The Center for Ocean-Aquifers Studies (COASt)

Proposed by Institute for Natural Resources and Institute for Water & Watersheds

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What does it take to extract water from nearshore and offshore aquifers? What strategic value does it have? What are its offshore and onshore environmental impacts? What are its policy, legal, economic and management issues? What are its social and economic impacts? How viable of an option is it to reduce water shortages and water conflicts?

Oregon State University (OSU) and the other flagship universities conduct very little research on nearshore and offshore aquifers. Research on Oregon water supplies on the coast has focused on the impact of onsite wastewater systems/septic tanks on shallow groundwater discharging to coastal waters using caffeine as a tracer (Portland State University); the impacts of fluctuating groundwater elevations and water quality at Darlingtonia Wayside Park near Florence and its namesake endangered plant (OSU's Water Resources Graduate Program and the Institute for Water & Watersheds); and in 2005, the Institute for Natural Resources conducted a reconnaissance-level inventory of groundwater and surface water drinking water supplies for the coastal communities. At the state level, to complement decades old planning studies for coastal basins, the Oregon Water Resources Department (OWRD) is funding a planning study of the mid-coast region because Newport water demands vary seasonally from a large water-dependent industrial load and a customer base of 10,000 regular residents averaging 2 million gallons of water per day (MGD) to up to 50,000 with tourists with water demands peaking at 5 MGD. While surface water supplies are at risk due to aging infrastructure, the seismic resiliency of dams, and costs for additional surface water development such as the Rocky Creek project are being shelved. *What other options exist?*

In a 2013 review article in *Nature*, researchers located on the driest continent (Australia) posited that 500,000 cubic km of water are stored in subsea aquifers on continental shelves around the world and they note that that volume of usable offshore groundwater is 100 times greater than what has been extracted from the Earth's subsurface since the start of the 20th century. This discovery is not wishful thinking, but the result of careful examination of decades of offshore drilling data for oil and gas on the continental shelves across the globe. This water source option has gone largely unexplored off of the Oregon coast as no offshore drilling for oil and gas has occurred along Oregon coast due to efforts of former Department of Geology and Mineral Industries (DOGAMI) Director Hollis Dole who was recruited by former President Nixon to develop national rules and regulations governing domestic offshore drilling.

The general lack of knowledge of coastal groundwater (both nearshore and offshore) including freshwater resources, as well as the interaction of discharging terrestrial groundwater with offshore environments, is new territory for the marine studies research enterprise worldwide. To address this – and to move beyond the reconnaissance level knowledge of existing shortages of water supplies along the Oregon coast, exurban growth, and associated impacts using domestic wells and onsite wastewater systems – we propose the ***Center for Ocean-Aquifers Studies (COASt)***, **a bold, innovative, and transformative research center focused on nearshore and offshore aquifers.**

COASt proposes drilling *Subsea Well No. 1* – the first offshore freshwater well in the world – off the coast of Newport. Based on DOGAMI bathymetric maps, the depth to fresh water offshore from Newport approaches 100 meters. COASt's primary mission with Subsea Well No. 1 is to understand issues around extracting water from nearshore and offshore aquifers and to solve local water supply problems for Newport, providing a case study for regional and international coastal communities. This is not so far-fetched if one considers that the "price" of a typical offshore drilling project approaches $100M versus

the $300M desalination and associated groundwater replenishment project currently under consideration in Monterey, California. And, with Cascadia 9.0's looming impacts on the Oregon coast and inland, it may be better defined and monitored with a deep offshore observation well operated and maintained by the geotectonic research scientists within CEOAS.

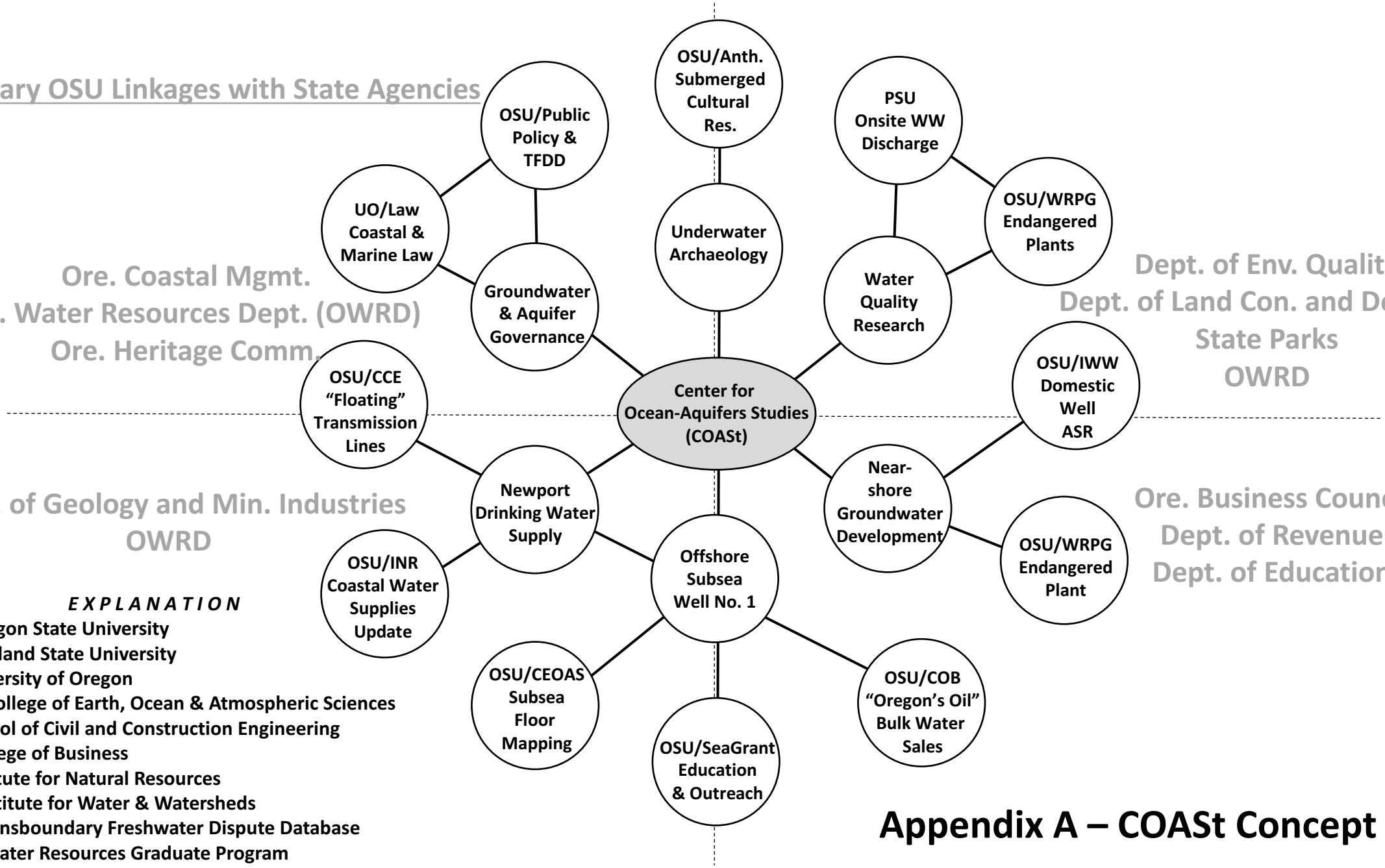
COASt has a clear, productive alignment with the strategic plan of the MSI (see Appendix A) including academic and outreach, engagement, and partnerships goals that leverage the natural and socio-economic laboratory of Oregon's coastal watersheds, estuaries, and ocean systems for research innovations, broader impacts, and collaborations at statewide, national and international levels.

COASt is transdisciplinary in exploring new territory, yielding productive advances, and stretching disciplinary boundaries. COASt has a strong potential for substantive cross-unit collaboration, engagement and support, ideally linking units that have not historically worked together.

- Exploration and exploitation of subsea aquifers provides unique scientific and engineering challenges, as well as untapped business opportunities. OSU is uniquely qualified to design, oversee the building of, and develop Subsea Well No. 1 through CEOAS, the College of Engineering and the College of Business. In 2015, Turkey completed the Peace Water project, an 80-kilometer-long sea pipeline hanging 250 meters below the surface transporting approximately 54 MGD to the island of Cyprus. The question of economically scaling such a project to a subsea well is a growth opportunity for the College of Engineering.
- COASt recognizes the value of working directly with anthropologists in these submerged environments. Sea level rise and groundwater resources are important to coastal communities and coastal tribal land management. Ancient and historic settlements often relied on groundwater for drinking water supplies from shallow wells and springs. For example, the underwater village of Atlit-Yam located offshore of Israel was apparently based in part on groundwater. One of the oldest wells in the world, a 7,500-year-old water well, lies between 8 to 12 meters beneath sea level in the Bay of Atlit.
- The public policy and legal arguments for who has access and ownership for sub-seabed water are not crystal clear, thus providing new areas for OSU programs in water governance and public policy to work with the University of Oregon Law School by addressing such questions as: (1) How does "groundwater" impact the UN Commission on the Law of the Sea where countries can claim ownership to an Exclusive Economic Zone that extends 370 km offshore from its coastal baseline?; (2) Is it possible that a variant such as the Law of the Hidden Sea might apply to deep groundwater that is hydraulically connected to the sea?; (3) Should water stored in "fossil aquifers" such as offshore aquifers be viewed as part of the common(s) heritage of humans? Or, (4) Should government step aside and let business into the world of groundwater governance much like how the US and Mexico are dealing with subsea hydrocarbons in the Gulf of Mexico by "unitizing" maritime transboundary reservoirs?

Samuel Coleridge, English poet of *The Rime of the Ancient Mariner*, once said "Common sense in an uncommon degree is what the world calls wisdom." While sea level rise may be the "albatross around one's neck" for coastal communities, the "commons" sense research and development of near shore and offshore aquifers through COASt will ultimately lead to more cooperation and wiser use of onshore water resources. As depicted on Appendix A, COASt will engage with decision-makers, coastal communities and industries while providing clear pathways for knowledge to action at the state level, ultimately leading to serving as the beacon for collaboration and cooperation over subsea aquifers at national and international levels.

Preliminary OSU Linkages with State Agencies



Ore. Coastal Mgmt.
Ore. Water Resources Dept. (OWRD)
Ore. Heritage Comm.

Dept. of Env. Quality
Dept. of Land Con. and Develop.
State Parks
OWRD

Dept. of Geology and Min. Industries
OWRD

Ore. Business Council
Dept. of Revenue
Dept. of Education

EXPLANATION

OSU = Oregon State University
PSU = Portland State University
UO = University of Oregon
CEOAS = College of Earth, Ocean & Atmospheric Sciences
CCE = School of Civil and Construction Engineering
COB = College of Business
INR = Institute for Natural Resources
IWW = Institute for Water & Watersheds
TFDD = Transboundary Freshwater Dispute Database
WRPG = Water Resources Graduate Program

Appendix A – COASt Concept Map