UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

الإمارات العربية المتحدة
وزارة التغير المناخي
والبيئة

AGEDI
مبادرة أبوظبي العالمية للبيانات البيئية
Abu Dhabi Global Environmental Data Initiative

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هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

The Experiences of Arabian Gulf University (AGU) in Climate Change Studies

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Overview

- Introduction
- Expertise at AGU
- Inquiries in Climate Change:
  - Water Resources
  - Biodiversity: Mangrove
  - Coastal & Marine
- TNC, Bahrain

Introduction

- AGU is a **regional** educational and research institute founded 30 years ago.
- AGU is a **UNEP** collaborating center that contributed in several studies including:
  - **GEO** reports: GEO1, 2,3,4, 5,6.
  - **EOAR** 2010 with League of Arab States.
  - **National Communication Reports** for UNFCCC for Bahrain, Oman, and Kuwait; and Iraq as well.
  - **SOEs**: Yemen, Saudi Arabia, Bahrain.

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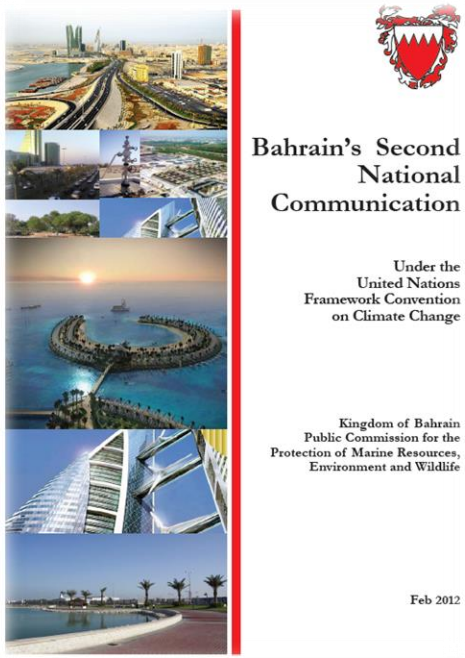
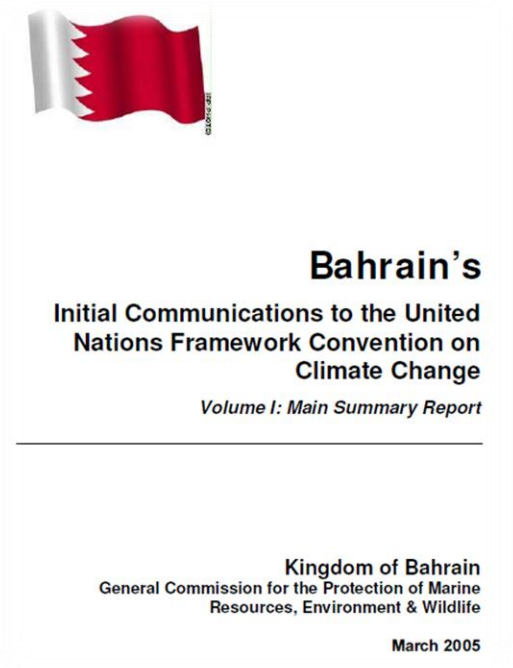
Introduction

- AGU participated in elaborating Bahrain's First and Second National Communication Reports (**1NC, SNC**) to UNFCCC.

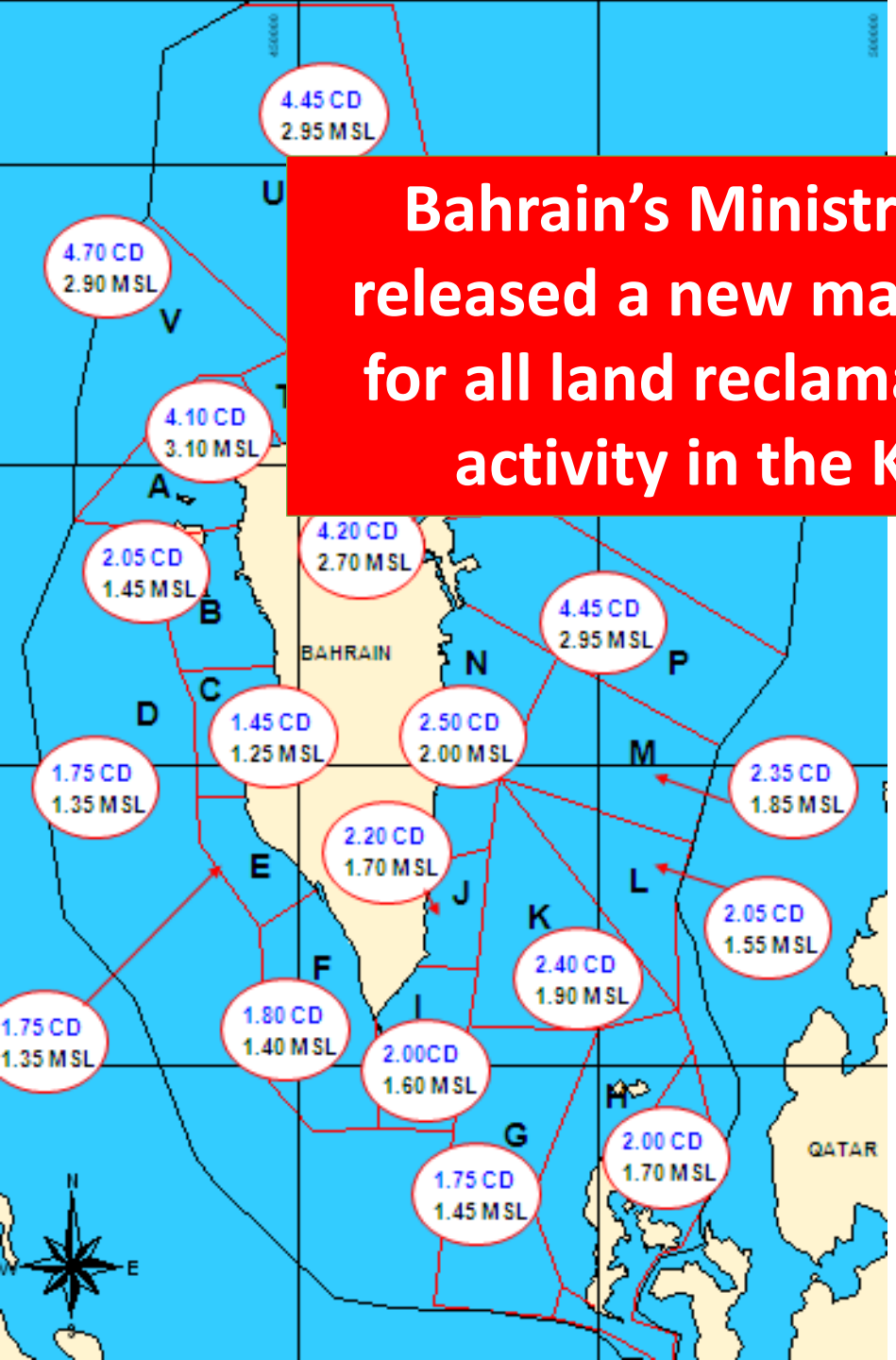


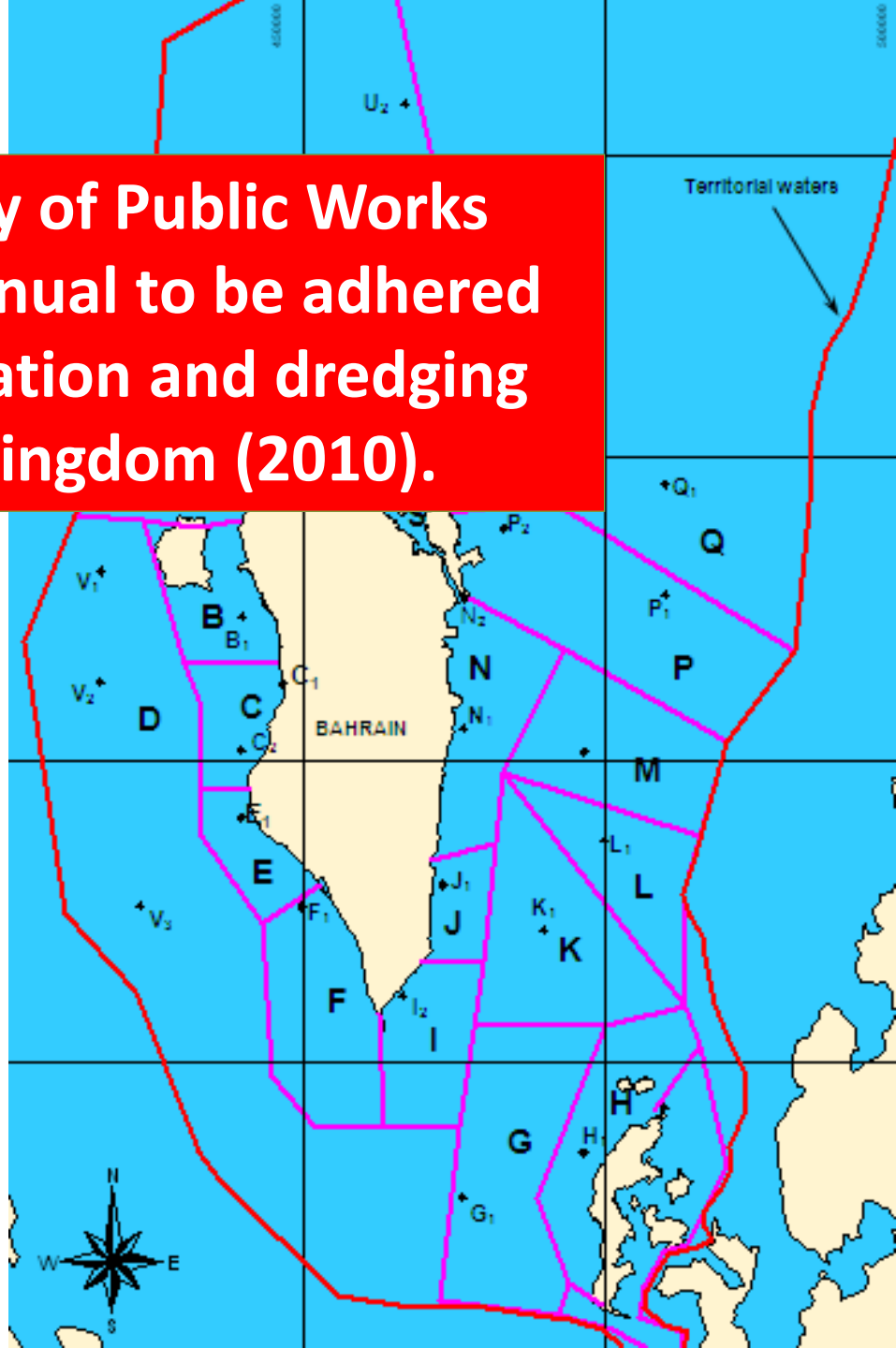


Introduction

- The Government of Bahrain adopted one of the recommendations of the First National Communication by issuing and enforcing a legislation governing levels of coastal reclamation as a measure to adapt to SLR.

Bahrain's Ministry of Public Works released a new manual to be adhered for all land reclamation and dredging activity in the Kingdom (2010).





Expertise at AGU

- AGU's experience depends on a range of scientific disciplines that are taught at the "**College of Graduate Studies**" and the "**College of Medicine and Medical Science**":
  - Integrated Water Resources Management
  - Innovation and Technology Management
  - Biodiversity
  - Health
  - Disaster Risk Reduction
  - Geoinformatics
  - Education and Awareness
  - Marine and Coastal Environments
  - Urban Environment
  - Environmental Management
  - Energy

Expertise at AGU

- The Climate Change Team (CCT) has gained **work's experience** by participating in the preparation of national communications for the Kingdom of Bahrain, as well as to contribute to the preparation of national communications reports of Kuwait, Oman, Iraq.

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Inquiries in Climate Change

1. **Water Resources**
2. **Biodiversity**
3. **Coastal & Marine**

1. Assessment of Climate Change Impacts on Water Resources in the Kingdom of Bahrain

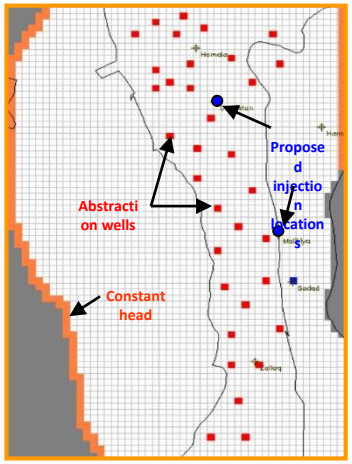
Prof. Waleed K. Zubari
Water Resources Management Program
College of Graduate Studies

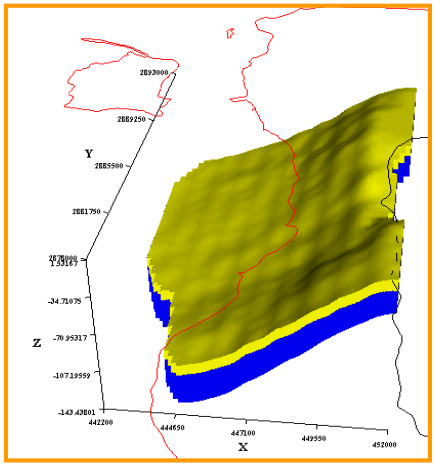
- Impact of Climate change on Water Resources in the **GCC** Countries.
- Use of **Simulation Models** in Groundwater Resources Management in the GCC Countries.
- Sustainability of Water Resources Management Systems within **IWRM** framework.
- Management of the **Water-Energy-Food Nexus**.

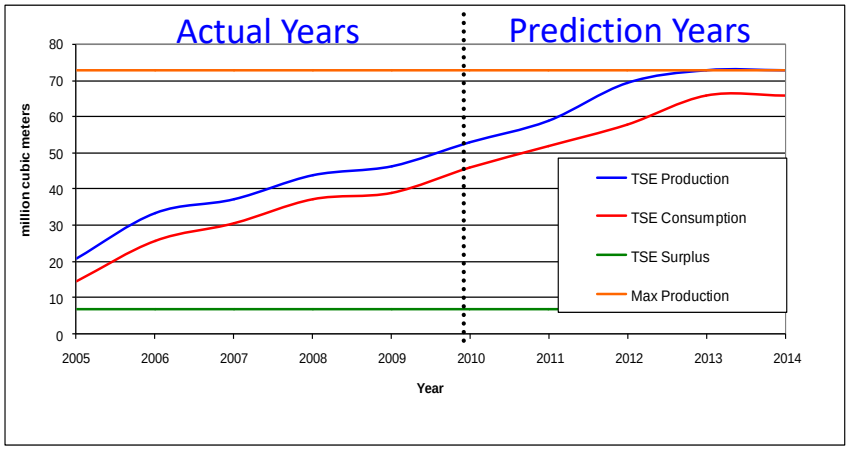
Groundwater Resources Vulnerability and Adaptation to Climate Change in the Kingdom of Bahrain

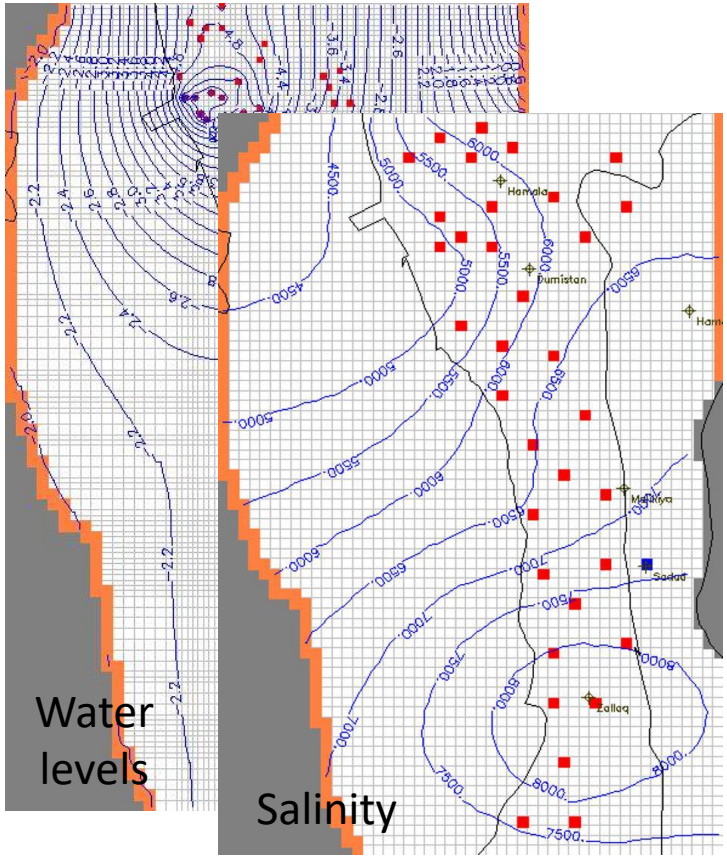
Simulation modeling

- Assessing the impact of temperature increase on WRM System.
- Investigating the impacts of sea level rise on desalination plants

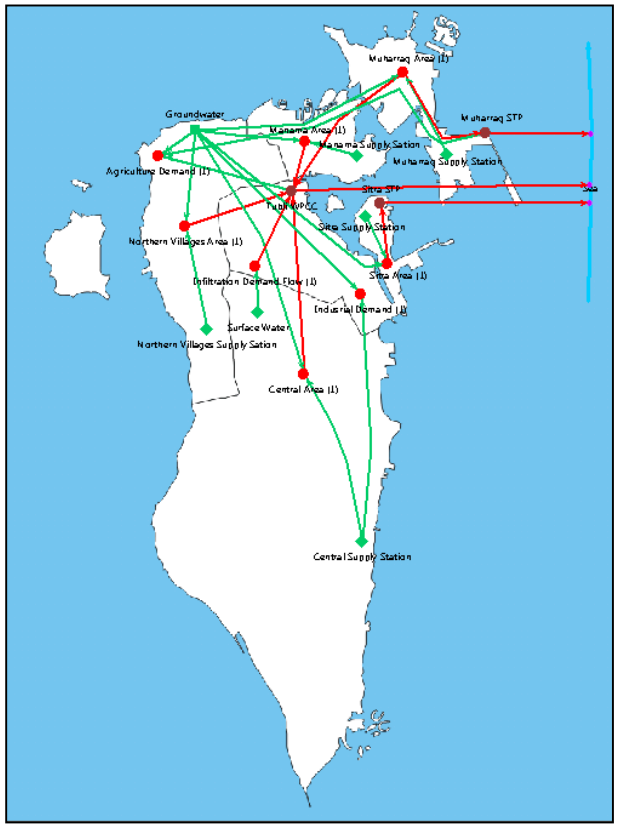








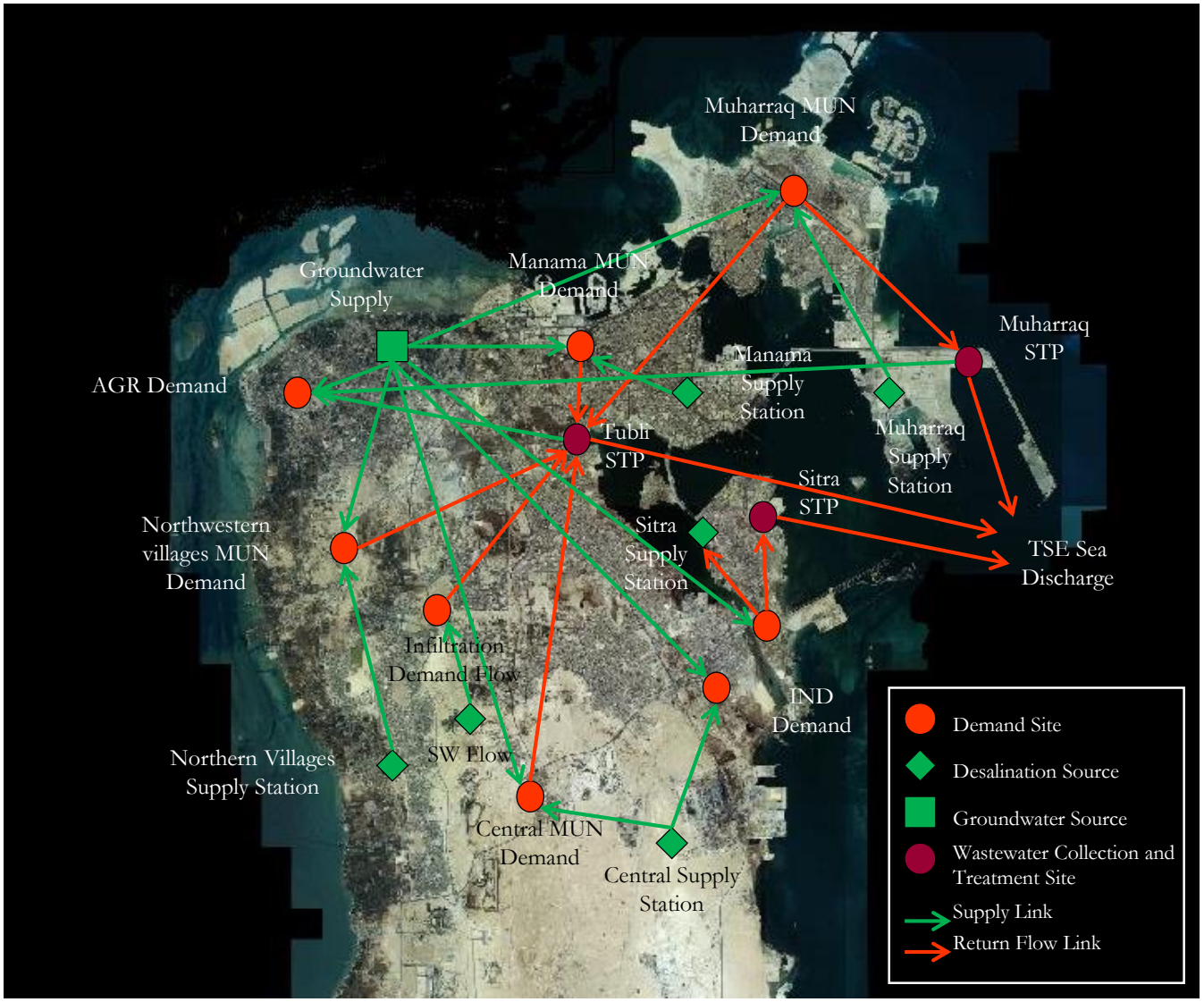
Conceptual WEAP Model for WR system in Bahrain



Sectoral water demands in Bahrain per catchment area (2000-2011)

Year	Municipal Demand, Mm³					AGR Demand, Mm³	IND Demand, Mm³	Total, Mm³
	Muharaq	Manama	Central	North Vill.	Sitra			
2000	15.4	28.8	65.0	14.3	3.4	174.5	7.6	309.11
2001	17.11	32.15	66.02	15.98	4.05	152.80	6.65	294.76
2002	17.30	32.41	67.07	16.74	4.45	156.00	6.76	300.73
2003	18.26	34.68	70.09	17.97	4.98	154.70	6.61	307.29
2004	19.44	37.51	71.91	18.91	5.98	145.80	6.11	305.66
2005	19.89	38.70	74.57	19.79	5.99	134.80	5.61	299.35
2006	20.86	40.91	79.19	20.82	6.08	133.90	5.55	307.32
2007	21.82	42.75	79.97	21.87	6.16	136.60	5.53	314.71
2008	25.44	49.52	84.67	24.59	6.25	143.50	5.51	339.48
2009	30.49	55.25	94.56	28.22	6.23	143.50	5.51	363.76
2010	33.54	61.15	102.65	30.12	6.08	143.50	5.51	382.55
2011	34.15	60.88	105.76	30.22	6.42	143.50	5.51	386.44

Conceptual WEAP Model for the Water Resources Management system in Bahrain



Adaptation Options: *Cost Reduction Analysis*

Effectiveness of adaptive management intervention in demand reduction in the municipal sector for the period 2012-2030

Management Interventions	Total Reduction by 2030 (Mm^3)	Reduction by 2030 (%)	Total Cumulative Reduction (Mm^3)
Leakage reduction in mun. network	44	12	432
Raising consumers awareness	35	10	527
Use of water saving devices	71	20	674
All adaptation measures combined	134	38	1,500

Cost reduction associated with adaptive management interventions in the municipal sector for the period 2012-2030

Management Interventions	Total Cum Reduction (Mm^3)	Financial Saving (MUS$)	CO_2 Emission (Mkg)	Natural Gas (Mm^3)
Leakage reduction in mun. network	432	831	5,672	363
Raising Consumers awareness	527	1,013	6,920	443
Use of water saving devices	674	1,296	8,850	566
All adaptation measures combined	1,500	2,885	19,695	1,260

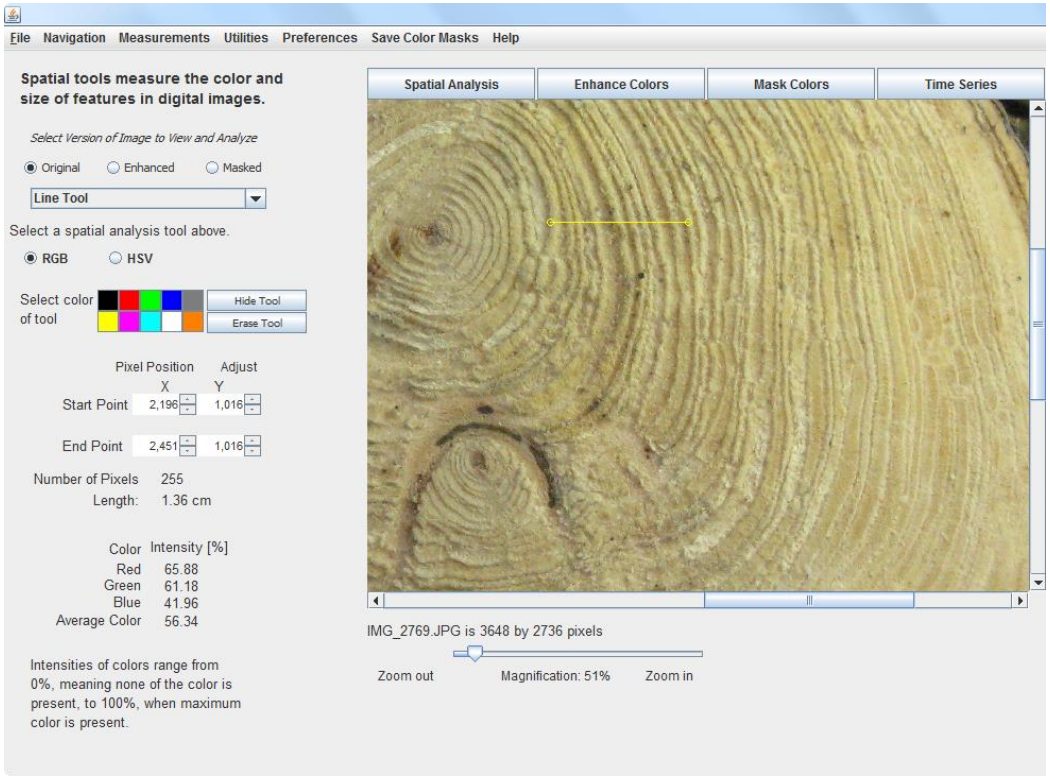
2. Ecology and Restoration of Mangrove Ecosystem (Avicennia marina) in Bahrain

Prof. Mohammad S. Abido
Environ. Sci.ces and Nat. Res. Program
College of Graduate Studies

- Quantitative description of some mangrove parameters.
- - community composition and structure.
- - mangrove stand parameters.
- - mangrove physiological parameters.

Age and growth of mangrove & Photosynthesis and Transpiration

- Age was estimated by counting growth rings.
- Width of annual growth was determined by digital basic software



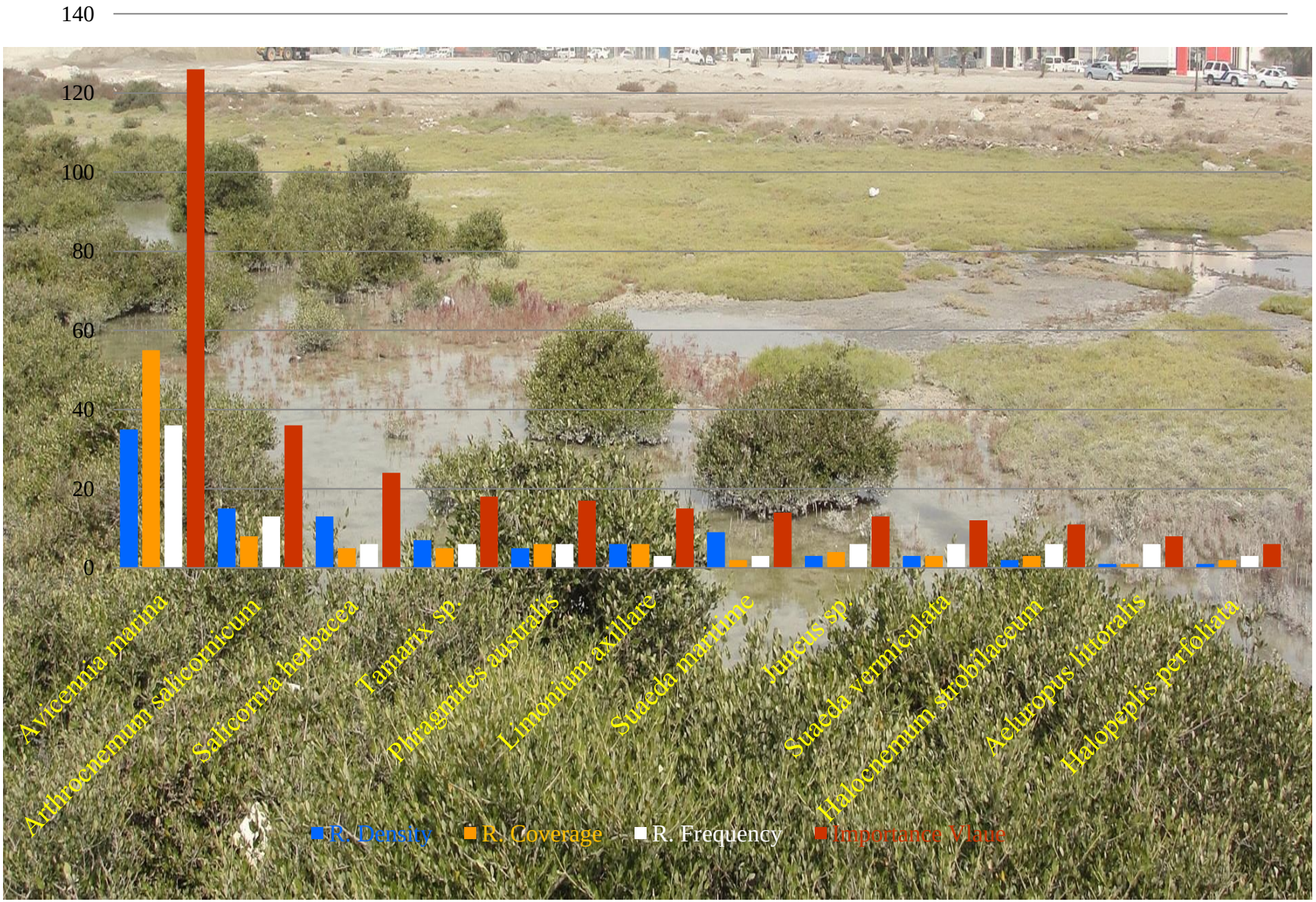
- CO_2 analyzer, The LI-6400XT Portable Photosynthesis System.

Mangrove Descriptors

Descriptor	Average	Range
Density	1250 tree/ha	945-1457
Coverage	66%	35-100%
Tree Heights	1.60 m	0.5-3.20m
Stem Diameter	13.2 cm	
Density of aerial roots	219 roots m^{-2}	188-275
Root Heights	40 cm	25- 60 cm

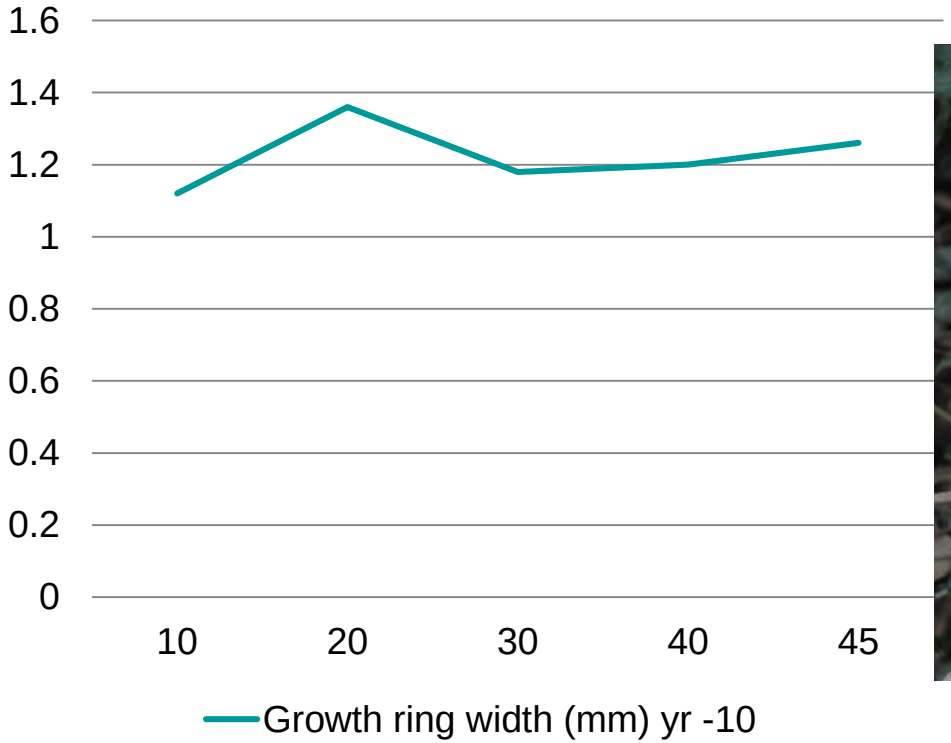
Mangrove Strata	Height (m)	Density (T/ha.)	% of Area
High	2.5	1350	9
Mid	1-2.5	1457	50
Low	1	945	41

Composition of Mangrove Community at Study Site



Age and growth of mangrove stand

- Age 45 years.
- Diameter 13.19 cm
- Growth rate 3 mm yr^{-1}
- Spring growth 85% of annual growth.



3. Assessing the Impacts of SLR on The Kingdom of Bahrain Coastal Area

Dr. Sabah Aljenaid
Geoinformatics Program
College of Graduate Studies

- Assessing the Impact of Climate Change on Coastal Zone: Coastal Vulnerability Index-**CVI**.
- Assessing the Impact of Climate Change on Coastal Zone: **Flooding and Inundation**.
- Assessing Carbon Stocks Resulting from Coastal **LULCC**.

exposure

sensitivity

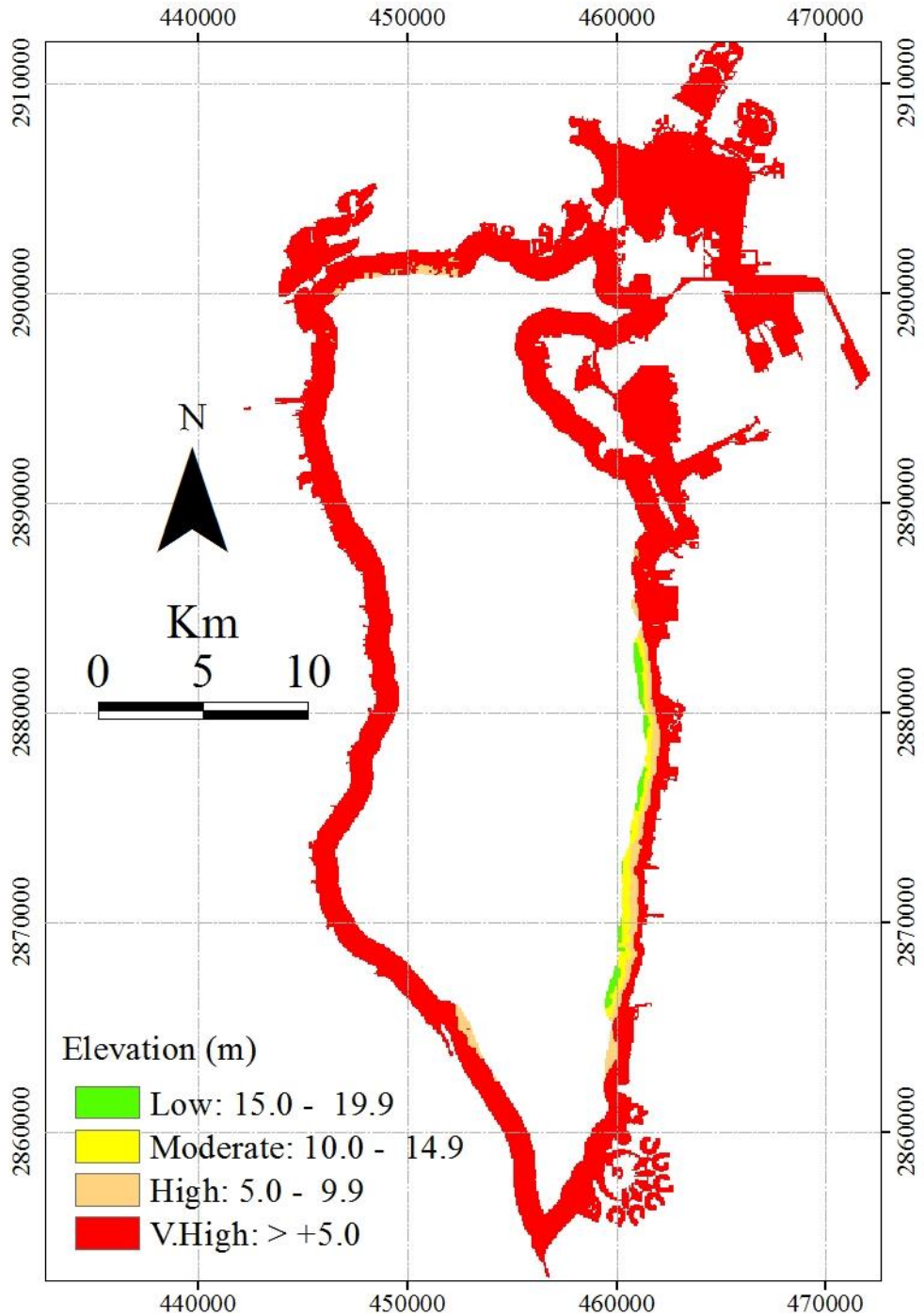
adaptive capacity

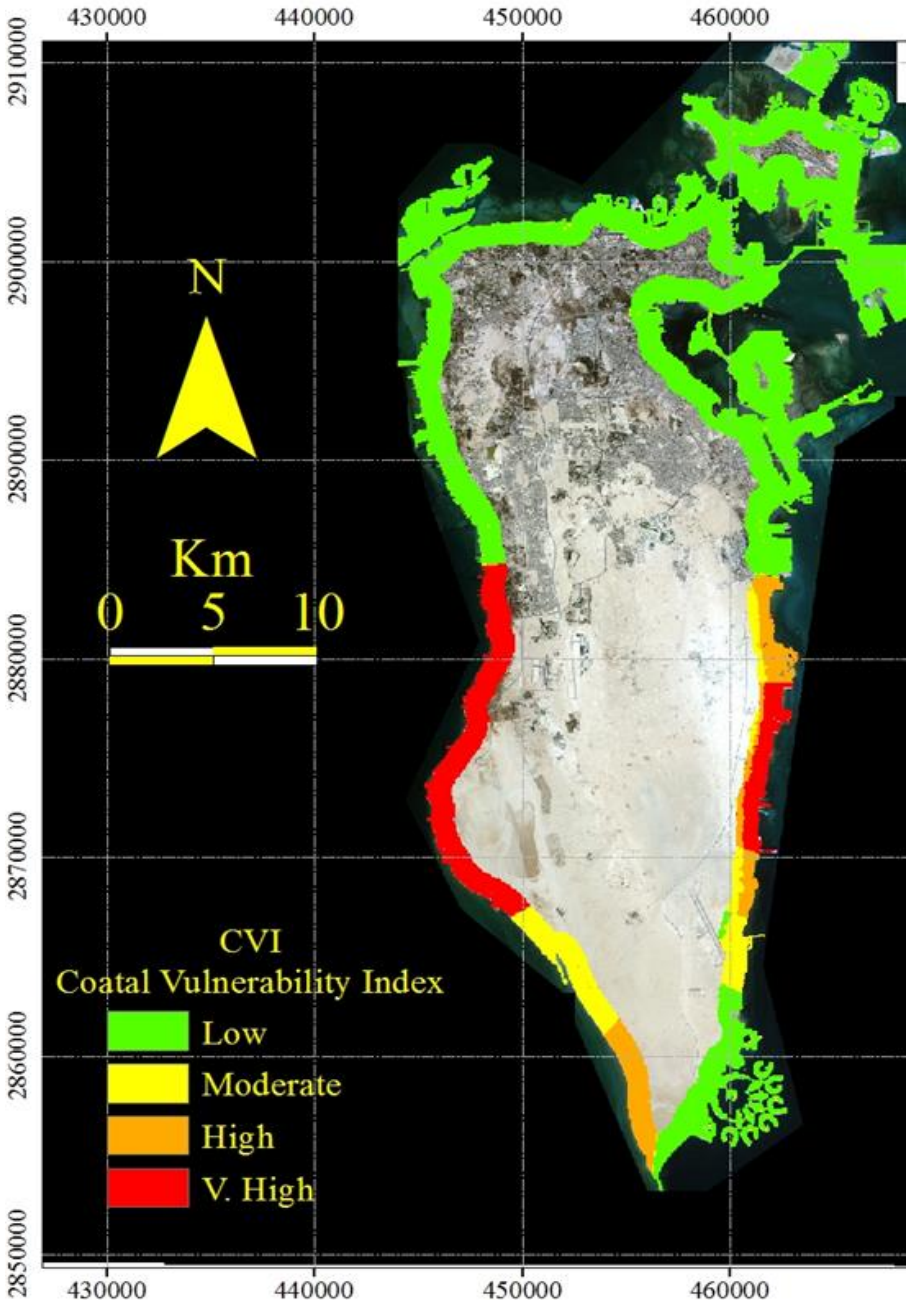
potential impact

vulnerability

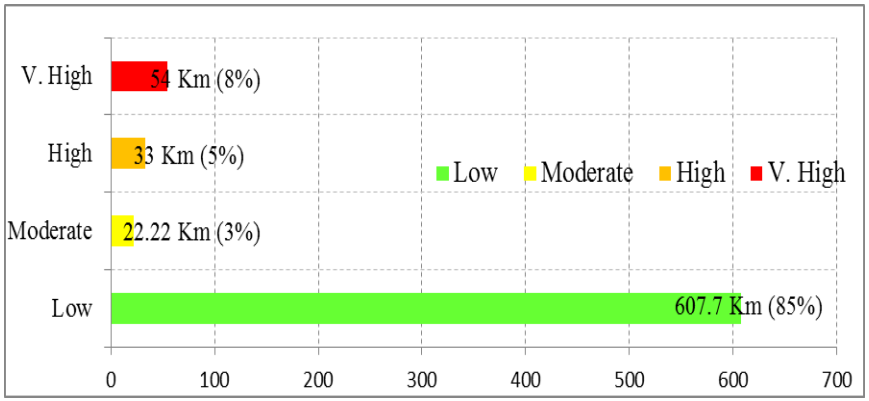
CVI: Costal Vulnerability Index

- Impact of Climate Change on Coastal Zone: Coastal Vulnerability Index-CVI.





The total coastal length in each risk category

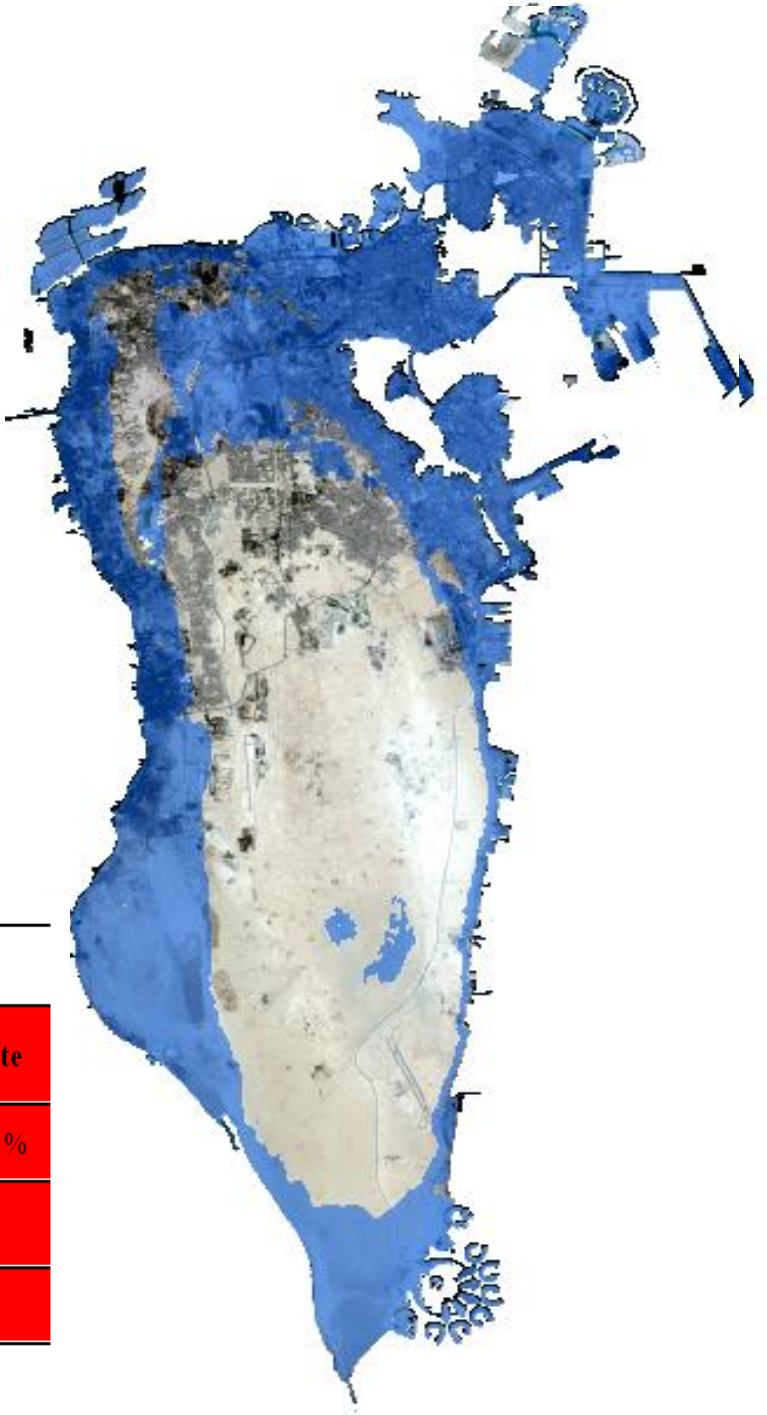


Inundation scenario analysis

- Assessing the Impact of Climate Change on Coastal Zone: Flooding and Inundation.

Results of the long-term inundation scenario analysis

	Sea level rise scenarios								
	No accelerated deglaciation			Low deglaciation rate			Extreme deglaciation rate		
Year	SLR	Total Area	Total %	SLR	Total Area	Total %	SLR	Total Area	Total %
2050	0.3meter	83	11%	0.5meter	84	11%	1meter	188	25%
2100	1.5meter	189	26%	2meter	272	36%	5meter	407	54%



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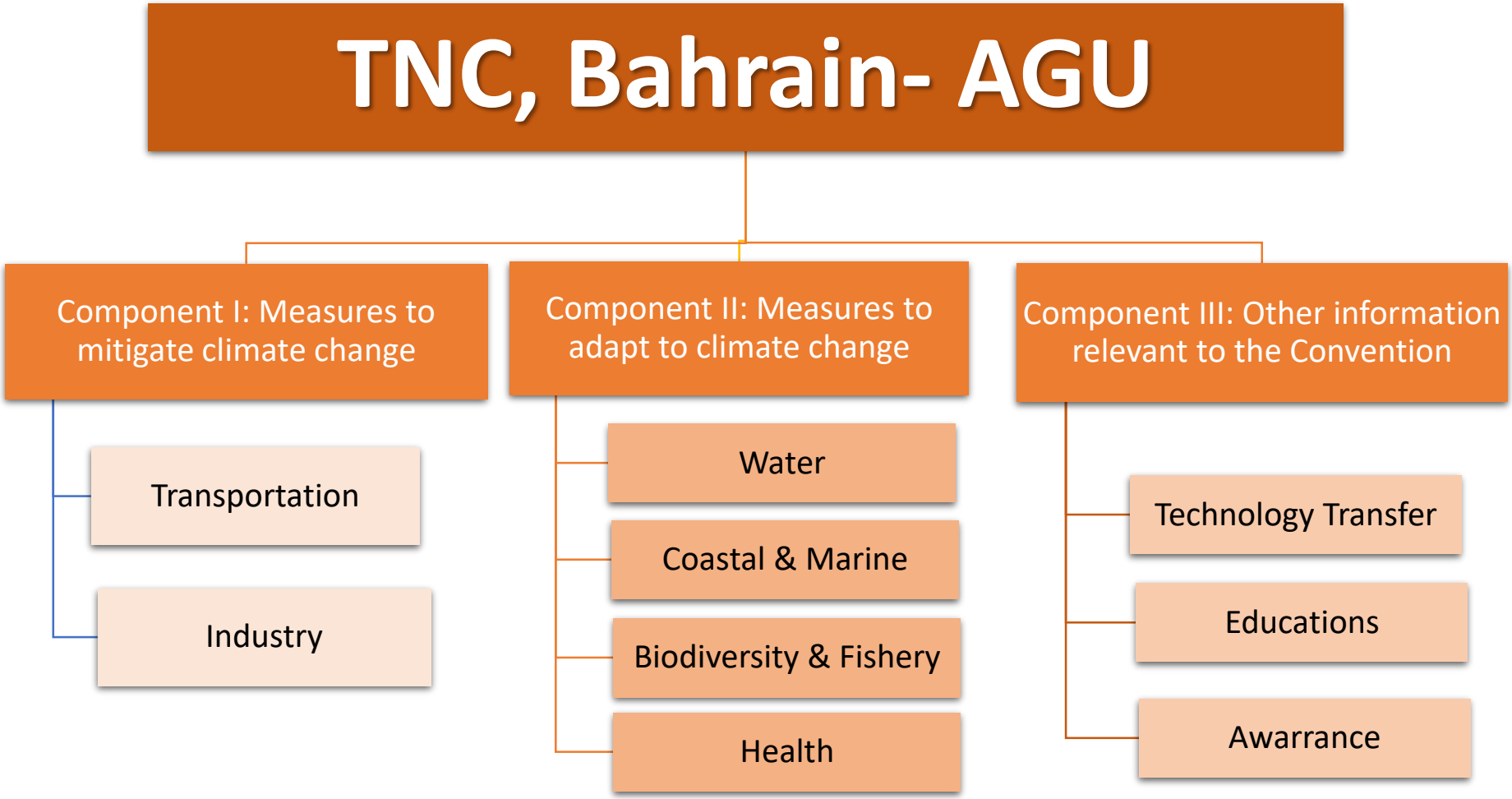
TNC, Bahrain- AGU
Component I: Measures to mitigate climate change
Transportation
Industry
Component II: Measures to adapt to climate change
Water
Coastal & Marine
Biodiversity & Fishery
Health
Component III: Other information relevant to the Convention
Technology Transfer
Educations
Awarrance

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Thank You

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