



OSU Graduate  
Water Resources Program

# Water Resources Engineering

Master of Science Degree

Graduate Information Handbook<sup>1</sup>

Water Resources Graduate Program  
Oregon State University  
Corvallis, Oregon 97331

Visit the Water Resources Graduate Program web site at <http://oregonstate.edu/gradwater/> and the OSU Graduate School web site at <http://gradschool.oregonstate.edu/> for current program and university information

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Schedule for M.S. Students  
 Schedule for Non-thesis Program<sup>2</sup>  
 (Full-time Students)

<b>Activity</b>	<b>When</b>
1. Identify at least two faculty members with whom you are interested in working. You may wish to contact them prior to or during your application process.	1. Prior to application
2. Confirm major advisor.	2. After application, prior to acceptance.
3. Initial advising and selection of first term classes	3. Before first term classes begin
4. Select two additional committee members and convene a meeting to discuss program of courses and project direction; <b>file graduate program with Graduate School</b>	4. Convene committee meeting in 1 <sup>st</sup> -2 <sup>nd</sup> term; program of study must be filed before completing more than 18 credits of graduate coursework
5. Prepare project proposal in consultation with major professor	5. 1 <sup>st</sup> -3 <sup>rd</sup> term
6. Seek financial support for proposed project	6. Ongoing and as needed
7. Complete courses in Graduate Program	7. Recommended by 4 <sup>th</sup> term
8. Submit draft of project paper to major professor	8. At least one term before oral examination
9. Revise and resubmit project paper based on major professor's comments to committee members, schedule final examination	9. At least two weeks before oral examination
10. Oral examination	10. 4 <sup>th</sup> term or later, but only with approval of major professor
11. Submit one electronic PDF copy of the final, revised thesis or project paper to the advisor.	11. After final approval by major professor
12. Exit interview	

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<sup>2</sup> Check with Graduate School for specific deadlines for graduation

Schedule for M.S. Students  
 Schedule for Thesis Program<sup>3</sup>  
 (Full-time Students)

<b>Activity</b>	<b>When</b>
1. Identify at least two faculty members you are interested in working with. You may wish to contact them prior to or during the application process.	1. Prior to application
2. Confirm major advisor.	2. After application, prior to acceptance.
3. Initial advising and selection of first term classes	3. Before first term classes begin
4. Select two additional committee members and arrange for a Graduate Representative through the Graduate School; convene committee to discuss program of courses and research direction; <b>file graduate program with Graduate School</b>	4. Convene committee meeting in 1 <sup>st</sup> -2 <sup>nd</sup> term; program of study must be filed before completing more than 18 credits of graduate coursework
5. Prepare research proposal in consultation with major professor; after approval, circulate proposal to all committee members and revise proposal based on comments	5. 1 <sup>st</sup> -3 <sup>rd</sup> term
6. Seek financial support for proposed project	6. Ongoing and as needed
7. Complete courses in Graduate Program	7. Recommended by 4 <sup>th</sup> term
8. Submit draft of thesis to major professor; revise as necessary	8. At least one term before oral examination
9. Submit copies of complete thesis to committee members	9. At least two weeks before oral examination
10. <b>Schedule final defense with Graduate School</b> and submit pretext pages to Graduate School for editing	10. Two weeks prior to oral examination
11. Oral examination	11. 4 <sup>th</sup> term or later, but only with approval of major professor
12. Submit one electronic PDF copy of the final, revised thesis or project paper to the advisor, and one electronic PDF copy to the OSU ScholarsArchive with the signed ETD form.	12. Within six weeks of oral examination
13. Exit interview	

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<sup>3</sup> Check with Graduate School for specific deadlines for graduation

## I. Introduction

This handbook was developed to provide information to graduate students in the Water Resources Engineering program at Oregon State University. It consolidates information for students entering a degree program in 2017 or later. Please refer to the OSU Graduate School web site (<http://gradschool.oregonstate.edu/>) for the *Graduate School Guide to Success* for the most important Graduate School regulations.

Students enrolled in the Water Resources Engineering program will be broadly trained to undertake life-long careers in water resources system design, and will have the option to focus on groundwater, surface water, or watershed engineering. Students will be required to take a minimum of 12 (M.S.) or 15 (Ph.D.) credits of graduate level engineering courses, and at least 6 (M.S.) or 9 (Ph.D.) credits of water science courses to support the engineering analysis. Water science courses may be selected from non-engineering departments across the campus, and are required to provide the students with the scientific context to understand the non-quantitative aspects of water resource systems. Students completing the WRE degree program will meet the coursework requirements to attain Professional Hydrologist certification through the American Institute of Hydrology (AIH). All students in WRE will be required to show prior to graduation competence in mathematics to the level of applied differential equations (MTH256), have a year of calculus-based physics, biology, and chemistry at the undergraduate level. See the degree program checklist (Appendix A) for entrance requirements, program requirements, and exit requirements. Graduates of the WRE degree program will have met three sets of program requirements and achieved the Graduate Learning Outcomes (Appendix F):

- A. **Entrance Requirements** All students entering the WRE degree program will be required to show basic competence in chemistry, physics, mathematics to integral calculus, and advanced competence (upper-division) in one science or engineering field.
- B. **Program Requirements** Students will complete a standard MS (45 cr.) or PhD (108 cr.) program based in water resources engineering but allowing for significant coursework in another field.
- C. **Exit Requirements** Students graduating from the program must show that they have a total of 37 cr. of water-related coursework based on the American Institute of Hydrology (AIH) standards (see <http://aih.engr.siu.edu/>). Up to 22 credits of this may be met by coursework taken elsewhere, including courses taken as an undergraduate, though it is expected that many of the requirements will be met by OSU coursework.

Required courses within each WRE focus area are identified in Appendix A and B. Students are also expected to include fundamentals of earth science (from geosciences, atmospheric sciences, or soil science).

## II. Graduate Program Requirements

### A. Responsibilities for Completing Graduate Program

**The student** will assume the major responsibility for his/her graduate program, follow program and university requirements, meet all deadlines, and initiate all steps involved in obtaining the degree. The student should meet regularly with the major advisor to discuss progress or difficulties in research, course work, or other matters. If experiencing major difficulties with the major professor, the student should discuss the matter with the Associate Director of their sub-field or the Director of the Water Resources Graduate Program.

**The major professor** will advise and guide students in their graduate programs, be informed of student progress and difficulties, edit research proposals and theses before they are given to committee members, encourage active participation in seminars, regional and national scientific meetings, and include students in other professional activities as appropriate.

**Members of the student's graduate committee** will serve as experts in certain specialized fields, as interested editorial critics of the student's writing (especially the thesis), and as participants in the various meetings and examinations held during the student's program.

**The Associate Director of the Water Resources Engineering** degree is involved in admission of graduate students, the development and review of required courses, provides oversight of WRE program, and will advise and guide students as necessary.

**The Director of the Water Resources Graduate Program** is involved in admission of graduate students, provides general orientation to the WRGP, ensures that the graduate program is implemented and standards are maintained, and assists in the solution of major problems that arise during a student's programs.

### B. Major Professor

Students admitted to the Water Resources Engineering program as regular graduate students will have a major professor who has agreed to supervise the student's work. It is the responsibility of the student to seek acceptance by a member of the Water Resources faculty as the major professor. The decision is made upon mutual agreement between the student and the professor concerned and should be reported to the Water Resources Graduate Program Director to initiate the final stage of the admission process.

### C. Student's Graduate Committee

The makeup of the graduate committees is governed by the policies of the Graduate School and the Water Resources Graduate Program. The **minimum** committee sizes are as follows:

Degree	Major Prof	Minor/Other	Grad Rep	Total
Non-thesis	1	2	0	3
Thesis	1	2	1	4

No committee is official until approved by program and Graduate School administrators. Administrative review will use the following guidelines:

1. All committee members must be Graduate Faculty. Adjunct members from other universities or organizations may also serve if approved by the WRGP and the Graduate School.
2. The committee must be appropriate to represent the proposed course of study and the relevant degree authority. ***At least two members of the committee must be members of the Water Resources faculty.***

The Major Professor assumes principal responsibility for directing research activities. When the Major Professor is on a courtesy faculty appointment, a member of the Water Resources regular faculty must serve as co-chair of the thesis committee and must sign the approved thesis.

If the student chooses an optional minor, the Minor Professor must be from outside the WRGP unless the minor area is entirely within Water Resources (for example, Water Resources Policy and Management). Graduate School rules require students to take at least fifteen credits for the minor and at least one course from the Minor Professor's department.

The student's committee for the M.S. degree consists of a minimum of three graduate faculty members: the major professor and two faculty members with some experience in the general area of the student's research area. In the thesis option, a Graduate Council Representative is chosen from a list provided by the Graduate School, and is a full voting member of the committee who attends all meetings, exams, and the final thesis defense. In the non-thesis option, there is no Graduate School representative on the committee.

### D. Grade Requirement

A grade point average of 3.0 (a B average) is required for all courses taken as a graduate student (even if they are undergraduate courses), and for courses included in a graduate program. **Neither grades below C nor S/U grades are accepted on a graduate program.**

## E. Program Requirements

Requirements for the M.S. degree are tailored to reflect the diversity of backgrounds of incoming students and to assure that everyone finishes the program with a common core of water resources knowledge beyond their particular specialization. This is accomplished through program requirements that include 6 credits of core Water Resources Graduate Program courses:

- WRP 524 Sociotechnical Aspects of Water Resources (3 cr.);
- WRP 507 Seminar and WRP 505 Journal Club (offered Fall term); *or* WRE 507 Seminar and WRE 505 Journal Club (offered Winter term) *or* WRS 507 Seminar and WRS 505 Journal Club (offered Spring term), and
- One more 1 cr. seminar (WRP, WRE, or WRS 507) - this seminar does not have to be taken with journal club.

Master's students in the WRE degree program are also required to take 12 credits of basic water engineering courses, including BEE 512 Physical Hydrology (3 cr), and a systems modeling course such as BEE 529 (3 cr), with the remaining 6 credits of water engineering courses selected from course options in their specialty area (surface, groundwater, or watershed engineering) (see Appendix B).

Master's students in WRE must also take 6 credits of water sciences courses, and either 3-6 credits for completing a master's research project or 6-12 credits of thesis research and thesis preparation. Specific coursework to meet requirements of the WRE degree program thus total between 24 and 30 credits (6 cr. core + 12 cr. graduate engineering + 6-12 cr. project or thesis) out of the 45 credits required by the OSU Graduate School for the Master of Science degree.

Students will choose the remaining coursework needed to earn the required total of 45 credits from supporting coursework in electives approved by the committee. These electives will total 15-21 credits, depending on the number of project or thesis credits in the program of study, as required to meet the total 45 credit minimum for the MS in WRE (see Appendix B for list of suggested courses). Students will work with their advisor to tailor an appropriate program. Thesis credits should be taken as WRE 503 with the major professor as instructor of record.

## F. Transfer Credits

Only graded, non-seminar graduate courses taken after the awarding of a Bachelor's degree from an accredited institution will be considered for transfer credit. Transfer courses must carry a grade of 'B' or better. Courses required to fulfill a previous degree requirement will not be awarded transfer credit. No transfer course may serve as a replacement for a core course. Transfer credit hours are limited to 15 quarter credit hours and subject to the approval of the student's committee and the Director of the Water Resources Graduate Program.

## G. Deficient Student Status

Graduate students are required to maintain a 3.0 cumulative GPA and a 3.0 program GPA. If a student earns more than any grade below "B" in any course included on the program of study, the student's academic performance will be examined by the major professor and the WRE curriculum committee to determine if the student may continue in the program or be dropped for academic deficiency. Two consecutive quarters of less than 3.0 GPA will result in immediate termination from the program, regardless of cumulative GPA.

## H. Professional Experience

Every graduate student is encouraged to include some experience of a professional nature in their program. If they have never worked in water resources organization, it is highly encouraged that they schedule a one-term internship with an outside organization. Students interested in internships should work with their major advisor and with the Associate Director to identify available internships and expectations for academic performance.

In addition, each student should include other opportunities for professional development in their work before completion of the degree. Examples include:

1. Presentation of research results in a professional context such as:
  - a. Professional meeting
  - b. Internship report to client
  - c. A seminar open to the public (required for thesis students)
2. Preparation of a competitive grant proposal

## I. Assistantships

University regulations require all students with an assistantship to register for a minimum of 12 hours each term while employed as a Teaching Assistant (TA) or Research Assistant (RA). Graduate assistants may register for a maximum of 16 hours, but are advised to confer with their major professors or program director when registering for more than 12 credits to avoid potential overload. Students on an assistantship can maintain their full-time status, and avoid overloading their schedules by signing up for Thesis hours with their major professor to "top up" their load to the 12 credit minimum.

Thesis students can include only 6 credits of thesis hours on their graduate program, but may enroll for up to 16 credits per term.

## J. Continuous Enrollment Policy

"Continuous graduate enrollment refers to the policy of requiring continuous registration of graduate students from the original matriculation until all degree requirements are met." All graduate students in a graduate degree program must

register continuously for a minimum of 3 graduate credits and pay fees, regardless of student location, if they will be using any university, department, or program resources (e.g., facilities, equipment, computing or library services, or faculty or staff time including exams) until their degree is granted or status as a graduate student is terminated, unless on authorized leave. See the Continuous Graduate Enrollment Policy on the Graduate School website for the entire description of continuous enrollment and leave of absence requirements.

#### K. Exceptions to Policy

A student may request in writing an exception to policy by petitioning the WRE Curriculum Committee through his or her major professor or the WRGP Program Director. A copy of the request must be filed with the program office.

#### L. Grievance Procedure

The program requires that professional relationships be maintained between faculty and students. When situations arise that cause concern, **the student is strongly encouraged to discuss the problem with his or her instructor.** If the student is not satisfied with the instructor's response, the student is encouraged to make written appeal through the following chain of academic administrators until a conclusion is reached: a) Associate Director – WRE; b) WRGP Director; c) Associate Dean of the Graduate School; d) Dean of the Graduate School; 3) Provost.

#### M. Study Program: Meeting with your Committee and Filing your Program

A Master's Program – a list of proposed courses you will take – must be filed by all graduate students with the Graduate School. The MS Program must consist of a minimum of 50% graduate "stand-alone" courses (not 400/500 "slash courses"). The Program form is available on the Graduate School website.

Program meetings and defenses may be held during any period when school is in session. This excludes the periods between regularly scheduled quarters and during official vacation periods. Students should be aware that most faculty are on nine-month appointments and may not be available during the three-month summer period.

It is the responsibility of each student to arrange the meeting and defense times and places, notify the Graduate School of scheduled defenses, and remind each committee member of the scheduled meeting or defense. At the time you schedule your thesis defense with the Graduate Schools, you should also apply for graduation if you have not already done so. Check the Graduate School web site for graduation deadlines.

Master's degree students must file a study program with the Graduate School before the completion of 18 hours of graduate course work. This includes hours reserved as an undergraduate student and hours earned as a post baccalaureate, graduate special student, or classified graduate student. If any revisions to the program are needed, complete these at least one term before the defense; the final signed program of study MUST be filed more than one term prior to the defense.

The program is worked out under the guidance of the student's committee and is signed by members of the committee and the Director of the Water Resources program before filing with the Graduate School. Each candidate's graduate program should include a substantial amount of work with at least four faculty members offering graduate instruction (e.g., teaching stand-alone courses).

Changes in the program may be made by submitting a Petition for Change in Graduate Program, available from the Graduate School. It is wise to wait and file one "change" form near the end of the student's tenure so repeated filings are not necessary.

The Major Professor shall chair the program meeting and the examination portion of the defense. The Graduate Council Representative chairs the portion of the meetings that involve the evaluation of the student's performance on a thesis-option oral defense.

#### N. Use of Human Subjects

Federal and university policies required that all research conducted by faculty, staff, and students using human subjects must be reviewed and approved by the institutional Review Board before initiating any portion of the project. In addition, the IRB now requires that all researchers using human subjects complete an on-line ethics course. Students should work with their major professors to submit their research project to the IRB for approval.

See: <http://research.oregonstate.edu/irb>

#### O. Research Requirements for the MS Degree in Water Resources Engineering

Graduate students are required to demonstrate the ability to define researchable problems, design research approaches, analyze relevant data, synthesize results, and report research findings in a succinct and logical manner. The WRE program allows students two alternatives to demonstrate their research competence. Students must complete either a research project and paper, or a thesis. The decision on which option is most appropriate to a student's program is made jointly by the student and the major professor. The nature of the research topic, student's circumstances, time frames, career aspirations, advisor's availability, and research funding will all play a factor in making this decision. The learning outcomes and assessment methods are different for research carried out on the thesis track

compared to the project-based research paper. One is not better than another. They are different.

The thesis track requires original research that makes a contribution to an academic discipline via a publication or publications that are judged to be of sufficient quality to appear in a peer reviewed journal. Publication in a journal as lead or co-author is expected (although not required) after the defense of the thesis.

Other students, hoping to acquire a set of skills and methods that can be applied to water resources issues in a governmental, non-governmental organization, or industry setting may choose, instead, to conduct a water resources engineering research project and write a research paper. The knowledge and skills acquired through coursework (and possibly including an internship experience) are applied in a capstone project and associated report that is relevant to the practice of science-based Water Resources Engineering and is effectively communicated to its target audience. This report may be produced in conjunction with an internship experience. Appendix C compares the thesis and non-thesis options (provided courtesy of Julia Jones, Geosciences Department OSU).

***The Research Paper:*** The research paper option is designed to expose students to research through a process that is more structured and less open-ended than the thesis option. As such, it can be done within one term if the student is well-organized, although early identification of the problem is recommended. Students often take longer to complete the process. Students should enroll for Research credits in their major professor's department to maintain full-time status while reducing course load to devote energy to the research paper. Research hours (or other blanket hours) are not graded, nor are they listed on the program of the non-thesis students.

Ideas for the research paper may come from other classes, work experience, or internships and will usually proceed through three steps:

- a. After consultation with the major professor, the student prepares a proposal, which includes a statement of the problem and the research design. Appendix D describes the components of the proposal. After obtaining approval, the student carries out the research and prepares a finished draft of the paper. See below for more specific details about the research paper. The major professor will provide at least one critical review of the paper in draft form.
- b. When the major professor decides the paper is ready to defend, the student will prepare a final copy of the research paper and distribute to committee members for review at least one week prior to the defense.
- c. The student schedules a meeting for the committee to come together to hear a defense of the paper and an examination to test the student's ability to integrate and interpret material learned in the program with emphasis on the work presented in the paper. Forms for scheduling the defense are available at the Graduate School website.

The student should be fully prepared to answer any question from committee members as it relates to all course work and to go beyond description of the concepts to engage in a critical discourse that demonstrates the student's critical analysis and synthesis of all course work. The final oral defense takes approximately 90 minutes to 2 hours. See Figure 1 for a typical defense agenda.

The first portion of a final defense is open to the public and includes a presentation by the student about the research. Faculty members and fellow students are encouraged to attend. After the presentation, audience members leave and the student is examined by committee members. At the conclusion of the examination, committee members meet in private to discuss the presentation and examination, vote whether to pass the student, and sign off on the examination form to the Graduate School.

If a student fails in the first attempt at the oral defense, a second re-examination may be held at the request of the student's major advisor and committee. A waiting period of three months between the failed defense and a re-examination is required to allow time for preparation of a successful defense.

The research paper can be on any subject in water resources Engineering, as agreed upon by your committee. There are no limitations for preferences for a particular theoretical or methodological approach. The research paper should be at least 25 pages in length. The paper will be judged on how well the student addresses four goals:

- a. Illustrates an in-depth, detailed and nuanced understanding of a specific issue, topic, or question in Water Resources Engineering.
- b. Illustrates an awareness of the theoretical issues raised in the appropriate literature, and discusses the student's project in the context of relevant published research. The paper should specifically address the question, "how does your research relate to and build on prior work, and what new contribution does it make to your field?".
- c. Expresses ideas, concepts, and arguments with precision and rigor.
- d. Enlarges the reader's understanding of the issue and topic.

To achieve the goals at the minimum, the research paper needs to have a(n):

- a. *Title and Signature Page.* The paper needs a title page and a committee signature page similar to that specified in the requirements for Theses and Dissertations at OSU.
- b. *Introduction and Statement of the Problem:* The paper needs to have a clearly and concisely stated question, essay, and argument. The first pages should clarify the topic and how the subject will be approached and analyzed.
- c. *Literature Review:* The paper needs an extensive review of the literature on the subject. This review shows that you have immersed yourself in the

subject, have read extensively about it, and have drawn your ideas and arguments from a variety of sources. The length of your literature review will vary by subject. The main purposes of the literature review are to show the reader that you know the subject and that you can place your thinking, methodology, and research results into ongoing research in the subject area. Your committee can help identify the relevant literature.

- d. *Discussion*: This section describes your results, analysis, and arguments in a readable and rigorous manner.
- e. *Conclusion*: This section summarizes your argument and shows how your work enhances our understanding of the subject.

**The Thesis:** While the thesis and research options share many similarities, the thesis is a more substantial commitment to research. Its length is not limited, and the process of research, writing, and defending the research usually takes place over several (3-4) terms. The thesis option is different from the non-thesis option in several ways including:

- a. the work is a substantial original contribution to the body of knowledge in the student's field,
- b. supervision of the thesis research is by a four-member committee, including a person chosen from a list of Graduate Council representatives;
- c. The thesis style is determined by the Graduate School document, Preparation of the Thesis, available at the OSU book store or from the Graduate School website. The Graduate School examines every thesis to ensure compliance with style requirements.
- d. Students can also choose to write their thesis as "publishable papers." This option is usually two publishable papers, which must be related in their overall research theme. A publishable paper is one that is targeted to a specific journal and is deemed publishable to the student's graduate committee. Student's using this style option must also include an introduction, literature review, and conclusion that tie the paper together into a common theme, all of which are bound together and submitted to the program as a thesis. The student's graduate committee and major professor must agree to this option before the student proceeds.
- e. A copy of the pretext pages of the Master's Thesis must be presented to the Graduate School for editing when scheduling the final oral examination at least one week prior to the examination. Additional copies of the thesis are distributed to the student's committee.

After consultation with the major professor, the student prepares a proposal, which includes a statement of the problem and the research design. Appendix D describes the components of the proposal. The student meets with the program committee to review the proposal and revise as necessary. After obtaining approval, the student carries out the research and prepares a finished draft of the thesis.

Since the thesis must meet the approval of a four-member committee, the major professor will insist on a high-quality product. If the work does not meet this standard, it will be redone or revised as often as necessary to meet the professor's expectation for a defensible thesis. When the major professor is satisfied with the thesis, the defense is scheduled and copies of the thesis are distributed to the committee for review at least one week prior to the scheduled defense. The student schedules a meeting for the committee to come together to hear a defense of the paper and an examination to test the student's ability to integrate and interpret material learned in the program with emphasis on the work presented in the paper. Forms for scheduling the defense are available at the Graduate School website.

A successful defense is determined by a vote of the committee. Even at the defense, committee members may insist on further revisions of the thesis before it is accepted. The Graduate School rules provide for a maximum of six weeks for revisions after the thesis defense. If more than six weeks elapse, a re-examination of the student may be required.

The oral defense focuses on the thesis, although questions pertaining to coursework are allowed. See Figure 1 for a typical defense agenda. Thesis presentations are open to the public, although the examination is closed. Defenses typically take about 2 hours to complete.

After a successful defense, a revised and bound copy of the thesis is provided to the major advisor and one electronic PDF copy is submitted to ScholarsArchive, the OSU Institutional Depository. See the Graduate School website for more information about electronic submittal of the thesis.

**Figure 1. Typical Agenda for Oral Defense**

1. Call to order and introductions
2. Purpose and format of meeting
3. Public presentation by student (approximately 30 minutes)
4. Open question and answer (approximately 15 minutes)
5. Visitors asked to leave and committee break (if necessary)
6. Review and questioning of student by committee (this can include questions about both the research and the coursework)
7. Student excused
8. Committee discusses student's performance
9. Committee votes on performance of student
10. Student returns and results announced to student
11. Graduate School forms signed

## P. Application for Degree

Students intending to graduate must file an Application for Degree and pay a graduation fee before the deadline to do so. Deadline dates for filing vary from year to year; students should check with their major professor or program support person to determine deadlines. Making application at the end of the term preceding the term of graduation is encouraged. Filing the application generates a final "TO DO" list from the Graduate School, which describes all program deficiencies. An early application allows the student ample time to correct any problems identified by the Graduate School. The Application for Degree is a one-time fee. If a student applies to graduate, pays the fee, but does not graduate during the term intended, the fee carries over until the student completes. However, in this instance the student must re-file the Application for Degree form with a new anticipated date of completion.

### **Exit interview**

Students are requested to participate in an exit interview with questions from the WRGP as well as a separate exit interview for the Graduate School, in order to provide feedback to help us maintain the excellence of our program and improve it over time. Students are always busy as they finish, but exit interviews are important to keeping our program strong. Please be sure to schedule your appointment before leaving Oregon State University! Similarly, we are asked by external and internal program review panels to track our graduates and their job placement. Please keep in touch during your professional career – perhaps you'll be nominated for a distinguished alumnus award!

### **Summary**

The information presented in this handbook has been prepared with the intent of assisting students by providing them with program specific information about the degree. Students must also meet the regulations and requirements imposed by the Graduate School. Students are responsible for keeping track of those requirements and for communicating with their advisor throughout their career at OSU.

We welcome you to the WRE program, and look forward to counting you among our successful alumni in a few years!

## Appendix A. Checklist 1 for WRE degree programs

<b>WATER RESOURCES ENGINEERING PROGRAM REQUIREMENTS</b>		
To be signed by WRE representative of student's committee and submitted with the student's program of study. Students must complete these requirements to receive a WRE degree.		
Student's Name : _____		
Degree (circle one):	MS	PhD
<b><u>Undergraduate Fundamentals</u></b>		
One year, Calculus Equiv. of: MTH 251, 252, (253 or 254)	<input type="checkbox"/>	<input type="checkbox"/>
Applied Differential Equations Equiv. of: MTH 256	<input type="checkbox"/>	<input type="checkbox"/>
One year Chemistry	<input type="checkbox"/>	<input type="checkbox"/>
One year Physics	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Graduate Requirements</u></b>		
<b>Water Resources Core Courses (6 cr.)</b>		
WRP 524: Socio-technical Aspects of Water Resources	<input type="checkbox"/>	<input type="checkbox"/>
WRP, WRS, or WRE 507: Water Resources Seminar	<input type="checkbox"/>	<input type="checkbox"/>
MS: 2 Credits total	<input type="checkbox"/>	<input type="checkbox"/>
PhD: 3 Credits total	<input type="checkbox"/>	<input type="checkbox"/>
WRP, WRS, or WRE 505 Water Resources Journal Club*	<input type="checkbox"/>	<input type="checkbox"/>
<b>Graduate Engineering Credits</b>		
BEE 512: Physical Hydrology (3 cr.)	<input type="checkbox"/>	<input type="checkbox"/>
Modeling Techniques (BEE 529 or equivalent)	<input type="checkbox"/>	<input type="checkbox"/>
(highly recommended: CE 547 Intro. Fluid Mechanics)	<input type="checkbox"/>	<input type="checkbox"/>
MS, 12 Credits	<input type="checkbox"/>	<input type="checkbox"/>
PhD, 15 Credits	<input type="checkbox"/>	<input type="checkbox"/>
<b>Water Science Courses/Credits</b>		
MS: 6 Credits	<input type="checkbox"/>	<input type="checkbox"/>
PhD: 9 Credits	<input type="checkbox"/>	<input type="checkbox"/>
<b>Thesis/Project Credits</b>		
MS Thesis (6–12 cr.)	<input type="checkbox"/>	<input type="checkbox"/>
MS Project (6 cr.)	<input type="checkbox"/>	<input type="checkbox"/>
PhD Dissertation (36 – 45 cr.)	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Exit Requirements</u> (may be met at previous institution, incl. undergraduate)</b>		
Professional Preparation Course (GEO 518 or equiv.)	<input type="checkbox"/>	<input type="checkbox"/>
37 cr. of AIH-required water coursework <sup>4</sup>	<input type="checkbox"/>	<input type="checkbox"/>

\* Journal club must be taken with one of the seminars. Students can choose to take WRP 505 and WRP 507, WRS 505 and WRS 507, or WRE 505 and WRE 507 together, and must take one (MS) or two (PhD) additional seminars, usually (but not limited to) WRP 507.

<sup>4</sup> 15 cr. in Category I of the AIH educational criteria (<http://aih.engr.siu.edu/hydro-certification.html>) defined as courses in which 90% of the material is hydrology, hydrogeology, or water quality, 13 cr. in Category II of the AIH educational criteria, defined as courses in which 10% of the material is hydrology, hydrogeology, or water quality, and 9 cr. in Category III of the AIH educational criteria, generally other science, water, engineering, or natural resources policy coursework.

## **Appendix B: Core Curriculum for MS in Water Resources Engineering**

### **Core Courses - Required (6 credits)**

WRP 524 Socio-technical Aspects of Water (3 cr.)

WRS, WRP, or WRE 507 Water Resources Seminar (1 cr.)

WRS, WRP, or WRE 507 *and* 505 Seminar and Journal Club (1 + 1 cr.)

(Master's students must take a total of 2 seminars; one seminar must be taken concurrently with the journal club)

### **Water Resources Engineering - Required Courses**

BEE 512 Physical Hydrology (3 cr.)

BEE 529 Biosystems modeling or equivalent (3 cr.) (AIH Category 2)

A course in either groundwater hydraulics or open channel hydraulics must be included in the additional 15 credits of water engineering coursework for the PhD. An additional 9 cr. of water science coursework are also required. In consultation with the committee, students select from courses offered across campus. A list of water-related courses can be found at: <http://oregonstate.edu/gradwater/wrgp-courses>

### **Suggested Courses for a Policy and Management Minor**

Students who wish to minor in Water Resources Policy and Management must take 15 additional credits in courses related to Water Resources Policy and Management (see web site above for list of potential courses).

## Appendix C: Comparison of Thesis and Project Options

	<b>Thesis</b>	<b>Project</b>
<b>Purpose</b>	Presents original research that contributes to the scholarly literature relevant to the practice of water resources Engineering.	Contributes to the practice of water resources Engineering via applied research and/or creative accomplishment.
<b>Format</b>	Formatted according to Graduate School requirements	Format is choice of student and advisor. A project may take many forms. All projects must be noteworthy for approach, content and accessibility to their target audience.
<b>Data Collection and Analysis</b>	Supervised research focused on original research, including literature review, data collection and analysis, and writing.	Uses methodology appropriate to the practice of WRE. This can include scientific research methods, application of analytical tools such as GIS or remotes sensing to WRE issue, literature review and/or the collection of material for extension and outreach materials. Can, but does not need to, involve primary data collection by the student.
<b>Committee</b>	Advisor, two additional committee members and graduate representative	Advisor and two additional committee members
<b>Standard expected</b>	Research must be publishable or have the potential to be published in a peer-reviewed journal.	The project report must communicate effectively findings, results and/or outreach materials to an audience of water resources practitioners. The project content must be well researched, relevant to its target audience, reliable and academically defensible. The examining committee must agree that with little modification the project report or project materials have the potential to be released to the public by a state agency, non-governmental organization, private consultancy, and/or university extension service.
<b>Length</b>	The length of thesis or research paper is not an indication of quality or difference between the two. Actual length will depend on the topic, methods and final product as agreed with the students committee. Both a thesis and project must be succinct as possible and each must be effectively communicated to its target audience.	
<b>Job qualification</b>	Job applicants often are asked to provide evidence of writing ability, and ability to work independently. Both the thesis and the project provide evidence of this ability.	

## Appendix D: Proposal Structure

Regardless of whether you do a thesis or project report, you must make a proposal to your major professor (and committee in the case of the thesis option) about what you plan to do. The proposal lays out the problem, tells the reader what is already known (and not known) about the problem, and describes in careful detail what you are going to do to answer the questions. While the content of the thesis proposal is a bit different from the project report, the design of the proposal is very similar.

### Thesis Proposal Structure

A thesis proposal can include a number of sections, described below. These are just examples. Of course, the content and subheads under each section will vary depending on the problem you are researching, your theoretical framework and the methodology you envision.

- I. Introduction.** This should consist of a brief summary of the problem you are proposing to investigate, what questions or hypotheses you intend to address, and how you envision doing the research.
- II. Review of Literature.** Here you review relevant literature that will enable you to make a case for the significance of your research. This is an interdisciplinary field. It is likely you will review more than one area of literature. Following this review, you should summarize the rationale for your research questions or hypotheses drawn from all the areas of literature you have reviewed. Finally, you should clearly state your main research questions or hypotheses.
- III. Methodology.** Here you describe your plans for collecting data as specifically as you can. Of course, the considerations you discuss here will vary depending on the nature of your research, e.g., whether quantitative or qualitative. The following are considerations you may need to discuss in a quantitative thesis: unit of analysis; population; sampling procedures; research instruments (questionnaire, coding categories); and reliability and validity of the methodology you plan to use. Some discussion of the limitations of your chosen approaches may be appropriate.

### Project Proposal Structure

The organization of a project proposal typically parallels that of a thesis proposal, including the following:

- I. Introduction.** A brief summary of what problem, topic(s) or issues you intend to address, and how you envision doing it.

- II. Background research.** Report any research that helps make a case for the significance of your project and provides the professional context for the paper. At least two types of background research are relevant here: research into the problem and appropriate methodologies to address the problem, and research to demonstrate the project's unique contribution to the practice of water resources Engineering.
- III. Methodology or Procedures.** Describe the procedural decisions and plans that will enable you to carry out the project. Obviously, different types of projects will require very different kinds of procedures. Creative projects will involve completely different types of procedures and methodologies, depending on the project.

## Appendix E: Graduate School Forms and Other Sources

Graduate Program forms and all other necessary forms are available on the web at <http://gradschool.oregonstate.edu/forms>

The OSU Graduate School Guide to Success, a step-by-step guide to getting through your graduate program can be found at <http://gradschool.oregonstate.edu/graduate-student-success>

OSU Graduate diploma and commencement deadlines: <http://gradschool.oregonstate.edu/progress/deadlines>

Information about graduate degrees can be found at <http://gradschool.oregonstate.edu/>

The Graduate School is available to answer any questions on degree requirements. Call 541-737-4881, stop by the Graduate School on the 3<sup>rd</sup> floor of Kerr Administration Building, or e-mail at [graduate.school@oregonstate.edu](mailto:graduate.school@oregonstate.edu)

The OSU Center for Writing and Learning: writing assistants are available to help with brainstorming, organization, grammar and usage, and all aspects of writing. There is also an online writing lab for assessment of writing problems (24-48 hour turnaround.) You can call 541-737-5640, visit at Waldo 123, or check the website at <http://cwl.oregonstate.edu>.

The OSU Academic Success Center: provides assistance with goal setting, study skills, listening habits, time management, and wellness. You can visit MU 203 or on the web go to: <http://gradschool.oregonstate.edu/graduate-student-success/grad-student-success-center>

## Appendix F. Graduate Learning Outcomes and Their Assessment

The Water Resources Engineering Program Assessment Plan describes the following overarching learning outcomes for students in the WRE program:

"....students will gain an advanced understanding of water resources engineering. Students will be sufficiently trained through disciplinary coursework and research experience to bring hydrologic engineering expertise to a team, and will have the breadth in water resources and environmental issues to be able to communicate with professionals from the broad range of specialties involved in water resources management and research."

**Scholarship** Program graduates demonstrated mastery and application of critical thinking that extends knowledge in water resources engineering by designing and conducting their thesis or project research and presenting results of this research at their final examination.

**Knowledge** By successfully completing the coursework required for the degree program, designing, conducting and presenting the results of a research project, and completing their thesis or project paper, program graduates demonstrated in-depth disciplinary knowledge and the capacity to apply that knowledge to a water resource issue. Graduates of the WRE program met the coursework requirements to gain Professional Hydrologist certification through the American Institute of Hydrology (AIH). With respect to knowledge benchmarks, all graduates passed their preliminary qualifying exam. The average GPA of all students enrolled in the WRE degree program was 3.8, and all students maintained a graduate GPA of over 3.0.

**Communication & Service** Program graduates have all demonstrated the ability to present the results of their research by completion of assignments in the core course WRP 524; or by presenting at the Water Resources Research Symposium held at OSU in May, and by presenting their work at professional meetings.

**Ethics & Diversity** Graduates of the WRE degree program receive training in ethics through research methods courses, the core course WRP 524, online training in ethics through OSU Office of Research Integrity. Students are also encouraged to participate in activities honoring diversity and multiculturalism such as the annual MLK Birthday Celebration.

Achievement of these outcomes will be assessed at the final defense by the committee.