

April 21, 2020

MARK GRISMER, CHAIR

Hydrological Sciences Graduate Group

THOMAS HARTER, CHAIR

Hydrological Sciences Graduate Group

RE: Hydrological Sciences Graduate Group Degree Requirements

Enclosed is a copy of the Hydrological Sciences degree requirements as approved by Graduate Council on April 17, 2020. These degree requirements are now the official requirements for the Hydrological Science Graduate Group and will be posted on the Office of Graduate Studies program webpage:

<https://grad.ucdavis.edu/programs/ghys>

Thank you for your efforts on behalf of graduate education.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Arnett". The signature is fluid and cursive, with a large initial "C" and a stylized "A".

Carlee Arnett, Chair
Graduate Council

CC: Jasmine Bonite, Project/Policy Analyst, Graduate Studies
Shila Ruiz, Graduate Group Coordinator

**HYDROLOGIC SCIENCES GRADUATE GROUP (HSGG)
PH.D. AND MS DEGREE REQUIREMENTS
Revised: JULY 1, 1992; MARCH 1, 2020
Graduate Council Approval: April 17, 2020**

Master's Degree Requirements

1) Admissions requirements:

Consideration for Program admission requires a bachelor's degree, a minimum undergraduate GPA of 3.0, three letters of recommendation, transcripts from all higher education institutions attended (unofficial transcripts at time of application and official transcripts prior to matriculation), GRE General Test scores, TOEFL or IELTS score (if applicable) and a complete Graduate Studies online application with fee by the stated admissions deadline. Applicants are strongly encouraged to learn about and communicate with HSGG faculty well before admissions deadlines to identify a willing major professor as their primary mentor prior to consideration for admission to the Program. Admissions decisions are made on a case-by case basis with the decision to recommend admission to the Dean of Graduate Studies made by the Program Admissions Committee on the basis of available space and the competitiveness of applicants compared to the eligible pool.

a) Prerequisites:

Applicants are expected to have passed the equivalent of the following UC Davis courses (see www.assist.org for guidance on equivalent UC courses):

- One year of calculus, (MAT 21A, B and, C)
- One course in probability/statistics, (STA 13, ECI 114, HYD 142, or PLS 120)
- One course in any computer programming language or equivalent demonstrated programming proficiency, (ECS 10, ENG 6)
- One course in introductory undergraduate physical geology, including laboratory, (GEL 50/50L)
- One course in introductory undergraduate hydrology, (HYD 141 or ECI 142)

In addition to the universal prerequisites stated above for all applicants, each applicant is expected to have passed the equivalent of the UC Davis courses (see www.assist.org for guidance on equivalent UC courses) for additional prerequisites for the specialization they intend to pursue and designate in their application. There are 5 specializations: (1) Physical Hydrology, (2) Water Policy and Management, (3) Hydrochemistry, (4) Hydrobiology, and (5) Earth Surface Processes.

Additionally required only of students pursuing a specialization in Physical Hydrology or Earth Surface Processes:

- One course in linear algebra, (MAT 22A, or equivalent)

- One course in differential equations, (MAT 22B, or equivalent)
- One year of general physics, (PHY 9A, B and, C, or equivalent)
- Two courses in general chemistry, (CHE 2A and, B, or equivalent)
- One course in undergraduate fluid mechanics (ENG 103, or equivalent)

Additionally required only of students pursuing a specialization in Water Policy and Management:

- One course in microeconomics, (ECN 1A, ECN100, or ARE 100A)
- One course in public policy analysis, (ESP 160, ESP 162, HYD 150, POL 108, or POL 109)

Additionally required only of students pursuing a specialization in Hydrochemistry:

- One year of general biology, (BIS 2A, B and, C, or equivalent)
- One year of general chemistry, (CHE 2A, B, and C, or equivalent)
- One course in aqueous chemistry (CHE 100, GEL 132, HYD 134, or equivalent)

Additionally required only of students pursuing a specialization in Hydrobiology:

- One year of general biology, (BIS 2A, B and, C)
- One year of general chemistry, (CHE 2A, B and, C)
- One course in introductory ecology, (ESP 100 or EVE 101)

b) Deficiencies:

Applicants are strongly recommended to have completed nearly all of their prerequisites prior to admissions, but given the uniqueness of our program it is common for students to have some deficiencies depending on the subject in which they received their undergraduate degree. Remaining course work deficiencies must be made up by the end of the first academic year following initial enrollment by earning a letter grade of “B” or better.

2) Masters Degree (M.S.) Plan I (Thesis) or Plan II (Comprehensive Examination)

Plan I. This plan requires a minimum of 30 units of upper division and graduate courses (the 100 and 200 series only), of which at least 14 must be graduate work in the major field exclusive of research units (299 or equivalent). Courses taken prior to admission to the program may be used to satisfy some course work requirements where designated, but may not be counted in the 30 unit requirement. In addition, this plan requires a minimum of 41 hours of effort toward designated cross-curriculum objectives that serve general graduate science education. Finally, a Master’s thesis and an exit seminar are required. The Master’s thesis cannot be approved by faculty until the exit seminar is given.

Plan II. This plan requires a minimum of 36 units of upper division and graduate courses (the 100 and 200 series only), of which at least 18 must be graduate work in the major field exclusive of research units (299 or equivalent). Courses taken prior to admission to the program may be used to satisfy some course work requirements where designated, but may not be counted in the 36 unit requirement. In addition, this plan requires a minimum of 41 hours of effort toward designated cross-curriculum objectives that serve general graduate science education. A comprehensive final examination in the major subject is required of each candidate. Although no thesis is required, there is a capstone requirement that is fulfilled by a project report that demonstrates application of the selected specialization.

3) Course Requirements - Core and Electives (total # units)

a) English Language Requirement

Students who have not obtained a previous degree at an approved English-medium institution or demonstrated English-language proficiency through an appropriate exam (e.g. TOEFL) are required to complete appropriate English-language courses, as described in the policy [Graduate Student Course Requirements – English as Second Language \(GC2018-02\)](#). Courses taken in satisfaction of this requirement do not count towards the units required for graduation.

b) General Graduate Science Education (59 hours)

Cross-curriculum objectives (CCOs) explicitly identify academic and professional skills essential to all students for success in a career using this degree. HSGG CCOs are listed in Appendix 1 and the CCO hours per course are listed in Appendix 2. Students are required to perform the specified minimum number of hours of effort for the following four CCO general education competency categories:

- 15 CCO hours of Reading & Critical Thinking (mean per HYD course is 8.4 hrs)
- 15 CCO hours of Communications (mean per HYD course is 9.5 hrs)
- 8 CCO hours of Management (mean per HYD course is 8 hrs)
- 21 CCO hours of Scientific Method (mean per HYD course is 13.7 hrs)

c) Core Courses (5-9 units)

HYD201A Principles and Applications of Hydrologic Science 3 units

HYD201B Principles and Applications of Hydrologic Science 2 units

- HYD201B is taken each year that a student is in the program (typically 1-3 times for an MS degree).

d) **A specialization with 4 depth requirements and 2 breadth requirements.** Among each specialization a student takes at least one course in each of the following breadth areas: physical hydrology; specialization-specific processes; chemistry or biology; and policy, economics, or law. Students having already completed the equivalent of all the HYD 1XX course requirements for physical hydrology in their undergraduate education, must fulfill the physical hydrology requirement through completion of an equivalent number of units of 200-level courses in physical hydrology topics, e.g., from the ‘hydrological processes’ listing in the physical hydrology specialization. (17-28 units)

i. **Specialization In Physical Hydrology (19-27 units)**

- One course in groundwater hydrology (4-5 units)
Choose among: ECI144, HYD144, HYD146
- One course in physical hydrology (3-5 units)
Choose among: ATM115, ATM133, ESP152, HYD110, HYD118, HYD124, HYD142, HYD143, HYD145, SSC107
- Two courses in hydrological processes (6-8 units)
Choose among: ECI240, ECI260, ECI264A, ECI264B, ECI276, ECI277A, ECI278, ECI289B¹, ECI 289I², HYD210, HYD242, HYD252, HYD254Y, HYD264, HYD269, HYD274
- One course in hydrochemistry or hydrobiology for breadth (3-6 units)
Choose among: CHE100, ECI140, ECI261, EVE101, HYD134, GEL132, HYD254Y, WFC120
- One course in water policy, law, or management for breadth (3 units)
Choose among: ARE293, ENV200A, ENV200B, ENV200C, ESM121, ECI155, ECI267, ECI273, ESP169, GEO212, HYD150, HYD-243

ii. **Specialization In Water Policy And Management (19-25 units)**

- One course in physical hydrology (3-4 units)
Choose among: ECI276, ESP152, GEL116, HYD110, HYD118, HYD124, HYD142, HYD143, HYD144, HYD145
- One course in water policy (3-4 units)
Choose among: ENV200A, ENV200B, ENV200C, ECI267, ESP169, ESP212A, ESP212B
- One course in water economics (4 units)
Choose among: ARE175, ARE176, ECI268
- One course in water resource systems (3 units)
Choose among: ECI249, ECI270, ECI273, ECI289I, HYD243
- One additional policy, economics, law, or geography courses (cannot use one already counted above) (3-4 units)
Choose among: ABT180, ARE175, ARE176, ARE293, ECI153, ECI155, ECI249, ECI267, ECI270, ECI273, ENV200A, ENV200B, ENV200C,

^{1,2} These are temporary course codes used by Civil & Environmental Engineering for Hydrologic (289B), or Water Resources (289I) Engineering courses that changes after approval as a regularly offered course.

ESM185, ESM186, ESP169, ESP212A, ESP212B, GEO212, HYD150, HYD182, HYD243, HYD273, HYD286

- One course in hydrochemistry or hydrobiology for breadth (3-6 units)
Choose among: CHE100, ECI261, EVE101, GEL132, HYD134, HYD254Y, WFC120

iii. **Specialization In Earth Surface Processes (18-29 units)**

- One course in physical hydrology (3-4 units)
Choose among: ATM115, ECI144, ECI276, ESP152, GEL116, HYD110, HYD118, HYD124, HYD142, HYD143, HYD144, HYD145
- One course in geospatial and statistical methods (3-4 units)
Choose among: ABT180, ESM185, ESM186, GEO200CN, HYD182, HYD273, HYD286, STA137
- One course in geomorphic, sediment, or soil processes (3-5 units)
Choose among: GEL109, GEL136, GEL140, GEL230, HYD252, HYD256, SSC100, SSC118
- One course in hydraulics (3-4 units)
Choose among: ECI141, ECI260, ECI264A, ECI264B, ECI277A, GEL150A, HYD254Y
- One course in hydrochemistry or hydrobiology for breadth (3-6 units)
Choose among: CHE100, ECI261, EVE101, GEL132, HYD134, HYD254Y, WFC120
- One course in water policy, law, or management for breadth (3-6 units)
Choose among: ARE293, ECI155, ECI273, ENV200A, ENV200B, ENV200C, ESM121, ESP169, ECI267, GEO212, HYD150, HYD243

iv. **Specialization In Hydrochemistry (17-25 units)**

- One course in physical hydrology (3-4 units)
Choose among: ATM115, ECI144, ECI276, ESP152, GEL116, HYD110, HYD118, HYD124, HYD142, HYD143, HYD144, HYD145
- One course in chemical processes (3-4 units)
Choose among: CHE233, ECI148A, ECI240, ECI243A, ECI243B, ECI245A, ECI245B, ECI261, ETX214, ETX240, ETX270, GEL146, GEL148, GEL227, SSC211, SSC219, SSC222
- One course in chemical analysis (2-5 units)
Choose among: CHE240, ETX220, ETX228, PLS211
- One course in experimental design and data analysis (3-5 units)
Choose among: ECI140, HYD273, PLS205, STA206

- One course in hydrobiology for breadth (3-4 units)
Choose among: ESP150A, ESP151, ESP152, ESP155, GEL150C, SSC219, WFC120
- One course in water policy, law, or management for breadth (3 units)
Choose among: ARE293, ECI155, ECI273, ENV200A, ENV200B, ENV200C, ESM121, ECI267, ESP169, GEO212, HYD150, HYD243

v. **Specialization In Hydrobiology (18-28 units)**

- One course in physical hydrology (3-4 units)
Choose among: ATM115, ECI144, ECI276, ESP152, GEL116, HYD110, HYD118, HYD124, HYD142, HYD143, HYD144, HYD145
- One course in geospatial methods (3-4 units)
Choose among: ABT180, ECS266, ESM 185, ESM 186, HYD182, HYD273, HYD286
- One course in terrestrial systems (3-4 units)
Choose among: ATM133, ECL200A, ECL200B, ECL208, ENH160, ESM141, ESM144, GEO211, HYD143, PLS130, PLS162, PLS163, SSC208, SSC219
- One course in aquatic systems (3-7 units)
Choose among: ECL214, ESP150A, ESP151, ESP152, ESP155, GEL150C, WFC120
- One course in hydrochemistry for breadth (3-6 units)
Choose among: CHE100, GEL132, HYD134
- One course in water policy, law, or management for breadth (3 units)
Choose among: ARE293, ECI155, ECI273, ENV200A, ENV200B, ENV200C, ESM121, ESP169, ECI267, GEO212, HYD150, HYD243

e) **Additional Electives:**

Students may need to complete additional coursework to meet the 30 unit (Plan I) or 36 unit (Plan II) requirements. Electives are chosen in consultation with the major professor and the assigned Graduate Adviser. Optional laboratory courses available in conjunction with a course with the same number are not required, so they are available to be used as additional electives.

f) **Summary:**

There is a minimum requirement of 30 units (Plan I) or 36 units (Plan II), which includes the following:

- General Graduate Science Education CCOs (59 hours)
- Core Courses (5-9 units)

- A Specialization (17-28 units)
- Additional Electives: as needed

All coursework must be approved by the major professor and a Graduate Adviser. Full-time students must enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U. Once course requirements are completed, students can take additional classes as needed, although the 12 units per quarter are generally fulfilled with a research class (299) and perhaps seminars. Per UC regulations students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

4) **Special requirements:**

Plan I requires an exit seminar prior to the final signature on the Master's thesis.

5) **Advising Structure and Mentoring:**

The primary responsibility for advising and mentoring graduate students will take place via the Major Professor. The student's Course Guidance Committee members and later the Thesis Committee for Plan I students also share responsibility for mentoring. Faculty mentors should follow and adhere to the Graduate Council Mentorship Guidelines and the UC Davis Principles of Community. Students may also seek advice from other HSGG faculty and the Student Affairs Officer.

The **Major Professor** is the faculty member who knows and advises the student about the specific courses that meet their specialization needs best and supervises the student's research and thesis; this person serves as the Chair of the Thesis Committee.

The **Graduate Adviser**, who is appointed by Graduate Studies, is responsible for tracking student progress with making up any missing prerequisites and moving through the degree requirements. This person is also a resource for information on academic requirements, policies and procedures, and registration information.

The **Student Affairs Officer (staff)** is responsible for independently managing, developing, and implementing academic advising, admissions and academic services, financial/administrative management, and program development and administration, under the general supervision of the HSGG chair. The SAO serves HSGG faculty and students, including as a first contact to find out how to address any issue.

The Mentoring Guidelines can be found in the HSGG graduate student handbook, available on the Group Website at <http://hsgg.ucdavis.edu>.

6) **Committees:**

a) **Admission Committee:**

Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. The Admissions Committee consists of three HSGG faculty (a Chair and two at-large faculty members). All complete applications are processed to screen out and decline applicants that do not meet the Office of Graduate Studies minimum academic requirements. Remaining complete applications are comprehensively reviewed and

ranked. The Admissions Committee recommends to accept or decline each applicant's request for admission through consideration of the ranking and faculty interest. A recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by both Graduate Studies and the Graduate Group. The admissions process is restricted to designated Graduate Studies application deadlines.

b) **Course Guidance Committee**

The Course Guidance Committee for MS Plan I and II students will be composed of the Major Professor and an assigned Graduate Advisor. The major professor will initiate course guidance prior to or at the outset of the first quarter of residence in the program. Students must then meet with their assigned Graduate Advisor thereafter during the first quarter of residence in the program. On the basis of these meetings, students are required to complete an approved educational plan by the end of their first quarter of residence in the program that shows how they intend to meet degree requirements. Students shall review and update their educational plan each fall quarter until Advancement to Candidacy.

c) **MS Plan I: Thesis Committee**

The student, in consultation with his/her major professor and Graduate Adviser, nominates three faculty to serve on the Thesis Committee. These nominations are submitted to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy. The major professor serves as Chair of the committee. No more than one member may be a non-HSGG faculty member or external scholar. The chair of the thesis committee shall not approve or sign an MS thesis prior to the student's exit seminar.

An external committee member is only to be requested and approved when the faculty at the University lack a critical capability to test the student's academic qualifications to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree, and a student must substantiate this in the request. Individuals who sponsor the student's research or have a financial interest or financial connection to the student and his/her research are not permitted to serve on the Thesis Committee. External committee members require the approval of the HSGG Graduate Advisor and the Dean of Graduate Studies using the External Committee Member Nomination form.

d) **MS Plan II: Comprehensive Examination Committee** *and its makeup.*

Three faculty examiners are nominated by the student, with guidance from the Course Guidance Committee. Students must provide the slate of nominees to the HSGG office no later than 30 days from the proposed date of the examination. No more than one non-HSGG faculty member may serve on the Examination Committee. External Committee members are allowed with the approval of the chair of the Hydrologic Sciences Graduate Group. The HSGG chair will assign one of the nominated HSGG faculty members as the committee chair. Final approval of examination topics rests with the committee chair.

The faculty members serving on the Examination Committee are expected to determine the quality of the performance of the candidate on all parts of the examination and not solely for the section covered by the examiner.

7) **Advancement to Candidacy:**

Every student must file an official application for Candidacy for the Degree of Master of Science and pay the Candidacy Fee after completing one-half of their course requirements and at least one quarter before completing all degree requirements; this is typically the fifth quarter, but can be sooner. The Candidacy for the Degree of Master form can be found online at: <http://www.gradstudies.ucdavis.edu/forms/>. A completed form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student's course plan after s/he has advanced to candidacy, the Graduate Adviser must recommend these changes to Graduate Studies. Students must have their Graduate Adviser and committee Chair sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved, Graduate Studies will send a copy to the appropriate Graduate Program Coordinator and the student; the Thesis Committee Chair will also receive a copy, if applicable. If Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application's deferral. Some reasons for deferring an application include: grade point average below 3.0, outstanding "I" grades in required courses, or insufficient units.

8) **Comprehensive Examination and/or Thesis Requirements:**

a) **Thesis Requirements (Plan I):**

Thesis committee meetings: The candidate and major professor should meet at least quarterly. In addition, the candidate is required to meet at least once a year with the other members of the thesis committee to discuss progress and any changes in research objectives.

Exit seminar: The candidate is required to announce and deliver an exit seminar to HSGG students and faculty as part of the degree requirements. The Chair of the Thesis Committee does not sign an approval of the thesis until after the exit seminar is delivered.

Thesis: Research for the Master's thesis is to be carried out under the supervision of a faculty member. At the discretion of the student and the Major Professor, a thesis may be formatted as either a traditional thesis or as a journal article manuscript with a thesis version that conforms to existing guidelines of Graduate Council and Graduate Studies. Once a thesis is submitted to the thesis committee, faculty have one month to provide reviews. The student will provide committee members with a revision for re-review, including an accounting of the changes that were done for the revision. Committee members may require further revision, each time taking no more than one month to review the thesis.

For the thesis to be acceptable for the degree, all members must sign the title page certifying that the student has completed the thesis to the committees' satisfaction. In cases where the committee members cannot reach a unanimous decision but a majority is favorable, the majority and minority will report their separate opinions on the merit of the thesis to the Graduate Adviser. The Graduate Adviser will make a

recommendation to be forwarded to the Dean of Graduate Studies for a final decision. If the thesis is regarded by the committee as of less than acceptable quality the student will be given an appropriate period of time by the committee in which to improve the work. If, after that period of time, (usually a quarter or more), the thesis is still unacceptable to a majority of the committee, they may recommend that the student be disqualified from further graduate study.

The thesis must be filed in a quarter in which the student is registered or on filing fee. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in final form are available from Graduate Studies; the dates are also printed in the UC Davis General Catalog and in the Class Schedule and Registration Guide issued each quarter. A student must have a GPA of 3.0 for the M.S. degree to be awarded.

b) Comprehensive Examination (Plan II):

The comprehensive examination has two parts and is administered to students registered or in current filing fee status, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The purpose of the examination is to evaluate and confirm the student's knowledge of Hydrologic Science and competence in scientific inquiry, writing, and oral communication.

Capstone Project Report: The candidate is required to write a project report demonstrating in-depth understanding, or application of their specialization knowledge and clear writing ability. Reports can range from an in-depth analysis of a hydrologic problem/issue to development of a hydrologic application that addresses a current need. Typically reports range from 20-50 pages and include a problem/issue statement/description and justification, approach, analysis and discussion. The report must be submitted to the committee at least one month prior to the date of the examination.

Oral Examination: The candidate is required to pass a comprehensive oral examination administered by the three faculty on the comprehensive examination committee. In the examination, the candidate gives a presentation to demonstrate their understanding of their specialization and showcase their oral communication skills. Then faculty examiners ask questions about the capstone project and the course material the student has taken toward earning the degree.

Timing: Students may take the comprehensive examination once they have advanced to candidacy and after they have completed their capstone project.

Outcome: After the examination, the faculty will confer and vote to decide if the candidate passed the exam, which requires unanimous consent of the committee. "Not pass" is specified when the committee in charge does not feel that the candidate's performance meets the standard for the field. A "not pass" judgment requires the approval of the Graduate Adviser for a retake. The examination may not be repeated more than once. The second exam must take place within one quarter of the first exam. The format of the second exam is the same as that of the first exam and may include the submission of an amended version of the report. Students taking the examination a second time have only the pass and fail options. Evaluation as a "fail" at either the first or second exam means that the student will be recommended for disqualification from further graduate work in the program to the Dean of Graduate Studies. The results of the examination must be reported to Graduate Studies using the Master's Report Form found at <http://www.gradstudies.ucdavis.edu/forms/>. The program must file the report

with Graduate Studies within one week of the end of the quarter in which the student's degree will be conferred.

9) Normative Time to Degree:

For Plan I students, advancement to candidacy is expected in the 5th academic quarter, and completion of the thesis is expected by the end of the 7th academic quarter. Entrance deficiencies may delay this timeline, but are not expected to delay more than 3 quarters.

For Plan II students, advancement to candidacy is expected in the 5th academic quarter, and completion of the comprehensive exam is expected by the end of the 7th academic quarter.

10) Typical Time Line and Sequence of Events:

Sample Study Plan

A sample study plan is provided below for the case of a Plan I MS student specializing in Water Policy & Management. A total of 34 units are achieved, with 16 units at the graduate level (excluding HYD299). An analysis of CCO hours is provided as well, showing that the CCO degree requirements are easily met as part of the normal course load. Depending on the research project and student, an MS thesis might be submitted for faculty review as early as the fall of year 2 or as late as the fall of year 3, but in the sample it is shown as occurring in the spring of year 2. Entrance deficiencies may delay this timeline by as much as 3 quarters.

Year 1	Fall	Winter	Spring
	HYD201A Principles and Applications of Hydrologic Science	HYD201B Principles and Applications of Hydrologic Science	HYD110 Irrigation Systems & Water Management
	HYD144 Groundwater Hydrology	HYD145 Water Science & Design	HYD243 Water Resources Planning & Management
	ECI267 Water Resources Management	HYD150 Water Law	HYD299 Research
	HYD299 Research	HYD299 Research	
Year 2	Fall	Winter	Spring
	ARE176 Environmental Economics	201B Principles and Applications of Hydrologic Science	HYD299 Research
	ECI276 Watershed Hydrology	HYD299 Research	(submit MS thesis)
	HYD299 Research	(advancement to MS candidacy)	

Cross-Curriculum Objective	HYD144	HYD145	HYD150	HYD243	HYD201A	Total
Reading & Critical Thinking	10	5	20	10	15	60
Communications	5	15	15	10	15	60
Management	10	25	5	15	0	55
Scientific Method	15	5	0	10	15	45

11) Sources of funding

Funding sources available to HSGG students, for which the HSGG has control, includes work study and graduate student fellowship support. The Group does not control any GSR or TA funding. Students should consult with individual faculty regarding research funding available to fund GSR and TA appointments. Students should also consult with the Student Affairs Officer regarding TA appointments.

12) PELP, In Absentia and Filing Fee status

Students must maintain appropriate student status at all times and to be eligible to complete the degree. Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide:

<http://www.gradstudies.ucdavis.edu/publications/>.

Ph.D. DEGREE REQUIREMENTS

1) Admissions requirements:

Consideration for Program admission requires a bachelor's degree, a minimum undergraduate GPA of 3.0, three letters of recommendation, transcripts from all higher education institutions attended (unofficial transcripts at time of application and official transcripts prior to matriculation), GRE General Test scores, TOEFL or IELTS score (if applicable) and a complete Graduate Studies online application with fee by the stated admissions deadline. Applicants are strongly encouraged to learn about and communicate with HSGG faculty well before admissions deadlines to identify a willing major professor as their primary mentor prior to consideration for admission to the Program. Admissions decisions are made on a case-by case basis with the decision to recommend admission to the Dean of Graduate Studies made by the Program Admissions Committee on the basis of available space and the competitiveness of applicants compared to the eligible pool.

a) Prerequisites:

Applicants are expected to have passed the equivalent of the following UC Davis courses (see www.assist.org for guidance on equivalent UC courses):

- One year of calculus, (MAT 21A, B and, C)
- One course in probability/statistics, (STA 13, ECI 114, HYD 142, or PLS 120)
- One course in any computer programming language or equivalent demonstrated programming proficiency, (ECS 10, ENG 6)
- One course in introductory undergraduate physical geology, including laboratory, (GEL 50/50L)
- One course in introductory undergraduate hydrology, (HYD 141 or ECI 142)

In addition to the universal prerequisites stated above for all applicants, each applicant is expected to have passed the equivalent of the UC Davis courses (see www.assist.org for guidance on equivalent UC courses) for additional prerequisites for the specialization they intend to pursue and designate in their application. There are 5 specializations: (1) Physical Hydrology, (2) Water Policy and Management, (3) Hydrochemistry, (4) Hydrobiology, and (5) Earth Surface Processes.

Additionally required only of students pursuing a specialization in Physical Hydrology or Earth Surface Processes:

- One course in linear algebra, (MAT 22A, or equivalent)
- One course in differential equations, (MAT 22B, or equivalent)
- One year of general physics, (PHY 9A, B and, C, or equivalent)
- Two courses in general chemistry, (CHE 2A and, B, or equivalent)
- One course in undergraduate fluid mechanics (ENG 103, or equivalent)

Additionally required only of students pursuing a specialization in Water Policy and Management:

- One course in microeconomics, (ECN 1A, ECN100, or ARE 100A)
- One course in public policy analysis, (ESP 160, ESP 162, HYD 150, POL 108, or POL 109)

Additionally required only of students pursuing a specialization in Hydrochemistry:

- One year of general biology, (BIS 2A, B and, C, or equivalent)
- One year of general chemistry, (CHE 2A, B, and C, or equivalent)
- One course in aqueous chemistry (CHE 100, GEL 132, HYD 134, or equivalent)

Additionally required only of students pursuing a specialization in Hydrobiology:

- One year of general biology, (BIS 2A, B and, C)
- One year of general chemistry, (CHE 2A, B and, C)
- One course in introductory ecology, (ESP 100 or EVE 101)

b) Deficiencies:

Applicants are strongly recommended to have completed nearly all of their prerequisites prior to admissions, but given the uniqueness of our program it is common for students to have some deficiencies depending on the subject in which they received their undergraduate degree. Remaining course work deficiencies must be made up by the end of the first academic year following initial enrollment by earning a letter grade of “B” or better.

2) Dissertation Plan C:

Plan C specifies a three-member (minimum) dissertation/final examination committee, a final oral examination, and no exit seminar.

3) Course Requirements - Core and Electives (total # units)

a) English Language Requirement

Students who have not obtained a previous degree at an approved English-medium institution or demonstrated English-language proficiency through an appropriate exam (e.g. TOEFL) are required to complete appropriate English-language courses, as described in the policy *Graduate Student Course Requirements – English as Second Language* ([GC2018-02](#)). Courses taken in satisfaction of this requirement do not count towards the units required for graduation.

b) General Graduate Science Education (59 hours)

Cross-curriculum objectives (CCOs) explicitly identify academic and professional skills essential to all students for success in a career using this degree. HSGG CCOs are listed in Appendix 1 and the CCO hours per course are listed in Appendix 2.

Students are required to perform the specified minimum number of hours of effort for the following four CCO general education competency categories:

- 15 CCO hours of Reading & Critical Thinking (mean per HYD course is 8.4 hrs)
- 15 CCO hours of Communications (mean per HYD course is 9.5 hrs)
- 8 CCO hours of Management (mean per HYD course is 8 hrs)
- 21 CCO hours of Scientific Method (mean per HYD course is 13.7 hrs)

c) **Core Courses (5-9 units)**

HYD201A Principles and Applications of Hydrologic Science 3 units

HYD201B Principles and Applications of Hydrologic Science 2 units

- HYD201B is taken each year that a PhD student is in the program until Advancement to Candidacy (typically 2-3 times).

d) **A specialization with 2 depth requirements and 1 breadth requirement all at the graduate level.**

i. **Specialization In Physical Hydrology (9-12 units)**

- Two graduate-level courses in physical hydrology or hydrological processes (6-8 units)

Choose among: ECI240, ECI260, ECI264A, ECI264B, ECI276, ECI277A, ECI277B, ECI277C, ECI278, ECI279, ECI289B³, ECI 289I⁴, HYD210, HYD242, HYD252, HYD254Y, HYD264, HYD269, HYD274

- One graduate-level course in water policy and management, Earth surface processes, hydrochemistry, or hydrobiology (3-4 units)

ii. **Specialization In Water Policy And Management (9-12 units)**

- Two graduate-level courses in water resource systems, water policy, or water economics (6-8 units)

Choose among: ENV200A, ENV200B, ENV200C, ECI249, ECI267, ECI268, ECI270, ECI273, ESP212A, ESP212B, GEO212, HYD243

- One graduate-level course in physical hydrology, Earth surface processes, hydrochemistry, or hydrobiology (3-4 units)

iii. **Specialization In Earth Surface Processes (9-12 units)**

- Two graduate-level courses in Earth surface analysis or processes (6-8 units)

^{3,4} These are temporary course codes used by Civil & Environmental Engineering for Hydrologic (289B), or Water Resources (289I) Engineering courses that changes after approval as a regularly offered course.

Choose among: ECI260, ECI264A, ECI264B, ECI277A, ECI277B, ECI277C, ECI278, ECI279, GEL230, HYD252, HYD254Y, HYD256, HYD273, HYD286

- One graduate-level course in physical hydrology, water policy and management, hydrochemistry, or hydrobiology (3-4 units)

iv. **Specialization In Hydrochemistry (8-13 units)**

- Two graduate-level courses in chemical processes, chemical analysis, experimental design, or experimental data analysis (5-9 units)

Choose among: CHE233, CHE240, ECI240, ECI243A, ECI243B, ECI245A, ECI245B, ECI261, ETX214, ETX220, ETX228, ETX240, ETX270, GEL227, PLS205, PLS211, SSC211, SSC219, SSC222, STA206

- One graduate-level course in physical hydrology, water policy and management, Earth surface processes, or hydrobiology (3-4 units)

v. **Specialization In Hydrobiology (9-14 units)**

- Two courses in hydrobiology (6-10 units)

Choose among: ECL200A, ECL200B, ECL208, ECL214, HYD273, HYD286, SSC208, SSC219

- One graduate-level course in physical hydrology, water policy and management, Earth surface processes, or hydrochemistry (3-4 units)

e) **Additional Electives:**

In consultation with their Course Guidance Committee and depending on their background, the student will take additional courses as necessary to achieve excellence in their specialization and a strong breadth across physical hydrology, water policy and management, Earth surface processes, hydrochemistry, and hydrobiology. Students who already have MS degrees may not need additional electives, while those who do not likely will need them.

f) **Summary:**

There is a minimum requirement of 13 units, which includes the following:

- General Graduate Science Education CCOs (59 hours)
- Core Courses (5-9 units)
- A Specialization (8-14 units)
- Additional Electives: as needed

All coursework must be approved by the student's Course Guidance Committee. Full-time students must enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U. Once course requirements are completed, students can take additional classes as needed, although the 12 units per quarter are generally fulfilled with a research class (299) and perhaps seminars. Per UC regulations students cannot enroll in more than 12 units of graduate level courses (200) or

more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

4) **Special Requirements:**

After passing the qualifying exam, PhD students are required to meet at least once annually with their dissertation committee members to review research progress. The maximum time that a student may remain in HSGG is ten years for the Ph.D. degree.

5) **Advising Structure and Mentoring:**

The primary responsibility for advising and mentoring graduate students will take place via the Major Professor. The student's Course Guidance Committee members and later the Dissertation Committee also share responsibility for mentoring. Faculty mentors should follow and adhere to the Graduate Council Mentorship Guidelines and the UC Davis Principles of Community. Students may also seek advice from other HSGG faculty and the Student Affairs Officer.

The **Major Professor** is the faculty member who knows and advises the student about the specific courses that meet their specialization needs best and supervises the student's research and thesis; this person serves as the Chair of the Dissertation Committee.

The **Graduate Adviser**, who is appointed by Graduate Studies, is responsible for tracking student progress with making up any missing prerequisites and moving through the degree requirements. This person is also a resource for information on academic requirements, policies and procedures, and registration information.

The **Student Affairs Officer (staff)** is responsible for independently managing, developing, and implementing academic advising, admissions and academic services, financial/administrative management, and program development and administration, under the general supervision of the HSGG chair. The SAO serves HSGG faculty and students, including as a first contact to find out how to address any issue.

The **Mentoring Guidelines** can be found in the HSGG graduate student handbook, available on the Group Website at <http://hsgg.ucdavis.edu>.

6) **Committees:**

a) **Admissions Committee:**

Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. The Admissions Committee consists of three HSGG faculty (a Chair and two at-large faculty members). All complete applications are processed to screen out and decline applicants that do not meet the Office of Graduate Studies minimum academic requirements. Remaining complete applications are comprehensively reviewed and ranked. The Admissions Committee recommends to accept or decline each applicant's request for admission through consideration of the ranking and faculty interest. A recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by both Graduate Studies and the Graduate Group. The admissions process is restricted to designated Graduate Studies application deadlines.

b) **Course Guidance or Advising Committee**

The Course Guidance Committee for PhD students will be composed of the Major Professor and an assigned Graduate Advisor. The major professor will initiate course guidance prior to or at the outset of the first quarter of residence in the program. Students must then meet with their assigned Graduate Advisor thereafter during the first quarter of residence in the program. On the basis of these meetings, students are required to complete an approved educational plan by the end of their first quarter of residence in the program that shows how they intend to meet degree requirements. Students shall review and update their educational plan each fall quarter until Advancement to Candidacy.

c) **Qualifying Examination Committee:**

The Qualifying Examination must be taken before the end of the 7th academic quarter (not including summer) after admission. All required courses must be completed before admission to the Qualifying Examination. Application for taking the Qualifying Examination is made by filing the application for Qualifying Examination form with Graduate Studies.

The student, in consultation with his/her major professor and Graduate Adviser, nominates five faculty to serve on the Examination Committee. These nominations are submitted to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy. The major professor may serve on the committee but does not serve as Chair of the committee. Four of the committee members must be HSGG faculty and one must be a non-HSGG faculty member.

An external committee member is only to be requested and approved when the faculty at the University lack a critical capability to test the student's academic qualifications to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree, and a student must substantiate this in the request. Individuals who sponsor the student's research or have a financial interest or financial connection to the student and his/her research are not permitted to serve on the Examination Committee. External committee members require the approval of the HSGG Graduate Advisor and the Dean of Graduate Studies using the External Committee Member Nomination form.

It is the student's responsibility to arrange the date and time of the examination in consultation with committee members. The student is responsible for reserving the room for the examination. No time limit has been set for the length of the examination but a typical examination is three hours in length. The QE Committee conducts the exam and submits results to the Office of Graduate Studies.

c) **Dissertation Committee:**

The role of the Dissertation Committee is to advise the doctoral student on the research topic and methods, review dissertation drafts and the final completed dissertation for acceptance, and participate in the final oral examination. The Dissertation Committee is a three-member committee identified by the candidate, in consultation with the Major Professor. The candidate should determine the desires of individual members regarding assistance with the research and dissertation review at the time the dissertation committee is constituted. The Major Professor will serve as Chair. At least two of the Dissertation Committee members will be HSGG faculty and one may be a non-HSGG faculty. The composition of the dissertation committee is entered on the Advancement to Candidacy Form and submitted to Graduate Studies for formal appointment in accordance with Graduate Council policy.

An external committee member is only to be requested and approved when the faculty at the University lack a critical scholarship need to evaluate the candidate's dissertation research, and a candidate must substantiate this in the request. Individuals who sponsor the candidate's research or have a financial interest or financial connection to the student and his/her research are not permitted to serve on the Dissertation Committee. External committee members require the approval of the HSGG Graduate Advisor and the Dean of Graduate Studies.

The candidate and major professor should meet at least quarterly. In addition, the candidate is required to meet at least once a year with the other members of the thesis committee to discuss progress and any changes in research objectives.

The candidate and faculty will coordinate a timeline for the candidate to present the dissertation to the dissertation committee. Once a dissertation is submitted to the dissertation committee, faculty have one month to provide reviews. The candidate will provide committee members with a revision for re-review, including an accounting of the changes that were done for the revision. Committee members may require further revision, each time taking no more than one month to review the dissertation. The dissertation committee will not sign the dissertation until after the final oral examination has taken place.

The Dissertation Committee will participate in a final oral examination of the candidate.

7) Advancement to Candidacy:

Before advancing to candidacy for a doctoral degree, a student must have satisfied all requirements set by the graduate program, must have maintained a minimum GPA of 3.0 in all course work undertaken (except those courses graded S or U), and must have passed a Qualifying Examination before a committee appointed to administer that examination. Normally, students advance by the end of the 9th quarter. The student must file the appropriate paperwork with Graduate Studies and pay the Candidacy Fee in order to be officially promoted to Ph.D. Candidacy. Refer to the Graduate Council website for additional details regarding the Doctoral Qualifying Examination at <http://gradstudies.ucdavis.edu/gradcouncil/policiesall.html>.

8) Qualifying Examination and Dissertation requirements:

a) Qualifying Examination

1. General Information

All students will complete all course requirements before taking their Qualifying Examination. Passing this exam makes the student eligible for Advancement to Candidacy. The qualifying exam should be taken before the end of the 7th academic quarter and no later than the end of the 9th academic quarter after admission to the Ph.D. program.

The primary purpose of the Qualifying Examination (QE) is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree. The QE must evaluate the student's command of the field, ensuring that the student has both breadth and depth of knowledge, and must not

focus solely on the proposed dissertation research. In addition, the QE provides an opportunity for the committee to provide important guidance to the student regarding his or her chosen research topic.

2. Written Portion of the Exam – Dissertation Prospectus

At a minimum the written portion of the exam consists of a research proposal called the Dissertation Prospectus. The Prospectus should be provided to members of the qualifying examination committee at least one month before the oral portion of the exam.

The Prospectus is an independently prepared proposal of 10-20 pages (double-spaced with continuous line numbering) describing the student's dissertation-specific literature review, research aims, scientific hypotheses, experimental and analysis approach, anticipated outcomes, progress to date, and broader significance. Concepts within the research proposal can be discussed with others (such as the student's major professor and peers), but the writing of the proposal should be solely the student's work (i.e., no editorial assistance is allowed) as the proposal will serve as evidence of the student's proficiency in scientific writing.

The qualifying exam committee will be responsible for assessing that the student's scientific reasoning and writing proficiency are satisfactory before advancement to candidacy. Furthermore, the Prospectus will provide information that may be discussed during the oral exam.

3. Oral Portion of the Exam

The oral portion of the qualifying exam is typically 3 hours in length and is intended to demonstrate the student's critical thinking ability, powers of imagination and synthesis, and depth and breadth of knowledge of the field of study. The committee will evaluate the student's general qualifications for a respected position as an educator or leader as well as the student's preparation in a special area of study based upon relevant portions of the student's previous academic record, performance on specific parts of the examination, and the student's potential for scholarly research as indicated during the examination.

4. Outcome of the Exam

The committee will reach a decision on the student's performance immediately after the oral exam. The committee, having reached a unanimous decision, shall inform the student of its decision to:

- “Pass” (no conditions may be appended to this decision),
- “Not Pass” (the Chair's report should specify whether the student is required to retake all or part of the examination, list any additional requirements, and state the exact timeline for completion of requirements to achieve a “Pass”),
or
- “Fail”.

If a unanimous decision takes the form of “Not Pass” or “Fail”, the Chair of the QE committee must include in its report a specific statement, agreed to by all members of the committee, explaining its decision and must inform the student of its decision. Having received a “Not Pass” the student may attempt the QE one additional time; the QE report must list the specific conditions and timing for the

second exam. After a second examination, a vote of “Not Pass” is unacceptable; only “Pass” or “Fail” is recognized. Only one retake of the qualifying examination is allowed. Should the student receive a “Fail” on the first or second attempt at the exam, the student will be recommended for disqualification from the program to the Dean of Graduate Studies.

b) The Dissertation

The completion of the Ph.D. includes two main components: 1) a written dissertation and 2) a defense/final examination consisting of a public departmental seminar followed by a closed examination restricted to members of the Dissertation Committee.

1. Dissertation: General Requirements

Filing of a Ph.D. dissertation with Graduate Studies is normally the last requirement satisfied by the candidate. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar or from the Bookstore). A candidate must be a registered student or in Filing Fee status at the time of filing a dissertation, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The Ph.D. Dissertation will be prepared, submitted and filed according to regulations instituted by Graduate Studies <http://gradstudies.ucdavis.edu/students/filing.html> Satisfaction of this requirement must be verified by the Dissertation Committee Chair.

2. Dissertation:

The research conducted by the student must be of such character as to show ability to pursue independent research. The dissertation reports a scholarly piece of work of publishable quality that solves a significant scientific problem in the field and is carried out under the supervision of a member of program while the student is enrolled in the program. The chair of the dissertation committee must be a member of the program and must be immediately involved with the planning and execution of the experimental work done to formulate the dissertation. The major professor’s laboratory is the setting for most of the student’s research activities, unless an alternative site and immediate supervisor are approved in advance by the Executive Committee.

Students should meet regularly with their dissertation committee. Informing committee members of progress as writing proceeds helps the members to plan to read the dissertation and provide feedback within this time frame. Once a dissertation is submitted to the dissertation committee, faculty have one month to provide reviews. The candidate will provide committee members with a revision for re-review, including an accounting of the changes that were done for the revision. Committee members may require further revision, each time taking no more than one month to review the dissertation. The dissertation committee will not sign the dissertation until after the final oral examination has taken place. After approved and signed by the dissertation committee the dissertation is submitted to Graduate Studies for final approval.

3. Final Oral Examination

The dissertation follows Plan C with a required final oral examination. The oral examination consists of two elements, a public seminar and a private dissertation defense.

All students completing a dissertation for the Ph.D. degree must present a public seminar on the results of their work as part of the final oral examination before the final dissertation can be accepted.

A minimum of two weeks before the final oral examination, a complete and defensible dissertation must be submitted to the Dissertation Committee for review. At this time the public seminar and dissertation defense date is scheduled. A defensible dissertation is one that has gone through (probably) multiple rounds of review and revision between the dissertation advisor and Ph.D. candidate.

The dissertation defense follows the public seminar and is an oral examination, restricted to members of the Dissertation Committee, on any aspects of the research. The possible outcomes of the dissertation defense are:

- i. Dissertation defense is certified as is. All members of the committee sign the dissertation.
- ii. Dissertation requires minor revisions. All members of the committee sign the dissertation, except the committee chair. The student completes the revisions and then obtains the signature of the committee chair when revisions are accepted.
- iii. Dissertation requires major revisions. The student is given one year to complete the revisions and is required to schedule a new dissertation defense date. No degree will be granted if the dissertation is not accepted at the second defense.

9) Normative Time to Degree

The normative time to degree for a student entering with or without a MS degree is approximately 3-5 or 5-6 years, respectively. The Graduate Council allows a maximum time of four years after a student passes the qualifying examination before s/he goes on probation for one year. If a student does not complete all degree requirements at the end of the probationary period the student will be dismissed (please see <http://gradstudies.ucdavis.edu/gradcouncil/timetodegree.pdf>).

10) Typical Time Line and Sequence of Events

Sample Study Plan

A sample study plan is provided below for the case of a PhD student specializing in Earth surface processes. A total of 22 units are achieved, with 19 units at the graduate level (excluding HYD299). An analysis of CCO hours is provided as well, showing that the CCO degree requirements are easily met as part of the normal course load. Depending on the research project and student, a PhD Research Proposal might be submitted for faculty review as early as the fall of year 2 or as late as the fall of year 3. Entrance deficiencies may delay this timeline by as much as 3 quarters.

Year 1	Fall	Winter	Spring
	201A Principles and Applications of Hydrologic Science	201B Principles and Applications of Hydrologic Science	HYD252 Hillslope Geomorphology and Sediment Budgets
	HYD273 Introduction to	HYD143 Hydrological	HYD299 Research

	Geostatistics	Processes in Ecosystems	
	HYD299 Research	HYD299 Research	
Year 2	Fall	Winter	Spring
	ECI267 Water Resources Management	201B Principles and Applications of Hydrologic Science	HYD299 Research
	HYD254Y Ecohydraulics	HYD299 Research	Qualifying Exam Preparation
	HYD299 Research		
Year 3	Fall	Winter	Spring
	HYD299 Research	HYD299 Research	HYD299 Research
	Qualifying Exam	(advancement to PhD candidacy)	
Years 4-6	Dissertation Research and Completion		

Cross-Curriculum Objective	HYD143	HYD252	HYD254Y	HYD273	Total
Reading & Critical Thinking	6	42	12	14	74
Communications	2	4	1	19	26
Management	3	3	2	2	10
Scientific Method	11	20	6.5	30	67.5

11) Sources of funding.

Funding sources available to HSGG students, for which the HSGG has control, includes work study and graduate student fellowship support. The Group does not control any GSR or TA funding. Students should consult with individual faculty regarding research funding available to fund GSR and TA appointments. Students should also consult with the Student Affairs Officer regarding TA appointments.

12) PELP, In Absentia and Filing Fee status.

Students must maintain appropriate student status at all times and to be eligible to complete the degree. Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide:

<http://www.gradstudies.ucdavis.edu/publications/>.

13) Leaving the Program Prior to Completion of the PhD Requirements.

Should a student leave the program prior to completing the requirements for the PhD, they may still be eligible to receive the Masters if they have fulfilled all the requirements (see Master's section). Students can use the Change of Degree Objective form available from the Registrar's Office: http://registrar.ucdavis.edu/local_resources/forms/D065-graduate-major-degree-change.pdf.