td>Name of College, School, or Division:</td>
<td>College of Agricultural and Life Sciences</td>
</tr>
<tr>
<td>Name of Department(s) or Area(s):</td>
<td>Department of Soil and Water Systems</td>
</tr>
</tbody>
</table>

Program Identification for Proposed New or Modified Program:

<table>
<thead>
<tr>
<th>Program Title:</th>
<th>Soil and Water Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree:</td>
<td>B.S.S.W.</td>
</tr>
<tr>
<td>Degree Designation:</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>Indicate if Online Program:</td>
<td>Yes</td>
</tr>
<tr>
<td>CIP code (consult IR/Registrar):</td>
<td></td>
</tr>
<tr>
<td>Proposed Starting Date:</td>
<td>July 1, 2017</td>
</tr>
<tr>
<td>Geographical Delivery:</td>
<td>Location(s) Moscow</td>
</tr>
<tr>
<td>Region(s):</td>
<td></td>
</tr>
<tr>
<td>Indicate (X) if the program is/has:</td>
<td>Self-Support</td>
</tr>
<tr>
<td>Indicate (X) if the program is:</td>
<td>Regional Responsibility</td>
</tr>
</tbody>
</table>

Indicate whether this request is either of the following:

- [X] New Degree Program
- [ ] Consolidation of Existing Program
- [ ] Undergraduate/Graduate Certificates (30 credits or more)
- [ ] New Off-Campus Instructional Program
- [ ] Expansion of Existing Program
- [ ] Other (i.e., Contract Program/Collaborative)

10/14/2016

<table>
<thead>
<tr>
<th>College Dean (Institution)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President for Research (Institution; as applicable)</td>
<td>Date</td>
</tr>
<tr>
<td>Academic Affairs Program Manager, OSBE</td>
<td>Date</td>
</tr>
<tr>
<td>Chief Academic Officer, OSBE</td>
<td>Date</td>
</tr>
<tr>
<td>SBOE/Executive Director Approval</td>
<td>Date</td>
</tr>
</tbody>
</table>

Provost/VP for Instruction (Institution)
Rationale for Creation or Modification of the Program

1. Describe the request and give an overview of the changes that will result. Will this program be related or tied to other programs on campus? Identify any existing program that this program will replace.

This request will create a new degree program in Soil and Water Systems (B.S. S.W.S.). The degree program will include three majors: 1) Environmental Soil Science, 2) Water Science and Management and 3) Agricultural Systems Management. The Environmental Soil Science major will replace an emphasis area in Soil and Land Use currently available under the Sustainable Crop and Landscape Systems major. The Agricultural Systems Management major currently exists and will be moved from a major under the Agricultural and Life Sciences degree to a major under the new Soil and Water Systems degree. The Water Science and Management major will be a new major. APPENDIX #1 is an overview of how our request here is part of the larger petition to reorganize all PSES instructional programs.

The text in this proposal will focus on the new major, Water Science and Management, since the other two majors/programs currently exist. The programs will be referred to as:
   A. Environmental Soil Science (ESS)
   B. Agricultural Systems Management (ASM)
   C. Water Science and Management (WSM)

2. Need for the Program. Describe the student, regional, and statewide needs that will be addressed by this proposal and address the ways in which the proposed program will meet those needs.

   A. Environmental Soil Science is an existing program with a total of 10 majors. This major serves all students interested in soil fertility, reclamation/bioremediation, soil water management and conservation. The University of Idaho is the only institution in the state offering a major in Soil Science. This is significant given that the number of retiring soil scientists is projected to be greater than the number of graduating seniors across all but one western state. All indications point to significant increases in the need for soil scientists at the BS level (see Table 1).

   B. Agricultural Systems Management is an existing major with an undergraduate enrollment of 50 students. The ASM degree largely serves students interested in an applied career in agriculture. Graduates find employment within the agricultural industry, or operate their own farms.

   C. Water Science and Management is a new proposed major. At the state and national scale, demand for graduates with BS degrees in the area of water science and management is growing. The demand for agricultural scientists in general is expected to increase and water shortages/drought is expected to continue and worsen in the future.

   a. Workforce need: Provide verification of state workforce needs that will be met by this program. Include State and National Department of Labor research on employment potential. Using the chart below, indicate the total projected annual job openings (including growth and replacement demands in your regional area, the state, and nation. Job openings should represent positions which require graduation from a program such as the one proposed. Data should be derived from a source that can be validated and
must be no more than two years old.

List the job titles for which this degree is relevant:
1. Soil and water conservationist
2. Hydrologist
3. Agricultural technician
4. Water quality/irrigation/precision ag specialist
5. Water quality/irrigation/precision ag specialist
6. Nutrient management specialist
7. Remote sensing technicians
8. Environmental engineer/technician/scientist
9. Farmer/rancher/forester
10. Consultant/advisor

NA = data not available

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Projected change (number of new jobs and % change)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ID</td>
</tr>
<tr>
<td>Agricultural and Food Sci. Technician</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>16.3%</td>
</tr>
<tr>
<td>Conservation Scientists</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>54.9%</td>
</tr>
<tr>
<td>Environmental Engineers</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>30.9%</td>
</tr>
<tr>
<td>Environmental Scientists and Specialists</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>24.7%</td>
</tr>
<tr>
<td>Farm and Home Management Advisors</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>29.4%</td>
</tr>
<tr>
<td>Farmers, Ranchers and other Agricultural Managers</td>
<td>3,630</td>
</tr>
<tr>
<td></td>
<td>25.3%</td>
</tr>
<tr>
<td>Forest and Conservation Technicians</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>30.7%</td>
</tr>
<tr>
<td>Hydrologists</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Life, Physical and Social Science Technicians, Other (includes precision ag and remote sensing technicians)</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>24.1%</td>
</tr>
</tbody>
</table>

Data from: http://www.projectionscentral.com/Projections/LongTerm

<table>
<thead>
<tr>
<th>State DOL data</th>
<th>Federal DOL data</th>
<th>Other data source: (describe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local (Service Area)</td>
<td>Estimates not available for the local region, but should reflect predictions at the state level.</td>
<td>State of CA predicts a 35% increase in the number of soil and plant scientist positions between 2012 and 2024 (36 out of 100 on the list of the top fastest growing occupations in CA).</td>
</tr>
</tbody>
</table>
CA also estimates a 26.3% increase in the number of Environmental Technicians and a 16.7% increase in Agricultural and Food Science Technicians over this same time period.

| Nation       | -1.9 to 12.5% increase in related positions across the US *= (see table 1) |

Provide (as appropriate) additional narrative as to the workforce needs that will be met by the proposed program.

The job outlook for graduates in the Water Science and Management major is strong, supporting increased enrollments. In 2015, USDA reported that opportunities in food, agriculture, renewable natural resources and the environment will grow more than 5% between 2015 and 2020 for graduates with at least a BS degree. The expected number of graduates trained in agricultural fields (35,400 per year) is lower than the expected number of annual openings (57,900). About 27% of the openings are expected to be in the science, technology, engineering and mathematics (STEM) fields targeted by the major. Within STEM fields, the strongest job markets will be for plant scientists, food scientists, sustainable biomaterials specialists, water resources scientists and engineers, precision agriculture specialists, and farm-animal veterinarians (USDA, 2015). Students in the B.S.S.W.S. program will receive the course work and experience required to work within several of these areas (water resources scientists and engineers and precision agriculture specialists).

**b. Student need.** What is the most likely source of students who will be expected to enroll (full-time, part-time, outreach, etc.). Document student demand by providing information you have about student interest in the proposed program from inside and outside the institution. If a survey of s was used, please attach a copy of the survey instrument with a summary of results as Appendix A.

This major will target full-time students interested in working in careers that include protection and monitoring of soil and water quality, soil and water conservation, irrigation, wastewater, and watershed management, precision agriculture and farming. Enrollments in the ESS and ASM majors are stable and efforts will be made to increase enrollments. The WSM major is filling a gap as UI does not currently offer a major in water management at the undergraduate level. Evidence of growing student interest in the Water Science and Management major includes:

1) Growth in the MS and PhD program in water resources, which currently has 35 students (9 new students in Fall 2016) indicates greater interest in water resources.

2) Enrollments (27 to 29 students between 2010 and 2013) in ecohydrology and environmental engineering tracks within the BAE degree. These tracks both had strong water components and are no longer active.

3) Growing attention focused on water shortages for food production, conservation of water resources and competing uses of water under drought within Idaho and the larger western US.
In general, we anticipate additional growth in undergraduate enrollment across The SWS majors due to 1) enhanced visibility of programs, 2) a new, more integrated approach to the study of soil and water resources and 3) expected growth in the job market (Table 1). The degree is not expected to compete with existing undergraduate degrees since we do not currently offer a water-related degree at the BS level. Water Resources, Hydrology and Civil Engineering offer water-related training, but only at the graduate level.

c. Economic Need: Describe how the proposed program will act to stimulate the state economy by advancing the field, providing research results, etc.

Agricultural production is an important component of Idaho’s economy. At the same time demand for food crops is increasing, agricultural producers are experiencing increased competition for land, energy and water, and being asked to reduce negative environmental impacts of farming. Documented declines in water availability and reallocation of water resources to non-agricultural uses are evidence of overuse of a resource that is essential to meeting the growing demand for food and keeping Idaho agriculture profitable.

This program will produce graduates that understand the critical importance of using science to better manage agricultural water. These graduates will fill critical roles in the agricultural industry, research facilities and state and federal agencies.

d. Societal Need: Describe additional societal benefits and cultural benefits of the program.

Production of graduates trained to work on more efficient water use/systems should translate to greater water and food security in the future.

e. If Associate’s degree, transferability:

Not applicable.

3. Similar Programs. Identify similar programs offered within Idaho and in the region by other in-state or bordering state colleges/universities.

While one or two water resource type courses are required or optional in several majors offered within the College of Natural Resources (Ecology and Conservation Biology, Environmental Science, Fishery Resources, and Forest Resources and Rangeland Management), no water majors are currently offered at the BS level at UI. Boise State does offer a hydrology emphasis under their BS in Geosciences, which is designed to prepare students for careers as hydrologists, geoscientists, and environmental scientists. Other, neighboring states commonly offer emphasis areas or minors in water resources. These programs do not have the strong influence of agriculture.

| Similar Programs offered by Idaho public institutions (list the proposed program as well) |
|-----------------------------------------------|-----------------------------------------------|
| **Institution Name** | **Degree name and Level** | **Program Name and brief description if warranted** |
| Boise State | Hydrology emphasis | BS Geosciences |
| | | Prepares students for careers as hydrologists, geoscientists, environmental scientists, strong geology influence |
Similar Programs offered by other Idaho institutions and by institutions in nearby states

<table>
<thead>
<tr>
<th>Institution Name</th>
<th>Degree name and Level</th>
<th>Program Name and brief description if warranted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington State University</td>
<td>Water Resources Engineering specialization</td>
<td>BS Civil Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Study of technologies that supply water.</td>
</tr>
<tr>
<td>Oregon State University</td>
<td>Specialization in Environmental Water Resources</td>
<td>BS Environmental Science- This specialization is designed to give students a foundation in the science of water while also examining the application of water policy in different settings.</td>
</tr>
<tr>
<td>Montana State University</td>
<td>Water Resources Minor</td>
<td>BS Earth Sciences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Designed to allow students from any major to explore water. Offers biophysical and social science courses.</td>
</tr>
</tbody>
</table>

4. **Justification for Duplication with another institution listed above.** (if applicable). If the proposed program is similar to another program offered by an Idaho public institution, provide a rationale as to why any resulting duplication is a net benefit to the state and its citizens. Describe why it is not feasible for existing programs at other institutions to fulfill the need for the proposed program.

   A. Environmental Soil Science- existing program that is unique within the state.
   B. Agricultural Systems Management- existing program with strong enrollment that serves a specific audience interested in applied agricultural production.
   C. Water Science and Management

The new Water Science and Management major is distinct from the emphasis area in Hydrology offered at Boise State and the Civil Engineering degree offered at UI. The Boise State emphasis area is focused in the geosciences, the proposed new major will be more reflective of the discontinued track in ecohydrology and water management associated with food production. Building off required coursework in soil ecosystems, soil fertility, and plant science/ecology not required in a water-focused civil engineering degree, the breadth of the major offered in this curriculum allows students to develop strong expertise in managing water in complex ecosystems including agriculture, forestry, and rangeland. The degree includes additional math and GIS-based mapping requirements to ensure that graduates have the ability to be successful in job roles such as quantitative hydrologist, and irrigation, precision agriculture, and watershed management technicians.

5. **Describe how this request supports the institution’s vision and/or strategic plan.**

   All three majors under the SWS bachelors will support the University of Idaho’s strategic plan.
<table>
<thead>
<tr>
<th>Goal</th>
<th>Objective</th>
<th>SWS’s contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarly and creative products of the highest quality and scope, resulting in significant positive impact for the region and the world.</td>
<td>Build a culture of collaboration that increases scholarly and creative productivity through interdisciplinary, regional, national and global partnerships.</td>
<td>SWS is an integrated major including elements of soil science, water science and agricultural mechanics. Students will be presented with concepts through the viewpoints of these three disciplines and will graduate with increased ability to tackle interdisciplinary problems. Students in each of the majors will be encouraged to conduct research in the faculty laboratories and produce scholarly works. The culture of the SWS Department is to employ undergraduates in the laboratory. This provides hands-on training and experience and excites students to conduct independent research.</td>
</tr>
<tr>
<td>Increase our educational impact</td>
<td>Provide greater access to educational opportunities to meet the evolving needs of society.</td>
<td>This proposal will create a new major to meet the needs of students who are increasingly aware of environmental resource issues surrounding food production. The degree will attract students who would have previously gone out of state to receive this training. Faculty responsible for SWS courses will continually assess, revise and improve our courses and overall program to ensure innovation and evolution.</td>
</tr>
<tr>
<td>Foster an inclusive, diverse community of students, faculty and staff and improve cohesion and morale</td>
<td>Build an inclusive, diverse community that welcomes multicultural and international perspectives.</td>
<td>SWS faculty represent four different countries and approximately 19% female. Building diversity will be a key goal and our approach will be student-centered to enrich the experience for all students. The program includes two student clubs that all students will be encouraged to participate in, helping to develop a cohesive culture of inclusion. Annual assessment interviews with students will improve retention and student satisfaction. The integrated approach to teaching within the SWS program is an efficient manner, which will allow students to access a new major while keeping costs as low as possible.</td>
</tr>
</tbody>
</table>

6. **Assurance of Quality.** Describe how the institution will ensure the quality of the program. Describe the institutional process of program review. Where appropriate, describe applicable specialized accreditation and explain why you do or do not plan to seek accreditation.

A. Environmental Soil Science- Existing program with established learning outcomes
B. Agricultural Systems Management- Existing program with established learning outcomes
C. Water Science and Management

This program will not require specialized accreditation. Internally, the program will be monitored using the same protocols applied to the existing majors. Exit interviews with undergraduate students will be conducted and responses recorded. Students will be strongly encouraged to complete advising evaluations. Teaching evaluations will be reviewed by the department head and peer-teaching evaluations will be completed each year. An experienced faculty member will serve as the academic advisor to students in the program and will utilize advising appointments to gather informal student feedback regarding courses, internships and
overall satisfaction with the program. The program will also be reviewed periodically with the established advisory committees at the department and college level. Learning outcomes will be established following the procedure currently utilized across UI programs.

7. **In accordance with Board Policy III.G., an external peer review is required for any new doctoral program.** Attach the peer review report as Appendix B.

Not applicable to this request.

8. **Teacher Education/Certification Programs** All Educator Preparation programs that lead to certification require review and recommendation from the Professional Standards Commission (PSC) and approval from the Board.

Will this program lead to certification?
Yes_____ No____X__

If yes, on what date was the Program Approval for Certification Request submitted to the Professional Standards Commission?

9. **Five-Year Plan: Is the proposed program on your institution’s approved 5-year plan? Indicate below.**

   Yes ___ No ___ X_

Proposed programs submitted to OSBE that are not on the five-year plan must respond to the following questions and meet at least one criterion listed below.

   **a. Describe why the proposed program is not on the institution’s five-year plan.** When did consideration of and planning for the new program begin?

This request is prompted by the 2014-15 Phase II Program Prioritization Process at the University of Idaho and by 2016 changes in leadership at the College of Agricultural and Life Sciences (CALS). The program prioritization process resulted in major restructuring of the existing Biological and Agricultural Engineering department that included a major change in curriculum, a name change to Biological Engineering, and a move from the College of Agriculture to the College of Engineering. The curriculum change and major refocus on biological engineering effectively eliminated option areas in agricultural engineering and ecohydrology. The primary faculty in these water and agricultural engineering fields remaining in CALS are a very small unit (5 members) and the existing ASM major does not cover these areas. This proposal will create a new, integrated major in water science and management, which will complement the existing majors in ESS and ASM. The major was conceived due to the recent changes associated with the program prioritization process and during a time when drastic changes were occurring with CALS and UI administration. Due to timing, therefore, the program was not added to the five-year plan.

   **b. Describe the immediacy of need for the program.** What would be lost were the institution to delay the proposal for implementation of the new program until it fits within the five-year planning cycle? What would be gained by an early consideration?

Delaying this major will result in the potential loss of undergraduate students interested in water science and water management related to agricultural production. The closest related
degree (ecohydrology and agricultural engineering tracks of the BAE degree) was terminated in 2014. With the major technological advances in agriculture and issues such as water availability, the job market for agricultural and water related graduates is strong. It is becoming more widely recognized that resilient and sustainable crop production requires an integrated understanding of the effect of management practices on water use and availability in the soil ecosystem. With the existing core faculty from the BAE department and the existing soils faculty there is a great opportunity to start a unique, highly attractive and competitive water science major. The longer we do not have a water major available at the undergraduate level, the more difficult it will be to gain a reputation in this growing field. The new major is also a result of a new department focused on soil and water (paperwork being submitted in Oct. 2016). Faculty in the new department are prepared and excited to offer the new major now.

Criteria. As appropriate, discuss the following:

i. How important is the program in meeting your institution’s regional or statewide program responsibilities? Describe whether the proposed program is in response to a specific industry need or workforce opportunity.

The SWS department will be responsible for training soil and water scientists, technicians, conservationists, farmers and other agricultural professionals. The water science and management major is specifically designed to meet a large and growing need within the state and nation for well-trained professionals able to work in areas related to water. The dryland and irrigated agricultural systems so important to Idaho’s economy are constrained by water availability. Education and training of more water professionals is required to meet the growing demand for food and fiber crops in a sustainable manner, ensuring food and water security.

ii. Explain if the proposed program is reliant on external funding (grants, donations) with a deadline for acceptance of funding.

While the faculty and administration will actively work with development, and the writing of external grants, funding is not required to begin the academic program (beyond what is required to create the new department of soil and water systems). Once established the major will be supported through traditional funding practices and budgets through the CALS.

iii. Is there a contractual obligation or partnership opportunity to justify the program?

There is no contractual obligation, however, stakeholders (Soil and Water Conservation Districts and Commodity Commissions for example) are in support of a more focused treatment of soil and water resources.

iv. Is the program request or program change in response to accreditation requirements or recommendations?

No.

v. Is the program request or program change in response to recent changes to teacher certification/endorsement requirements?

No.
10. Curriculum for the proposed program and its delivery.
   
a. Summary of requirements. Provide a summary of program requirements using the following table.
   
   Summary of program requirements for the new Water Science and Management major (complete curriculum is attached).

<table>
<thead>
<tr>
<th>Credit hours in required courses offered by the department(s) offering the program.</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit hours in required courses offered by other departments:</td>
<td>71</td>
</tr>
<tr>
<td>Credit hours in institutional general education curriculum</td>
<td>41 including senior experience (22 of these credits can be satisfied by taking courses required within the major)</td>
</tr>
<tr>
<td>Credit hours in free electives</td>
<td>16</td>
</tr>
<tr>
<td>Total credit hours required for degree program:</td>
<td>128</td>
</tr>
</tbody>
</table>

b. Additional requirements. Describe additional requirements such as comprehensive examination, senior thesis or other capstone experience, practicum, or internship, some of which may carry credit hours included in the list above.

   Students will be required to take the senior experience course *Pesticides in the Environment*. This class includes an interdisciplinary treatment of the movement and degradation of pesticides and is team taught by faculty in three different disciplines.


a. Intended Learning Outcomes. List the Intended Learning Outcomes for the proposed program, using learner-centered statements that indicate what will students know, be able to do, and value or appreciate as a result of completing the program.

   A. Environmental Soil Science- learning outcomes already exist
   B. Agricultural Systems Management- learning outcomes already exist
   C. Water Science and Management

Development of the ability to apply scientific principles to the management and conservation of water in agricultural, domestic and wildland environments.

Ability to assess the sustainability of agricultural systems from a water standpoint, applying economic, social and natural-resource related criteria.

Understanding of the roles and responsibilities of water professionals in society

Ability to effectively communicate science-based data to a variety of audiences

12. Assessment plans

a. Assessment Process. Describe the assessment process that will be used to evaluate how well students are achieving the intended learning outcomes of the program.

   All three majors will be assessed following the established protocols at the University of Idaho. Assessment has been conducted on the Soil and Land Use emphasis area and
ASM major and these methods and past findings will be transferred to the new department. Along with the majors in ESS and ASM, the WSM major will be assessed on an annual basis, following the required procedures currently in use. Exit interviews, online surveys, and peer and student evaluations of teaching will be utilized.

b. Closing the loop. How will you ensure that the assessment findings will be used to improve the program?

We anticipate that the Department of Soil and Water Systems (which does not yet exist and so does not yet have an administrative structure) will include a departmental faculty Curriculum Committee that will be charged with interpretation of annual Learning Outcome metrics for all SWS instructional programs and that will recommend specific policy for consideration and implementation by the department chair. Focus also will be on curricular and co-curricular changes (such as simplification of the curriculum and consideration of how our course requirements can allow for double-majors from other UI departments and colleges). An underpinning objective will be to contribute to UI Strategic Plan Goals for undergraduate enrollment.

c. Measures used. What direct and indirect measures will be used to assess student learning?

A. Environmental Soil Science

Direct Benchmarks:
Demonstrated ability to apply academic knowledge to real-world problems and controversies using case studies in Senior Experience Capstone course (ENT/PLSC/SOIL 438); performance on parts of standardized exams that assess ability to integrate and synthesize various concepts; successful completion of internships; numbers of students participating in clubs/organizations and service learning; passing scores of the professional soil scientist exam.

Indirect Benchmarks:
Student internship reporting, including feedback from both student and employer; student evaluations of teaching; student grades in core courses, including performance on lecture exams, laboratory exams, class projects, and term papers.

Indirect Benchmarks:
Exit interviews with graduating seniors, including overall assessment of degree program, internships, student clubs/organizations and opportunities for service learning.

B. Agricultural Systems Management

Direct Benchmarks:
Alumni surveys (2 and 5 years following graduation), placement data for graduates, advisory board evaluation of curriculum.

Indirect Measure Process:
Student evaluations of course and instructor quality in courses required by major and emphasis areas are 3 or higher; students receive a grade of C or higher in all courses required by major and emphasis areas.
Face-to-Face Measures:
Exit interviews with graduating seniors, including overall assessment of degree program, internships, student clubs/organizations, and opportunities for service learning activities.

Face-to-Face measures:
Student exit interviews.

C. Water Science and Management

Direct measurements:
Demonstrated ability to apply academic knowledge to real-world problems and controversies using case studies in Senior Experience Capstone course (ENT/PLSC/SOIL 438); performance on parts of standardized exams that assess ability to integrate and synthesize various concepts; successful completion of internships with various employers around the region; numbers of students participating in clubs/organizations and service learning.

Indirect measures:
Student evaluations of course and instructor quality in courses required by major and emphasis areas are 3 or higher; students receive a grade of C or higher in all courses required by major and emphasis areas.

Face-to-face measures:
Student comments during annual focus group discussions; results of exit interviews, quality of student project in senior experience project.

d. Timing and frequency. When will assessment activities occur and at what frequency?

Following the standard, UI procedure, data on the metrics will be gathered during the fall and spring semesters (Sept-May). Findings will be available to faculty to view in April and May. Faculty will meet to discuss the findings between May and early Sept. These meetings will be used to determine appropriate changes and actions. Any changes to the learning outcomes and metrics will be reported.

Enrollments and Graduates

13. Existing similar programs at Idaho Public Institutions. Using the chart below, provide enrollments and numbers of graduates for similar existing programs at your institution and other Idaho public institutions.

Current enrollment and numbers of graduates for the hydrology emphasis area under the BS in Geosciences at Boise State University.

| Existing Similar Programs: Historical enrollments and graduate numbers |
|--------------------------|--------------------------|--------------------------|
| Institution and Program Name | Fall Headcount Enrollment in Program | Number of Graduates From Program (Summer, Fall, Spring) |

Enrollments and Graduates
14. **Projections for proposed program:** Using the chart below, provide projected enrollments and number of graduates for the proposed program:

<table>
<thead>
<tr>
<th>BSU</th>
<th>FY__</th>
<th>FY__</th>
<th>FY__</th>
<th>FY16 (most recent)</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15 (most recent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISU</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UI</td>
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<tr>
<td>LCSC</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>FY_17 (first year)</th>
<th>FY_18</th>
<th>FY_19</th>
<th>FY_20</th>
<th>FY_21</th>
<th>FY_22</th>
<th>FY_17 (first year)</th>
<th>FY_18</th>
<th>FY_19</th>
<th>FY_20</th>
<th>FY_21</th>
<th>FY_22</th>
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<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
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<td>0</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>7</td>
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</tbody>
</table>

15. **Describe the methodology for determining enrollment and graduation projections.** Refer to information provided in Question #2 “Need” above. What is the capacity for the program? Describe your recruitment efforts? How did you determine the projected numbers above?

The numbers in the table above reflect the number of students in the ecohydrology and environmental engineering tracks of the discontinued BAE degree along with the enrollment trends for the hydrology emphasis area at BSU. Currently, we have the capacity required to handle the expected enrollments. If enrollments exceed our expectations, more sections of our classes will need to be offered and additional support will be required.

16. **Minimum Enrollments and Graduates.** Have you determined minimums that the program will need to meet in order to be continued? What are those minimums, what is the logical basis for those minimums, what is the time frame, and what is the action that would result?

Minimum enrollment in the Water Science and Management track will be set at nine students. We consider this to be critical mass. Together with students from the Environmental Soil
Science and Agricultural Systems Management majors, we expect the degree to average approximately 80-100 students after the first four years.

**Resources Required for Implementation – fiscal impact and budget**

17. **Physical Resources.**

   a. **Existing resources.** Describe equipment, space, laboratory instruments, computer(s), or other physical equipment presently available to support the successful implementation of the program.

      A. Environmental Soil Science – existing program with existing teaching facilities.
      B. Agricultural Systems Management – existing program with existing teaching facilities.
      C. Water Science and Management – it is anticipated that this program will share existing teaching space with the ASM program in JML and ESS in the Iddings Agricultural Sciences building. Teaching budgets supplied by CALS for all programs will be utilized to cover the cost of regular laboratory supplies.

   b. **Impact of new program.** What will be the impact on existing programs of increased use of physical resources by the proposed program? How will the increased use be accommodated?

      At this point, no new courses are being added for the new major. This will reduce the need for space and other resources. If new courses are added in the future, space will be shared with the ESS and ASM majors.

   c. **Needed resources.** List equipment, space, laboratory instruments, etc., that must be obtained to support the proposed program. Enter the costs of those physical resources into the budget sheet.

      No additional resources are required to support the new major since no new courses are being added.

18. **Library resources**

   a. **Existing resources and impact of new program.** Evaluate library resources, including personnel and space. Are they adequate for the operation of the present program? Will there be an impact on existing programs of increased library usage caused by the proposed program? For off-campus programs, clearly indicate how the library resources are to be provided.

      Currently the Water Resources program is working closely with the UI library to increase access to water-related journals. Journals and other resources adequate for the Water Resources (MS and PhD only) should be suitable for students in the new major. A faculty member associated with the new degree will work with the Water Resources director to ensure that all needs are met.

   b. **Needed resources.** What new library resources will be required to ensure successful implementation of the program? Enter the costs of those library resources into the budget sheet.
None should be required above those currently being requested by the Water Resources program.

19. **Personnel resources**

   a. **Needed resources.** Give an overview of the personnel resources that will be needed to implement the program. How many additional sections of existing courses will be needed? Referring to the list of new courses to be created, what instructional capacity will be needed to offer the necessary number of sections?

   No new courses or sections should be necessary within the first 4-5 years of the program. Should enrollments exceed our expectations, additional sections of ASM 305 and 315 will likely be required. This will require, ideally, additional computers and a graduate student teaching assistant stipend.

   b. **Existing resources.** Describe the existing instructional, support, and administrative resources that can be brought to bear to support the successful implementation of the program.

   The general mechanisms used to fund academic programs within CALS will be suitable to support this new major. Classroom space is currently available in JML. Faculty and instructors are available and currently teaching the required courses.

   c. **Impact on existing programs.** What will be the impact on existing programs of increased use of existing personnel resources by the proposed program? How will quality and productivity of existing programs be maintained?

   The courses required for this degree have always been required within the ESS and ASM majors. In addition, most of the classes were required within the terminated Ecohydrology and Agricultural Engineering tracks. For these reasons, we do not anticipate a negative impact on any existing program. As stated earlier, if the student numbers expand beyond our expectations, ASM 305 and 315 will likely have to be expanded by an additional section and supplemented with a teaching assistant.

   d. **Needed resources.** List the new personnel that must be hired to support the proposed program. Enter the costs of those personnel resources into the budget sheet.

   The proposed new major does not require additional courses. If student numbers exceed our projections, a graduate student teaching assistantship will be required. Any open/opening faculty positions will need to be replaced to cover the existing courses.

20. **Revenue Sources**

   a) **Reallocation of funds:** If funding is to come from the reallocation of existing state appropriated funds, please indicate the sources of the reallocation. What impact will the reallocation of funds in support of the program have on other programs?

   Funding that currently supports the courses included in this proposal is already in
existence and currently allocated to the existing units (Soil and Land Resources and Agricultural Systems Management).

b) **New appropriation.** If an above Maintenance of Current Operations (MCO) appropriation is required to fund the program, indicate when the institution plans to include the program in the legislative budget request.

Not applicable.

c) **Non-ongoing sources:**
   i. If the funding is to come from one-time sources such as a donation, indicate the sources of other funding. What are the institution’s plans for sustaining the program when that funding ends?
      Not applicable.
   ii. Describe the federal grant, other grant(s), special fee arrangements, or contract(s) that will be valid to fund the program. What does the institution propose to do with the program upon termination of those funds?
      Not applicable.

d) **Student Fees:**
   i. If the proposed program is intended to levy any institutional local fees, explain how doing so meets the requirements of Board Policy V.R., 3.b.

   There will be no change to existing laboratory fees, which are required in several Environmental Soil Science and Agricultural Systems Management courses.

   ii. Provide estimated cost to students and total revenue for self-support programs and for professional fees and other fees anticipated to be requested under Board Policy V.R., if applicable.
      Not applicable.

21. Using the budget template provided by the Office of the State Board of Education, provide the following information:

   *Note: The shifting enrollment headcounts contained in the budget templates that follow are based on current undergraduate and graduate student enrollments and an anticipated annual enrollment increase of 5%.*

   - Indicate all resources needed including the planned FTE enrollment, projected revenues, and estimated expenditures for the first four fiscal years of the program.
   - Include reallocation of existing personnel and resources and anticipated or requested new resources.
   - Second and third year estimates should be in constant dollars.
   - Amounts should reconcile subsequent pages where budget explanations are provided.
   - If the program is contract related, explain the fiscal sources and the year-to-year commitment
from the contracting agency(ies) or party(ies).

- Provide an explanation of the fiscal impact of any proposed discontinuance to include impacts to faculty (i.e., salary savings, re-assignments).

Program Resource Requirements.
- Indicate all resources needed including the planned FTE enrollment, projected revenues, and estimated expenditures for the first four fiscal years of the program.
- Include reallocation of existing personnel and resources and anticipated or requested new resources.
- Second and third year estimates should be in constant dollars.
- Amounts should reconcile subsequent pages where budget explanations are provided.
- If the program is contract related, explain the fiscal sources and the year-to-year commitment from the contracting agency(ies) or party(ies).
- Provide an explanation of the fiscal impact of any proposed discontinuance to include impacts to faculty (i.e., salary savings, re-assignments).

<table>
<thead>
<tr>
<th>I. PLANNED STUDENT ENROLLMENT</th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FTE</td>
<td>Headcount</td>
<td>FTE</td>
<td>Headcount</td>
</tr>
<tr>
<td>A. New enrollments</td>
<td></td>
<td>99</td>
<td></td>
<td>104</td>
</tr>
<tr>
<td>B. Shifting enrollments</td>
<td>$0</td>
<td>94</td>
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<tr>
<td>Total Enrollment</td>
<td>$0</td>
<td>94</td>
<td>0</td>
<td>99</td>
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</table>

<table>
<thead>
<tr>
<th>II. REVENUE</th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
</tr>
</thead>
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<tr>
<td></td>
<td>On-going</td>
<td>One-time</td>
<td>On-going</td>
<td>One-time</td>
</tr>
<tr>
<td>1. New Appropriated Funding Request</td>
<td></td>
<td></td>
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<tr>
<td>2. Institution Funds</td>
<td>$1,336,800</td>
<td>$1,218,450</td>
<td>$1,242,120</td>
<td>$1,287,364</td>
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<tr>
<td>3. Federal</td>
<td>$598,434</td>
<td>$598,434</td>
<td>$598,434</td>
<td>$598,434</td>
</tr>
<tr>
<td>4. New Tuition Revenues from Increased Enrollments</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>5. Student Fees</td>
<td>$2,801</td>
<td>$2,801</td>
<td>$2,801</td>
<td>$2,801</td>
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<tr>
<td>6. Other (i.e., Gifts)</td>
<td>$31,384.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Revenue</td>
<td>$1,938,035</td>
<td>$31,384</td>
<td>$1,819,685</td>
<td>$0</td>
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</tbody>
</table>

Ongoing is defined as ongoing operating budget for the program which will become part of the base.

One-time is defined as one-time funding in a fiscal year and not part of the base.
### III. EXPENDITURES

#### A. Personnel Costs

<table>
<thead>
<tr>
<th></th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. FTE</td>
<td>12</td>
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<tr>
<td>2. Faculty</td>
<td>$677,956</td>
<td>$698,294.7</td>
<td>$698,294.7</td>
<td>$719,243.52</td>
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<tr>
<td>3. Adjunct Faculty</td>
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<tr>
<td>4. Graduate/Undergrad Assistants</td>
<td>$190,504</td>
<td>$190,504</td>
<td>$190,504</td>
<td>$190,504</td>
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<tr>
<td>5. Research Personnel</td>
<td>$156,750</td>
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<tr>
<td>6. Directors/Administrators</td>
<td>$150,000</td>
<td>$154,500.0</td>
<td>$159,135.0</td>
<td>$163,909.05</td>
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<tr>
<td>7. Administrative Support Personnel</td>
<td>$40,000</td>
<td>$41,200.0</td>
<td>$42,436.0</td>
<td>$43,709.08</td>
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<tr>
<td>8. Fringe Benefits</td>
<td>$300,494</td>
<td>$309,509.0</td>
<td>$318,794.3</td>
<td>$328,358.08</td>
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<tr>
<td>9. Other:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Personnel and Costs**: $1,515,704  $1,394,008  $1,409,164  $1,445,724  $0
### B. Operating Expenditures

<table>
<thead>
<tr>
<th></th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>$10,000.00</td>
<td>$10,200.00</td>
<td>$10,404.00</td>
<td>$10,612.08</td>
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<tr>
<td>Professional Services</td>
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<td></td>
</tr>
<tr>
<td>Other Services</td>
<td>$5,000.00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Materials and Supplies</td>
<td>$397,330.41</td>
<td>$405,277.02</td>
<td>$413,382.56</td>
<td>$421,650.21</td>
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<tr>
<td>Rentals</td>
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<td></td>
<td></td>
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<tr>
<td>Materials &amp; Goods for Manufacture &amp; Resale</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$10,000.00</td>
<td>$10,200.00</td>
<td>$10,404.00</td>
<td>$10,612.08</td>
</tr>
</tbody>
</table>

| Total Operating Expenditures | $422,330 | $0 | $425,677 | $0 | $434,191 | $0 | $442,874 | $0 |

### C. Capital Outlay

<table>
<thead>
<tr>
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<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
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</thead>
<tbody>
<tr>
<td>Library Resources</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Equipment</td>
<td>$31,384.00</td>
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</tr>
</tbody>
</table>

| Total Capital Outlay    | $0 | $31,384 | $0 | $0 | $0 | $0 | $0 | $0 |

### D. Capital Facilities

#### Construction or Major Renovation

<table>
<thead>
<tr>
<th></th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
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### E. Other Costs

<table>
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<tr>
<th></th>
<th>FY 17</th>
<th>FY 18</th>
<th>FY 19</th>
<th>FY 20</th>
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</thead>
<tbody>
<tr>
<td>Utilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance &amp; Repairs</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

| Total Other Costs       | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |

| TOTAL EXPENDITURES      | $1,938,035 | $31,384 | $1,819,685 | $0 | $1,843,355 | $0 | $1,888,598 | $0 |

| Net Income (Deficit)    | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |

Budget Notes (specify row and add explanation where needed: e.g., "I.A., B. FTE is calculated using..."):

I.A.B.
APPENDIX #1. Current PSES Undergraduate and Graduate Curricula (grey box, left) and their proposed placement in PSES-derivative departments Plant Sciences (green box, right), Entomology, Plant Pathology and Nematology (orange box, right) and Soil and Water Systems (blue box, right).

**Plant, Soil, and Entomological Sciences**

**Degree:** B.S.Ag.L.S. Agricultural and Life Sciences

**Major:** Sustainable Food Systems

**Major:** Sustainable Crop and Landscape Systems

Emphasis areas:
- Sustainable Cropping Systems
- Environmental Horticulture
- Plant Biotechnology
- Insects and Society
- Soils and Land Use

**Minors:**
- Crop Science*
- Horticulture*
- Plant Science*
- Soil Science*

**M.S. degrees:**
- Plant Science*
- Entomology*
- Soil and Land Resources*

**Ph.D. degrees:**
- Plant Science*
- Entomology*
- Soil and Land Resources*

**Entomology, Plant Pathology and Nematology (Bifurcated)**

**Degree:** B.S.Ag.L.S. Agricultural and Life Sciences*

**Major:** Entomology (formerly Insects and Society emphasis area)

**Minors:**
- Entomology*
- Plant Protection*

**M.S. degree:** Entomology*

**Ph.D. degree:** Entomology*

**Soil and Water Systems (Renamed)**

**Degree:** B.S.Ag.L.S. Agricultural and Life Sciences*

**Major:** Sustainable Food Systems*

**Degree:** B.S.SWS Soil and Water Systems (new)

**Majors:**
- Environmental Soil Science (formerly Soils and Land Use emphasis area)
- Agricultural Systems Management*
- Water Science and Management (new)

**Minors:**
- Soil Science*
- Agricultural Systems Management*

**M.S. degree:** Soil and Land Resources*

**Ph.D. degree:** Soil and Land Resources*

* indicates no change
APPENDIX #2. Course requirements for the proposed majors.

Courses required in all majors in the Department of Soil and Water Systems

ASM 315 Irrigation Systems and Water Management 3 cr
COMM 101 Fundamentals of Public Speaking 2 cr
GEOG 385 GIS Primer 3 cr
MATH 143 Pre-calculus Algebra and Analytic Geometry 3 cr
SOIL 205 The Soil Ecosystem 3 cr
SOIL 206 The Soil Ecosystem Lab 1 cr
SOIL 438 Pesticides in the Environment 3 cr
STAT 251 Statistical Methods 3 cr

One of the following (3 cr):
AGED 406 Exploring International Agriculture 3 cr
SOC 350 Food, Culture, and Society 3 cr

One of the following (3 cr):
ENGL 313 Business Writing 3 cr
ENGL 317 Technical Writing 3 cr

One of the following (3 cr):
PLSC 102 The Science of Plants in Agriculture 3 cr
REM 221/FOR 221 Ecology 3 cr

Agricultural Systems Management (B.S.S.W.S.)
Required course work includes the university requirements (see regulation J-3), the Department of Soil and Water Systems core and the following:

ACCT 201 Introduction to Financial Accounting 3 cr
ACCT 202 Introduction to Managerial Accounting 3 cr
AGEC 278 Farm and Agribusiness Management 4 cr
AGEC 289 Agricultural Markets and Prices 3 cr
AGEC 356 Agricultural and Rural Policy 3 cr
ASM 107 Beginning Welding 2 cr
ASM 112 Introduction to Agricultural Systems Management 3 cr
ASM 200 Seminar 1 cr
ASM 202 Agricultural Shop Practices 2 cr
ASM 305 GPS and Precision Agriculture 3 cr
ASM 331 Electric Power Systems for Agriculture 3 cr
ASM 409 Agricultural Tractors, Power Units and Machinery Management 4 cr
ASM 412 Agricultural Safety and Health 2 cr
ASM 433 Agricultural Processing Systems 3 cr
BUS 190 Integrated Business and Value Creation 3 cr
BLAW 265 Legal Environment of Business 3 cr
BIOL 102 Biology and Society 3 cr
BIOL 102L Biology and Society Lab 1 cr
ECON 202 Principles of Microeconomics 3 cr

**One of the following (4 cr):**
- CHEM 101 Introduction to Chemistry I 4 cr
- CHEM 111 Principles of Chemistry I 4 cr

**One of the following (4 cr):**
- PHYS 100, 100L Fundamentals of Physics and Lab 4 cr
- PHYS 111, 111L General Physics I and Lab 4 cr
- PHYS 211, 211L Engineering Physics I and Lab 4 cr

AGEC Elective - Upper Division 3 cr
Agricultural and Technical Electives 10 cr
Life Science Elective 3 cr

**Courses to total 128 credits for this degree**

**Environmental Soil Science (B.S.S.W.S.)**
Required course work includes the university requirements (see regulation J-3), the Department of Soil and Water Systems core and the following:

- CHEM 111 Principles of Chemistry I 4 cr
- CHEM 112 Principles of Chemistry II 5 cr
- BIOL 115 Cells and the Evolution of Life 3 cr
- BIOL 115L Cells and the Evolution of Life Laboratory 1 cr
- BIOL 250 General Microbiology 3 cr
- BIOL 255 General Microbiology Lab 2 cr
- GEOL 111 Physical Geology for Science Majors 3 cr
- PHYS 111 General Physics I 3 cr
- PHYS 111L General Physics I Lab 1 cr
- PHYS 112 General Physics II 3 cr
- PHYS 112L General Physics II Lab 1 cr
- SOIL 400 Seminar 1 cr
- SOIL 415 Soil and Environmental Physics 3 cr
- SOIL 422 Environmental Soil Chemistry 3 cr
- SOIL 446 Soil Fertility 3 cr
- SOIL 454 Pedology 3 cr
- SOIL 425 Microbial Ecology 3 cr
- SOIL 499 Directed Study 1 cr

**One of the following (4 cr):**
- BIOL 213 Principles of Biological Structure and Function 4 cr
- PLSC 205 General Botany 4 cr
One of the following (3 cr):
CHEM 275 Carbon Compounds 3 cr
CHEM 277 Organic Chemistry I 3 cr

One of the following (1 cr):
GEOL 111L Physical Geology for Science Majors Lab 1 cr
GEOL 101L Physical Geology Lab 1 cr

One of the following (4 cr):
MATH 160 Survey of Calculus 4 cr
MATH 170 Analytic Geometry and Calculus I 4 cr

Courses to total 128 credits for this degree

Water Science and Management (B.S.S.W.S.)
Required course work includes the university requirements (see regulation J-3), the Department of Soil and Water Systems core and the following:

CHEM 111 Principles of Chemistry I 4 cr
CHEM 112 Principles of Chemistry II 5 cr
MATH 170 Analytic Geometry and Calculus I 4 cr
MATH 175 Analytic Geometry and Calculus II 4 cr
BIOL 115 Cells and the Evolution of Life 3 cr
BIOL 115L Cells and the Evolution of Life Laboratory 1 cr
GEOL 111 Physical Geology for Science Majors 3 cr
PHYS 111 General Physics I 3 cr
PHYS 111L General Physics I Lab 1 cr
PHYS 112 General Physics II 3 cr
PHYS 112L General Physics II Lab 1 cr
SOIL 415 Soil and Environmental Physics 3 cr
SOIL 422 Environmental Soil Chemistry 3 cr
SOIL 446 Soil Fertility 3 cr
ASM 305 GPS and Precision Agriculture 3 cr
BE 450 Environmental Hydrology 3 cr
BE 452 Environmental Water Quality 3 cr
GEOL 309 Ground Water Hydrology 3 cr

One of the following (1 cr):
GEOL 111L Physical Geology for Science Majors Lab 1 cr
GEOL 101L Physical Geology Lab 1 cr
One of the following (3 cr):
HYDR 409 Quantitative Hydrogeology 3 cr
HYDR 412 Environmental Hydrogeology 3 cr
HYDR 414 Ground Water-Surface Water Interaction 3 cr

One of the following (3 cr):
FOR 326 Fire Ecology and Management 3 cr
FOR 462 Watershed Science and Management 3 cr

One of the following (3 cr):
GEOG 475 Intermediate GIS 3 cr
GEOG 424 Hydrologic Applications of GIS and Remote Sensing 3 cr
FOR 472 Remote Sensing of the Environment 3 cr

Courses to total 128 credits for this degree