Students enrolled in the Certification in Sustainable Water Management program are required to complete any four of the approved courses (12 credits).

SUMA PS5146 Water Systems Analysis – IN PERSON
Offered by the MS in Sustainability Management Program
Area 3: Physical Dimensions
Call Number: 12258
Points: 3
Instructor: Haralambos Vasiliadis
Day/Time: Tuesday, 6:10-8:00 PM
Course Description: This class provides a structured introduction to the integrated analysis of physical and institutional systems for water management and development. Multiple scales and settings, from developing country villages to a US city water supply to regional watershed restoration to national planning are considered. The emerging global water crisis driven by rapid population growth and its relation to agricultural water use will be a recurrent theme through the class. Novel topics include the consideration of climate variability and change in developing system operation rules and infrastructure planning. The course includes modules on integrated water management and water systems analysis including water supply/demand imbalances, the modeling and design of a regulatory system for water allocation and tools for conservation incentives and insurance system design; and a multi-scale view of operation and planning from weekly to seasonal to decadal planning for multiple, competing objective. There will be guest lectures from engineers/scientist/professors working in the water sector. This course provides students with an analytic framework for operating, managing, and planning water systems, considering values and needs.

SUMA PS5701 Water Governance – IN PERSON
Offered by MS in Sustainability Management Program
Call Number: 29309
Points: 3
Instructor: Michael Puma
Day/Time: Thursday, 6:10pm-8:00pm
Course Description: Water is widely recognized as the most essential natural resource for Earth's ecosystems and human society. Yet the relationship between water and society is complex. Water is a multifaceted resource that is important to all economic sectors and across a range of spatial scales from local to global. Water is also frequently a hazard; flooding, droughts, and contaminated water are formidable threats to human well-being. To deal with this seemingly dual nature of water, people have long modified the water cycle through engineering schemes like dams, reservoirs, irrigation systems, and interbasin transfer systems as well as through land use and land-cover change. To even the casual observer, a clear and robust plan is needed to manage and govern water given the multitude of ongoing human activities impacting the water cycle. This course will provide an overview of the political, social, economic, and administrative systems that affect the use, development, and management of water resources. Students will be introduced to current themes that influence water governance including sustainable development, integrated water resource management, water rights and pricing, corruption, and equity for marginal groups. These themes will be explored at the local, national, and international levels to provide students with a holistic understanding of water governance issues.

SUMA PS4145 The Science of Sustainable Water – IN PERSON
Offered by the MS in Sustainability Management Program

Call Number: 12251
Points: 3
Instructors: Wade McGillis
Day/Time: Monday, 4:10pm-6:00pm
Course Description: The sustainability of water resources is a critical issue facing society over the coming decades. Water resources are affected by changes not only in climate but also in population, economic growth, technological change, and other socioeconomic factors. In addition, they serve a dual purpose; water resources are critical to both human society and natural ecosystems. The objective of this course is to first provide students with a fundamental understanding of key hydrological processes. Students will then use this understanding to explore various sustainable strategies for integrated water resources management. Numerous case studies will be highlighted throughout the course to illustrate real world, practical challenges faced by water managers. Students will be asked to think critically and to use basic quantitative and management skills to answer questions related to sustainable water development. Considering the importance of water to society the understanding that students obtain from this course will be an essential part of their training in sustainable management.

SUMA PS5230 Earth's Climate System – IN PERSON
Offered by the MS in Sustainability Management Program
Area 3: Physical Dimensions
Call Number: 12269
Points: 3
Instructor: Ben Cook
Day/Time: Tuesday, 4:10PM-6:00 PM
Course Description: This course examines the fundamental physical processes that control the primary features and patterns of variability of the Earth's climate system. Specific topics include energy balance and the greenhouse effect, the circulation of the oceans and atmosphere, land surface interactions and feedbacks, the role of the biosphere and cryosphere, paleoclimatoloy, climate modeling, and global and regional patterns of climate variability and change observed and expected as a consequence of anthropogenic influences. The goal of the course is to provide students with the opportunity to gain a fundamental understanding of the processes that give rise to observed climate variability at a range of temporal and spatial scales. Students will develop the quantitative skills and knowledge to allow them to independently evaluate scientific claims about the state and behavior of Earth's climate system in the past, present and future. The course includes case study modules that integrate an understanding of the physical processes and important feedbacks in the context of policy- and management-relevant aspects of current and future climate change.

SUSC PS5190 Remote Sensing for Aquatic Environments – IN PERSON, depending on class size and preferences
Offered by MS in Sustainability Science Program/ SPS
Call Number: 12286 (Instructor Approval Required)
Points: 3
Instructor: Ajit Subramaniam
Day/Time: Tuesday, 6:10-8:00 PM
Course Description: Aquatic systems are critical for provisioning ecosystem services that have sustained human civilization as evidenced by the establishment of the earliest civilizations on banks of rivers or along a coast. Apart from regulating climate, aquatic systems provide food and transportation services, fresh water lakes and reservoirs provide water for consumption and irrigation, and coastal systems offer recreational services. But growing human population, especially along the coast, has endangered the quality of ecosystem services. The primary finding of the Millennium Ecosystem Assessment was that 15

out 24 ecosystem services examined are being degraded or being used unsustainably (MEA 2005). Monitoring the aquatic ecosystem and understanding how to distinguish between anthropogenic and natural variability is an essential aspect of sustainability science. This course will provide an introduction to the use of remote sensing techniques that can be used to study the aquatic environment. There are several space-based sensors that provide information relevant to sustainable management of aquatic resources. Depending on the sensor, observations are made as frequently as every day and spatially covering the entire globe. Understanding the spatial and temporal context around an issue can help discriminate between local and far field effects and time series of remote sensing data can be constructed to investigate causes and consequences of environmental events. Thus knowledge of the basic science of remote sensing, understanding how to select the appropriate sensor to answer a question, where to find the data and how to analyze this data could be critical tools for anyone interested in oceanic, coastal, and freshwater resource management. The course will follow active learning techniques and will consist of a lecture to introduce concepts followed by a discussion and lab time for hands on activities to learn and use tools for analysis of remote sensing data. After the introduction of the basic principles of remote sensing, a series of case studies will be used to explore concepts in sustainability such as water quality, nutrient loading and hypoxia, coral reefs. Remote sensing tools that are used to investigate and address environmental questions such as the effects of shutting down a sewage treatment plant, mapping of suspended sediment concentrations will be demonstrated and used by the students. Each case study will be briefly introduced at the end of the previous class and students will be encouraged to come prepared with scenarios relevant to their interest and work that they can explore with relevant remote sensing tools. Time will be set aside during the "lab-time" hands-on session for students to develop a project where a question of interest can be progressively investigated through the semester using the tools learnt, culminating in a final presentation. The use of computers to download and analyze data is required for this course.

EESC GU4925 Introduction to Physical Oceanography
Offered through Earth and Environmental Sciences, Graduate School of Arts and Sciences
Call Number: 12456
Points: 3
Instructor: Andreas Thurnherr
Day/Time: Tuesdays and Thursdays 8:40am – 9:55am
Course Description: Prerequisites: Recommended preparation: a solid background in mathematics, physics, and chemistry. Physical properties of seawater, water masses and their distribution, sea-air interaction influence on the ocean structure, basic ocean circulation pattern, relation of diffusion and advection with respect to distribution of ocean properties, ocean tides and waves, turbulence, and introduction to ocean dynamics.