

Abu Dhabi Sewerage Services Company (ADSSC)

The Sustainable Role of Treated Wastewater in the UAE

Presented to

Gulf Wastewater Treatment and Reuse

9 February 2010

The Sustainable Role of Treated Wastewater in the UAE

- ADSSC overview
- TSE in the water cycle
- Demand and supply forecasting and issues [Abu Dhabi]
- Current TSE quality
- 4th Stage treatment
- Institutional issues
- Latest developments
- In a nutshell



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Abu Dhabi Sewerage Services Company

ADSSC Overview

ADSSC

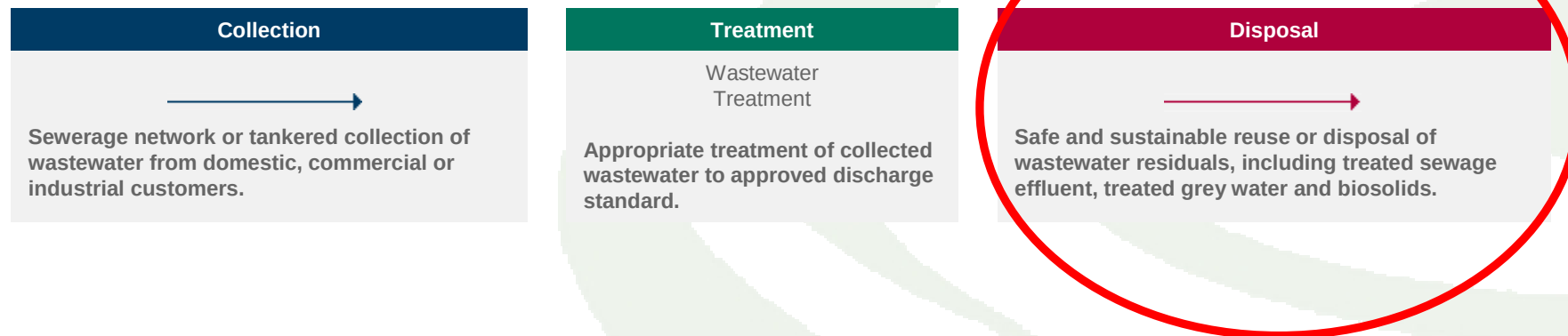
Wastewater

The Wastewater Sector is governed by Law No (17) of 2005 as amended by Law No (18) of 2007.

In addition, Law No (19) of 2007 identifies the regulated activities that are the responsibility of the Bureau. With regard to the Wastewater Sector, the following activities are defined:

- Collection of sewage from premises;
- Treatment and process of sewage and wastewater; and
- Disposal of wastewater and sewage.

These three regulated activities are illustrated below:



Abu Dhabi Law

Law No (17) of 2005 concerning the Establishment of Abu Dhabi Sewerage Services Company

- **Article (6)**

- 4. The Company may, after the approval of the Regulation and Supervision Bureau;
- a) collect fees for providing sewerage services and for the connection of facilities to the sewerage network in the Emirate; and
- b) sell the treated wastewater effluent to the Department (PRFD).

Abu Dhabi Law

Law No (12) of 2008 Amending Some Provisions of Law No (17) of 2005 Concerning the Establishment of Abu Dhabi Sewerage Services Company

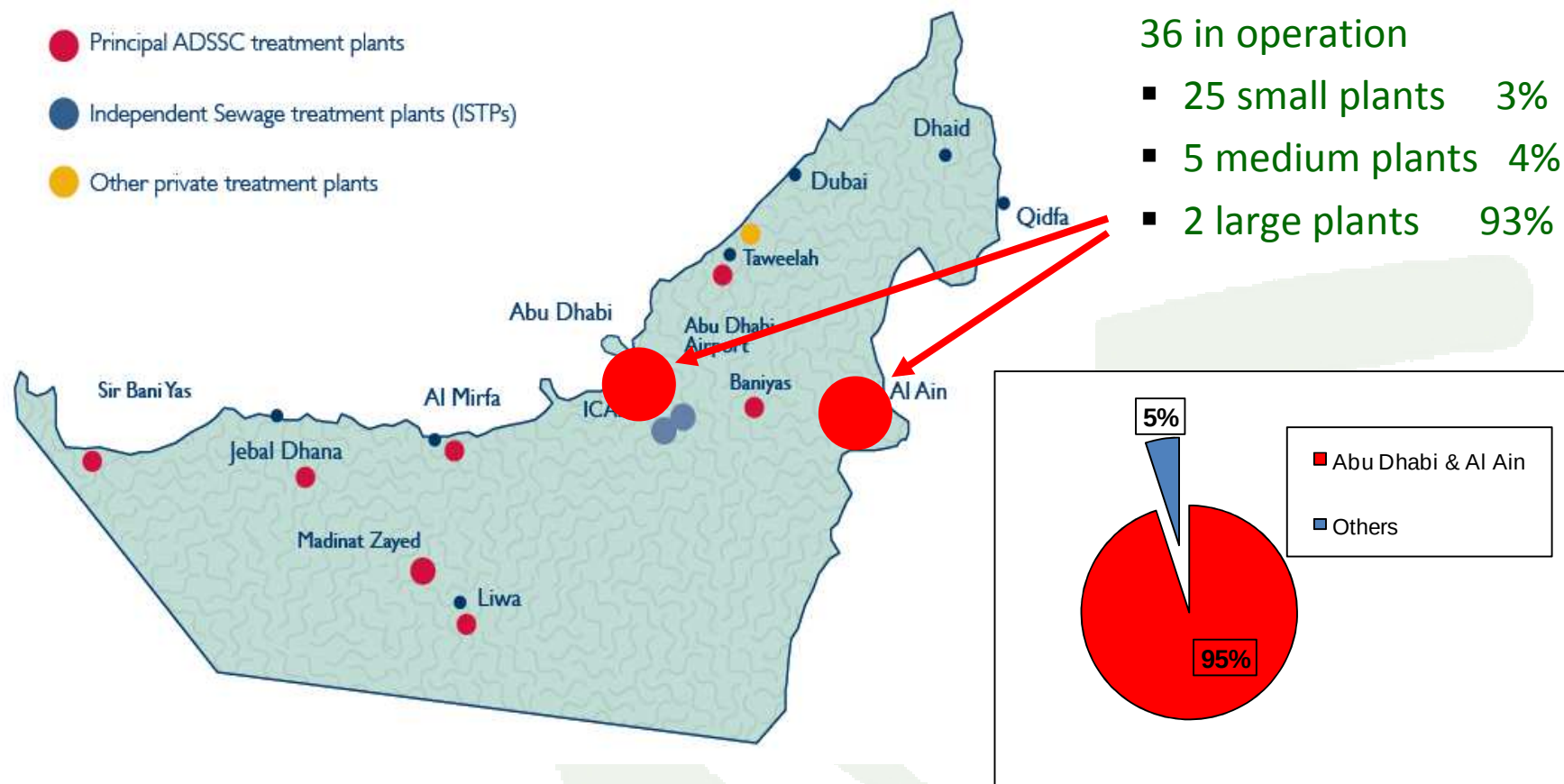
- **Article (1)**

- Article (6) of the Law No (17) of 2005 shall be replaced by the following:
- 4. The Company, after attaining the prior approval of the Regulation and Supervision Bureau, shall be responsible of the following:
 - a) collection of fees for providing sewerage services, including the connection of premises to the sewerage system in the Emirate; and
 - **b) selling of the treated wastewater effluent.**



Sewerage treatment plants in Abu Dhabi - 2007

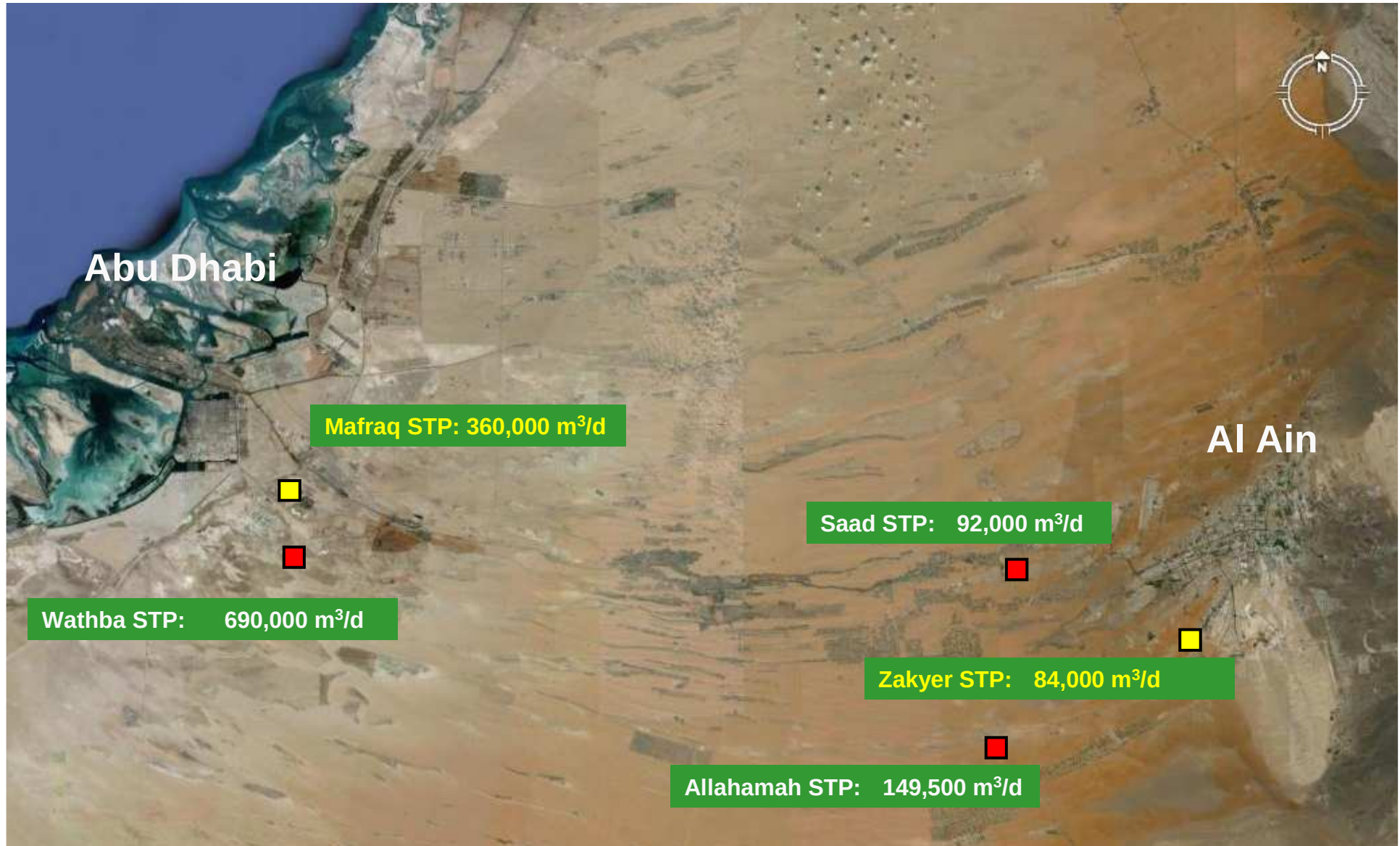
Share of TSE Production



Main Wastewater Treatment Plants



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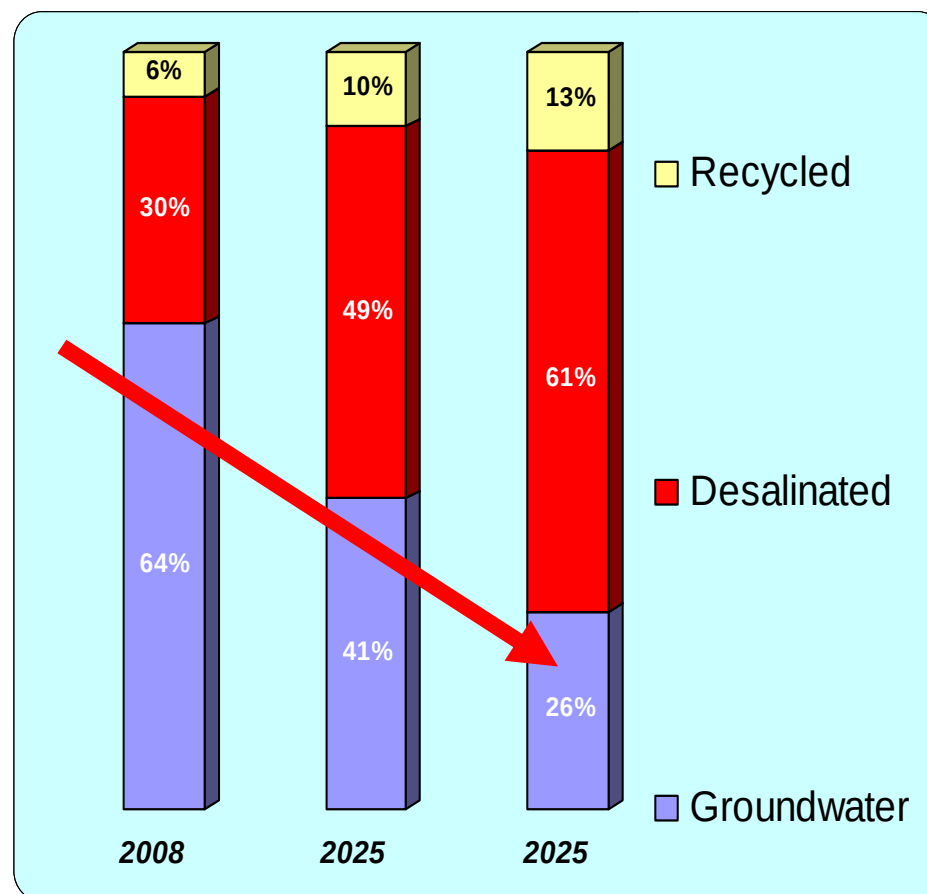
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TSE in the water cycle

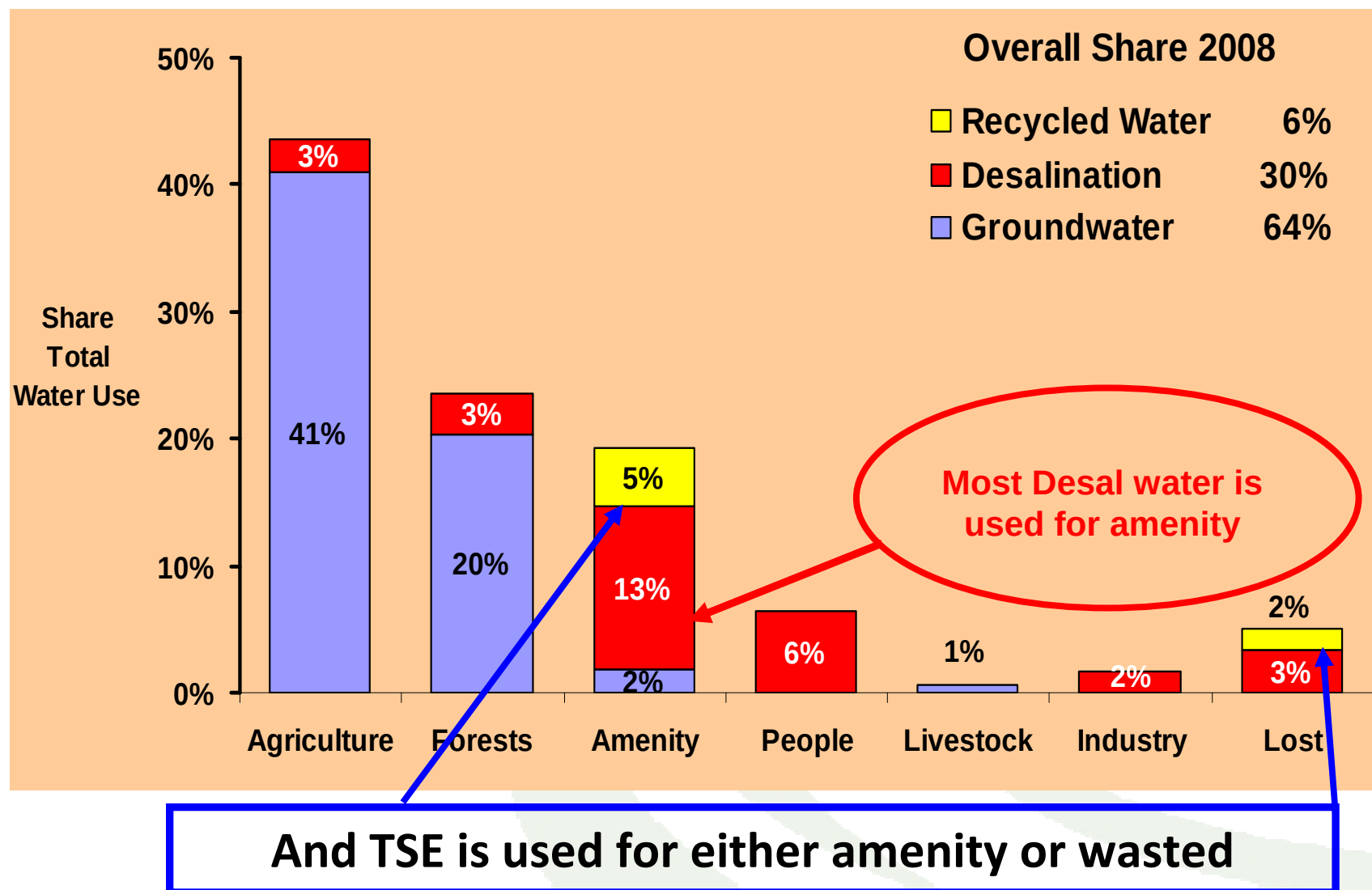


Treated sewage effluent (TSE) is a small share of all water resources

- If fresh groundwater is mined at the rate suggested in the Water Master Plan, most of the fresh groundwater - except in Liwa - will have been effectively exhausted by 2025
- To maintain present irrigated area, desalinated water will have to be used, and used more efficiently
- There will not be enough recycled TSE water to make up the deficit

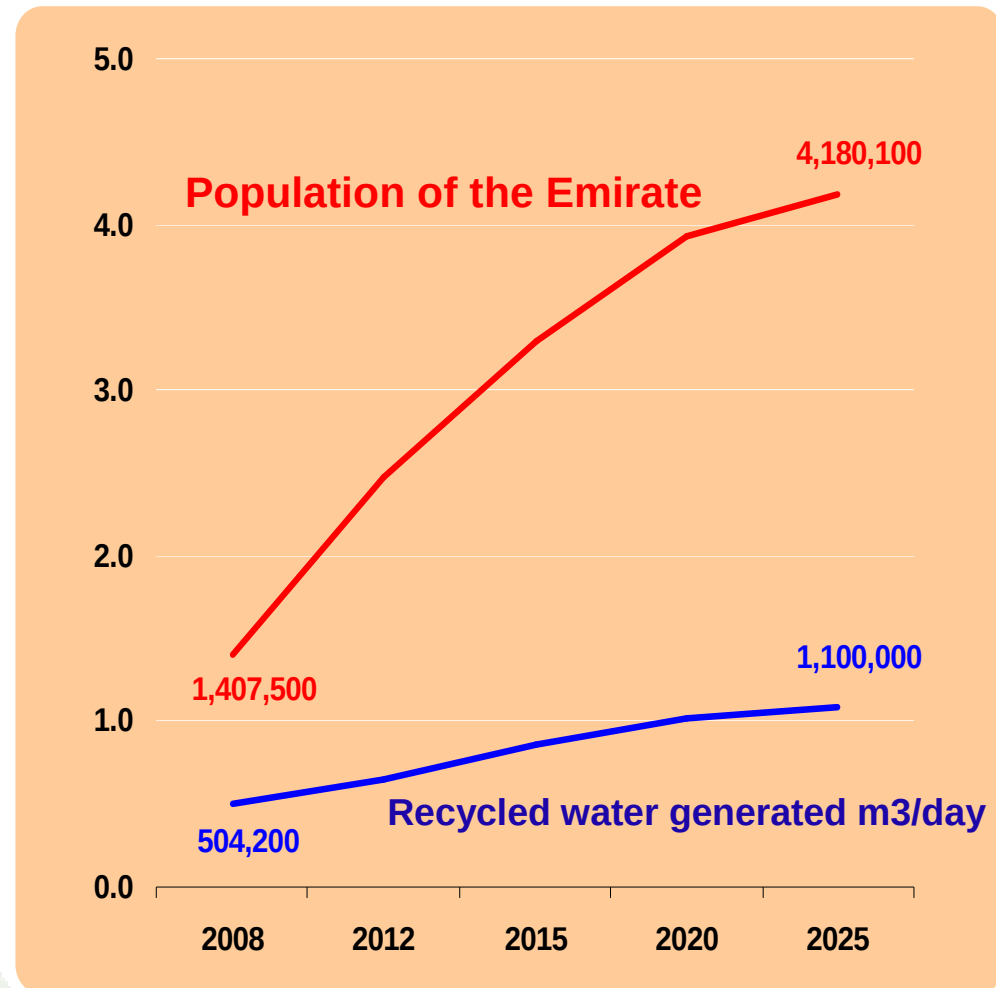


Recycled water has restricted uses in the Emirate's water – uses in 2007



HOW MUCH RECYCLED WATER WILL BE AVAILABLE?

- The volume of recycled water will grow with the population increase
- But better management, plumbing and conservation campaigns will reduce water consumption
- Per capita use in 2008 was 360 litres a day
- It is planned to reduce this to 260 litres per day by 2025
- International best practice is about 200 l/c/d



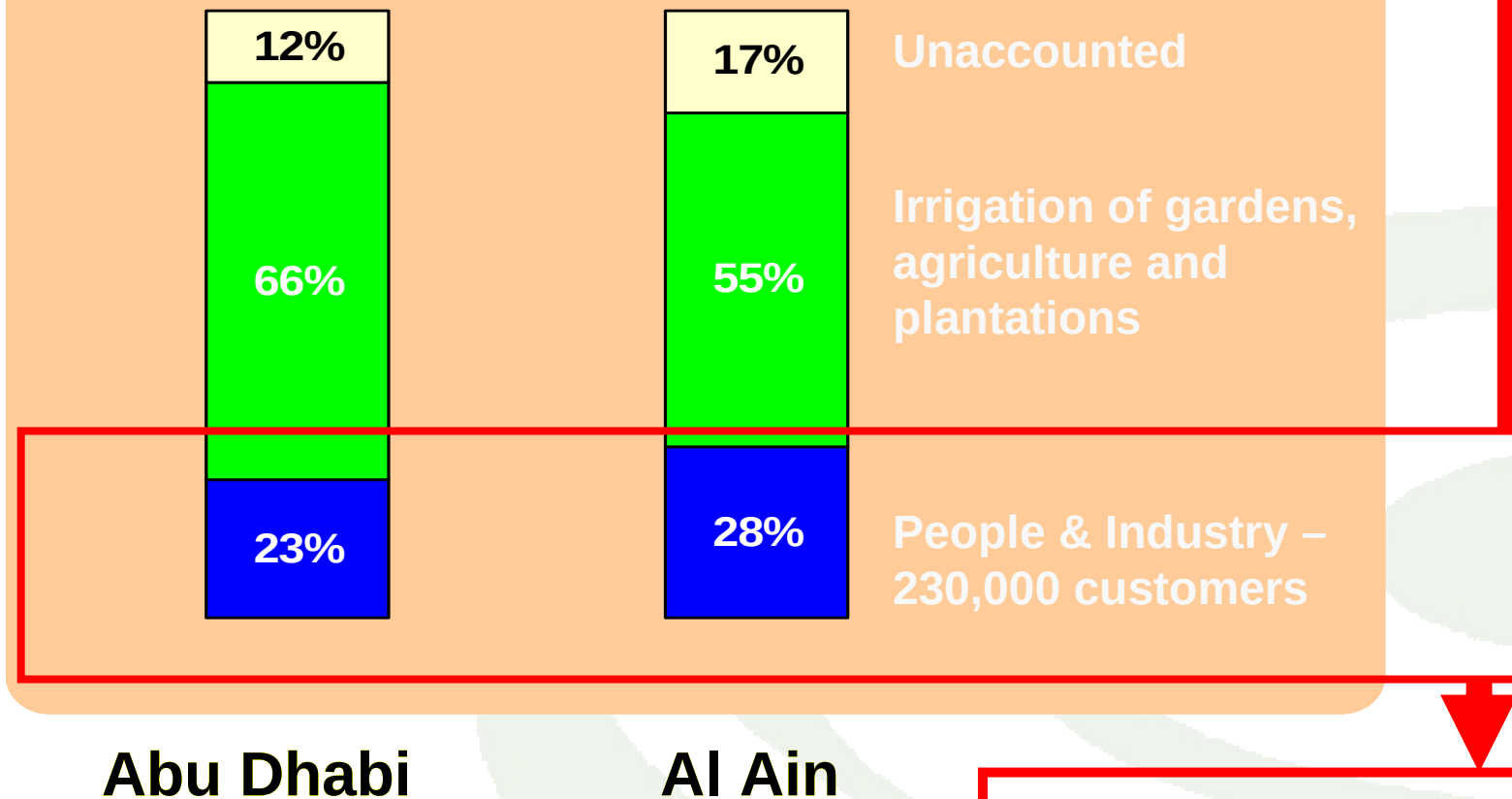


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The Emirate has the highest per capita water use of desalinated water in the world - the amount going to the sewers is small

Per capita consumption is about 200 litres per day

Uses of Desalinated water



Recycled Water



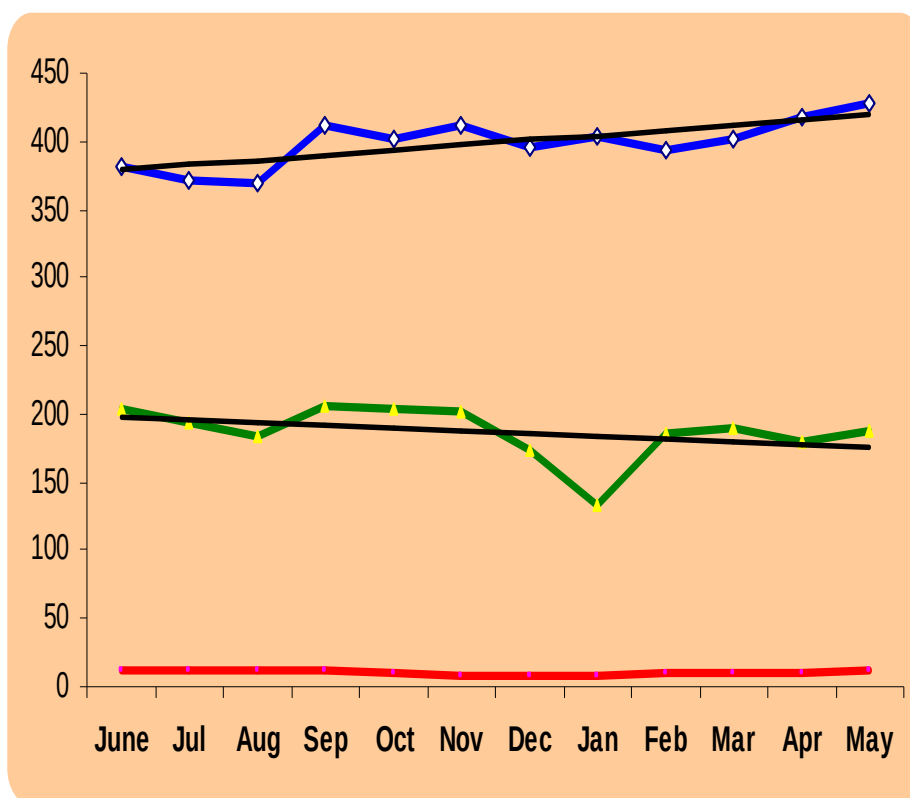
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Abu Dhabi City



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The 200,000 m³/day that is “wasted” in Abu Dhabi will be eliminated by efficiency improvements – it will not be available for irrigation



Total TSE Produced

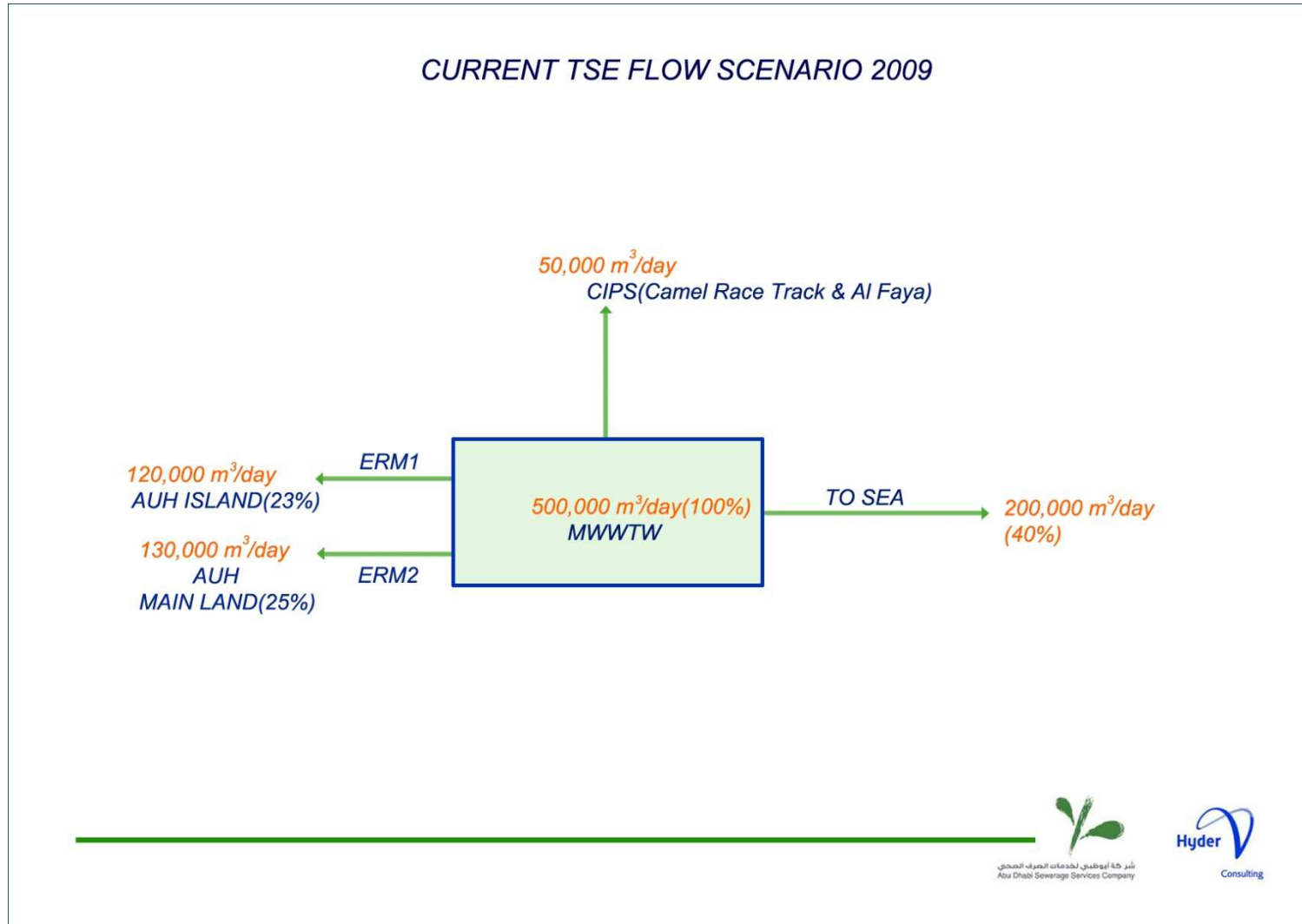
200,000 m³/day to the sea
– “wasted water”

Used by the Parks & Gardens

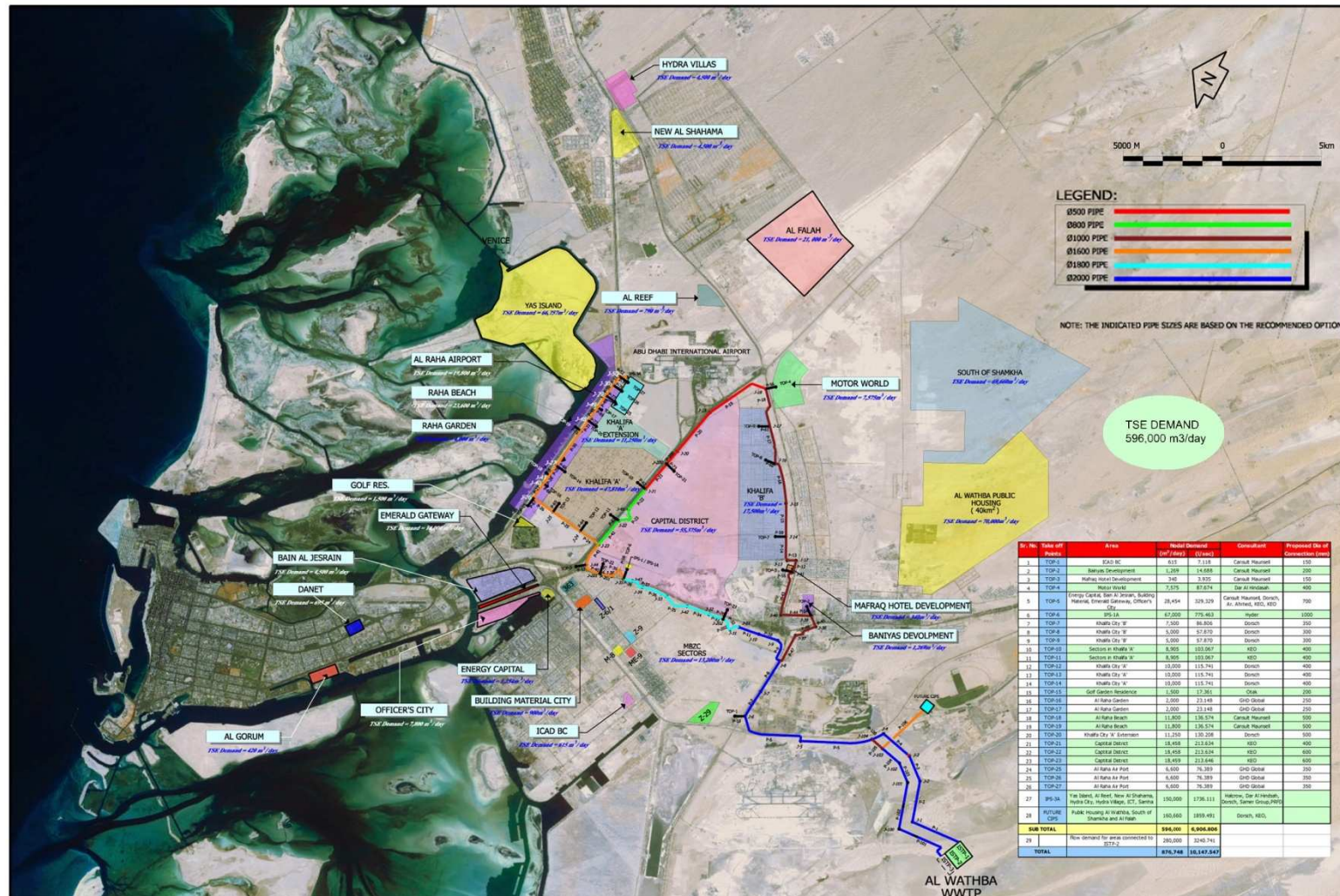
Used in Mafraq internally

Abu Dhabi – Mafraq 2007-08

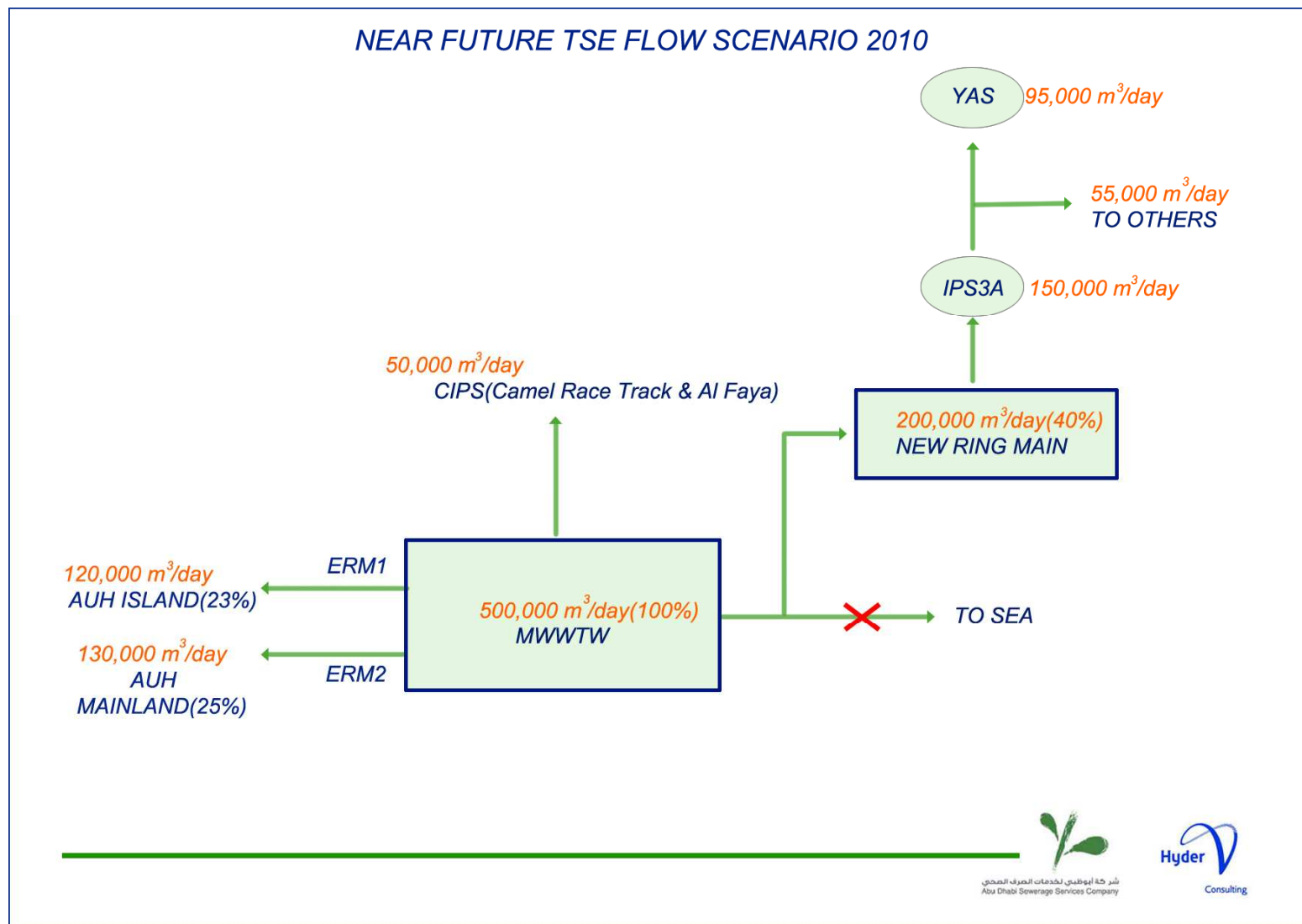
Abu Dhabi City current TSE flow diagram



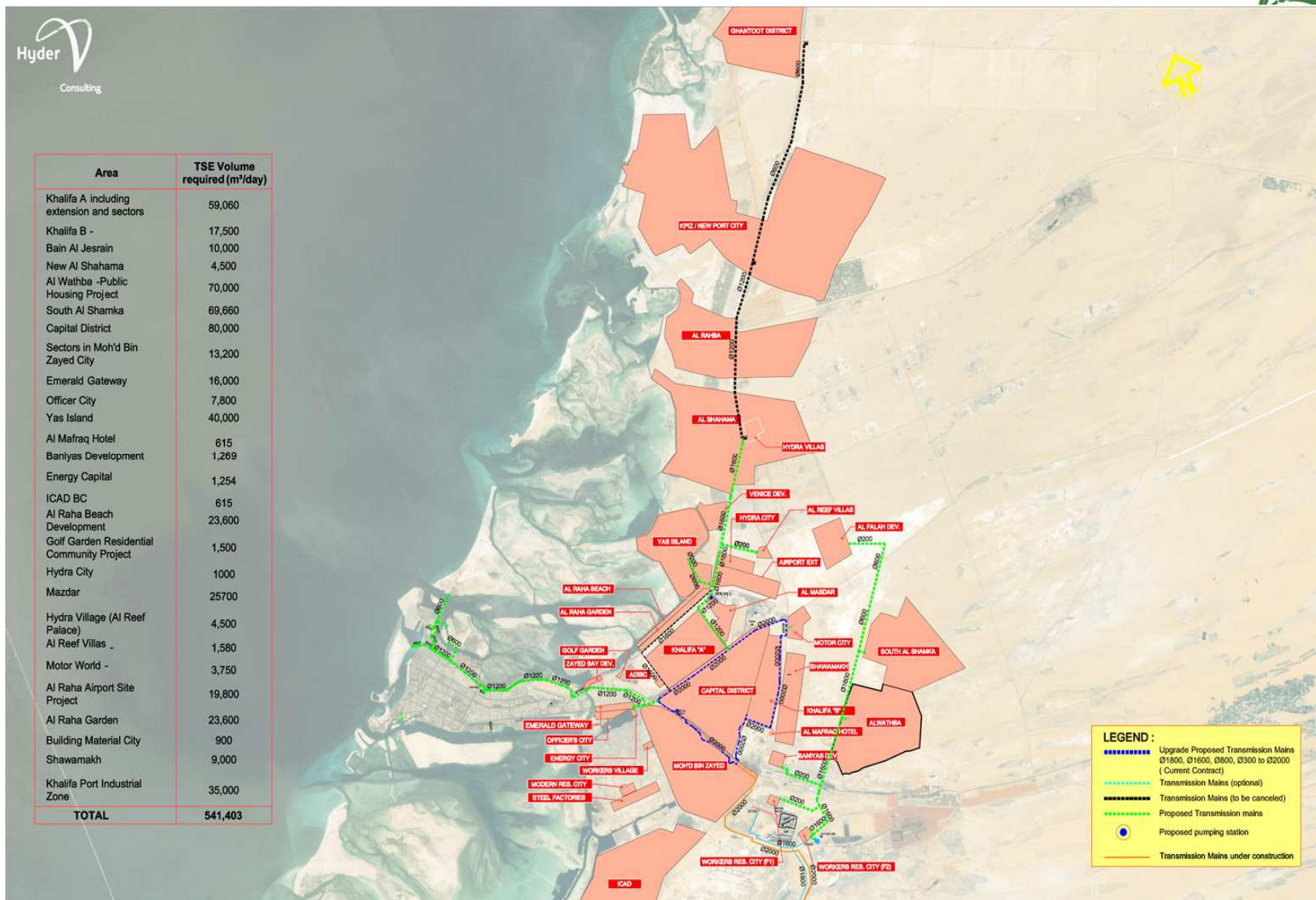
Abu Dhabi City Current and Future TSE Network



Abu Dhabi City future flow diagram



TSE Demands and Availability

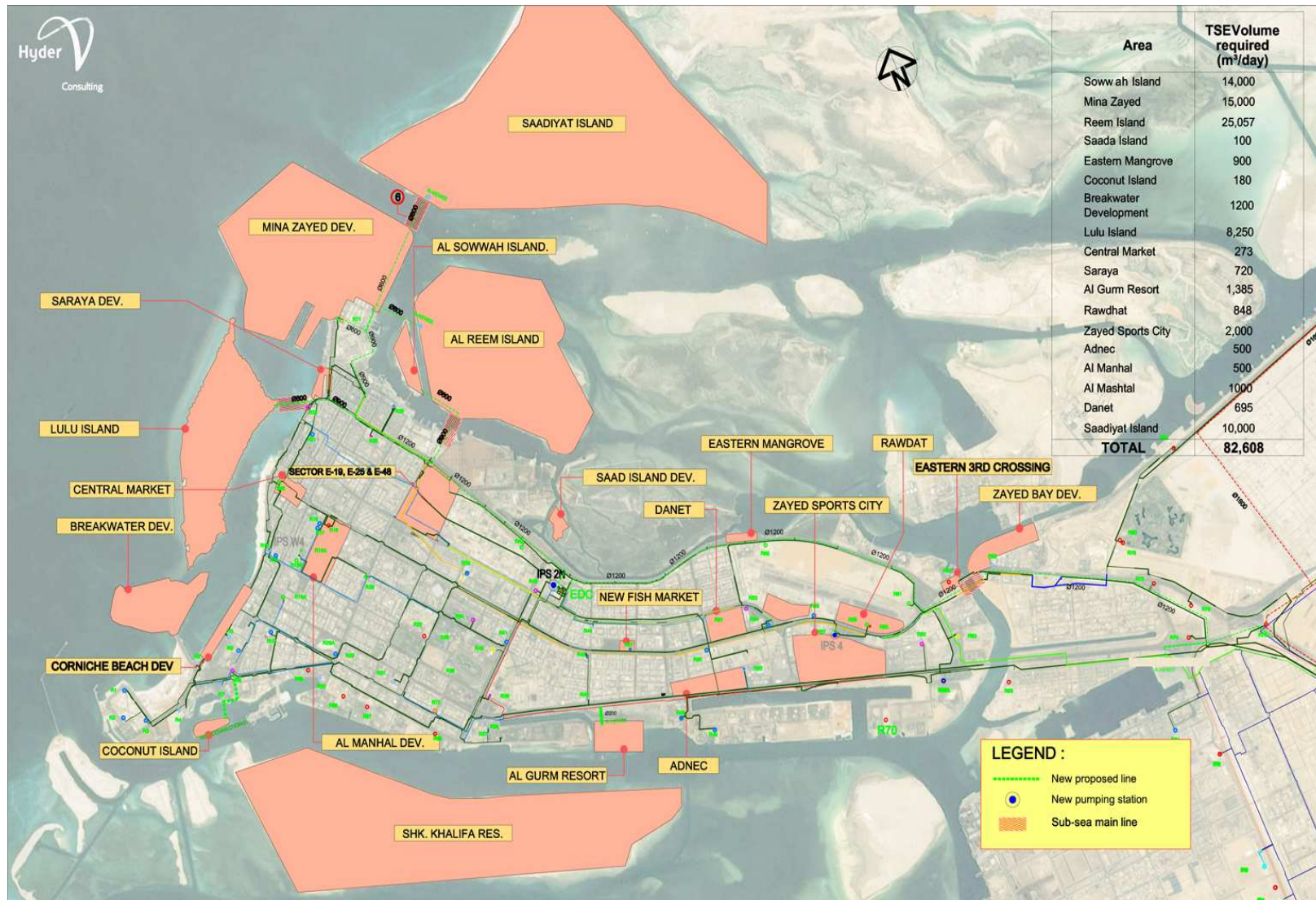


Peak Water Demand Summary: Mainland Only

TSE Demands and Availability



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Wastewater Services Company

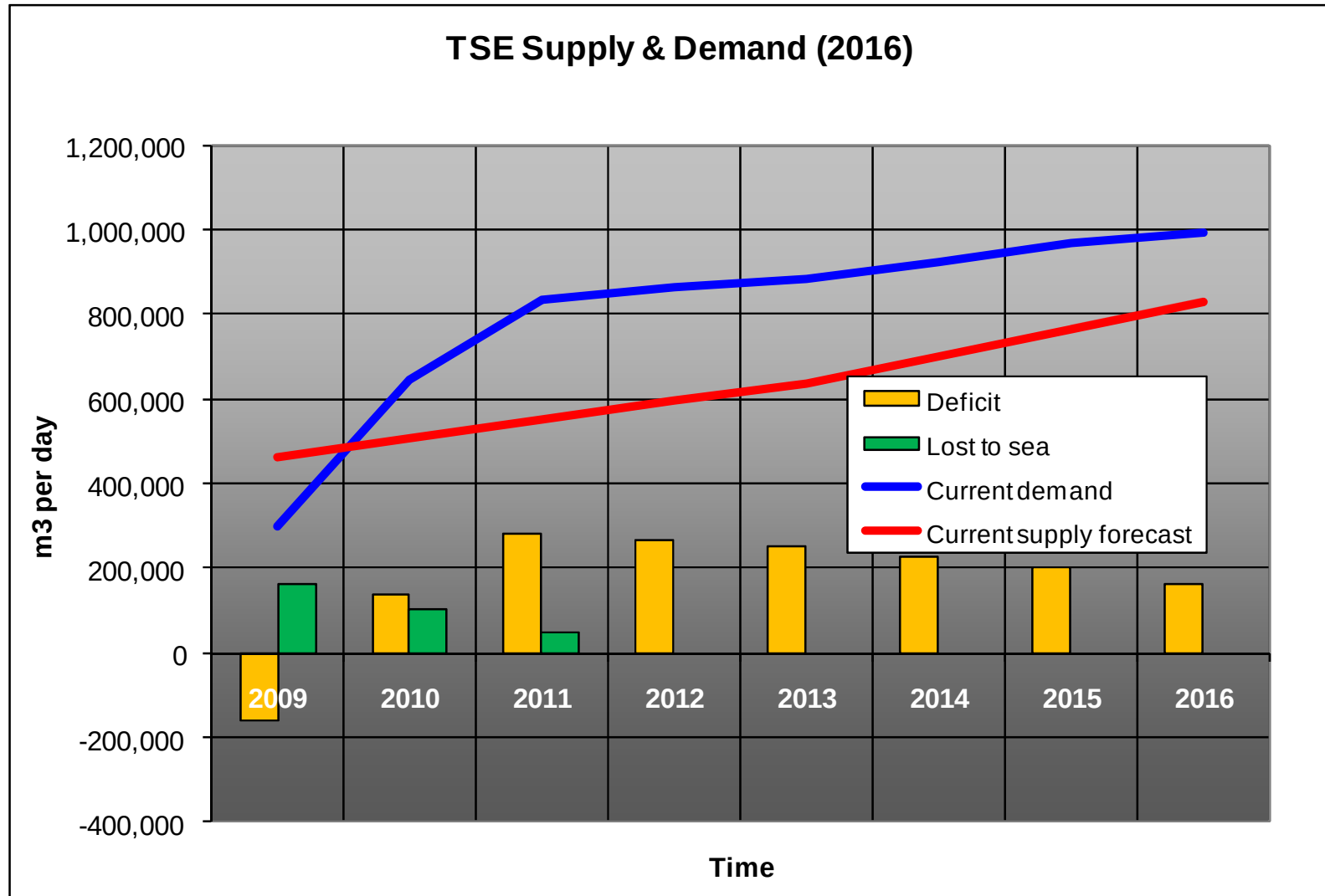


Peak Water Demand Summary: Island Only

TSE Demands and Availability Abu Dhabi Island & Mainland



Abu Dhabi City Demand v Supply (until 2016)



Summary for Abu Dhabi

- The opportunities for new uses of recycled water in Abu Dhabi are very small.
- Hundreds of several \$millions of investment already made in amenity irrigation by ADSSC.
- A public good dilemma of transferring from amenity for all to a private good for a few farmers.
- Fragmented planning of irrigation network.
- ADSSC has already planned the complete use of all recycled water for Abu Dhabi.
- A significant amount of Abu Dhabi's recycled water is groundwater inflow – ongoing and planned investment in new and replacement assets will eventually infiltration.
- Dumping of TSE to the gulf will stop.
- It is very likely that there will not be enough recycled water at present use rates to meet all future needs.
- Water conservation in Abu Dhabi through improving irrigation efficiency and increased use of dry land landscaping will be required.



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TSE Quality



Approved End Uses (RSB Draft Regulations)

Approved-end-use	Public health standards	Irrigation standards	Special criteria
Irrigation of urban areas	PI	Required	
Unrestricted irrigation of agricultural areas	PII	Required	
Restricted irrigation of agricultural and forestry areas	PIII	Required	
Irrigation of domestic gardens	PI	Not applicable	
Toilet Flushing	PI	Not applicable	
Fountains and water features	PI	Not applicable	<i>Legionella</i>
Air conditioning processes	PI	Not applicable	<i>Legionella</i>
Street cleaning and dust suppression	PII	Not applicable	
Vehicle washing	PII	Not applicable	
Concrete manufacture	PII	Not applicable	
Fire fighting	PI	Not applicable	<i>Legionella</i>

Draft RSB Regulations

Regulation and Supervision Bureau Proposed Public Health Standards (Schedule A)				
Parameter	Unit	P I ^{*1}	P II ^{*2}	P III ^{*3}
<i>pH</i>	<i>Value</i>	6 to 8	6 to 8	6 to 8
<i>Total suspended solids</i>	<i>mg/l</i>	10	20	30
<i>Biochemical oxygen demand(BOD₅)</i>	<i>mg/l</i>	10	10	20
<i>Turbidity</i>	<i>NTU</i>	5	10	n/a
<i>Residual Chlorine</i>	<i>mg/l</i>	0.5 to 1	0.5 to 1	n/a
<i>Dissolved oxygen</i>	<i>mg/l</i>	> 1	> 1	> 1
<i>Faecal Coliforms</i>	<i>CFU/100ml</i>	< 100	< 1000	n/a
<i>Intestinal Enterococci</i>	<i>CFU/100ml</i>	< 40	< 200	n/a
<i>Helminth Ova</i>	<i>Number/litre</i>	< 0.1	< 0.1	< 1

Draft RSB Regulations and Mafrag quality

Regulation and Supervision Bureau Proposed Public Health Standards (Schedule A)					
Parameter	Unit	P I ^{*1}	P II ^{*2}	P III ^{*3}	Mafrag Monthly average
<i>pH</i>	<i>Value</i>	6 to 8	6 to 8	6 to 8	7
<i>Total suspended solids</i>	<i>mg/l</i>	10	20	30	2.8
<i>Biochemical oxygen demand(BOD₅)</i>	<i>mg/l</i>	10	10	20	1.00
<i>Turbidity</i>	<i>NTU</i>	5	10	n/a	1.00
<i>Residual Chlorine</i>	<i>mg/l</i>	0.5 to 1	0.5 to 1	n/a	1.40
<i>Dissolved oxygen</i>	<i>mg/l</i>	> 1	> 1	> 1	
<i>Faecal Coliforms</i>	<i>CFU/100ml</i>	< 100	< 1000	n/a	
<i>Intestinal Enterococci</i>	<i>CFU/100ml</i>	< 40	< 200	n/a	
<i>Helminth Ova</i>	<i>Number/litre</i>	< 0.1	< 0.1	< 1	

Draft RSB Regulations (and Mafraq quality)

Regulation and Supervision Bureau Proposed Irrigation Standards (Schedule A)							
Parameter	Unit		Mafraq (spot)	Parameter	Unit		Mafraq (spot)
Aluminium	mg/l	5	0.007	Manganese	mg/l	0.2	0.024
Arsenic	mg/l	0.1	0.003	Molybdenum	mg/l	0.01	0.003
Beryllium	mg/l	0.1	0.0001	Nickel	mg/l	0.2	0.002
Cadmium	mg/l	0.01	0.0006	Selenium	mg/l	0.02	0.002
Chromium	mg/l	0.1	0.005	Vanadium	mg/l	0.1	0.001
Cobalt	mg/l	0.05	0.0002	Zinc	mg/l	2	0.03
Copper	mg/l	0.2	0.0003	Iron	mg/l	5	0.03
Fluoride	mg/l	1	0.27	Lead	mg/l	5	0.01
Lithium	mg/l	2.5	0.017				



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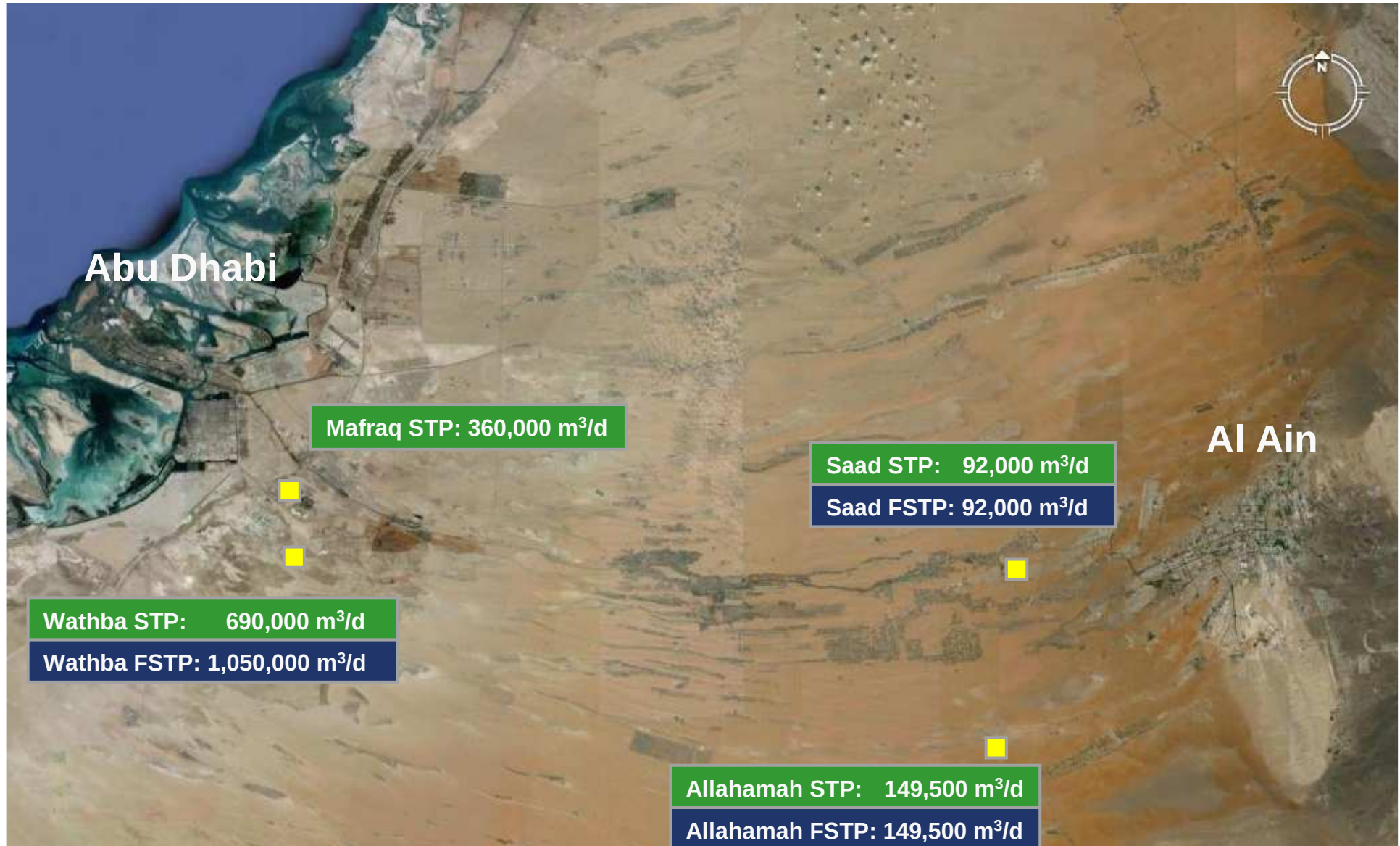
4th Stage Treatment



4th Stage Treatment Plants Proposed Location



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Resolution
No. 36
C12/2009

*"In all STPs in the
Emirate of Abu
Dhabi, the least
treatment stage
permitted will be
quarternary stage
with the use of
fine fiber."*

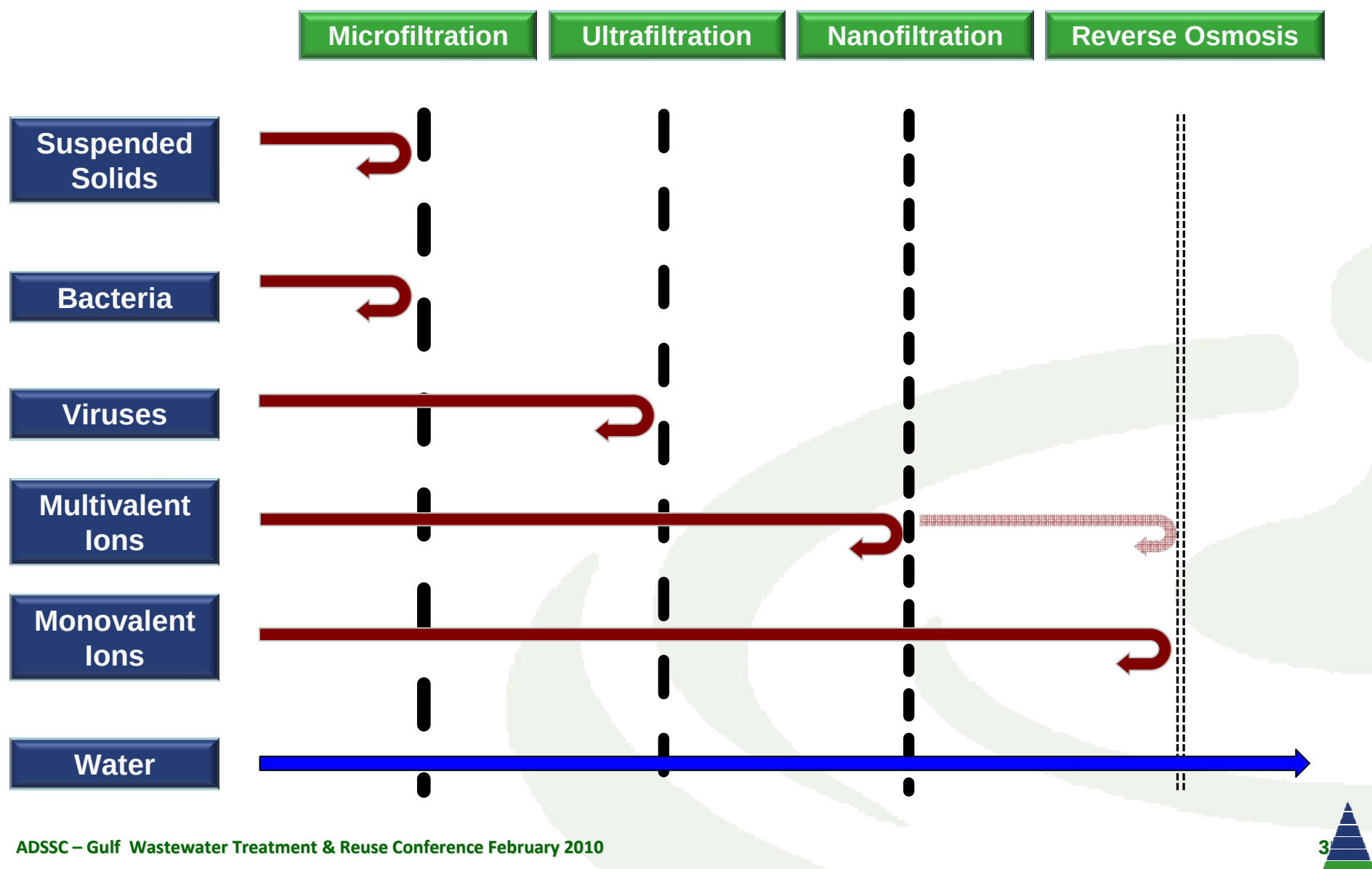
ADSSC to carry
out a feasibility
study to add
Fourth Stage
Treatment Plants
to the large
Sewage
Treatment Plants

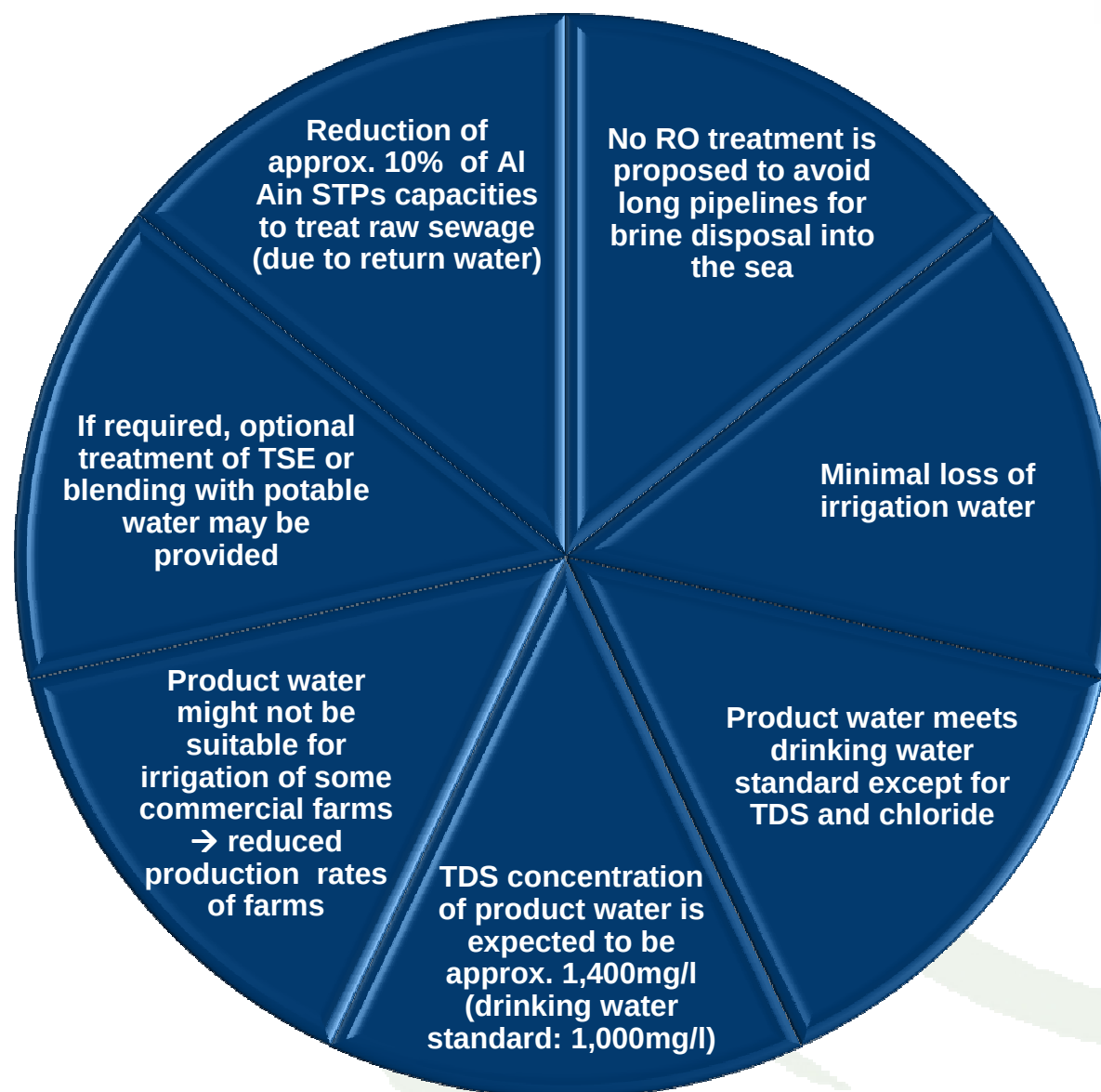
ADWEA /
ADSSC
appointed
Cardno
International to
carry out the
Feasibility Study

Cardno has
been ADWEA's
and ADSSC's
Technical
Adviser for the
Wathba 1,
Wathba 2, Saad
and Allahamah
STPs (ISTP1&2
on BOOT
basis) since
2006



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Advantages and Disadvantages

Option 1 – Wathba FSTP with Reverse Osmosis

Advantages

Quality of product water will comply with RSB's and WHO's drinking water standards.

Disadvantages

High capital and operational costs.

Reduction of irrigation water availability by approx. 15%.

Removal of nutrients from product water.

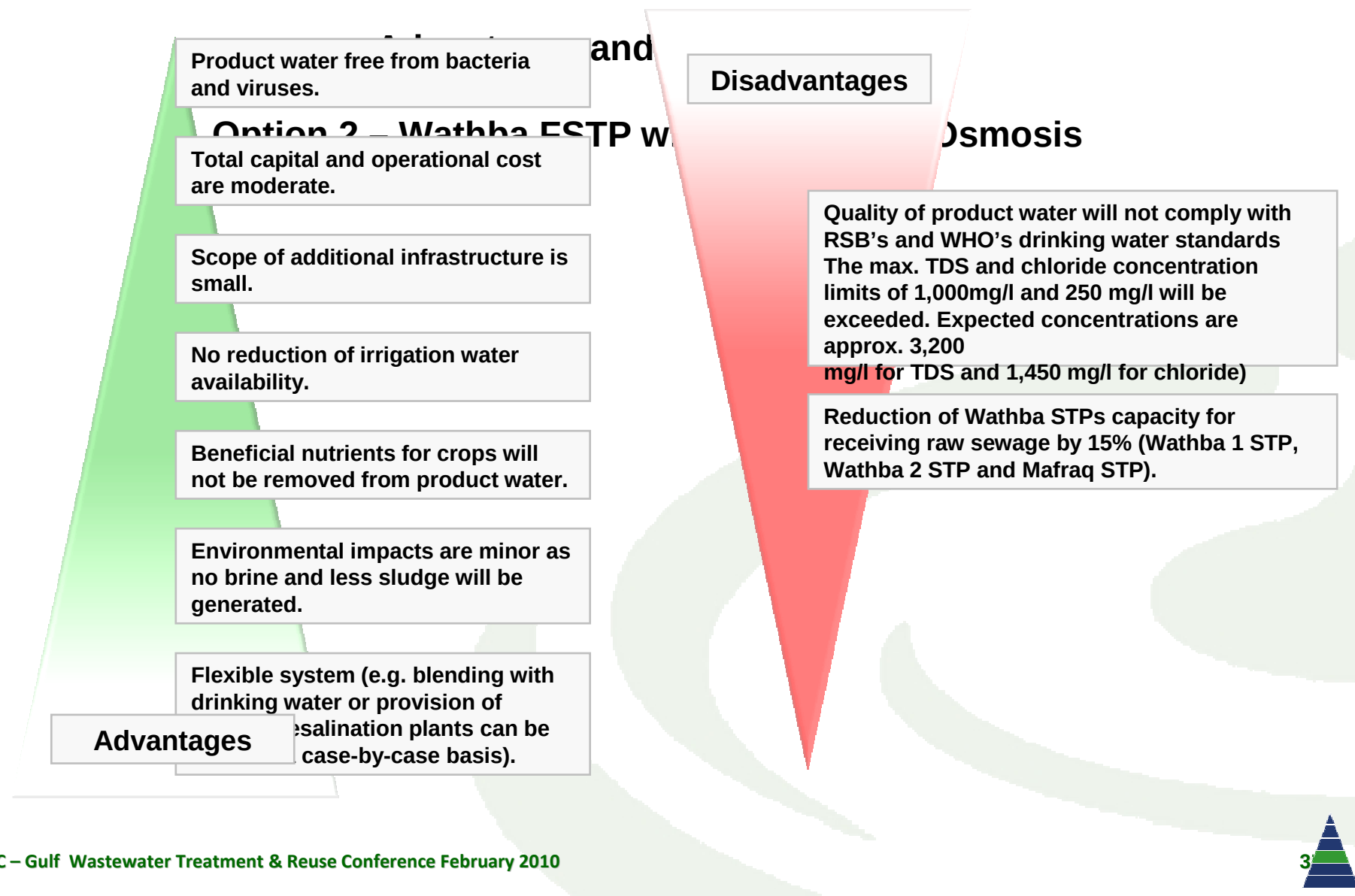
Substantial power consumption.

Extensive infrastructure for (i) brine treatment and (ii) reject water and sludge disposal will be required.

Impacts of reject water on the marine environment (e.g. discharge of phosphorous and nitrate to the sea).

Reduction of Wathba STPs capacity for receiving raw sewage by 15% (Wathba 1 STP, Wathba 2 STP and Mafraq STP).

If TDS and chloride concentrations are reduced in the future then the reverse osmosis may become redundant.





Al Ain

Return Water:
Saad FSTP: 9,200 m³/d
Allahamah FSTP: 14,950 m³/d
Total FSTP: 24,150 m³/d

Saad STP: 92,000 m³/d

Saad FSTP: 92,000 m³/d

10%

90%

STP

Ultrafiltration

Post Treatment
(No Desalination)

To Irrigation

Inflows:
Saad STP: 82,800 m³/d
Allahamah STP: 134,550 m³/d
Total STP: 217,350 m³/d

Output:
Saad FSTP: 82,800 m³/d
Allahamah FSTP: 134,550 m³/d
Total FSTP: 217,350 m³/d

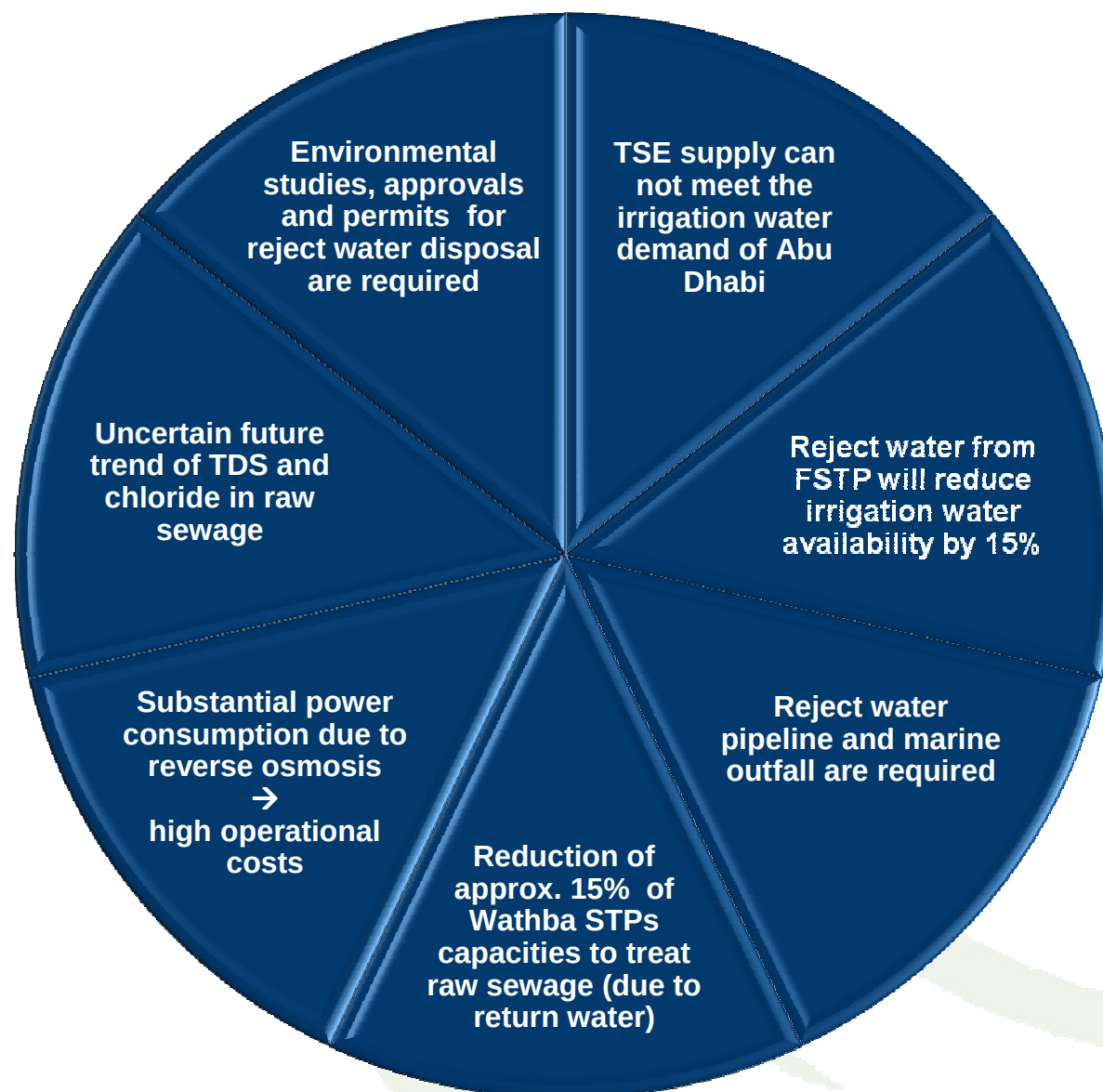
Allahamah STP: 149,500 m³/d

Allahamah FSTP: 149,500 m³/d





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Conclusion

Abu Dhabi & Al Ain FSTPs

1. Implementation of proposed FSTPs in Abu Dhabi and Al Ain is feasible.
2. Comparison of technical solutions (Option 1 – incl. RO / Option 2 – excl. RO) for Abu Dhabi FSTP results in the preferred solution being Option 2.
3. If required, Option 2 (excl. RO) provides flexibility (i) to blend product water with potable water or (ii) to add de-centralised reverse osmosis plants in the future.
4. The existing and future TSE / product water system should be further reviewed
 - (i) to evaluate potential deterioration of product water due to existing condition of TSE distribution system, and
 - (ii) to assess the irrigation water demand for farming and forestry in more detail.



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Institutional Issues



Institutional Issues (1)

- ADSSC was, until 2008, by law, only allowed to provide recycled water to the municipalities. The change in the law has resulted in ADSSC becoming a TSE distribution company with implications for CAPEX and OPEX forecasts.
- An independent and new, regulated irrigation company may better serve all potential customers. Combined assets from ADSSC and the Municipalities would make it easier to serve all customers and ensure better planning and O&M and encourage water saving through cost reflective tariffs.
- Farmers use desalinated water in preference to recycled water because it is free.
- To increase use of recycled water in farming either desalinated water will have to be banned or made more expensive to use than recycled water.
- Differential water tariffs favouring recycled water or administrative allocation rules will have to be introduced.
- Planning its use without regard to all water supply and uses causes problems – the Al Ain waterlogging problem is an example of this.



Institutional Issues (2)

- Planning of all water sources and uses needs to be under a unitary authority to avoid conflicting plans for supply, use and disposal of polluted water.
- There is a need for capacity-building to bring all water resources planning and management to the standards of best international practice.
- To achieve this there will have to changes to the current way in which water is planned, allocated and managed.
- Standards and Regulations need to be developed for all water uses to avoid adverse incentives.
- Currently adverse pricing incentives encourage the wasteful use of desalinated water – and this is an incentive for farmers not to use recycled water.
- The advantages of using recycled water needs to be disseminated, and publicity and public education will be needed to make its use acceptable.
- Currently adverse pricing incentives encourage the wasteful use of desalinated water – and this is an incentive for farmers not to use recycled water.

Issues currently faced by ADSSC

- Supply priority
- Asset demarcation
- Customer register
- Meter reading
- CAPEX/OPEX requirements
- Network upgrade (3B AED)
- Billing system
- Payment collection
- Terms and Conditions
- Regulatory Issues
 - Residual Regulations
 - Reuse Agreements
 - Health and Safety Plans
- Combating infiltration.
- Building sewer and treatment capacity does not equate to higher sewage flows.
- TSE return to developers must be based on actual sewage flows provided.
- Population increases must be realized or demand cannot be met.



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Latest Developments



Latest Developments (1)

Resolution issued by Mohammed Bin Zayed Al Nahyan,
Crown Prince Executive Council Chairman

24 December 2009

- Resolution of the Chairman of the Executive Council No (87) of 2009 Regarding the Formation of a Committee to Design & Implement Water & Agricultural Strategy in the Emirate of Abu Dhabi
- A permanent committee to design and implement water and agricultural strategy in the Emirate of Abu Dhabi shall be set-up, comprising their Excellencies

Mohammed Ahmed Al Bowardi, Chairman,

Majid Ali Al Mansouri, Chairman Deputy,

and the membership of their excellencies:

Rashed Mubarak Al Hajeri	Chairman of the Dept of Municipal Affairs
Khalifa Mohammed Hamad Faris Al Mazroui	Abu Dhabi Municipality
Dr Muttar Mohammed Saif Al Muaimi	Al Ain Municipality
Hmoud Hmaid Al Mansouri	Western Region Municipality
Rashid Khalfan Al Shuraiki	Abu Dhabi Food Control Authority
Mubarak Obaid Al Dhaheri	Abu Dhabi Sewerage Services Company
Ahmed Saif Al Darmaki	Abu Dhabi water & Electricity Authority
A representative from Regulation and Supervision Bureau	



Latest Developments (2)

The committee's tasks are as follows:

- All water resources in the emirate including underground & desalinated water and treated sewage effluent shall be specified with all their current and future uses.
- Modern technologies of generating and treating waters shall be reviewed and studied with a view to developing these technologies, and use renewable energy resources in producing these waters.
- Collate & establish a data base for water resources and methods of using them, which includes agriculture, forests, industry, domestic, recreational & gardening uses.
- Evaluate & review policies and strategies of treating and reusing sewage water. Study the best ways to enhance treated water uses in agricultural sector and its implications for food self- sufficiency.
- Review and analyze criteria related to maintaining levels of underground waters in order to ensure a strategic stockpile, and plan emergency water supply.
- Study effective water rationing methods in different sectors, and activate the application of the guiding lines to implement water & treated sewage effluent networks.
- Study modern technologies in agriculture and irrigation to ensure water supplies & enhance food security policies.
- Study the possibility of using native plants in cities & parks.
- Suggest laws & frameworks related to developing and administering the water sector.
- Study the suggestion of establishing Abu Dhabi Water Council.



TSE in a Nutshell (1)

- ADSSC currently produces approximately 580,000 m³/day of treated sewage effluent which is suitable for unrestricted agricultural irrigation and urban landscape irrigation.
- Currently some TSE is wasted and ADSSC are investing in significant infrastructure to fully utilize 100% of TSE for urban irrigation.
- We acknowledge that this is a valuable yet finite resource that should be fully utilized for the benefit of the Emirate.
- The quantity of available TSE depends on population growth and potable water consumption. Demand in Abu Dhabi outstrips supply. There may be a surplus in Al Ain.
- Management of TSE needs to be addressed along with other water resources under a fully regulated and demand managed environment.
- Population increases must continue or demand cannot be met – building sewerage capacity does not equate to higher sewage flows.
- TSE strategy must be considered along with desalinated water strategy.



TSE in a Nutshell (2)

- Current irrigation practices need to be optimized in terms of measurement and control (automation, instrumentation and drip irrigation methods for example).
- Minimizing demand through intelligent and restrained landscaping design.
- In Al Ain agriculture could benefit if less desalinated water is consumed.
- Future strategy may be to treat the TSE to a potable standard for use in agriculture, landscaping and forestry.
- There is a potential for a new irrigation company to be established.
- TSE shall be managed under a fully integrated water cycle management policy determined by higher authorities.
- Abu Dhabi and Al Ain cities can continue to be “green”.



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Thank You