A PRACTICAL STEP TOWARDS SUSTAINABILITY: DECENTRALISED WASTEWATER MANAGEMENT IN OMAN.

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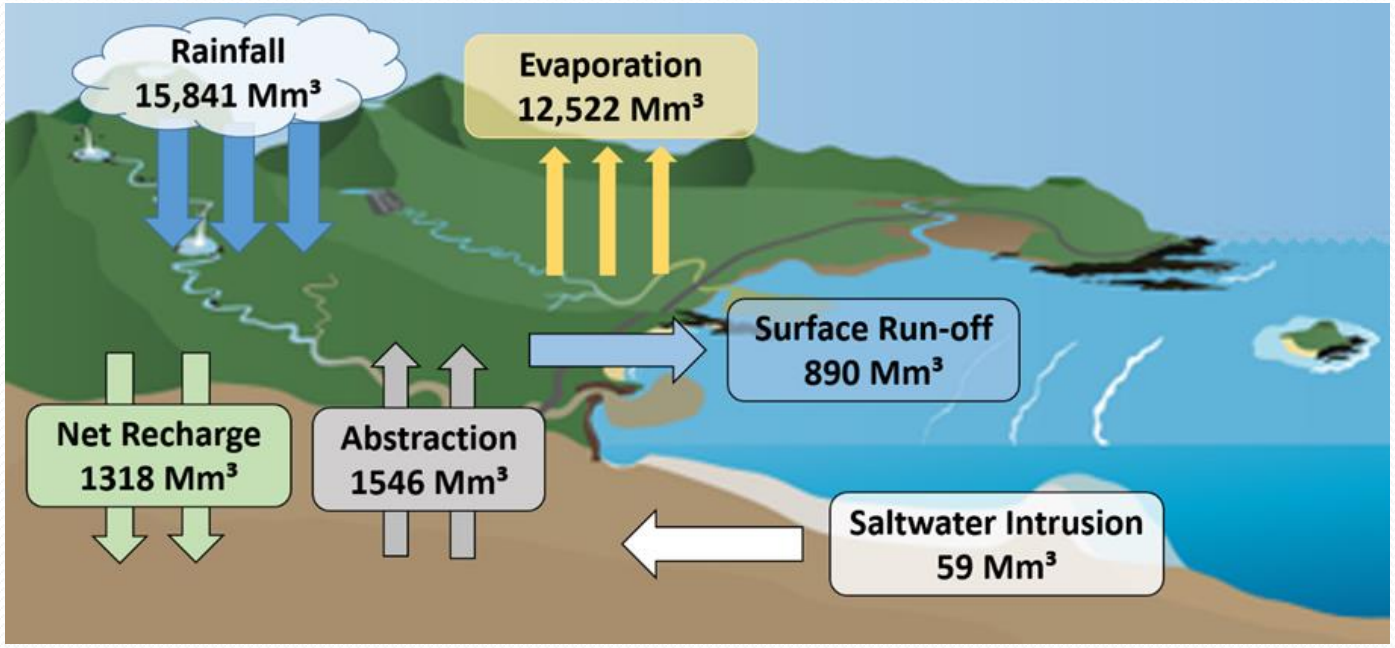
Outline

- **Background**
- **Integrated Wastewater Management Scenarios**
- **Multi-Functional Facility**

Why this is important for Oman?



National demand exceeds resources by (316 Mm^3)

Source: Al-Barwani , A. 2016

An increase in population of 2.4 million by 2040

Source: NCSI, 2015

Regional Municipalities, Haya sign agreement

STRATEGY: As per the deal signed, Haya Water will manage, operate and maintain waste water facilities of the ministry for 5 years

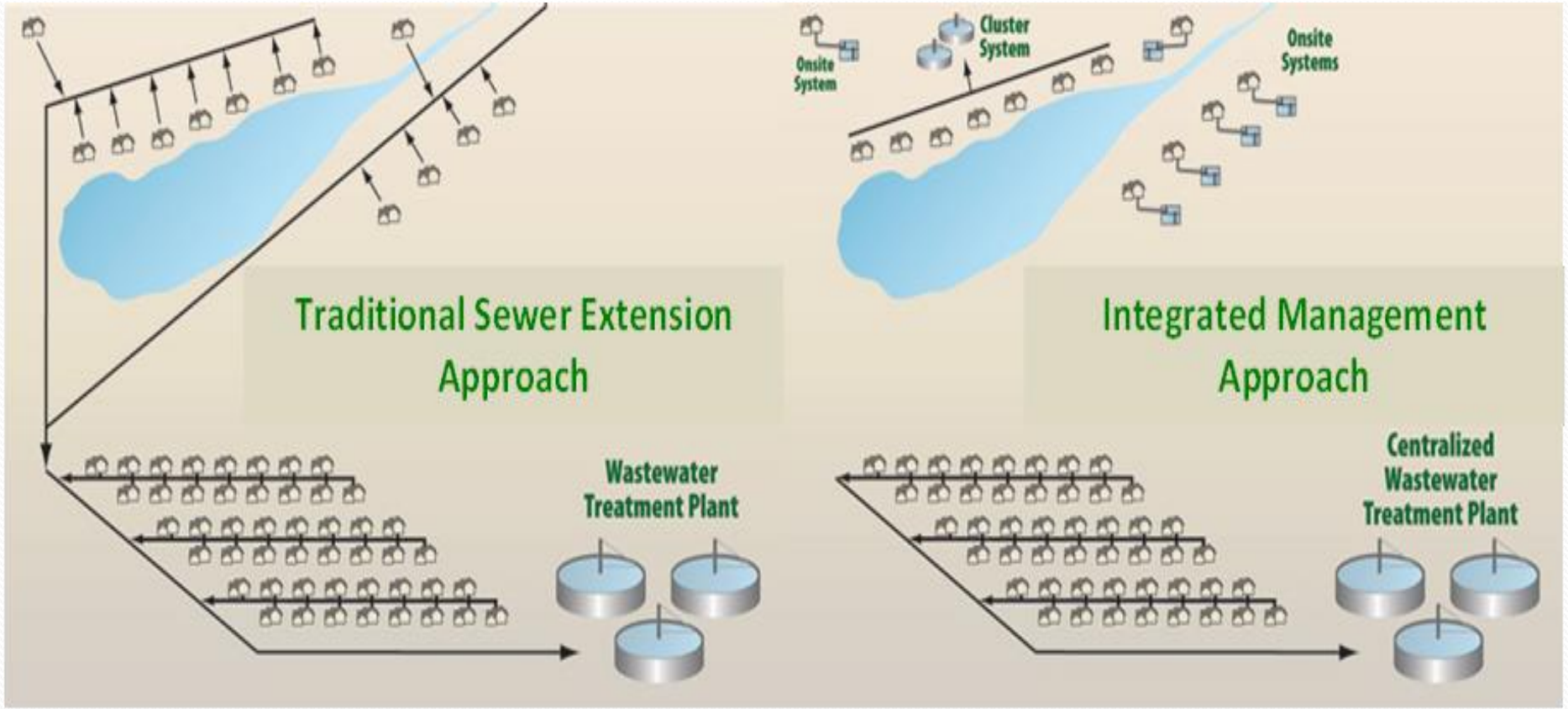
MUSCAT: The Ministry of Regional Municipalities and Water Resources and Haya Water signed yesterday an agreement in which Haya Water will manage, operate and maintain the waste water facilities of the ministry for five years.

The two sides agreed that the management, operation and previously owned by the ministry will be transferred to Haya Waters by developing a national strategy and integrated plan to put the studies, design, construction and development, in addition to the services of supervision, design and operation of the waste water facilities owned by the ministry in all the governorates except the Governorate of the decision of the Council of Ministers.

The agreement was signed by Ahmed bin Mohammed al Shuhi, Minister of Regional Municipalities and Water Resources on behalf of the ministry and by Mohsen bin Mohammed bin Ali al Shaikh, Chairman of Muscat Municipality and Chairman of Haya Waters Board of Directors. — ONA

Source: Oman Observer (16-07-2015):
http://omanobserver.om/full-pages/.

What are the benefits?

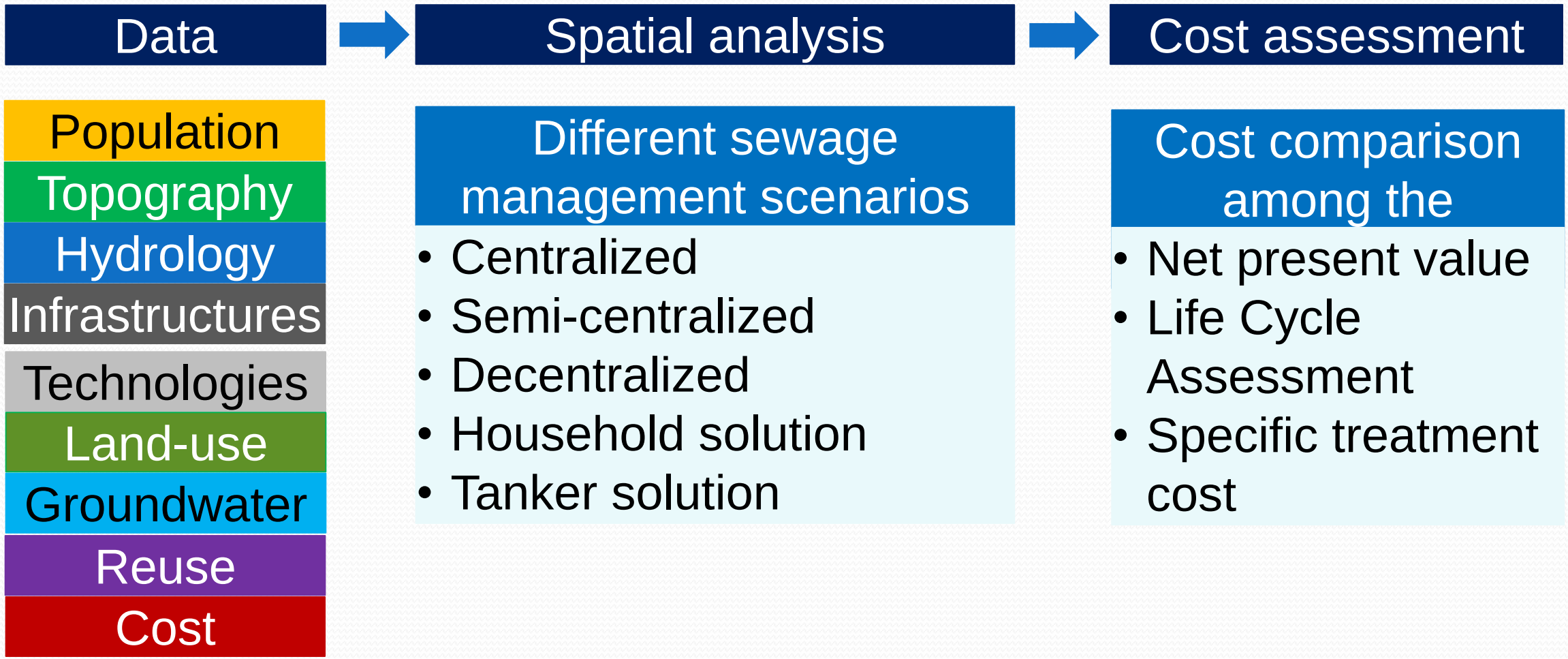


Traditional sewer extension and integrated management approach that uses a variety of system scales to provide treatment that matches the context, based on D'Amato, Striano, Moeller (2011).

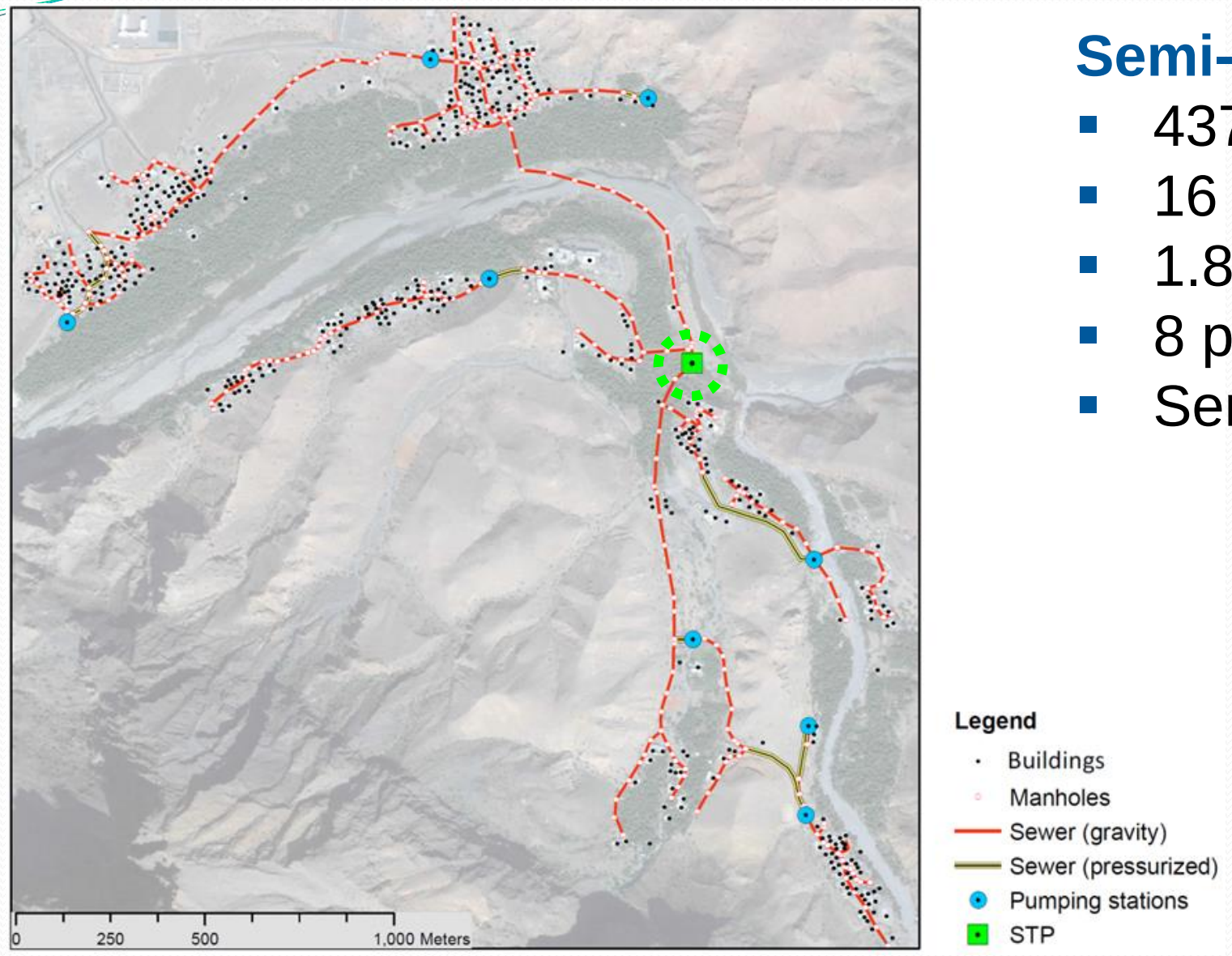
Decentralized Wastewater Management

Treatment plant	ONSITE	CLUSTER	SEMI CENTRAL
Scale of service	Individual building or property	Neighborhood in a community	Small community
Typical person equivalents	4-50	50-500	500-5000

GIS-based decision support tool: Al Mazarih Case Study



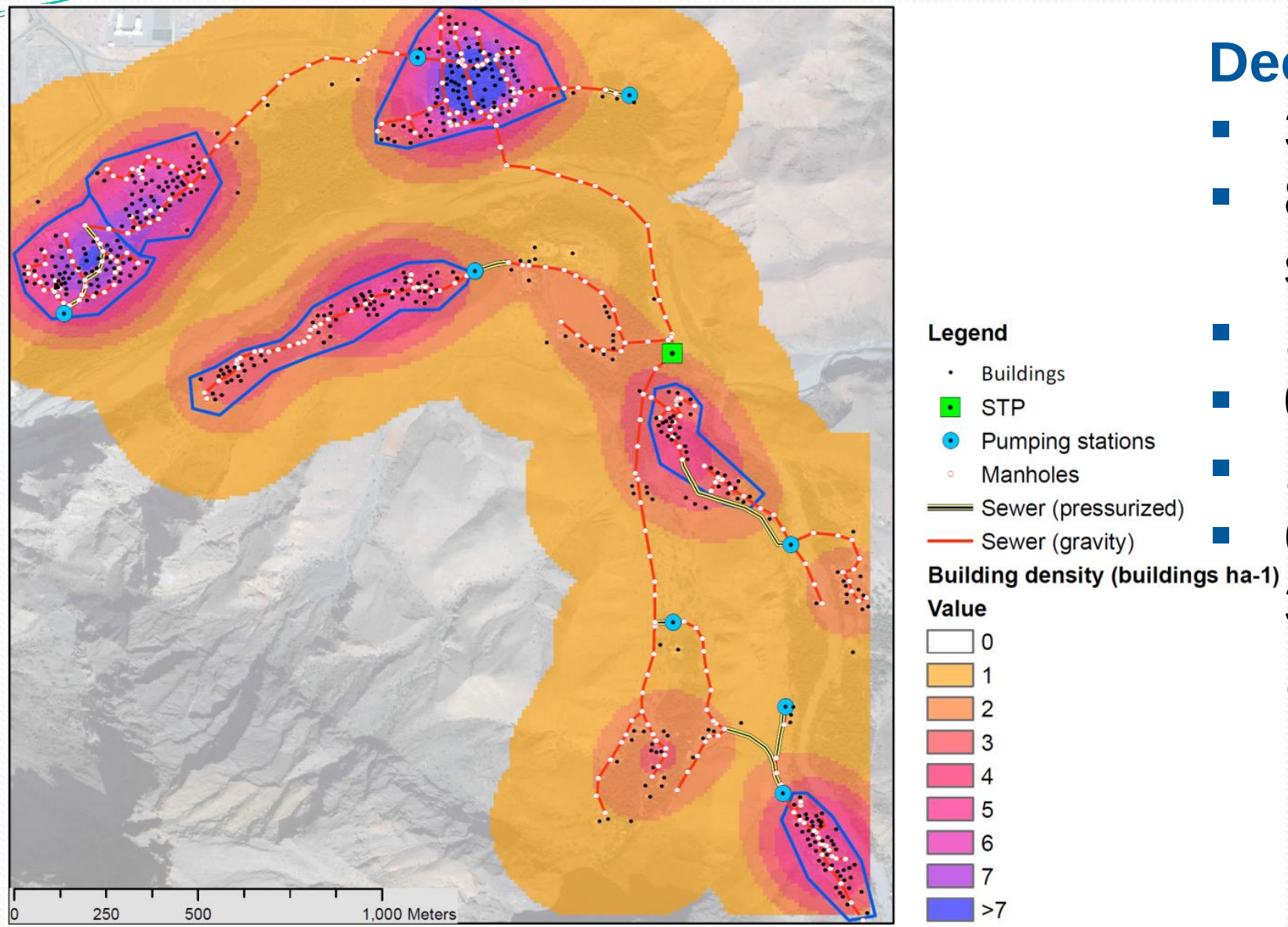
GIS-based decision support tool: Al Mazarih Case Study



Semi-centralized scenario

- 437 connected buildings
- 16 km gravity sewer
- 1.8 km pressurized sewer
- 8 pump stations
- Semi-central STP (2000 PE)

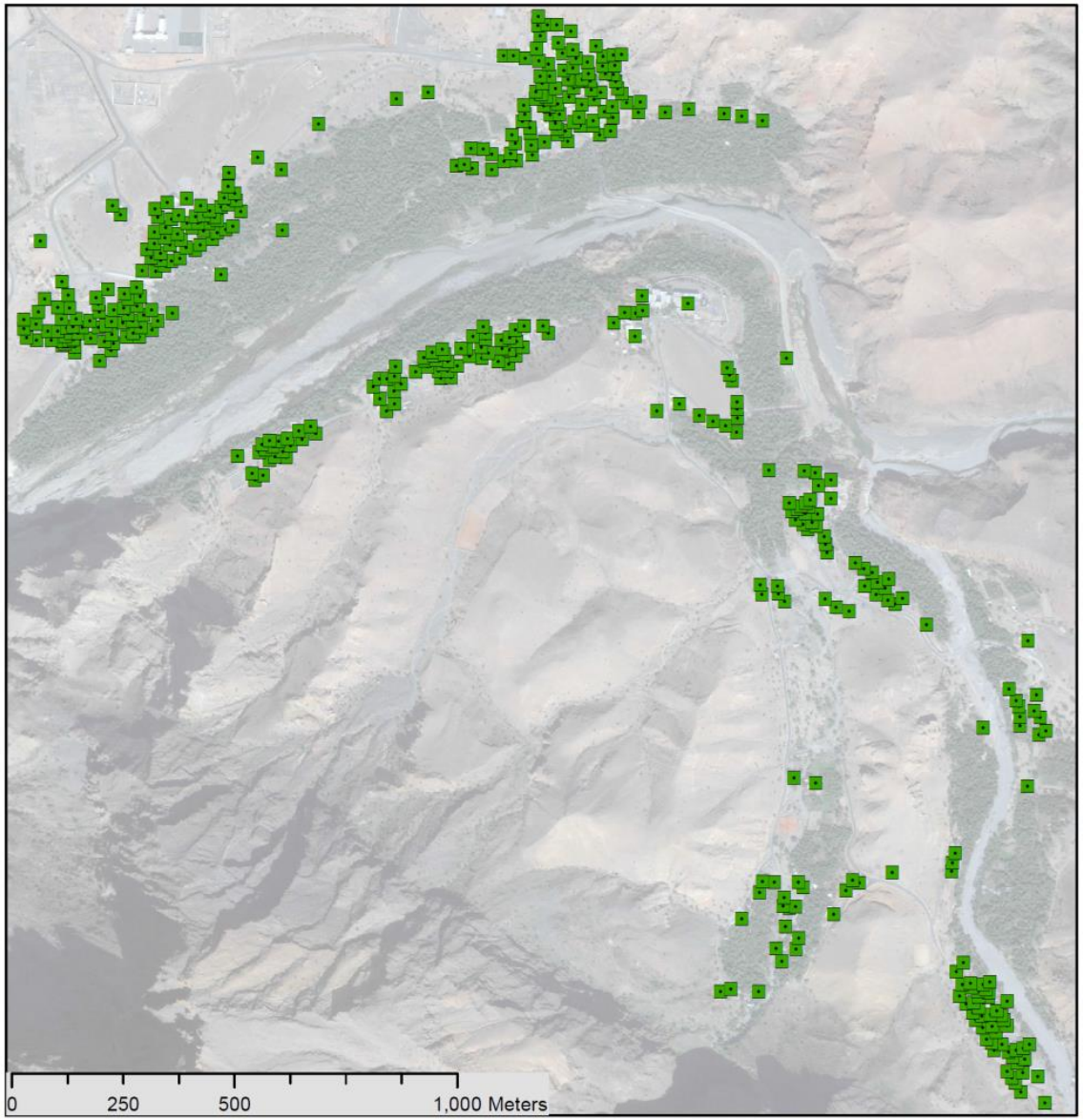
GIS-based decision support tool: Al Mazarih Case Study



Decentralized scenario

- 355 connected buildings
- 82 onsite treatment systems
- 11 km gravity sewer
- 0.3 km pressurized sewer
- 1 pump station
- 6 decentralised STPs for 33 to 94 buildings (c.a. 150 to 500 PE)

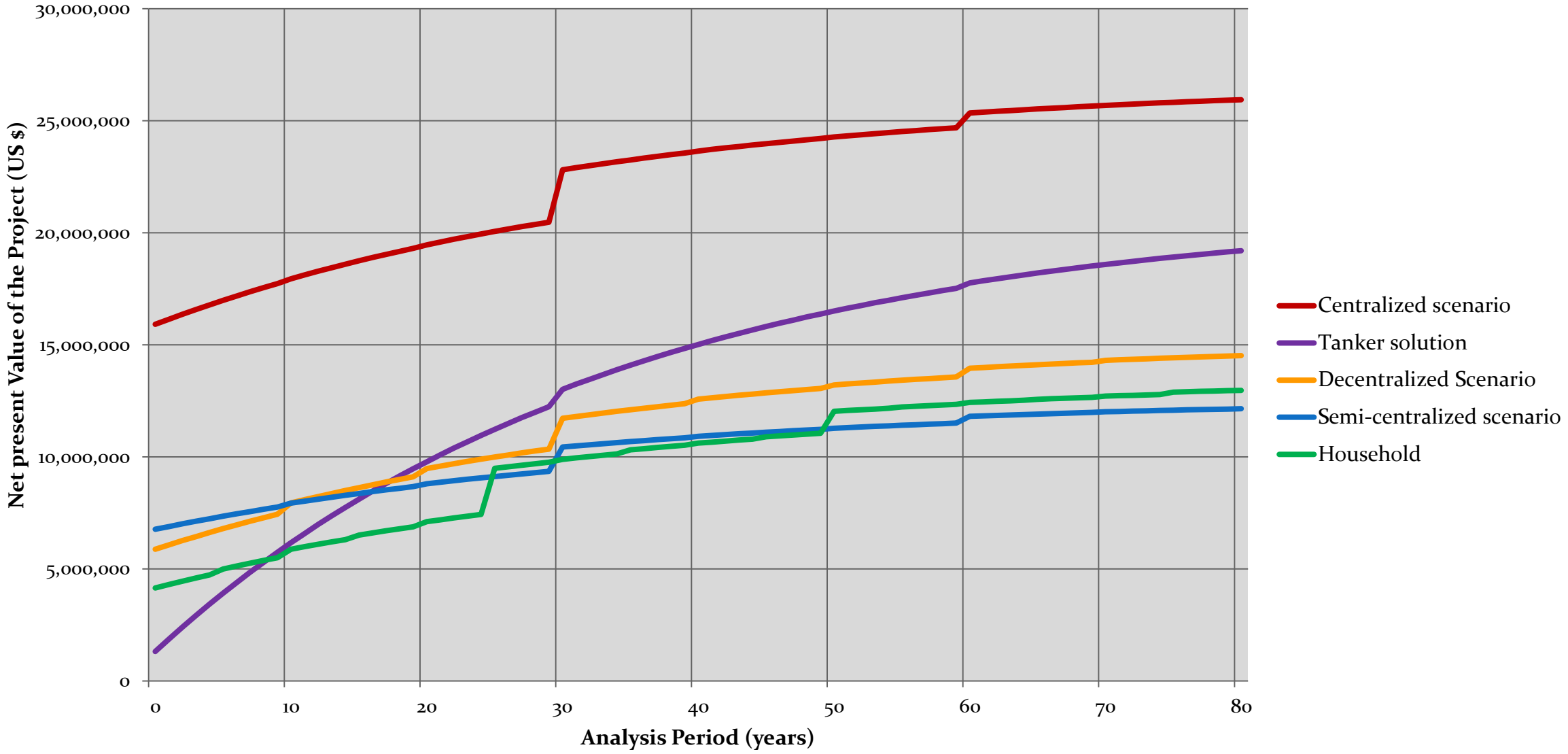
GIS-based decision support tool: Al Mazarih Case Study



Household solution

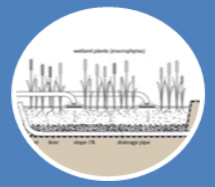
- 437 buildings
- Treatment System Size: 6 PE
- Treatment Technology: SBR

GIS-based decision support tool: Al Mazarih Case Study



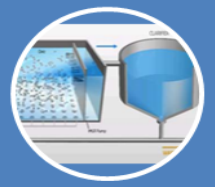
How to Choose the Right Technology?

Technologies For Decentralized Wastewater Treatment



Eco-Technologies

- Constructed Wetlands
- Sand and Soil Filters
- Purification Ponds



Activated Sludge Technologies

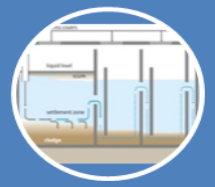
- Activated Sludge Process with Sludge Recirculation
- Activated Sludge Process in Sequencing Batch Reactor (SBR)

Biofilm Technologies

- Trickling Filter
- Fixed Bed Reactor
- Aerated Fixed Bed Reactor
- Fluidized Bed reactor
- Rotating Disk Biofilm Reactor

Membrane Technologies

- Reverse Osmosis
- Nanofiltration
- Ultrafilteration
- Microfiltration

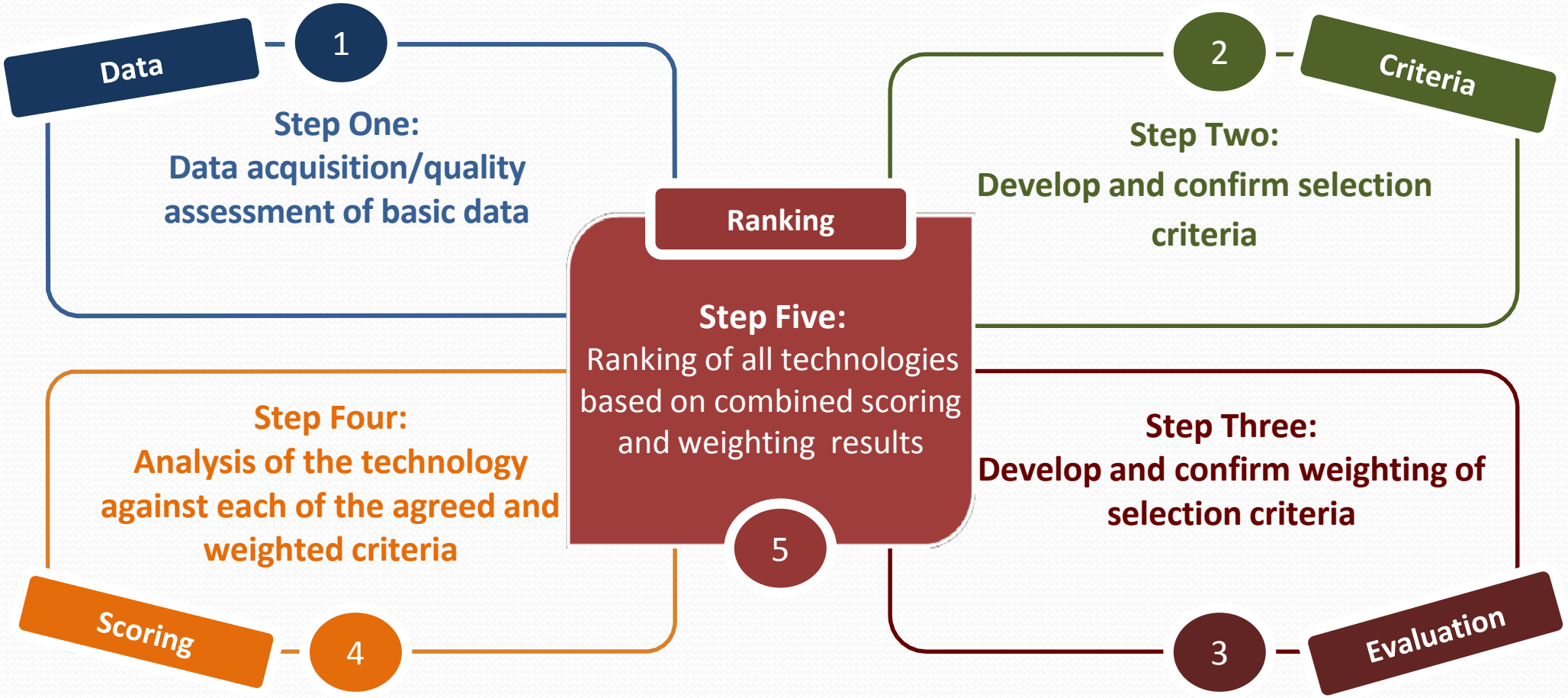


Anaerobic Technologies

- Upflow Anaerobic Sludge Blanket (UASB)
- Anaerobic Fixed Bed Reactor
- Anaerobic Baffled Reactor (ABR)

Techniques / processes

How to Choose the Right Technology?



How to Choose the Right Technology?

Data

1

Step One:
Data acquisition/quality assessment of basic data

Step Three:
Develop and confirm weighting of selection criteria

3

Evaluation

Does this help in choosing the appropriate treatment systems??

Multifunctional R&D facility (National Platform)

Key Technologies

Research & Development

Testing and Certifications

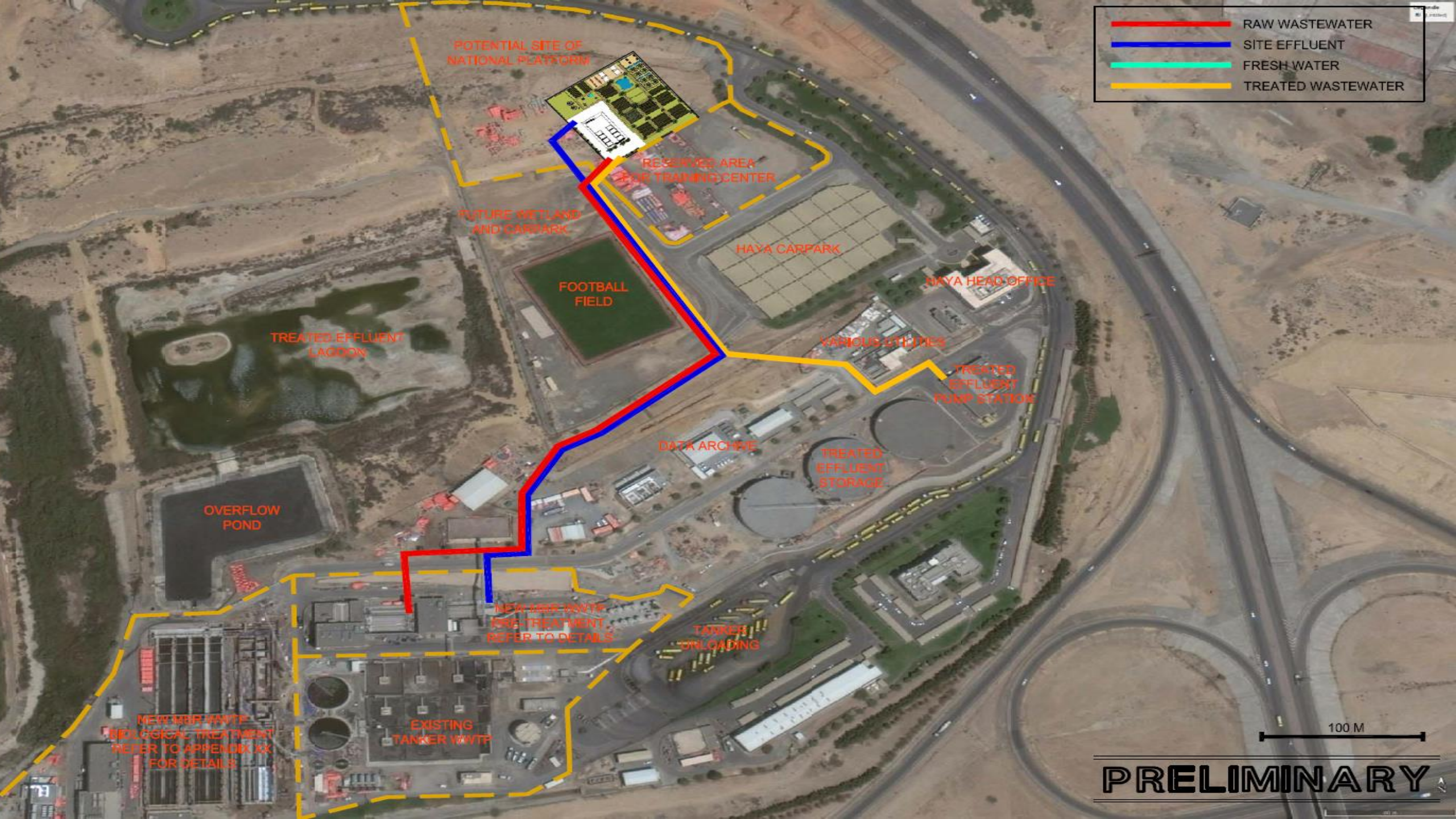
Dry Demonstration

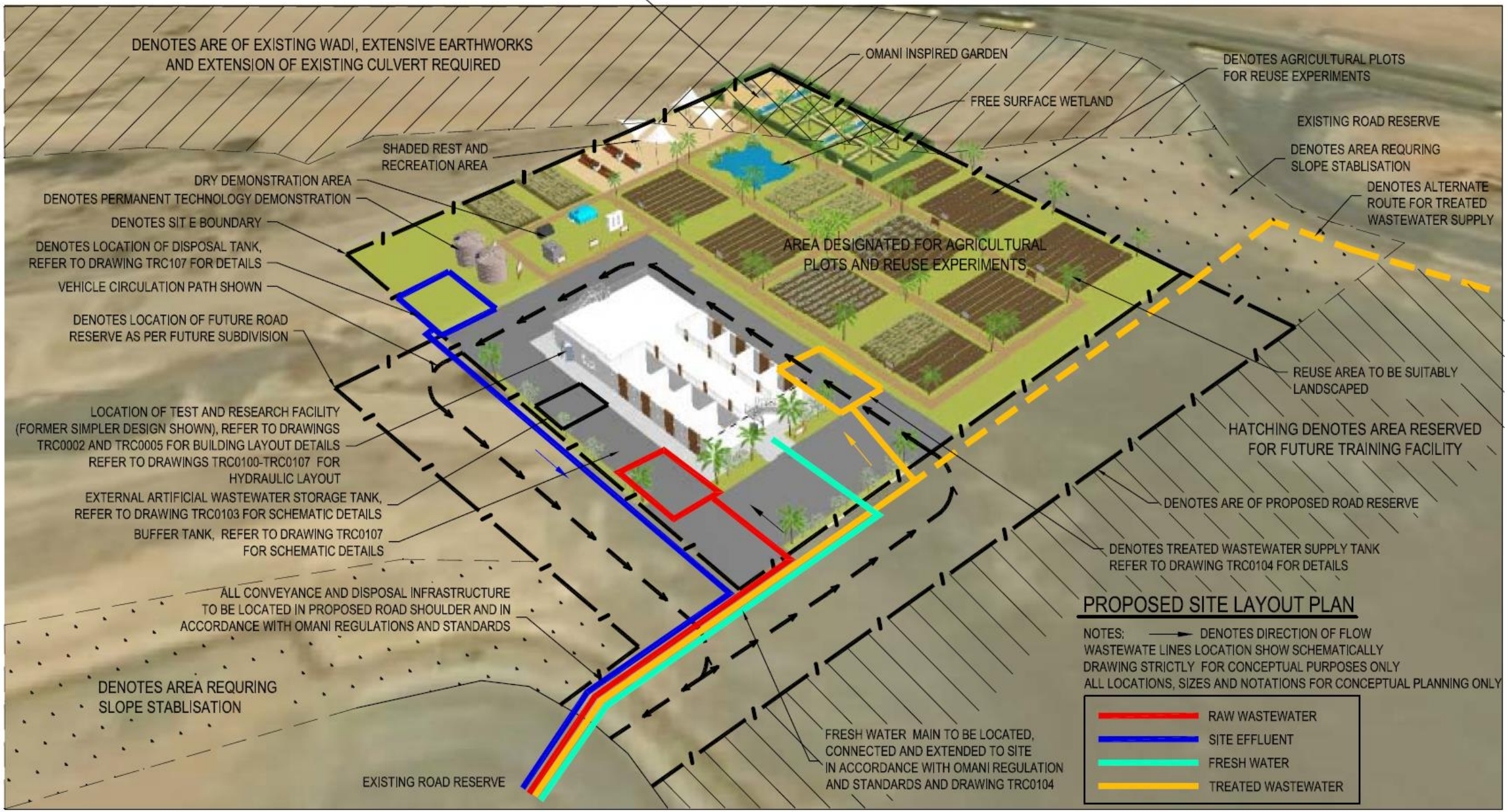
Training & Education

Agricultural Reuse (Water & Nutrients Recycle)

Health and Safety

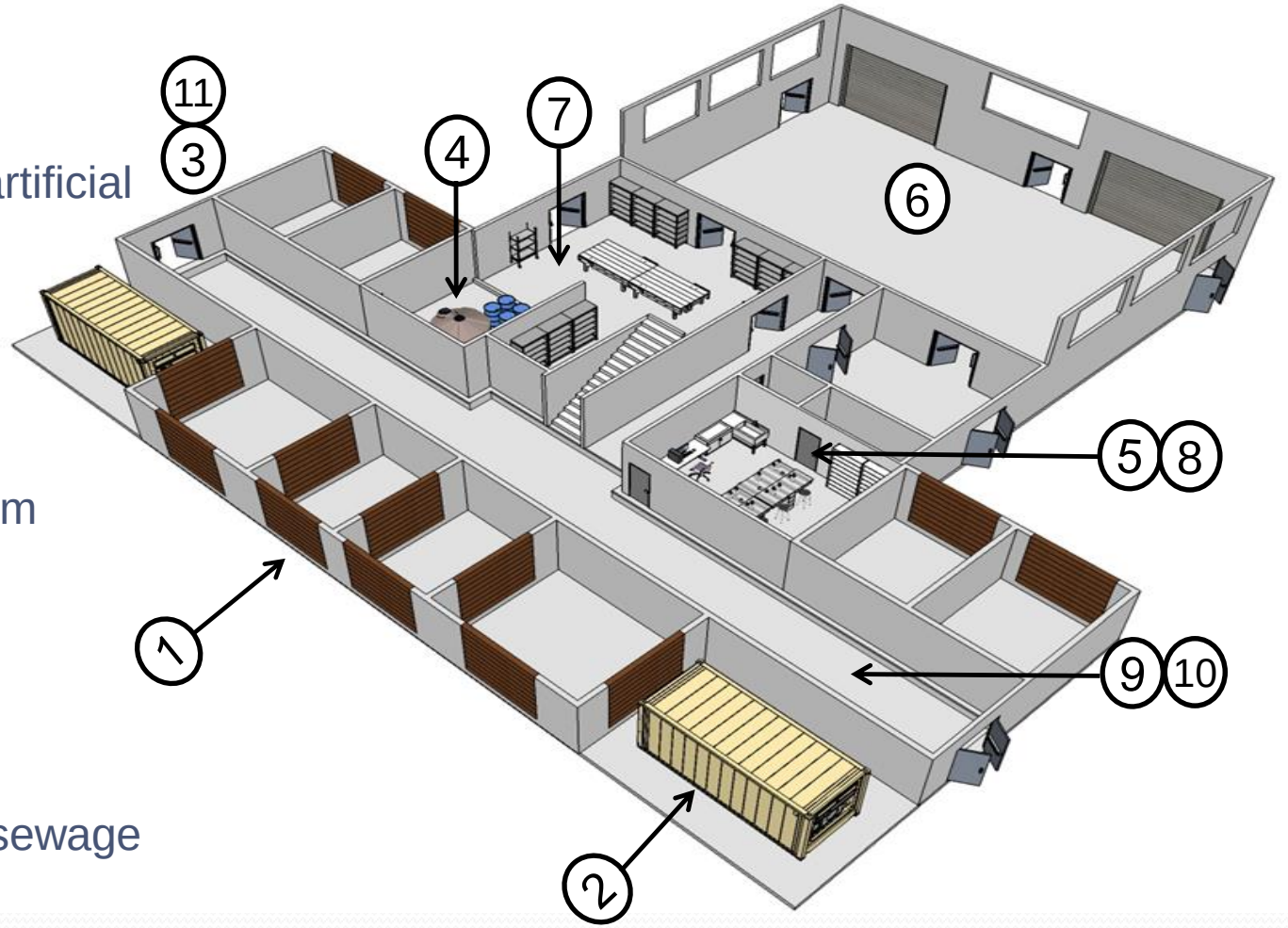
Public awareness and outreach


RAW WASTEWATER
SITE EFFLUENT
FRESH WATER
TREATED WASTEWATER
POTENTIAL SITE OF NATIONAL PLATFORM
RESERVED AREA FOR TRAINING CENTER
FUTURE WETLAND AND CARPARK
HAYA CARPARK
FOOTBALL FIELD
HAYA HEAD OFFICE
TREATED EFFLUENT LAGOON
VARIOUS UTILITIES
TREATED EFFLUENT PUMP STATION
DATA ARCHIVE
TREATED EFFLUENT STORAGE
OVERFLOW POND
NEW MBR WWTP PRE-TREATMENT REFER TO DETAILS
TANKER UNLOADING
NEW MBR WWTP BIOLOGICAL TREATMENT REFER TO APPENDIX XX FOR DETAILS
EXISTING TANKER WWTP
100 M
PRELIMINARY

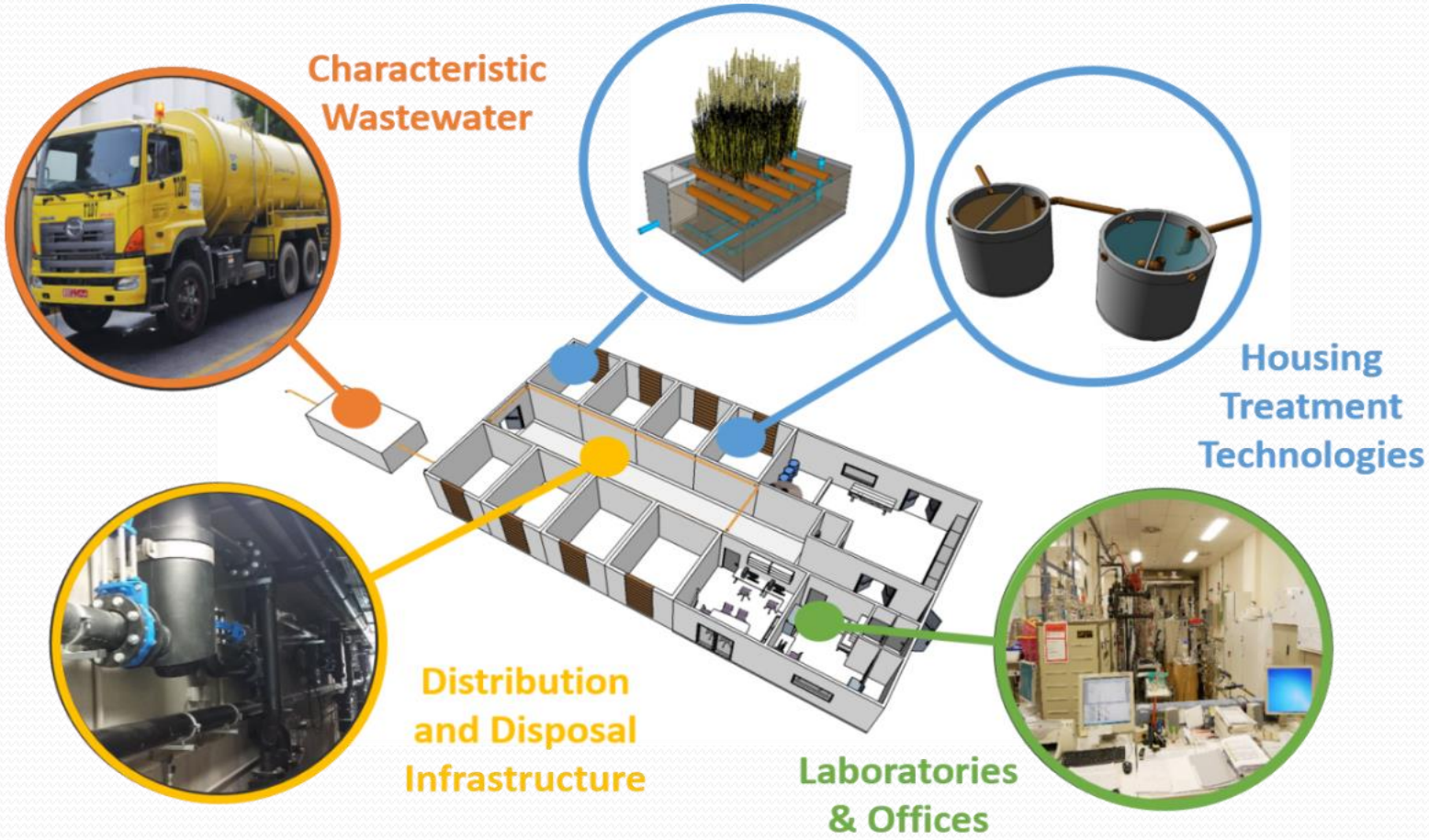

HATCHED AREA TO BE ABLE TO RELOCATE
IN ACCORDANCE EARTHWORK REQUIREMENTS
DENOTES ARE OF EXISTING WADI, EXTENSIVE EARTHWORKS
AND EXTENSION OF EXISTING CULVERT REQUIRED
OMANI INSPIRED GARDEN
FREE SURFACE WETLAND
DENOTES AGRICULTURAL PLOTS
FOR REUSE EXPERIMENTS
EXISTING ROAD RESERVE
SHADED REST AND
RECREATION AREA
DENOTES AREA REQURING
SLOPE STABLISATION
DENOTES ALTERNATE
ROUTE FOR TREATED
WASTEWATER SUPPLY
DRY DEMONSTRATION AREA
DENOTES PERMANENT TECHNOLOGY DEMONSTRATION
DENOTES SIT E BOUNDARY
DENOTES LOCATION OF DISPOSAL TANK,
REFER TO DRAWING TRC107 FOR DETAILS
VEHICLE CIRCULATION PATH SHOWN
AREA DESIGNATED FOR AGRICULTURAL
PLOTS AND REUSE EXPERIMENTS
DENOTES LOCATION OF FUTURE ROAD
RESERVE AS PER FUTURE SUBDIVISION
REUSE AREA TO BE SUITABLY
LANDSCAPED
LOCATION OF TEST AND RESEARCH FACILITY
(FORMER SIMPLER DESIGN SHOWN), REFER TO DRAWINGS
TRC0002 AND TRC0005 FOR BUILDING LAYOUT DETAILS
REFER TO DRAWINGS TRC0100-TRC0107 FOR
HYDRAULIC LAYOUT
HATCHING DENOTES AREA RESERVED
FOR FUTURE TRAINING FACILITY
EXTERNAL ARTIFICIAL WASTEWATER STORAGE TANK,
REFER TO DRAWING TRC0103 FOR SCHEMATIC DETAILS
DENOTES ARE OF PROPOSED ROAD RESERVE
BUFFER TANK, REFER TO DRAWING TRC0107
FOR SCHEMATIC DETAILS
DENOTES TREATED WASTEWATER SUPPLY TANK
REFER TO DRAWING TRC0104 FOR DETAILS
ALL CONVEYANCE AND DISPOSAL INFRASTRUCTURE
TO BE LOCATED IN PROPOSED ROAD SHOULDER AND IN
ACCORDANCE WITH OMANI REGULATIONS AND STANDARDS
PROPOSED SITE LAYOUT PLAN
NOTES: → DENOTES DIRECTION OF FLOW
WASTEWATE LINES LOCATION SHOW SCHEMATICALLY
DRAWING STRICTLY FOR CONCEPTUAL PURPOSES ONLY
ALL LOCATIONS, SIZES AND NOTATIONS FOR CONCEPTUAL PLANNING ONLY
DENOTES AREA REQURING
SLOPE STABLISATION
FRESH WATER MAIN TO BE LOCATED,
CONNECTED AND EXTENDED TO SITE
IN ACCORDANCE WITH OMANI REGULATION
AND STANDARDS AND DRAWING TRC0104
EXISTING ROAD RESERVE
RAW WASTEWATER
SITE EFFLUENT
FRESH WATER
TREATED WASTEWATER

Multifunctional R&D facility (National Platform)

1. Concrete cased testing boxes (plug and play)
2. Open testing boxes
3. Primary sewage distribution system
4. Mixing and dosing station with secondary artificial sewage distribution line
5. Combined office and meeting space
6. Technical hall
7. Media equipped education and training room
8. SCADA
9. Auto-sampling
10. Service Corridor
11. Numerous treated, untreated and artificial sewage supply and collection tanks



Testing Wastewater Technologies



Potential Reuse Research Topics

Summary

- Facilitate the assessment and pre-selection process of any small and medium STP’s prior to any implementation.
- The assessment results can be most efficiently incorporated into decision-making processes about implementation strategies. This investment-decision will substantially reduce the uncertainty and investment risk.
- Technology development and enhancement infrastructure
- The platform designed to have outreach activities in order to increase community awareness and knowledge about sewage management.

Thanks for your attention

References

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2. D'Amato, V, Elizabeth Striano, and Jeff Moeller (2011), Decentralized Wastewater Management Has Possibilities, PMplus, May 2011, Volume 93, Number 4: *http://webapps.icma.org/pm/9304/public/pmplus1.cfm?title=Decentralized Wastewater Management Has Possibilities&subtitle=Think of it as a community's new sustainability tool.&author=Victor D%27Amato, Elizabeth Strian*

3. National Centre for Statistics and Information's (NCSI). 2015. Report titled 'Population Projection in Sultanate of Oman2015-2040: https://www.ncsi.gov.om/Elibrary/LibraryContentDoc/ben_population%20projections%20In%20Sultanate%20of%20Oman_fa17fe2c-34fe-4d6b-93fd-1f7746e7b23e.pdf