## University of Michigan
### Engineering Sustainable Systems
#### Sustainable Water Systems specialization

<table>
<thead>
<tr>
<th>2 Year MS &amp; MSE Plan</th>
<th>Requirement*</th>
<th>Notes</th>
<th>Course #</th>
<th>Credits</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td><strong>Civil Engineering Core</strong></td>
<td>15CR from the Civil and Environmental Engineering Department</td>
<td>Required: CEE 520, CEE 521, CEE 522</td>
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<td></td>
<td>Minimum of 2 additional CEE courses in Environmental and Water Resource Engineering</td>
<td>See List A for sample of approved courses (next page)</td>
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<tr>
<td>Natural Resources and Environment</td>
<td><strong>SS CORE</strong></td>
<td>6 CR in Systems Analysis for Sustainability</td>
<td>Required: NRE 557/CEE 586 And one course from List A1 (next page)</td>
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<td></td>
<td>9 CR total</td>
<td>Sustainable Design &amp; Technology Minimum 3CR</td>
<td>Required: See List A2 for acceptable courses (next page)</td>
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<td></td>
<td>Sustainable Enterprise Minimum 3CR</td>
<td>See List A3 for acceptable courses (next page)</td>
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<td>Additional 3 CR minimum from list A1, 2, or 3</td>
<td>See attached list (A1-3) of acceptable courses in these specializations</td>
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<td></td>
<td><strong>NRE Core</strong></td>
<td>NRE 509 NRE 510</td>
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<td>IAMS Requirement Two courses; 3 CR minimum Please see page 3 for approved courses.</td>
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<td></td>
<td><strong>Analytics</strong></td>
<td>3 CR in Analytics</td>
<td>NRE 538 or equivalent required:</td>
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<td><strong>Opus</strong></td>
<td>Students are not expected to complete an Opus, but could petition to do a thesis/practicum or project*</td>
<td>At most 6 CR of NRE 700/701</td>
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<td><strong>Cognates (Rackham requirement)</strong></td>
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<td></td>
<td><strong>TOTALS</strong></td>
<td>MINIMUM CREDIT HOURS BY SCHOOL</td>
<td>“NRE” – Minimum 25 CR</td>
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<td>“CEE” – Minimum 15 CR</td>
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<td><strong>TOTAL CREDIT HOURS</strong></td>
<td>Minimum 54 Credit Hours</td>
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*Any waiver or substitution of degree requirement must be approved by the appropriate faculty and submitted to OAP

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Last Updated 07/22/2014
# Natural Resources and Environment

### A) Sustainable Systems Core (1-3)

1) **Systems Analysis for Sustainability (at least 6CR*)**

- NRE 501.036 (3cr)
- NRE 597 (3cr)
- NRE 557/CEE 586 (3cr)
- NRE 550/STR 566 (3cr)

*At least two courses need to be from the courses listed above

- NRE 570 (1.5cr)
- NRE 501 (1.5cr)
- NRE 531 (4cr)

2) **Sustainable Design & Technology (3CR)**

- NRE 501.037 (3cr)
- NRE 574/PUBPOL 519 (3cr)
- NRE 501.039 (3cr)
- NRE 605/BA 605 (3cr)
- NRE 687 (4cr)
- ARCH 575 (3cr)
- CEE 460 (3cr)
- CEE 582 (3cr)
- CEE 686/CHE 686 (2-3cr)

3) **Sustainable Enterprise (3CR)**

- NRE 567 (3cr)
- NRE 512/LHC 536 (2.25)
- NRE 513/STR 564/564 (3cr)
- NRE 527/BE 527 (3cr)
- NRE 532 (3cr)
- NRE 533 (3cr)
- BE 555 (1.5)
- NRE 560/UP 560 (3cr)
- ENGR 521 (3cr)
- ES 520 (1.5cr)
- FIN 637 (2.25cr)
- FIN 583 (1.5cr)
- STRAT 735-739 (1.5cr)

### B) Sustainable Systems Electives

B1) Additional SS courses (can count towards Non-Opus option)

- NRE 514 (2cr)
- NRE 523 (3cr)
- EHS 672 (3cr)
- NRE 558/CEE 587 (3cr)
- NRE 686/PUBPOL 563 (3cr)
- BA 612 (2.25cr)
- ESENG 501 (3cr)
- Econ 437 (3cr)
- UP 533/ARCH 506 (3cr)

- Consumption, Trade, and Environmental Input-Output Analysis (W)
- Environmental Systems Analysis (F)
- Industrial Ecology (W)
- Systems Thinking for Sustainable Development (W)
- Environ Economics: Quantitative Methods & Tools (WN A)
- Five courses on selected topics in Env. Economics (FA B & WN A&B)
- Principles of GIS (W)
- Urban Sustainability (F)
- Sustainable Energy Systems (F)
- Land Use and Global Change (F)
- Ecological Design Approaches to Brownfield Redevelopment (F)
- Green Development (W)
- Landscape Planning (F)
- Building Ecology (F)
- Design of Environ Engineering Systems (F)
- Environmental Microbiology (F)
- Case Studies in Environ Sustainability (W)
- Sustainable Design of Technology Systems (F)
- Transportation Energy & Climate (W)
- Ethics Corporate Management (F or W)
- Strategies for Sustainable Development (F)
- Energy Markets and Energy Politics (F)
- Natural Resources and Environ Conflict Management (F)
- Negotiation Skills (F)
- Non Market Strategy (F)
- Behavior and Environment (F)
- CleanTech Entrepreneurship (F)
- CleanTech Venture Opportunities (F)
- Finance and Sustainable Enterprises (F)
- Energy Project Finance (W)
- Topics in Global Sustainable Enterprise (F)

*Last Updated 07/22/2014*
B2) Sustainable Systems Themes (see links for course listings):

Energy Systems - http://www.snre.umich.edu/node/7746/#energy
Mobility Systems - http://www.snre.umich.edu/node/7746/#transportation
Water Systems - http://www.snre.umich.edu/node/7746/#water
Food Systems - http://www.snre.umich.edu/node/7746/#food
Built Environment - http://www.snre.umich.edu/node/7746/#buildenv
Climate Change - http://www.snre.umich.edu/node/7746/#climchange

Cognates
SNRE – Minimum 4 credits outside SNRE. Can be fulfilled with CEE coursework.
CEE – 6 credits of non-CEE coursework. Can be fulfilled with one advanced Mathematics course (proper choice of SNRE
Analytical courses can also satisfy this requirement) and one SNRE course.

Integrated Analytic Methods and Skills Requirement
Students are required, at some point during their time enrolled in the program, to take 2 courses composing at least 3 credits
from a faculty-approved list of courses that focus on integrative analytic methods and skills. The faculty-approved existing
courses that satisfy this requirement are listed below:

Fall
501 – Land Use and Global Change
501 – Urban Stormwater
501 – Ecosystem Services
514 – Environmental Impact Assessment
533 – Negotiation Skills
536 – Mediation Skills
597 – Environmental Systems Analysis
662 – Localization Seminar
677 – Climate Adaptation Seminar (2nd 7 week)

Winter
501 – Science and Management of the Great Lakes
501 – Biofuels and Sustainability
501 – Advanced LCA Methods and Software Tools (W14 – 2nd 7 weeks)
501 – Applied Ecosystem Modeling (W14 – 2nd 7 weeks)
550 – Systems Thinking for Sustainable Development
557 – Industrial Ecology
570 – Environmental Economics
581 – Advanced Environmental Education
589 – Ecological Restoration
641 – Interdisciplinary Research Methods
687 – Landscape Planning
787 – Metro Studio (MLA only)