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Structures in the Marine Environment

Australian Water School (AWS)

August 2023

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Agenda



Introduction to Offshore Wind

- What it is / How it Works
- History / Evolution



Regulatory & Permitting Framework

- Multi-tiered Approach
- Assess Impacts
- Measures to Reduce or Offset Impacts



Marine Environmental & Social Considerations

- Marine Biological Resources
- Cultural and Tribal/First Nations Resources
- Socioeconomic Resources

1. Introduction to Offshore Wind



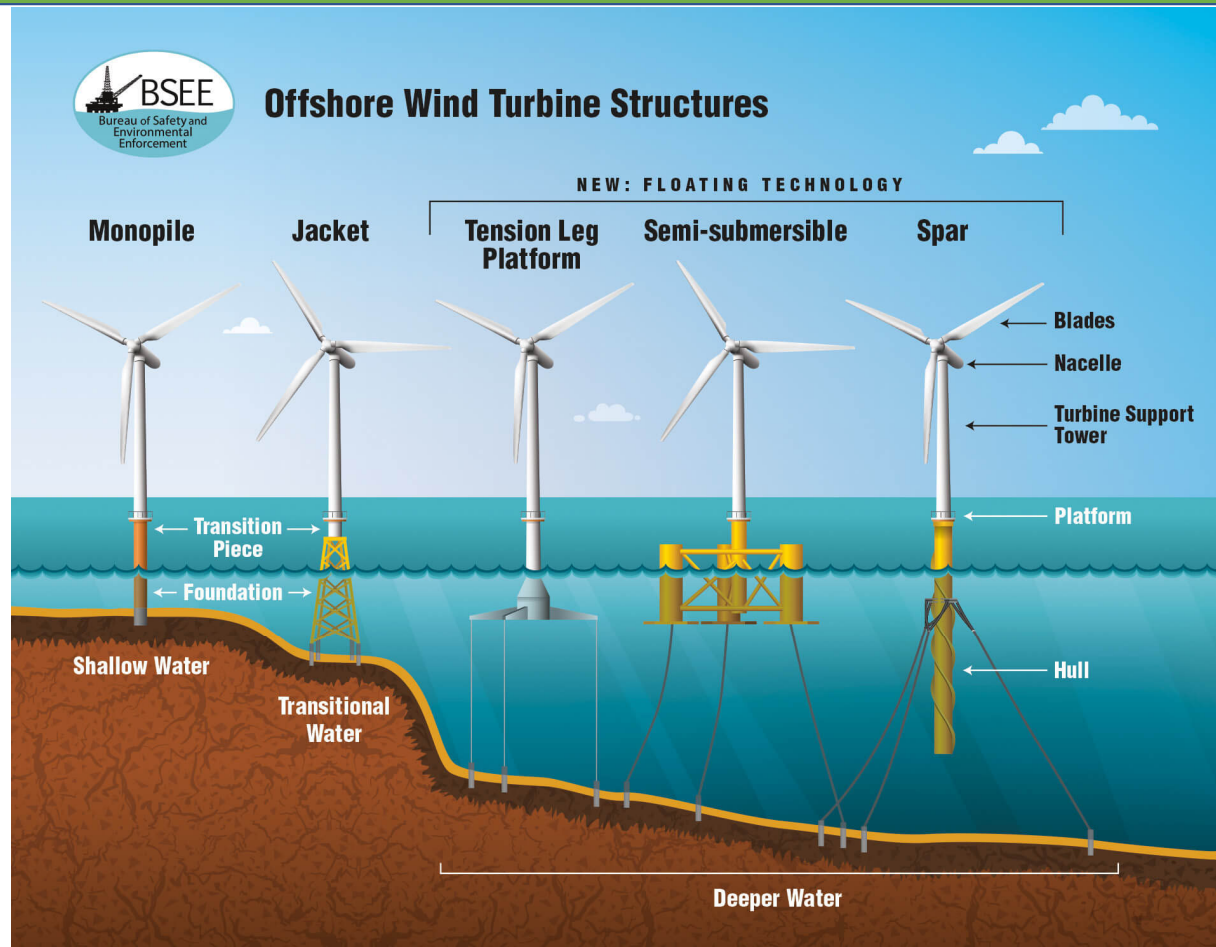
Offshore Wind Farms (Fixed Bottom)



Offshore Wind Farms (Floating)



Foundation Types: Fixed and Floating

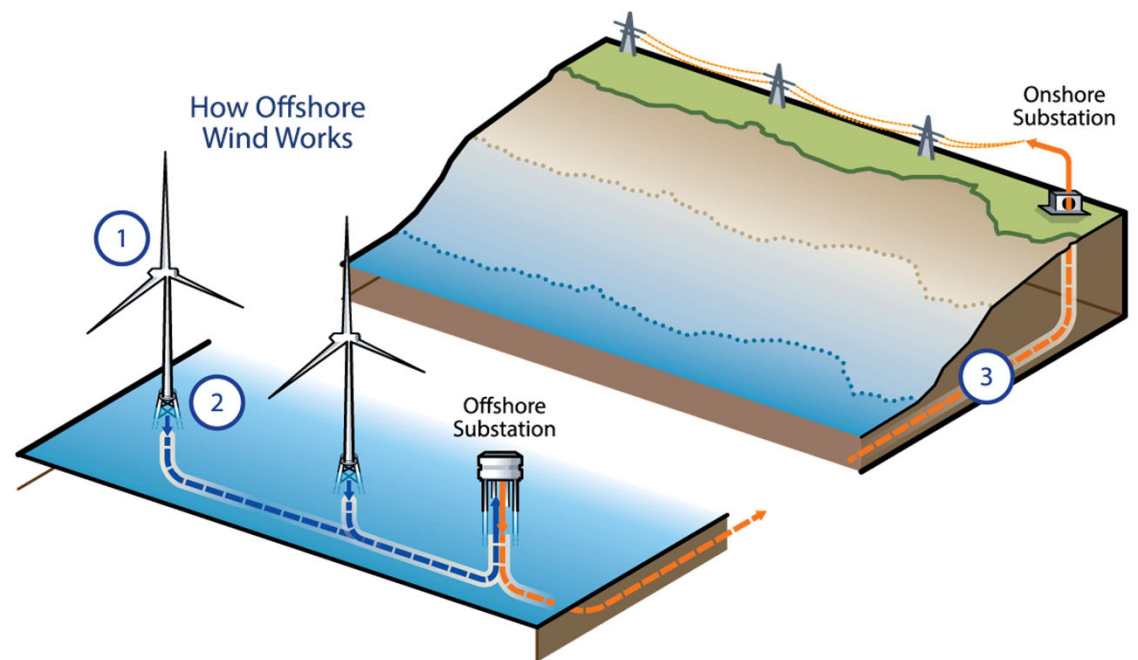


Layout of OSW Farm (Fixed)

1. Offshore Turbines capture the wind's energy and generate electricity.

2. Foundations secure turbines to the ocean floor and cables transmit electricity to an offshore substation

3. Electricity flows through a buried cable to an onshore substation and is transferred to the existing transmission network.



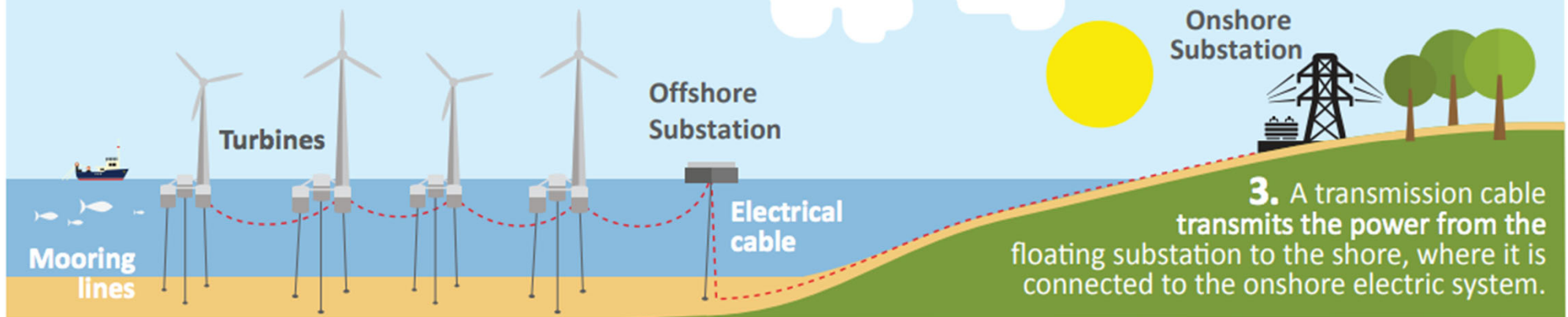
Layout of OSW Farm (Floating)

How Offshore Floating Wind Farms Work

1. Floating wind turbines are configured in an array to optimize the capture of wind energy.

2. Energy captured by the turbines is conveyed through a transmission line to a floating substation.

3. A transmission cable transmits the power from the floating substation to the shore, where it is connected to the onshore electric system.

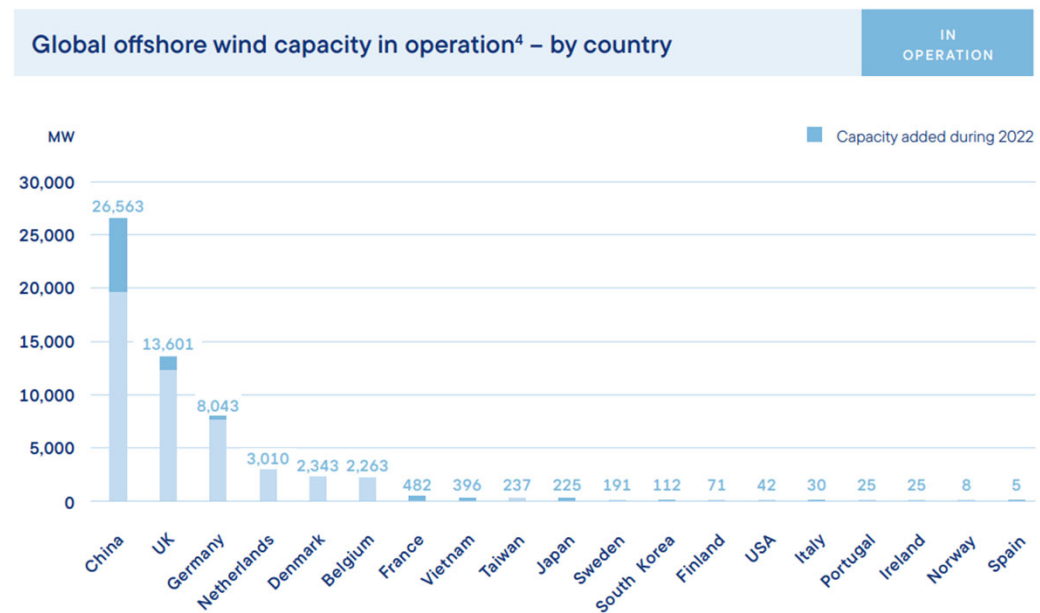


Evolution of Offshore Wind



Global OSW Market

- **First OSW Farm: Orsted's Vindeby OSWF, Denmark, 1991, 3-MW WTGs**
- **2014: 69 OSW Farms constructed in Europe**
- **Capacity increased 10x 2010-2020; planning 10x again by 2035 (519 GW)**
- **2021 record year deployment 16 GW**
 - China commissioned ~14 GW (16-MW WTG operational July 2023)
 - 2022 slightly less (9.4 GW)
- **Globally: ~58 GW of OSW (2022)**
- **3 floating OSW projects on in 2021 (57 MW)**
- **Australia: Fed Govt declares 6 Wind Energy Zones**



2. Regulatory & Permitting Framework



Hard to Summarize at Global Scale, But...

- Countries have/need to establish regulatory framework – likely tiered levels of approval
- Sequencing of regulatory process can vary / matters
- Assess environmental and social/socioeconomic impacts
- Consider Alternatives to reduce impacts
- Consider Mitigation to offset impacts

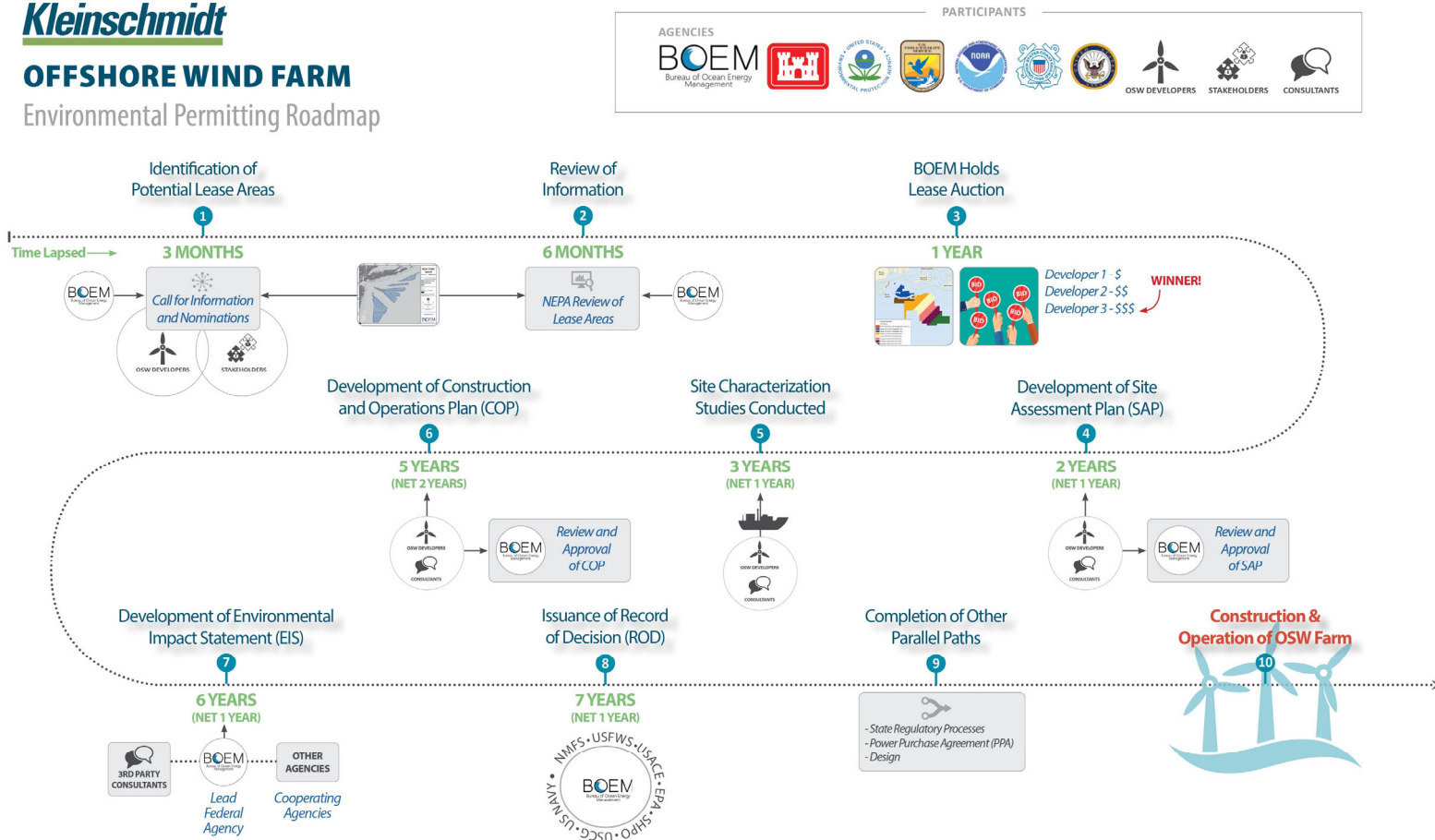


U.S. Offshore Wind Regulatory Roadmap

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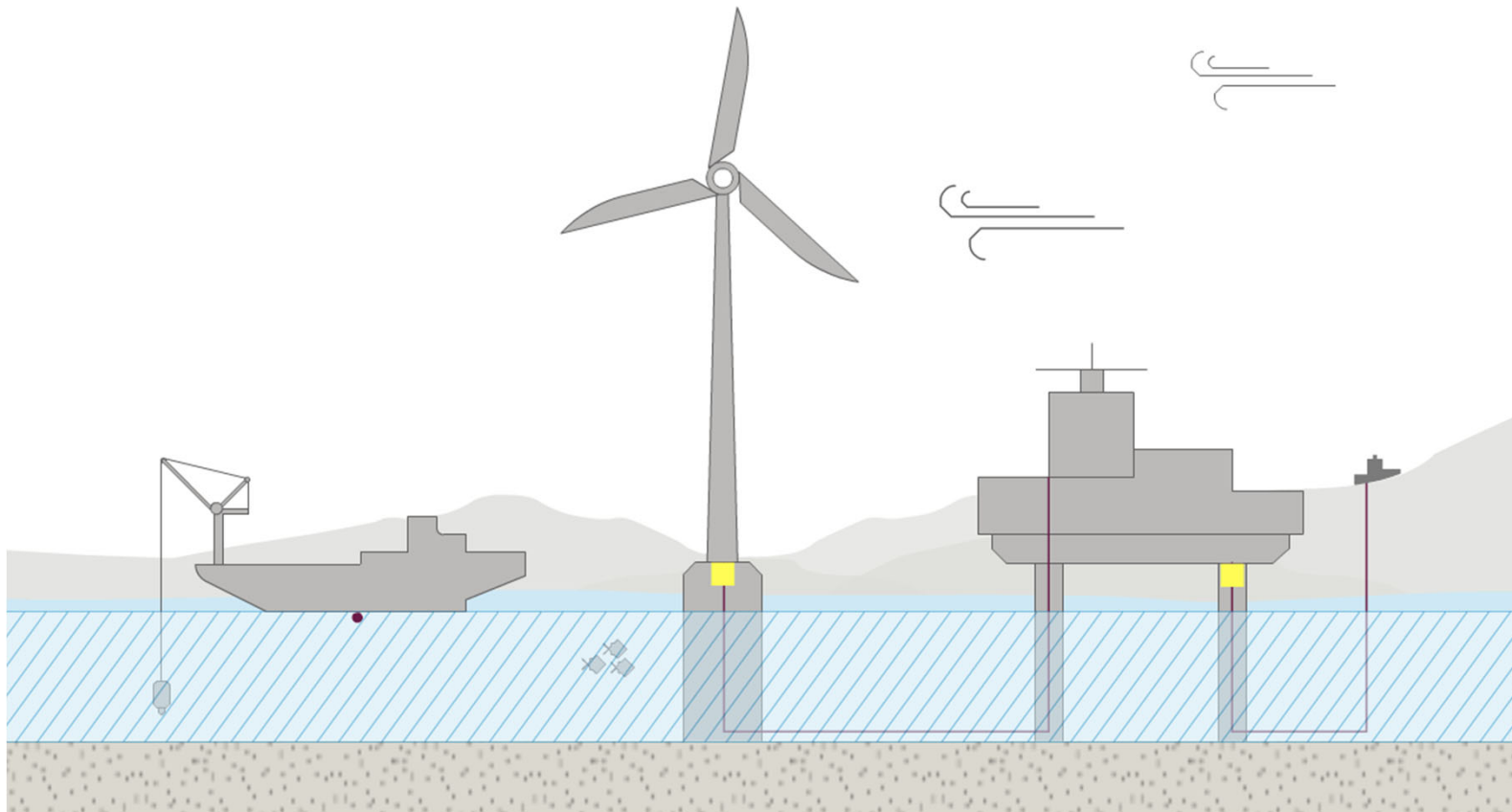
OFFSHORE WIND FARM

Environmental Permitting Roadmap



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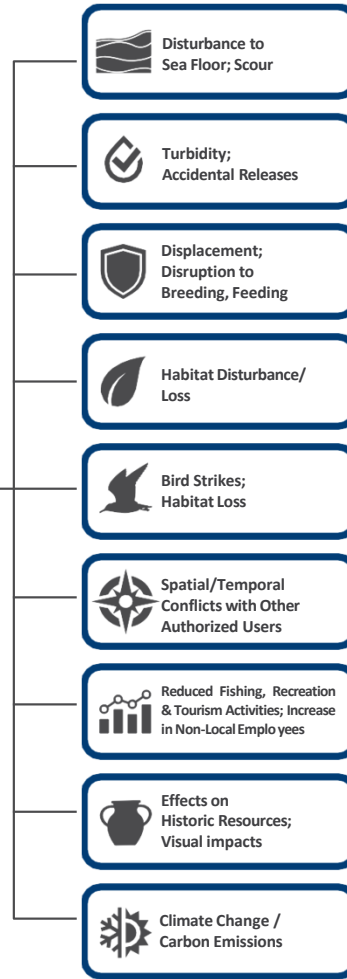
3. Marine Environmental & Social Considerations



IMPACTS MATRIX



POTENTIAL IMPACTS TO RESOURCES



POTENTIAL CONSEQUENCES

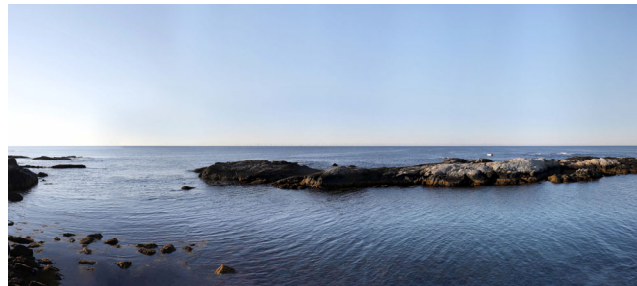


RESOURCE KEY

- Geology & Hazards
- Coastal & Marine Uses
- Water Quality
- Socioeconomics
- Threatened and Endangered Species
- Archaeological Resources
- Sensitive Bio Resources/Habitats
- Air Quality/Climate Change
- Avian Resources

Controversies in the U.S. include Potential Impacts to:

- Commercial Fishing (Operations and Stocks)
- Protected Species
- Visual Resources
- Cultural & Tribal Resources
- Glauconite Sands



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**HYDROPOWER
ENGINEERING**



**DAM SAFETY AND
WATER INFRASTRUCTURE
ENGINEERING**



**LICENSING AND
PERMITTING**



**ENVIRONMENTAL
SERVICES**



**FISHERIES
ENGINEERING**



**WATER RESOURCE
ENGINEERING AND
HABITAT RESTORATION**



**MODELING,
STATISTICS,
AND GIS**



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Questions?

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