



Food and Agriculture
Organization of the
United Nations

GLOBAL
SYMPOSIUM on
SOILS and **WATER**

02-05 October, 2023

Soil and water:
a source of life

Abu Dhabi's Integrated Approach to Soil Salinity
Management and Water Conservation

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SOIL DEGRADATION

- Around 2 000 ha of agricultural soil is lost due to salt-induced degradation every day worldwide.
- The harsh environmental conditions of Abu Dhabi (high temperature, high evaporation, limited irregular rainfall and fragile soil structure with low organic content) are natural drivers for land degradation.
 - Almost 63 % of the land in the emirate is susceptible to wind erosion while 18 % is susceptible to primary soil salinity.
- Moreover, anthropogenic degradation factors include poor land management and inappropriate agricultural practices.
 - More than 80 % of irrigated land in Abu Dhabi Emirate is affected by salinity to various degrees, resulting in a reduction in soil quality and crop yield.



OVERUSE OF GROUNDWATER

- In addition to a low natural recharge rate, the rapid socio-economic change is increasing demand for water.
- Agriculture and forestry are causing groundwater abstraction that exceeds the natural recharge rate.
- Groundwater level are depleted due to the high rate of extraction.
 - Among the 100,000 wells found across Abu Dhabi Emirate, some are suffering from extreme groundwater level decline greater than 15 metres with decreased water quality and increased salinity.
- Over abstraction of groundwater resulted in an increase of its salinity ultimately resulting in reduction in soil quality and crop yield.



SOIL SALINITY SURVEY

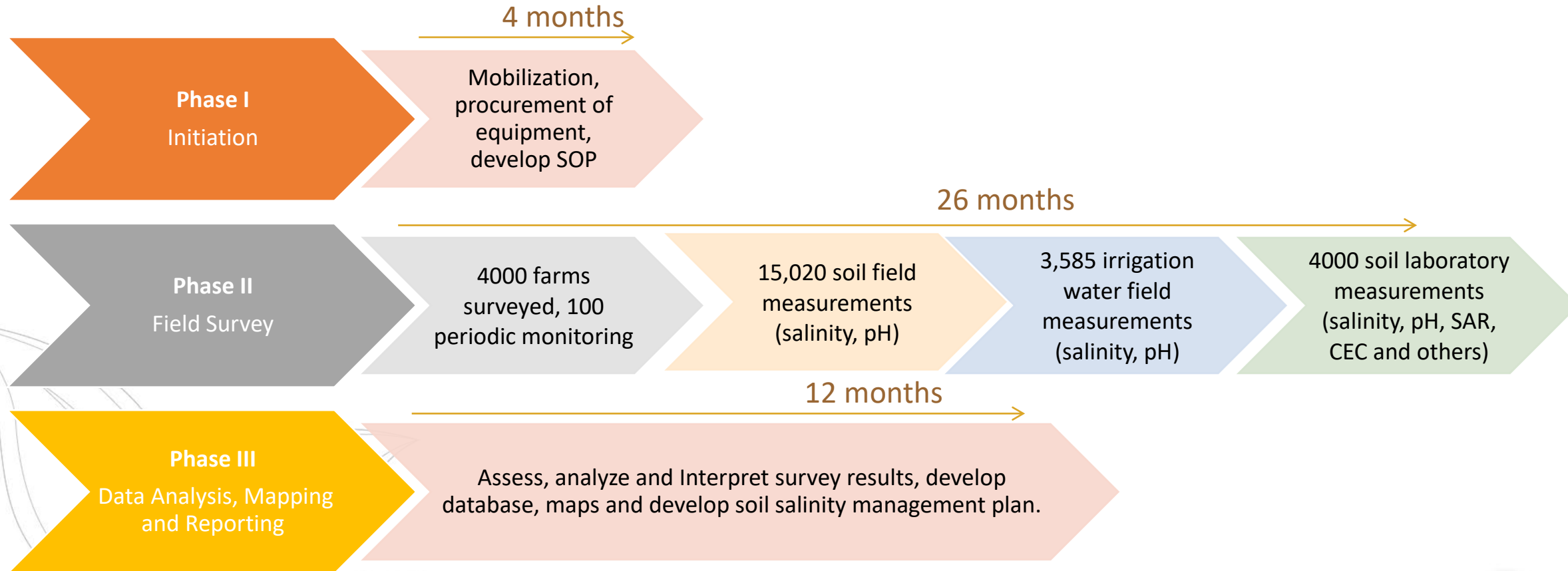
Project objectives:

1. Assess the levels of salinity in agricultural soil;
2. Periodic monitoring to understand the seasonal changes in soil salinity
3. Develop a soil salinity management plan in agricultural land
4. Determine KPIs to measure the performance of the plan in managing soil salinity in agricultural land.



SOIL SALINITY SURVEY - THE PROJECT PHASES

3-year project



On-site Farm Soil Analysis

Multi parameter probe for measurement of EC, pH and temperature

Munsell Colour Chart

GPS Data Logger

Sampling bottle rack for preparation of soil-water suspensions

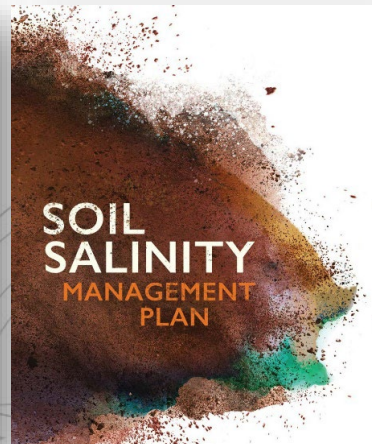
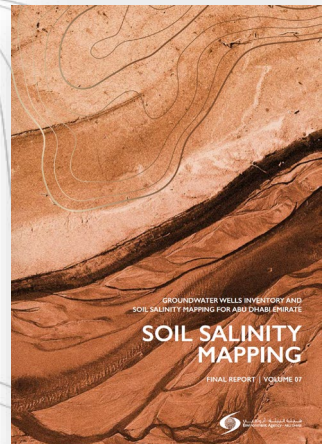
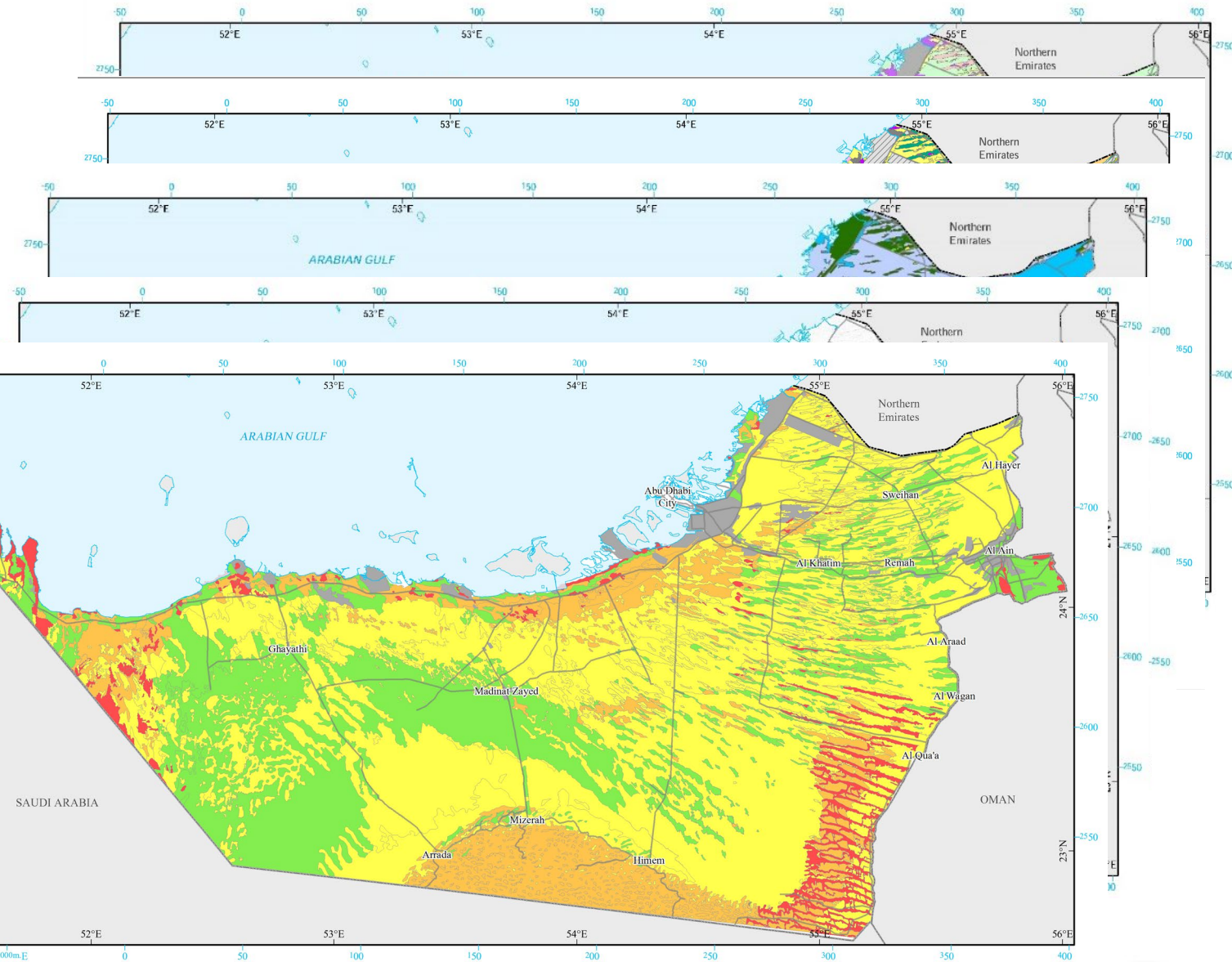
Sieve for grain size analysis

Auger

SURVEY RESULTS

Produce maps on 3 different scales for the agricultural areas:

- 1:25,000
- 1:100,000
- 1:500,000
- Soil salinity maps at 3 soil depths
- Soil classification map
- Soil pH map at 3 soil depths
- SAR map at 3 soil depths
- Soil irrigation suitability map



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SURVEY RESULTS

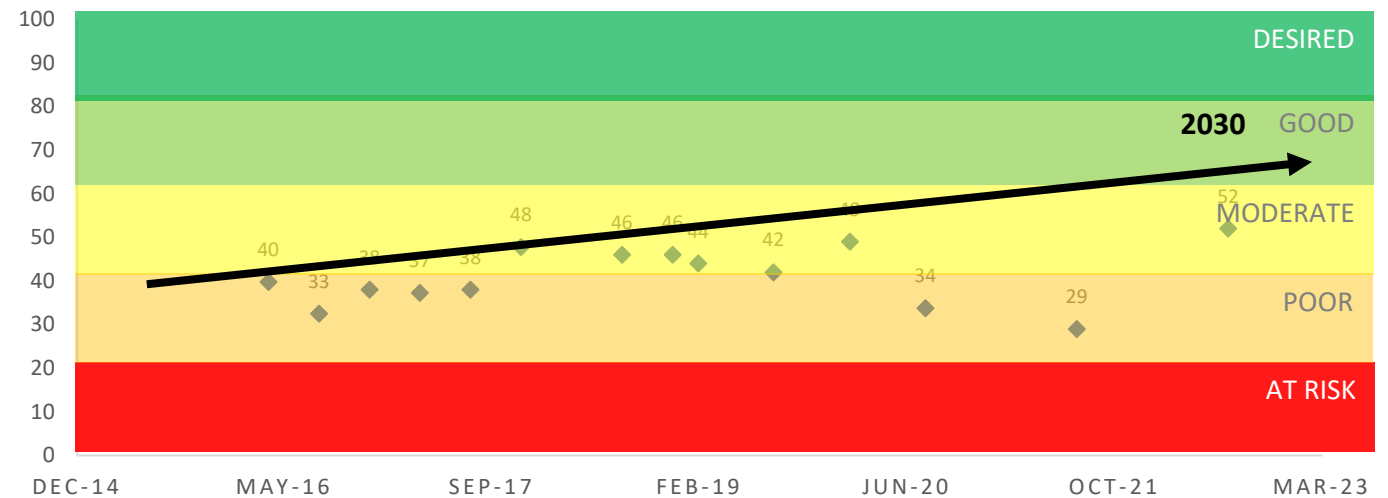


Average soil salinity 8-16 dS/m (highly saline soil, FAO)

High salinity tolerant crops such as date palm are facing 50% reduction in yield.

Around 8000 farms were abandoned due to high salinity with the costs of rehabilitation overcoming profitability.

SOIL SALINIZATION INDEX



The index tends to aggregate and generalize trends and so should be viewed as a policy tool to give a general overview of state and trend over time.

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SOIL SALINITY MANAGEMENT PLAN

This plan was developed in collaboration with all relevant stakeholders locally and nationally.

The technical committee included representatives of:

- Abu Dhabi Agriculture and Food Safety Authority (ADAFSA)
- Abu Dhabi Municipality (ADM)
- Abu Dhabi National Oil Company (ADNOC)
- Al Ain Municipality (AAM)
- Al Dhafra Region Municipality (DRM)
- Department of Municipalities and Transport (DMT)
- International Center for Biosaline Agriculture (ICBA)
- Ministry of Climate Change and Environment (MOCCAEC)
- Statistics Centre Abu Dhabi (SCAD)



SOIL SALINITY MANAGEMENT PLAN



SECTION I

- General principles for the best use of groundwater resources, and the maintenance and improvement of soil resources.

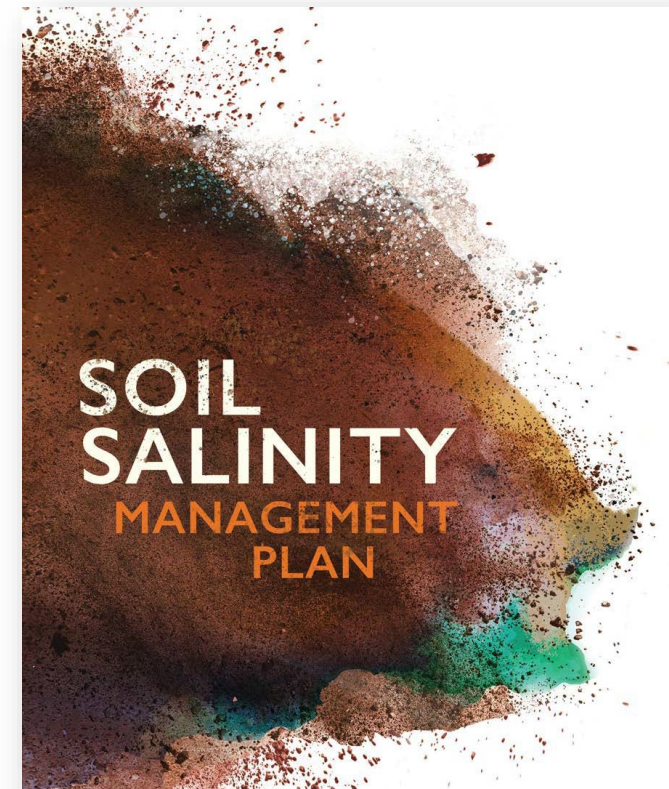
SECTION II

- Recommended actions are listed in separate tables for each of the 16 irrigation districts. A description is given of the existing conditions of irrigated soils and irrigation water, and specific recommendations are developed for each area (irrigation, crop selection, fertilization and other parameters).

SECTION III

- Terms, categories and classes of soil and irrigation water are explained as used in the characterization and recommendations produced for each individual irrigation district. Explanations and examples are also provided for crop water requirements and leaching requirements.

- <https://www.ead.gov.ae/storage/soil%20Salinity%20low%20res%20English.pdf>



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SOIL SALINITY MANAGEMENT PLAN- SECTION I

1. **A long-term policy** should match good quality water resources to the best available soils;
2. **Providing incentives** to abandon locations with highly saline water and/or soil resources with severe restrictions.
3. **Farm soil survey mapping** and UAESIS data from the Soil Map of the Emirate of Abu Dhabi should be leveraged as much as possible to shape future regional agricultural policies.
 - Conducting rural planning reviews to determine if good soil resources match good water resources and vice versa.
 - Reviewing the suitability of locations with highly saline water and/or soil resources with severe restrictions.
 - If practical, reviewing the possibility of relocating agricultural properties and businesses.
4. **scientific approaches** should be enlisted to improve the reasonable use of soil and water resources: applying water in appropriate quantities according to crop water requirements and leaching needs.
5. **Management recommendations** issued to control salinity and alkalinity need to deal with the principal factors influencing salinity: precipitation, leaching, ascending capillary action of dissolved salts, irrigation management and impermeable layers.

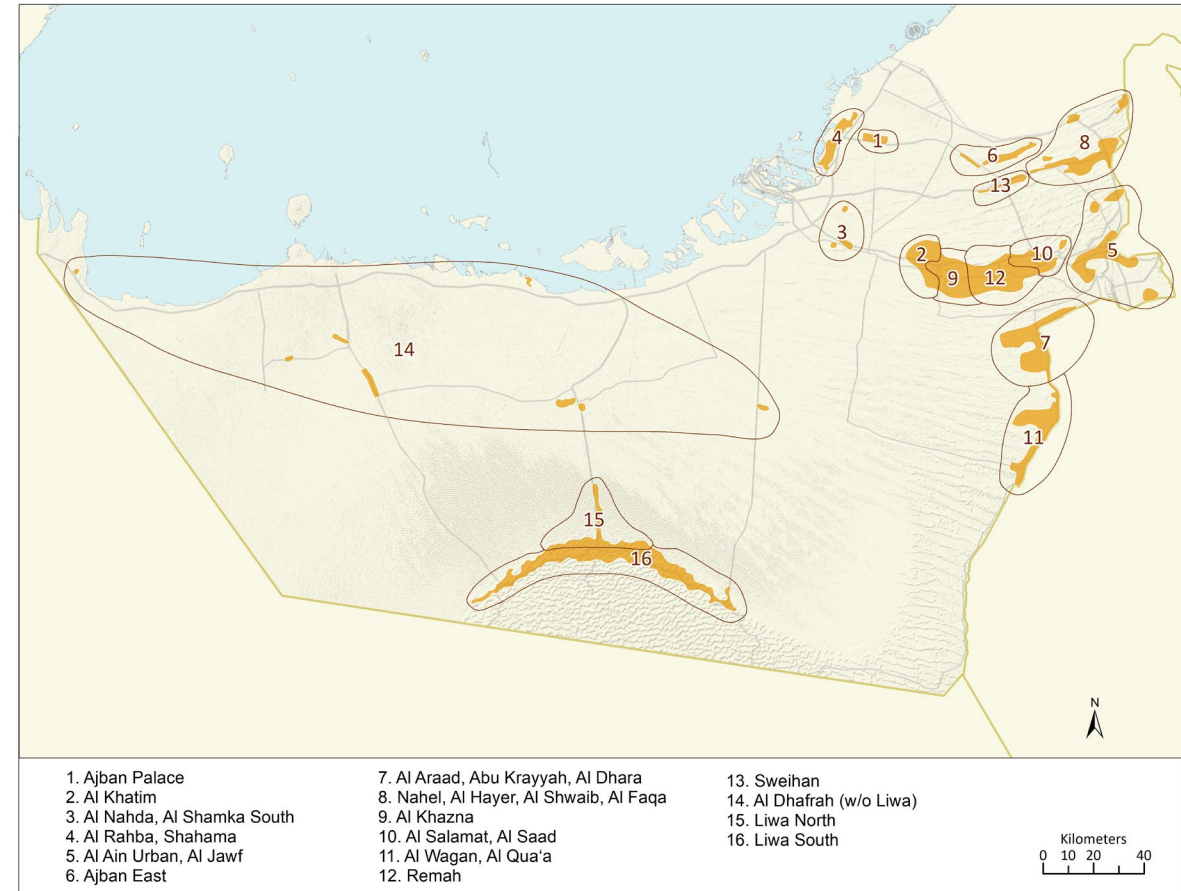


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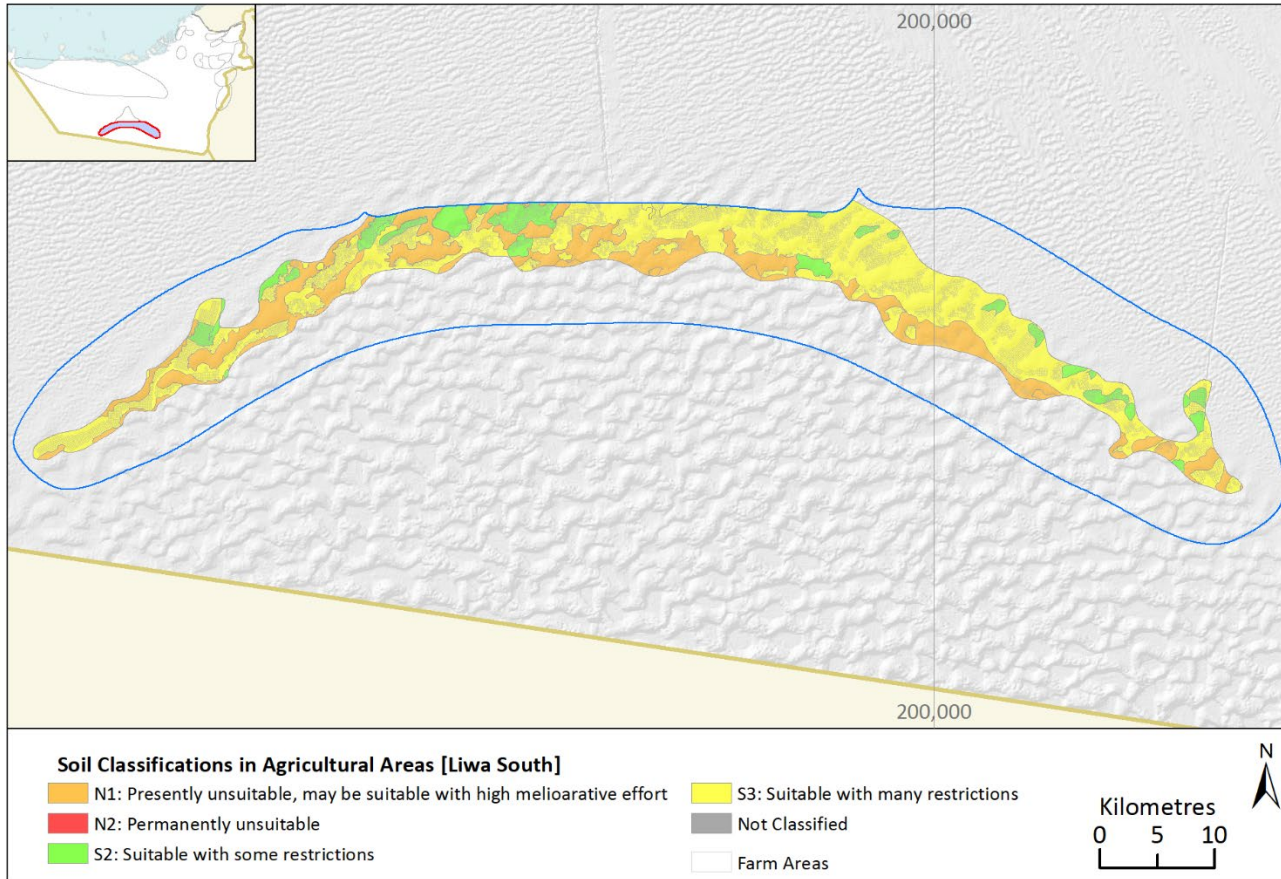
SOIL SALINITY MANAGEMENT PLAN- SECTION II

- The agricultural area was divided into 16 irrigation districts.
- Specific restrictions and recommendations for each irrigation district regarding to:
 - Soil,
 - Irrigation,
 - Salinity management.



SOIL SALINITY MANAGEMENT PLAN- SECTION II

Specific Recommendations For Irrigation Districts



Liwa South



SOIL SALINITY MANAGEMENT PLAN- SECTION II

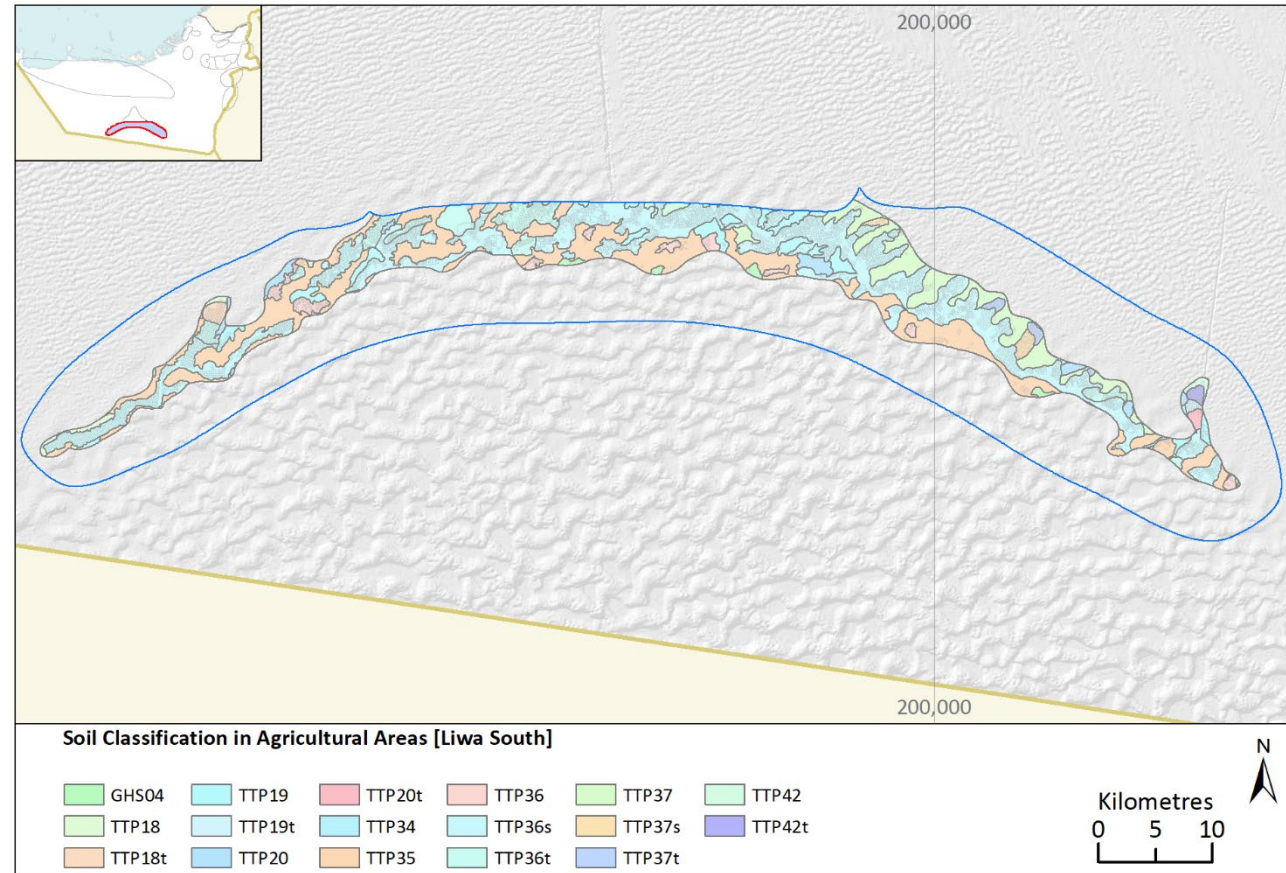
Specific Recommendations For Irrigation Districts

Recommendations for Liwa South



Map Units	TTP36s	TTP36t
Total Farm Area	7,550.7 ha 68%	1,652.2 ha 15%

MAP UNITS	TTP36s	TTP36t
DESCRIPTION	Typic Torripsamments consociation, undulating rises and valleys, agricultural use, high salinity	Typic Torripsamments consociation, undulating rises and valleys, agricultural use, low salinity
IRRIGATION	All-year crops with drip irrigation no more than 32,000 m ³ /ha. Switch from flood irrigation to sprinkler or drip	All-year crops with drip irrigation no more than 32,000 m ³ /ha. Switch from flood irrigation to sprinkler or drip
LEACHING (DESALINATION)	Apply in winter months. Target salinity maximum 1.5 x of irrigation water salinity, apply 27% above crop water requirements for drip and sprinkler irrigation. No extra leaching needed for flood irrigation (high percolation losses)	Apply in winter months. Target salinity maximum 1.5 x of irrigation water salinity, apply 27% above crop water requirements for drip and sprinkler irrigation. No extra leaching needed for flood irrigation (high percolation losses)
CROP SELECTION	Salinity and alkalinity resistant crops: Date palm, Rhodes grass, Alfalfa	Moderately salinity resistant crops, vegetables, except alkalinity susceptible avocado, nuts, citrus
FERTILIZATION	Low fertilizer quantities in frequent doses, organic fertilizer	Low fertilizer quantities in frequent doses, organic fertilizer
DRAINAGE CONTROL	Not needed	Not needed
ALKALINITY CONTROL	Gypsum soil amendments when using desalinated water	Gypsum soil amendments when using desalinated water
MELIORATION MEASURE	Desalination plant, terrain levelling, compost/manure	Compost/manure, terrain levelling



SOIL SALINITY MANAGEMENT PLAN- SECTION III

Terms of Soil, Water & Crop Management

This section provides definitions for terms and expressions considered necessary to understand water and soil conditions. It further presents management recommendations for specific agricultural areas identified in the Emirate of Abu Dhabi.

- Leaching of salinity, Calculating the Leaching Requirement percentage (surface irrigation & drip irrigation)
- Crop selection according to water quality
- Soils with drainage problems, over-irrigation
- Irrigation suitability
- Crop tolerance and yield potential of selected crops as influenced by irrigation water salinity (EC_w) or soil salinity (EC_e) - Water Quality for Agriculture; FAO.

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SOIL SALINITY MANAGEMENT PLAN

Next Steps

- **Develop an executive soil salinity management plan** based on the soil salinity management plan in collaboration with all relevant stakeholders
- **Development of soil protection policy** for the Emirate of Abu Dhabi which will address soil salinity and other pressures on the soil of Abu Dhabi Emirate.
- **Conduct a long-term soil monitoring programme** to report KPIs which are essential for developing a nationwide model for the optimization of available water and soil resources.
- **Manage irrigation as per the recommendations** for each district to reduce soil salinity and maintain a sustainable healthy agricultural soil.



Thank you

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