REFERENCES AND EXPERIENCES

INDEX

1. INTRODUCTION. SWRO OVERVIEW 3
2. REFERENCE PLANT: MONTAZAH- OVERVIEW 7
3. REFERENCE PLANT: ERC- OVERVIEW 9
4. BAGOUSH (MARSA MATROUH) 10
5. REMELAH 11
6. NCIC INDUSTRIAL PLANT 12
7. TECHNICAL FEATURES 12
8. PROJECTS SUMMARY 13
9. Operation and Maintenance 20

1. INTRODUCTION. SWRO OVERVIEW

For more than 30 years, the world water industry has developed cost-effective and sustainable solutions using reverse osmosis desalination technology as a strategy for addressing the country's water resource challenges. During this period, an industry has evolved, establishing companies that have accumulated a wealth of knowledge and experience in the research, design, construction, operation and maintenance of desalination plants. **TAM** company has participated in this market through advanced membrane technology.

TAM is recognized as one of the leader companies in the use of seawater and brackish water RO desalination and has an on-going commitment to developing this technology, through which it has earned the trust and confidence from both the clients and suppliers at international levels.

TAM is dedicated to providing clients with the benefit of our global experience through tailored, reliable solutions for public and private applications. More specifically, in the field of seawater desalination, our staff has a history of over 25 year experience and our portfolio of more than 40 desalination and re-use plants with a total installed capacity by **TAM** of more than 140.000 m3/d reinforces the strength and depth of our knowledge and expertise in this field.

The table below lists our seawater desalination and ultrafiltration for Re-use projects. Many of them are located in the Red Sea.

Project	Location	Capacity (m3/day)	Year
Ain Sokhna	Ain Sokhna	70000	2020-2021
Ain Sokhna	Ain Sokhna	100000	2018-2019
NCIC Industrial Complex	Ain Sokhna	32000 expandable to 64000	2016-2019
Water Department-Cairo (UF)	New Capital	100000	2020
REMELAH	Remelah	48000	2014-2017
Bagoush (Marsa MATROUH) SWRO	Bagoush	24000	2011-2013
AL DABAA	AL Dabaa North Coast	40000 expandable to 100,000	2018-2019

Project	Location	Capacity (m3/day)	Year
MONTAZAH Water Desalination	Sharm El-Sheikh	18000	2009
ERC - Egyptian Resorts Company	Hurghada	14000	2008
ORIENTAL Coast	Marsa Alam	1250	2009
GRAND Group	Sharm El-Sheikh	9000	2009
Rotana Group	Hurghada-Sharm	2400	2007
BLUE BAY Resort	Ras Sudr - South Sinai	1150	2006
GRAND Group	Hurghada	1000	2009
REVIERRA Resorts	Sharm El-Sheikh	1000	2008
DANA BEACH Resorts	Hurghada	1000	2004
Shams Safaga Resort	Safaga	750	2006
RADAMIS Resort	Sharm El-Sheikh	1700	2009
ALF LEILA Resort II	Hurghada	3100	2008
ALBATROS Resort Group	Hurghada	2800	2008
NAKHEEL Sunrise resort	Sharm El-Sheikh	500	2009
GHANAZ Resort	Sharm El-Sheikh	700	2008
MARINA BANYIAS Resort	Marsa Alam	500	2008
Ras Sudr	Ras Sudr	30000	2020-2021
ABU ZENIMA	ABU ZENIMA	20000	2020-2021
DAHAB	DAHAB	15000	2020-2021

Our knowledge and experience of operating and maintaining desalination plants has given us an intimate understanding of process performance, membrane fouling and optimisation techniques. This unique capability extends through each phase of the project lifecycle allowing us to minimize whole life costs of facilities, and to construct and operate plants at an optimum total water cost.

It is noteworthy that TAM is the Egyptian desalination company with more experience in Egypt. Our years of experience in different projects in the country have provided a depth knowledge of the local resources so as the customer preferences what allows TAM adapt its designs to the Egyptian market requirements.

TAM have also been awarded the design and construction of the largest private seawater desalination plant in RED SEA Egypt (AIN SOKHNA) and two of the largest public plant for the Egyptian Army in Marsa- Matrouh and Remelah with a total capacity of 48,000 m3/d.

In the industrial sector, we have also been awarded the design and construction of the phase one a 32.000 m3/day plant for NCIC (Nasr Chemical Industrial Company) to deliver industrial quality water, what requires two pass of Reverse Osmosis for the total production of the plant.

In most cases TAM Environmental Services is in charge of the long-term operations and maintenance contract.

Partnership with DESALIA

Tam Environmental services acquires percentage of 75% of **Desalia** Spanish company shares.

DESALIA is a partner of TAM for the Egyptian market since the beginning of the activities in this country. This association has brought excellent achievements and improvements for both companies; TAM is in charge of the projects under the supervision and with the cooperation of DESALIA.

TAM is a company based in Egypt, established in 2001 as O&M contractor, operating its first owned plant in 2003. TAM is a turnkey solutions provider since 2004, introducing its firs 6000 m3/day RO plant in Egypt in 2005. The services provided include design, architectural and civil, marine works, process detailed design, electromechanical works and O&M.

TAM is currently operating several of the largest RO plant in Egypt for the Armament Authority: Bagoush 24.000 m3/day, Remelah I 24.000 m3/day, Remelah II, 24.000 m3/day, etc.

TAM has a daily production capacity of 150.000 m3/day, has installed a capacity of 40.000 m3/day and is involved in the construction of 135.000 m3/day.

As main references we can highlight EL SOKHNA plant in Red Sea, Bagoush, Remelah and AL DABAA in Mediterranean.

As mentioned, TAM is developing all projects in Egypt in partnership with Desalia in Spain.

Membrane technology expertise

TAM has developed an extensive knowledge on membrane technology which enables the company to achieve a highly regarded position in the industry as a specialist in SWRO desalination. TAM with Desalia's research and development (R&D) programmes continue to develop solutions and opportunities.

TAM´s experts are in a position to challenge the data of the design software normally provided by membrane manufacturers. Once these programmes are run, our specialists discuss and debate certain parameters and calculations of the software, ensuring that results are absolutely correct and consider the specific characteristics of each desalination plant.

The most practical application of this knowledge is its reflection in the conditions of membrane guarantees obtained from suppliers. Membrane suppliers normally specify conditions for membrane cleaning in their guarantees. Some of these cleaning methods are aggressive to the membranes, bringing slight membrane performance deterioration, which inevitably ensures the membrane must be replaced early.

Anti-fouling practices such as anti-bacterial shocks through changes in the pH, are softer measures that do not compromise membrane integrity. This enables the operator to lengthen the period of time between more aggressive cleanings. Consequently, the membrane life is extended, with a subsequent saving in operational cost without decrease in the output quality.

Reference plants

We present the main references: AIN EL SOKHNA, NCIC Industrial Complex, Bagoush (Marsa Matrouh), Remelah, Montazah and AL DABAA as our reference plants, with some relevant features as:

- Project implemented due to the need for an alternative secure source
- Modular designs
- Focus on achieving budget targets including whole-of-life cost;
- Security through long term operations and maintenance contracts (5 years);
- Proximity to residential areas;
- Client focus on durability and reliability
- Challenging timeline delivery (18 months construction)
- Located in Mediterranean and Red Sea

2. REFERENCE PLANT: MONTAZAH- OVERVIEW

Each of the two phases of the desalination facilities at Montazah were awarded by the client to TAM through a competitive tender process. The scope of the award included design and build, plus the operation and maintenance of the facilities for a 5-year period.

Phase I was awarded to TAM during 2007 and became operational in 2008. Phase II was awarded in 2008 and was operational within 12 months (early 2009) and in-line with the client's demands.

The assessment process to award the contract for Muntazah was a traditional competitive tender process, with key appraisal measures including:

- Successful seawater reverse osmosis track record;
- Ability to achieve design, construction, commissioning and operations target dates;
- Knowledge of and access to best practices;
- Compliance record in relation to quality and regulatory aspects;
- Robust approach to environmental stewardship and sustainability;
- Extensive technical capability;
- Demonstrable track record of achieving target capital cost; and
- Achieving target operational costs.

For strategic reasons, TAM engaged DESALIA (commissioning and operation) as partners for this project and was awarded the contract in 2007.

The main factor for being awarded this project was the proven success achieved on other plants, combined with a robust design and the best price.

We were successful in securing phase II of the project, similar as detailed above but greater emphasis was given to the requirement to move rapidly from the award of the contract through to becoming fully operational.

TAM was awarded the contract in February 2008 and through detailed design and planning, effective management and timely procurement of plant and managing the end-to-end process, the plant was commissioned and 100% operational in November 2009.

3. REFERENCE PLANT: ERC- OVERVIEW

Phase I was awarded to TAM during 2008 and became operational in 2009. Phase II was awarded in 2009 and was operational within 12 months (early 2010) and in-line with the client's demands.

4. BAGOUSH (MARSA MATROUH)

TAm signed the contract of Bagoush SWRO plant in September 2011 and started production of water in June 2013, a real record for the complete installation, start up and operation for a big desalination plant.

The scope of supply is a turnkey complete desalination plant for 24.000 m3/day capacity, divided in four trains (each 6.000 m3/day capacity), with a second pass, remineralization to meet WHO potable water requirements, and two storage tanks for product water, each 10.000 m3. Also 5 years of Operation and Maintenance are included in the contract.

- Conceptual Design
- Architectural & Civil
- Marine Works
- Process Detailed
- Electromechanical Works
- 5 years of Operation & Maintenance Services

5. REMELAH

TAM signed the contract of Bagoush SWRO plant in September 2014, the scope of supply is similar to Bagoush: a turnkey complete desalination plant for 48.000 m3/day capacity, divided in eight trains (each 6.000 m3/day capacity), with a second pass and remineralization to meet WHO potable water requirements, and two storage tanks for product water, each 10.000 m3.

- Conceptual Design
- Architectural & Civil
- Marine Works
- Process Detailed
- Electromechanical Works
- 1 Year of Operation & Maintenance Services

6. NCIC INDUSTRIAL PLANT

TAM has recently finished construction and started the startu p of the first phase of the project with a capacity of 32.000 m3/day of industrial quality water.

7. TECHNICAL FEATURES

As described above, the desalination facilities of Montazah and ERC were built in phases. The following table illustrates key features of the projects.

Plant name	Montazah	ERC	Bagoush	Remelah	NCIC	AIN SOKHNA
Plant capacity (m3/d)	18.000	14.000	24.000	48.000	32.000	100.000
Number of lines	5	4	4	8	4	12
Capacity of each line (m3/d)	6.000	4.000	6.000	6.000	8.000	8.350
Recovery	42%	45%	40%	40%	38%	37%
Pre-treatment	filtration	Filtration	Filtration	Filtration	Filtration	Filtration
Energy recovery system	Pelton turbine	Pelton turbine	PX	PX	PX	Filtration
Specific energy conversion	3.9 kWh/m3	4.10 kWh/m3	3.70 kWh/m3	3.70 kWh/m3		

8. PROJECTS SUMMARY

Ain Sokhna		
Plant capacity: 100.000 m3/d Construction period: 2018-2019 Operating period: 2019-2020	Client name: Water Department Location: Ain Sokhna	
This plant supplies desalinated water for irrigation and drinking purposes for a private customer		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	3 MONTHS	22 MONTHS	4 WEEKS	15MONTHS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 15 months
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase yet to commence

NCIC Industrial Plant		
Plant capacity: 32.000 m3/d First phase: 32.000 m3/d Construction period: 2016-2018 Operating period: 2018-2019	Client name: Nasr Chemical Industrial Company Location: Ain Sokna	
This plant supplies desalinated water for irrigation and drinking purposes for a private customer		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	3 MONTHS	20 MONTHS	4 WEEKS	1 YEAR

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 6 years
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase yet to commence

REMELAH DESALINATION PLANT		
Plant capacity: 48.000 m3/d Rack size: 6.000 m3/d Construction period: 2013-2014 Operating period: 2015	Client name: Holding Company for Water & Wastewater Location: Remelah. Matrouh (Egypt)	
Marsa Matrouh is the largest Desalination Plant in Egypt.		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	4 MONTHS	16 MONTHS	4 WEEKS	1 YEARS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 1 year
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase comply with expected quality

BAGOUSH (MARSA MATROUH) DESALINATION PLANT		
Plant capacity: 24.000 m3/d Rack size: 6.000 m3/d Construction period: 2012-2013 Operating period:	Client name: Water Department Location: Bagoush Matrouh (Egypt)	
Marsa Matrouh is the largest Desalination Plant in Egypt.		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	4 MONTHS	16 MONTHS	4 WEEKS	5 YEARS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 5 years
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase comply with expected quality

EGYPTIAN RESORTS COMPANY		
Plant capacity: 14.000 m3/d Construction period: 2007-2008 Operating period:	Client name: ERC Location: Hurghada	
At 14,000 m3/d, ERC desalination plant is the largest in Egypt for a private customer		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	3 MONTHS	8 MONTHS	3 WEEKS	6 YEARS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 6 years
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase yet to commence

MONTAZAH DESALINATION PLANT		
Plant capacity: 18.000 m3/d Rack size: 6.000 m3/d Construction period: 2007-2008 Operating period:	Client name: Montazah for Desalination Location: Sharm el Sheik	
At 18,000 m3/d, Montazah desalination plant is the largest in operation in Sharm el Sheik		

Stages	Design	Construction	Commissioning	Operations & Maintenance
	4 MONTHS	12 MONTHS	4 WEEKS	5 YEARS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 5 years
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase comply with expected quality

RADAAMES		
Plant capacity: 750 m3/d First phase: 10.000 m3/d Construction period: 2007-2008 Operating period:	Client name: Location: Sharm el Sheik	

This plant supplies desalinated water for irrigation and drinking purposes for a private customer

Stages	Design	Construction	Commissioning	Operations & Maintenance
	3 MONTHS	8 MONTHS	3 WEEKS	6 YEARS

Key Role:	EPC + O&M contractor
Responsibilities:	• Detailed process and engineering design • Construction • Commissioning • Operation for 6 years
Stakeholder Liaison:	• During the EPC phase a client nominated project director will be on site to deliver a technical assistance • The client approves the construction and design of the plant • Weekly report during the O&M phase indicating the quality and quantity of the product water • Regular periodic meetings
Environmental Compliance:	• Formal acceptance by EPA and coastal authorities on scheduled inspections • The plant will comply with Environment Impact Report and obtained approval by the EPA • Monitoring of sea water intake and brine discharge will be done to assess no adverse effects to the local environment • As the O&M contractor, we will fulfil an online database for the environment ministry indicating the product water quality
O&M Record	• O&M phase yet to commence

REFERENCE LIST Operation and Maintenance			
Project	LOCATION	CAPACITY (M3/D)	Year
Ain Sokhna (512000 M3/D)	Ain Sokhna "Phase 1"	32000	2016
	Ain Sokhna "Phase 2"	100000	2016
	Ain Sokhna "Phase 3"	70000	2016
Remila	Marsa Matrouh	48000	2014
Ras Sedr	South Sinai	30000	2018 / 2019
Baghoush	Marsa Matrouh	24000	2012
Abu Zenima	South Sinai	20000	2018
Montazah For Water Desalination	Sharm El Sheikh	18000	2008
Travco Group	Hurghada	15800	2008
Dahab	South Sinai	15000	2018
Four Season	Sharm El Sheikh	9500	2005-2018
Al Batros Group	Hurghada	6200	2009
Stella Makady	Hurghada	3600	2010
Tirana Aqua Park	Sharm El Sheikh	1700	2001
Grand Azur (Rexos)	Sharm El Sheikh	1600	2016
Kharafi Group	Hurghada	1400	2007
Sea Club	Sharm El Sheikh	1400	2007
Rexos Sharm Oriental	Sharm El Sheikh	1400	2007
Rotana Group	Sharm	1400	2008
Nubian Village	Sharm El Sheikh	950	2007
Sharm Land - Sea Life Aquapark	Sharm El Sheikh	700	2008
El Salam HCWW	Marsa Alam	700	2014
Mont Marie	Sharm El Sheikh	500	2013
Citadel Azur	Hurghada	500	2003

TAM BOO PLANTS:			CAPACITY (M3/D)	Year
TAM C2	DAHABYA - Dahab Sinai	1	300	2008
TAM C3	Koraya (Marsa Alam)	1	2500	2017-2018
TAM	Soma bay (safaga)	1	700	2008
TAM	Tulip Taba	1	500	2019
Total			4000	

TAM STP PLANTS:				
CLIENT	LOCATION	CAPACITY M3/D	OEM	Year
Montazah for Water Treatment	Sharm El Shiekh - South Sinai	5000	TAM	2011
Four Season	Sharm El Shiekh - South Sinai	2000	TAM	2018
Citadel Azur	Hurghada - Red Sea	400	TAM	2005
		7400	M3/DAY	