References of Sievertconsult and its associates

(Mizan Consult FZE, Blumberg-engineers)

REED BED TREATMENT SYSTEMS (CONSTRUCTED WETLANDS) IN THE MIDDLE EAST

U.A.E., Oman, Jordan, Qatar, KSA

Labor Camp
Mirfa, Abu Dhabi, U.A.E.

Raw waste water reed bed:
Treatment of raw waste water from a labour camp to avoid tanker disposal and reuse of treated water for irrigation.

Client:
Waagner Biro Gulf

Contractor:
Waagner Biro Gulf (with support for planning, design, construction supervision, start-up and operation by Mizan Consult)

.

Population equivalent:
80 PE

Planning: 04/2011
Construction: 05-07/2011

Pre-treatment:
- Macerator pump station
- Sludge Filtration & Mineralization in Reed Bed
  (2 basins, vertical flow)

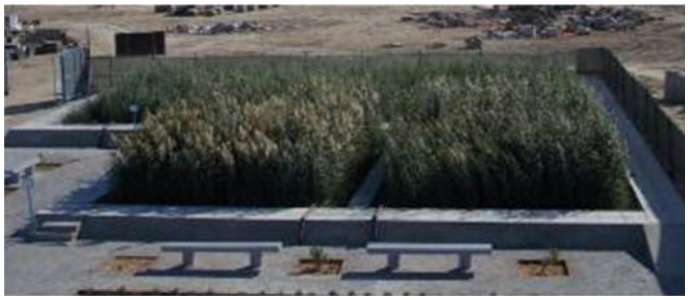
Biological treatment step:
- Reed Bed, vertical flow
  (1 basin, vertical flow)

Outlet:
- 20 m³ of treated water per day.
- Direct reuse of the water for:
  irrigation

Space requirement:
- 400 m²


Installation of dams


Spray nozzles test Stage B


Reed Bed treatment system after 6 months of operation

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU	
Raw sewage, Inflow	383	279	45.4	5.53	357	129			7.65
Reed Bed Stage B, TSE*	<12	< 5	0.2	0.02	933	< 10			7.8
ADSSC/RSB-Standard P1	-	10	-	-	-	10	1	5	6 - 8
ADSSC/RSB-Standard P3	-	50	2	2	-	50	>3	75	6 - 9

*Treated sewage effluent

Savannah Lodge,
Sir Bani Yas Island, Abu Dhabi, U.A.E.

Client:
TDIC

Contractor:
Hilalco

Main Consultant:
Parsons with specialised reed bed sub-consultant Mizan Consult for design, construction supervision, start-up and operation

Population equivalent:
90 PE

Planning: 2010
Construction: 04-10/2011

Pre-treatment:
- Macerator pump station
- Sludge Filtration & Mineralization Reed Bed (2 basins, vertical flow)

Biological treatment step:
- Reed Bed, vertical flow (2 basins, vertical flow)

Outlet:
- 18 m³ of treated water per day.
- Direct reuse of the water for: irrigation

Space requirement:
- 1100 m²


Excavation of basins


Casting pump station


Sand filling of basins


Basins after 3 months

Anantara Hotel,
Sir Bani Yas Island, Abu Dhabi, U.A.E.

Client:
TDIC

Contractor:
Hilalco
Waagner Biro Gulf

Main Consultant:
Parsons with specialised reed bed sub-consultant Mizan Consult for design, construction supervision, start-up and operation

Population equivalent:
Phase 1: 300 PE
Phase 2: 1200 PE

Planning: 2010
Construction: 04-10/2011

Pre-treatment:
- Tanker discharge station
- Manual bar screen
- Macerator pump station
- Sludge Filtration & Mineralization
  Reed Bed Stage A
  (4 basins, vertical flow, 4 x 248 m²)

Biological treatment step:
- Reed Bed, vertical flow
  (4 basins, vertical flow, 4 x 360 m²)

Outlet:
- 62.5 m³ of treated water per day.
- Direct reuse of the water for:
  Irrigation

Space requirement total:
- 8000 m²

Contract value: 16 Mio AED


Excavation of pump station


Pump station


Earth basins


First TSE discharge

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU	
Inflow	86	91	22.6	2,27		55	2	24.6	7.55
TSE*	28.5	10	nd	0.355		3.5	7.46	1.53	7.75
ADSSC P1	-	10	-	-	-	10	>1	5	6 - 8
ADSSC P3	-	50	2	2	-	50	>3	75	6 - 9

*Treated sewage effluent

Labor Camp
Sila, Abu Dhabi, U.A.E.

Raw wastewater reed bed for the treatment of complete camp waste water to avoid tankering and reuse of treated water for irrigation.

Client:
Waagner Biro Gulf

Contractor:
Waagner Biro Gulf (with support for planning, design, construction supervision and start-up by Mizan Consult)

Population equivalent:
200 PE
Planning: 07/2011
Construction: 08/2011 - 04-2012

Stage A, after planting reed

Pre-treatment:
- Macerator pump station
- Sludge Filtration & Mineralization Reed Bed (2 basins, vertical flow, 260 m²)

Biological treatment step :
- Reed Bed, vertical flow (1 basin, vertical flow, 340 m²)

Outlet:
- 40 m³ of treated water per day.
- Direct reuse of the water for: irrigation

Space requirement:
- 800 m²

	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
Raw Inflow	148	48.7	8.8	364	50		
TSE*	2	0.13	2.1	1324	<5		
ADSSC P1	10	-	-	-	10	1	5
ADSSC P3	50	2	2	-	50	>3	7

*Treated sewage effluent

Labour camp, Al Sifa, Oman

Raw wastewater reed bed for the treatment of labour camp waste water to avoid tankering and reuse of treated water for construction, road watering and irrigation.

Client:
Muriya Tourism Development Oman

Contractor:
Bauer Oman (with support for planning, design, construction supervision, start-up and operation by Mizan Consult engineer)


Earth works

Population equivalent:
100 PE, 14 m³/day

Planning: 09/2009
Construction: 11-12/2009

Sewage treatment:
Raw sewage reed bed

- Cutter pump station
- Vertical filtration reed bed
- Horizontal biological reed bed
- Storage tank, tanker filling


Basins after planting

Outlet:
- Storage and reuse for construction

Advantages:
- No sewage storage & discharge
- Green technology for the project
- Production of fertilizer


Basins after 1 year of operation

Space requirement:
- 1400 m²

	COD	BOD	NH4-N	NO3-N	TDS	TSS	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	
Raw sewage	910	330	62	-	1000	680	7.3
Reed Bed 1 OUT	20	8	22	5	1150	52	7.8
Reed Bed 2 OUT, FINAL	18	7	1.6	6	1200	7	7.9

After 1 year of operation

Sewage sludge mineralization, Resort
Zighybay, Oman

Treatment of the wastewater from a five star hotel in an activated sludge process (STP) and treatment of the surplus sludge from the STP in a sludge mineralization reed bed to avoid sludge tankering and produce fertilizer from sludge for the in-house farming.

Client:
Six Senses Resort Zighy Bay

Contractor:
Bauer Emirates Environment (with support for planning, design, construction supervision, start-up and operation by Mizan Consult)

Planning:	06-08/2009
Construction:	08-10/2009
First sludge removal:	06 - 2020

Population equivalent:
1500 PE, 300 m³/d wastewater

Sludge Reed Bed area:

2 x 150 m²

Filter layer

Planting

After 6 month of operation, view from the private hotel beach

Wetland roof, Dubai, U.A.E.

Treatment of complete raw wastewater from an operation container in a roof reed bed

Client:
Dubai Municipality

Contractor:
Waagner Biro Gulf (with support for planning and design by Mizan Consult engineer)


Container before installation

Population equivalent:
4 PE

Planning: 10/2007
Construction: 12/2007

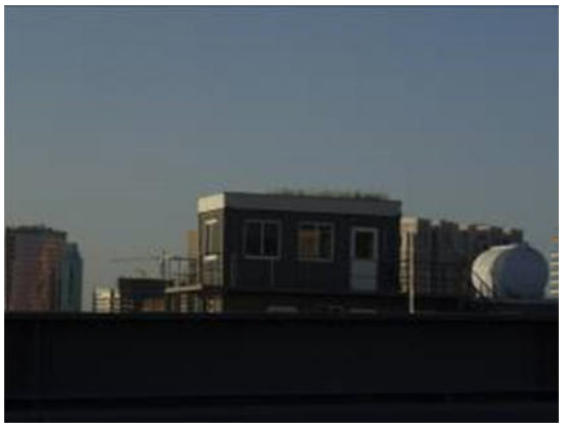
Pre-treatment:
No pre-treatment
- only grinder pump station

Biological treatment step:
- within the layer of a green roof

Outlet:
- No outlet
- Direct reuse of the wastewater for roof top irrigation

Advantages:
- No septic tank
- No sewer connection
- Direct reuse of wastewater
- No contact of people with sewage
- Cooling of container by irrigated green roof

Space requirement:
- 15 m²


Container with wetland roof after planting


Container after 3 years of operation

Grey-water treatment Labour camp Al Awir, Dubai, U.A.E.

Treatment of grey-water (Showers, washbasins) at a labour camp and reuse of treated grey water for filling a fish pond and irrigation.

Client:
Waagner Biro Gulf

Contractor:
Waagner Biro Gulf (with support for planning, design, construction and operation by Mizan Consult)


Filling of filter material

Population equivalent:
250 PE

Planning: 12/2005
Construction: 01-03/2005

Pre-treatment:
- Settlement tanks
- Pumping station

Biological treatment step :
- vertical subsurface flow constructed wetlands


Reed Bed after 1 year of operation

Outlet:

25 m³ of blended water per day.

- Direct reuse of the water for:

Irrigation
Road watering
Car washing
..Fish pond

Space requirement:
- 450 m²


Reed bed and fish pond with treated water

	COD	BOD	TKN	NO_3-N	NH_4-N	PO_4-P	TDS	TSS	CL	SO_4	Salinity	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[‰]	
Septic tank IN	162	67	2.1	1	3.6	7.0	314	47				7.1
Reed Bed IN	131	18			6.7	8.2	257	36				7.1
Reed Bed OUT	10.5	2.0	2.5	2.6	0.7	4.8	420	0	113.5	45	0.4	7.7

Site camp, Lagoons, Dubai U.A.E.

Treatment of waste water from a sales office with a reed bed

Client:
Wade Adams

Contractor:
Waagner Biro Gulf (with support for planning and design by Mizan Consult)

Treatment of wastewater
from a site camp.

Population equivalent:
200 PE

Planning: 03/2006
Construction: 03/2006

Pre-treatment:
- Septic tanks
- Pumping station

Biological treatment step:
- Reed Bed (vertical flow)

Outlet:

6 m³ of treated water per day.

- Direct reuse of the water for:
  irrigation

Space requirement:
- 150 m²


Filling of filter material

New planted reed


After 2 months of operation

	COD	BOD	TKN	NH_4-N	PO_4-P	TSS	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	
Septic IN	400	193			9	186	6.9
Septic Out	301	114			8	70	7.0
Reed Bed OUT	16	3	2.8	0.2	1.8	0	7.4

Drilling Camp, Abu Butabul, Oman

Client:
British Gas

Contractor:
Bauer Emirates Environment (with support for design, construction supervision, start-up and operation by Mizan Consult)

Capacity:
200 population equivalent
35 m³/d

Pre-treatment:
- Raw sewage lift station with grinder

Biological treatment step:
- 2 vertical flow constructed wetlands for suspended solids removal and
  organic load reduction
- 2 horizontal flow constructed wetlands for biological treatment

Outlet:
- Storage pond and direct reuse for
  irrigation

Sludge treatment:
- Sewage sludge mineralization (primary sludge) at first treatment step

Area requirement:
- 1,800 m²

Operating costs
Power consumption
5 kWh/d
Amount of composted sludge:
10 m³/year
Period of sludge removal
20 years
Maintenance staff: 0,03 skilled worker


Reed bed 1. stage, under construction


Reeds after 8 months of operation (08-2008)


Reed Beds after 2 years operation (01-2010)

	COD	BOD	NH4-N	TDS	TSS	pH	FC
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]		/100ml
Reed Bed 2 out, final effluent	30	5	<0.1	2,000 – 8,800	< 5	7.9	Not detected

Sewage sludge mineralisation reed bed Al Salt, Jordan

Client:
KfW, Waj Jordan

Contractor:
Bauer Emirates Environment (with support for design, construction-supervision and start-up by Mizan Consult)


Filter layer installation

Capacity:
8 m³/day surplus sludge (2.5 %DS)

Planning: 05/2011
Construction: 07-10/2011


Sludge bed 2 months under operation

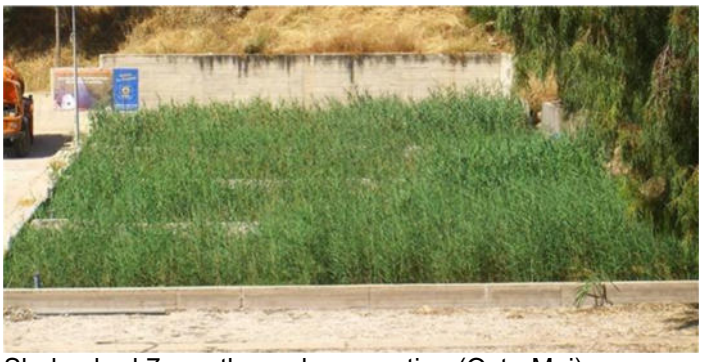
Sewage treatment:
Extended aeration

- Aeration basin
- Settling tanks
- Multimedia filtration

Sewage sludge treatment:
- sludge mineralization reed beds (vertical flow)

Outlet:
- Sludge liquor is pumped back to STP

Advantages:
- No sludge storage & discharge
- Production of fertilizer


Sludge bed 7 months under operation (Oct.- Mai)

Space requirement:
- 640 m²

Oil drilling water treatment

Reed irrigation fields with oil drilling water

Client:
PDO, Oman

Location:
Nimr, Oman

Contractor (BOOT):
Bauer Nimr L.L.C.

Reed Bed Specialist during tender design:
Wolfram Sievert as Projects Manager of Bauer Emirates Environment Abu Dhabi and Design/Proposal Engineer of Bauer Resources Schrobenhausen during tender phase

Daily flow:
45.000 m³/day oil drilling water

Planning: 2009
Construction: 2010-2011

Oil water treatment:
Reed irrigation fields

Salt lagoons

Outlet:
- Total evaporation of oil water

Advantages:
- No recharge of oil water
- Greening the desert
- Production of biomass for energy or eco building materials


Basins under construction


Basins after planting

Space requirement:
6.000.000 m² (600 ha)

TSE infiltration reed beds (Pilot test)

TSE infiltration reed basins to reuse surplus TSE to green the desert and protect the environment (avoid of surplus TSE discharge into the sea)

Client:
Ajman Sewerage

Contractor:
Waagner Biro Gulf LLC

Location:
Industrial area Ajman, U.A.E.

Daily flow:
30 m³/day

Planning: 07/2009
Construction: 09-11/2009

Sewage treatment:
UASB

Tertiary treatment:
Vertical flow reed planted irrigation fields

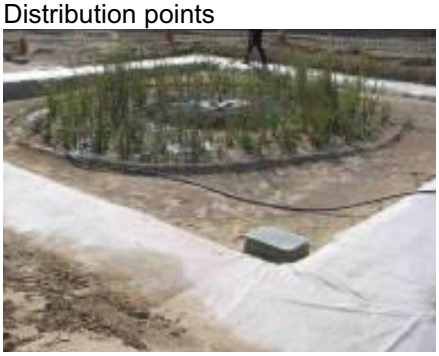
Outlet:
- Recharge of ground water

Advantages:
- No TSE discharge into the sea
- Tertiary treatment of TSE
- Ground water recharge & storage
- Future reuse of TSE from ground water storage
- Greening the desert

Space requirement:
- 200 m²


Drainage pipes


Distribution points


Reed plants, 11/2009


05/2010

	COD	BOD	NO_3-N	NH_3-N	PO_4-P	TDS	TSS	pH
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	
TSE from UASB	319	144	4.7	48.7	11.3	3559	36.7	7.3
Drainage collection in 1.2m	38	5	0.8	3.4	1.3	2084	7	7.1

Infiltration rate desert sand: 90 l/m²xday

Grey water treatment, Resort Zighybay, Oman

Treatment of the laundry water from a five-star hotel in a reed bed system and reuse of the treated grey water for irrigation.

Client:
Six Senses Resort Zighy Bay

Contractor:
Intermass, Sharjah (with support for planning, design, construction supervision, start-up and operation by Mizan Consult)

Planning:	2012
Construction:	2012
Renovation:	2023

Population equivalent:
1500 PE, 20 m³/d grey water

Reed Bed area:

Stage A: 2 x 100 m²
Stage B: 1 x 250 m²

Reed plant harvesting after 8 years operation

Al Hamra Housing Project, Ras Al Khaimah, U.A.E.

Client :
Ministry of Public Works

Contractor:
First Gulf Line (Main)

Main Consultant:
KN-International (with support by Mizan Consult)

Population equivalent:
Phase 1: 100 villas, 800 PE, 216 m³/day

Planning: 2012-2013
Construction: 04/2014-04/2015

Pre-treatment:
- Tanker discharge station
- Manual bar screen
- Macerator pump station


Start of excavation and filling


Pump station

- Sludge Filtration & Mineralization
  Reed Bed Stage A
  (4 basins, vertical flow, 4 x 675 m²)

Biological treatment step :
- Drainage pump station
- Reed Beds, vertical flow
  (4 basins, vertical flow, 4 x 900 m²)

Outlet:
- 150-200 m³ of treated water per day.
- Direct reuse of the water for:
  Irrigation & Tanker filling

Space requirement total:
- 12.000 m²

Contract value:
- 4 Mio AED (RBC), total 16 Mio AED


Drainage system

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
Inflow	446	175	33.4	11.6		308		386
TSE	22	7	0.99	0.35		<5		0.33
ADSSC P1	-	10	-	-	-	10	>1	5

Al Haray Housing Project,
Fujeirah, U.A.E.

Client:
Ministry of Public Works

Contractor:
Dar AlWd

Main Consultant:
KN-International (with support for design, construction supervision and operation by Mizan Consult)

Population equivalent:
Phase 1: 132 villas, 880 PE, 316 m³/day

Planning: 2012-2013
Construction: 2013-2014

Pre-treatment:
- Tanker discharge station
- Manual bar screen
- Macerator pump station

- Sludge Filtration & Mineralization
  Reed beds Stage A
  (4 basins, vertical flow, 4 x 1000 m²)

Biological treatment step:
- Drainage pump station
- Reed beds, vertical flow
  (4 basins, vertical flow, 4 x 1325 m²)

Outlet:
- 220-316 m³ of treated water per day.
- Direct reuse of the water for:
  Irrigation & Tanker filling

Space requirement total:
- 15.000 m²

Contract value:
- 7 Mio AED (RBC), total 25 Mio AED


Start of excavation and filling


Liner installation


Drainage system

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
Inflow	260	105	37.8	12.2		138		93.2
TSE	31	9	1.15	0.23		6		2.71
ADSSC P1	-	10	-	-	-	10	>1	5
ADSSC P3	-	50	2	2	-	50	>3	75

Doha North STP TSE Lagoon, Qatar

TSE storage lagoon with integrated reed bed filter

Client:
Ashgal Infrastructure Works, Qatar

Contractor:
Keppel Seghers, Waagner Biro Gulf

Main Consultant:
KEO, Stanley Consultants (with support for design, construction supervision and operation by Mizan Consult)


Liner installation

Data of lagoon:
- *Deep pond: 8,753 m²*
- *Shallow pond: 5,064 m²*
- *Reed planted wetland area 18,821 m²*
- *Walkway 568 m²*
- *Gazebo 3 Nr.*
- *Circulation pump: 600 l/s,*
- Total Storage volume: 18.000 m³

Planning: 2012
Construction: 2012-2015

Drainage system and gravel filter

Treatment of lagoon water:
- Gravel filled reed planted wetland area
- Drainage water collection system
- Recirculation pump


Wetland area, fresh planted

Space requirement total:
- 33.000 m²

Contract value:
- 7 Mio AED

Al Haray Housing Project, Fujeirah, U.A.E.

Client:
Ministry of Public Works

Main Contractor:
DarAlWd

Specialized contractor:
Reed Bed Contracting L.L.C.

Main Consultant:
KN-International (with support for design by Mizan Consult engineer)

Population equivalent:
Phase 2: 198 villas, 1584 PE, 576 m³/day

Planning: 2014-2015
Construction: 2015-2016

Pre-treatment:
- Tanker discharge station
- Basket screen
- Lifting pumps
- Rotor rakes

- Sludge Filtration & Mineralization
  Reed Bed Stage A
  (10 basins, vertical flow, 6 x 1000 m²)

Biological treatment step:
- Drainage pump station
- Reed Bed, vertical flow
  (4 basins, vertical flow, 6 x 1325 m²)

Outlet:
- 500 - 700 m³ of treated water per day.
- Direct reuse of the water for:
  Irrigation & Tanker filling

Space requirement total:
- 22.000 m²

Mountain Wildlife Visitor Center, Kalba, Sharjah, U.A.E.

Client:
Government of Sharjah. H. H. Ruler's office

Contractor:
Hardco
Specialized contractor:
Reed Bed Contracting L.L.C.

Main Consultant:
URS, Mott Mac Donald (with support for planning and design by Blumberg engineers and Mizan Consult)

Population equivalent:
1000 visitors, 30 staff members, 30 m³/day

Planning: 2013-2014
Construction: 2015
Start: 12-2015

Pre-treatment:
- Lift Station
- Septic tank
- Grinder lift station

Biological treatment step :
- Vertical subsurface flow constructed wetland (2 basins, 2 x 300 m²)

Outlet:
- 20-30 m³ of treated water per day.
- Direct reuse of the water for: Irrigation

Space requirement total:
- 1.050 m²

Contract value:
- 1.09 Mio AED


Excavation septic tank


Installation of distribution pipes


Reed Bed under operation

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
Inflow	-	-	-	-		-		-
TSE	-	-	-	-		-		-
ADSSC P1	-	10	-	-	-	10	>1	5
ADSSC P3	-	50	2	2	-	50	>3	75

Dubai Creek Harbour, Wetland Recovery Center, U.A.E.

Collection and nursing of wetland plants from a backfilling site to preserve wetland plants for future planting in a compensation wetland

Client:
EMAAR, The Lagoons Phase One L.L.C.

Main Consultant:
Mott Mac Donald

Specialized Consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Population equivalent:
210,000 reed plants

Planning: 2016
Construction: 2016-2017
Start: 03-2017

System:
- TSE Irrigated Nursery

Outlet:
- 20-30 m³ TSE.
- Direct reuse of the water for:
  Road watering

Space requirement total:
- 11 x 312 m²

Contract value:
- 2.9 Mio AED

Excavation of reed plants

Nursery fresh potted reeds

Nursery after 4 month

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
Inflow	216	82	6.39'	47	2662	47'	4.7'	6.92'
TSE	-	-	-	-		-		-
ADSSC P1	-	10	-	-	-	10	>1	5
ADSSC P3	-	50	2	2	-	50	>3	75

TSE, used for irrigation of the nursery

Dubai Creek Harbour, Wetland Creation, U.A.E.

Client:
EMAAR, The Lagoons Phase One L.L.C.

Supervision Consultant:
Mott Mac Donald

Specialized Consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Population equivalent:
100,000 m² wetland

Planning: 2016-2017
Construction: 2017-2018
Start: 10-2018

Pre-treatment:
- TSE from Municipality used for filling

Biological treatment step:
Area A 33,543m² surface flow wetland
Area B 20,015 m², pond with islands
Area C 46,442 m² planted submerged vertical gravel filter

Outlet:
- 2750 m³ TSE/day (Summer)
- 3250 m³ TSE/day (Winter)
- Direct reuse of the water for:
  Irrigation tank top up

Space requirement total:
- 100,000 m²

Contract value:
- 22.5 Mio AED

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	Turbidity
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	NTU
TSE-IN	216	82	6.39'	47	2662	47'	4.7'	6.92'
TSE-OUT	<40	<6	<5	< 3		<5		-

Haya Water, Pilot Reed Bed

Client:
Haya-Water, Oman

Consultant:
Sievertconsult

Contractor:
Reed Bed Contracting L.L.C.

Population equivalent:
220 PE

Planning: 2016
Construction: 2016
Start: 01-2017

Pre-treatment:
- Buffer tank
- Anoxic tank (25 m³)

Biological treatment step:

Stage A: 3 x 139 m² (417 m²)
Stage B: 2 x 312,5 m² (625 m²)

Outlet:
- 20 m³/day
- Reuse for irrigation

Space requirement total:
- 1300 m²

Contract value:
- 0,6 Mio AED

	COD	BOD	NH4-N	PO4-P	TDS	TSS	DO	VHO
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	Oval/L
TSE-IN	974	330	59	11	1456	508	-	30
TSE-OUT	24	5	0,3	0,7	1730	2	6,4	0
MD 145/93 Standard A	150	15	5	30	1500	15	-	< 1

Sewage sludge mineralisation reed bed Wadi Hassan, Jordan

Client:
giz, Borda Water Authority of Jordan (WAJ)

Consultant:
Blumberg & Sievertconsult

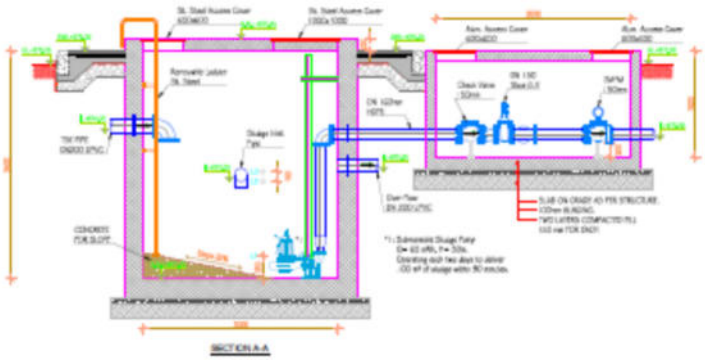
Layout plan

Capacity:
Wastewater per day 900 m³
50 m³/day surplus sludge with 3 %DS (1500 kg DM)

Planning: 2018
Construction: 2018/2019

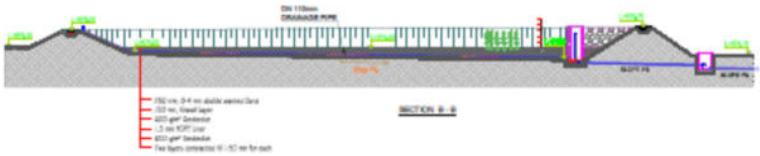
Sewage treatment:
Extended aeration

- Aeration basin
- Settling tanks



Distribution chamber

Sewage sludge treatment :
- Sludge thickener
- Sludge drying beds (summer operation)
- sludge mineralization reed beds (winter operation)



Section

Load of sludge mineralization reed bed
- 6 month per year (winter)
- 70 kg DM /m²xyear
- 11.7 kg DM/month (operation in winter)
- Treated sewage irrigation during summer and start-up (40 m³/day)

Output:
- Sludge liquor is pumped back to STP
- 686 m³ mineralized sludge per year accumulating in the basins, removal after 10 years.

Advantages:
- No liquid sludge handling, storage & disposal for 10 years
- No use of chemicals and energy only for pumping

Space requirement:
- 3,911 m² (reed bed surface)
- 9,238 m² (total area)

feynan ecolodge

jordan's great escape

(Decentralized Wastewater Management for Adaption to Climate Change in Jordan)

Client :
giz, Borda, Water Authority of Jordan (WAJ)

Contractor:
Shabatat Contracting

Consultant:
Ingenieurbüro Blumberg

Population equivalent:
5 m³/day

Planning: 2016
Construction: 2018
Start: 12-2018

Pre-treatment:
- Biogas-chamber for blackwater as primary Treatment (20 m³, 3 – 5 m³ Biogas per day)
- ABR (Anaerobic 'Baffled Reactor, 5 Chamber total 29 m³)

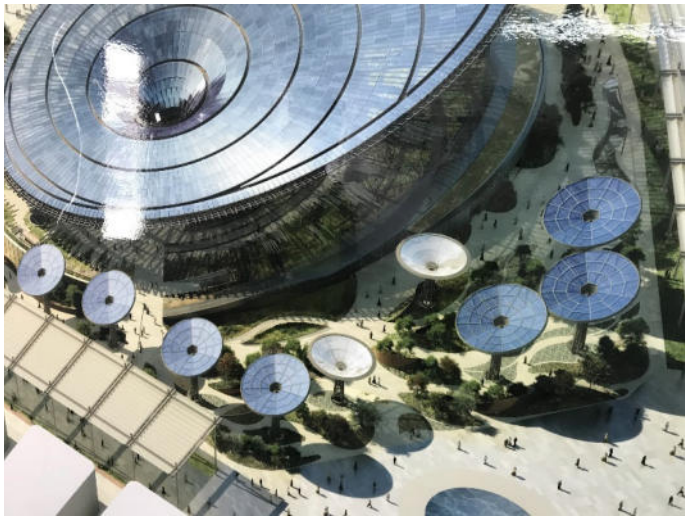
Biological treatment step :
- Solar lift station
- Syphon chamber
- Vertical flow constructed wetland: 2 x 75 m² (150 m²)
- Solar lift station to irrigation tank

Outlet:
- 4 m³/day
- Reuse for irrigation

Space requirement total:
- 200 m²

	COD	BOD	NO_3	PO4-P	TDS	TSS	DO	VHO
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	Oval/L
IN	527	305	53 (NH_4)	12	-	299	-	-
TSE-OUT	40	5	30	2	-	5	2	0
JS 893/2006 Category A	100	30	30	15	1500	50	-	< 0.1

(Sustainable Pavilion, Water Management)



Client :
EMAAR

Main Contractor :
ASGC

Reed Bed Contractor:
Reed Bed Contracting L.L.C.

Consultant:
Sherwood, Grimshaw

Specialised consultant:
Sievertconsult

Waste Water:
55 m³/day black-Water (Reed bed & UF)
7 m³/day grey water (UF)
20 m³/day desalination of ground water (RO)
11 m³/day condensate (UF)
Evaporation pond for brine

Planning: 2019
Construction: 2019-2020
Start: 09-2020 (21)

Reuse:
- Black water for toilet flushing and irrigation
- Grey water for hand washing & ablution
- Condensate and groundwater for potable use

Biological treatment step:
- Black water: Reed Bed & aeration tanks

Mechanical treatment step:
- Black water: Ultrafiltration
- Grey water: Disk filter and Ultrafiltration
- Ground water: Filter & RO
- Condensate: Disk Filter and Ultrafiltration

Space requirement total:
- Black water: Settling tanks in landscaping 25 m³, Reed Beds 771 m² + 2 x 30 m³ aeration tanks, Ultrafiltration skid
- Grey water: 25 m³ buffer tank, Disk & UF-Skid
- Condensate: 25 m³ buffer tank, Metal removal and Adsorbtion Filter

Raw wastewater treatment by constructed wetlands in Al Azraq, Jordan

Employer:
BORDA Aman, Water Authority of Jordan (WAJ)

On behalf of:
Swiss Agency for Development and Cooperation (SDC)

Consultant:
Ingenieurbüro Blumberg (Blumberg Engineers)

Short description:
Two-stage wastewater treatment plant for a town in the Governorate of Zarqa

Population equivalent:
8358 PE
Daily loading rate:
515 m³/d

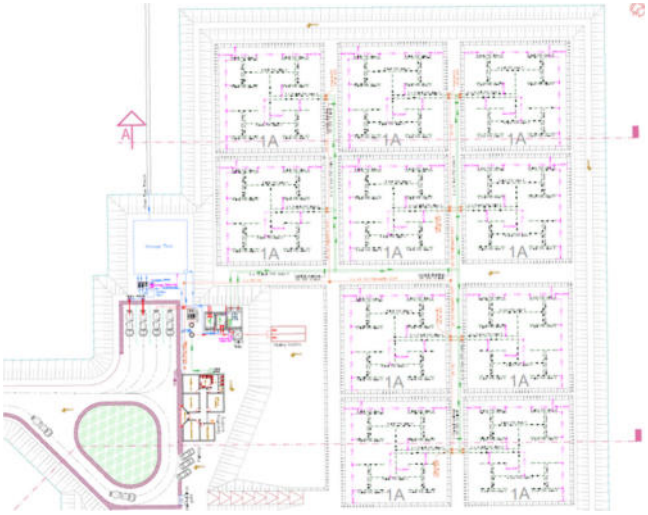
Project status:
Inception Phase: 11-2017 – 06-2018
Planning completed: 11-2019
Implementation Phase: 2020 - 2021

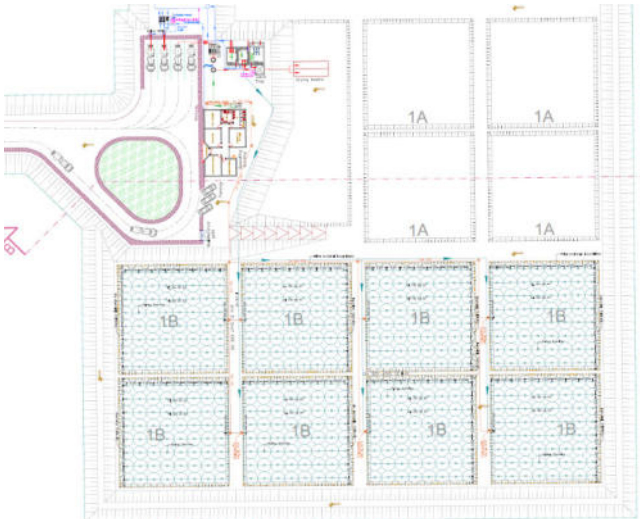
Pre-treatment:
- 2 tanker discharge stations
- 2 automatic bar screen (40 mm)

Stage A reed beds:
- Syphon: V = 30 m³, Q = 140 l/s
- 10 basins á 1,000 m²

Stage B reed beds:
- Pump station: V = 40 m³, Q = 32 l/s
- 8 basins á 1,000 m²

Effluent discharge reuse:
- Storage pond and reuse for irrigation and non potable reuse on site





	COD	BOD	NO_3	PO4-P	TDS	TSS	DO	VHO
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	Oval/L
IN								
TSE-OUT								
JS 893/2006 Category A	100	30	30	15	1500	50	-	< 0.1

سفاري الشارقة
Sharjah Safari

Reed Bed System, KAC

Treatment of staff accommodation
waste water in a raw waste water double stage reed bed and reuse of TSE for irrigation

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
Two-stage raw wastewater treatment plant for Keeper Accommodation,
extension of existing aerated reed bed

Population equivalent:
130
Daily loading rate:
20 m³

Pre-treatment:
Raw wastewater lift station with grinder pumps

Stage A reed beds:
3 x 70 m²
Stage B reed beds:
2 x 167 m²

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 2

Treatment of toilet water for
toilet flushing with ABR and reed bed

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
ABR and vertical flow reed bed treatment plant for visitor toilets

Population equivalent:
23
Daily loading rate:
3.4 m³

Pre-treatment:
ABR

Stage A reed beds:
N/A
Stage B reed beds:
2 x 28.5 m²

Reuse:
Direct reuse for toilet flushing, TSE from reed bed is fed directly into toilet flushing tanks

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 2.2

Surplus raw wastewater treatment and Evapotranspiration & Infiltration in a constructed wetland

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Population equivalent:
362
Daily loading rate:
62 m³

Pre-treatment:
N/A

Stage A reed beds:
4 x 113 m²
Evapotranspiration & Infiltration Fields:
4 x 250 m²

Reuse:
Groundwater replenishment

Evapotranspiration & Infiltration Wetland:

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 3.0

Treatment of visitor and restaurant waste water in an ABR and vertical reed bed and reuse of TSE for toilet flushing and irrigation

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
ABR and vertical flow Reed Bed

Population equivalent:
293
Daily loading rate:
44 m³

Pre-treatment:
ABR

Stage A reed beds:
N/A
Stage B reed beds:
2 x 366.5 m²

Reed Bed System, Zone 04 BOH

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
Raw wastewater treatment with double stage reed bed

Population equivalent:
83
Daily loading rate:
26.8 m³

Pre-treatment:
N/A

Stage A reed beds:
3 x 40 m²
Stage B reed beds:
2 x 112.5 m²

Reuse:
Direct reuse for irrigation

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 10-1

Treatment of visitor and restaurant waste water in a raw waste water reed bed and reuse of TSE for irrigation

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
Raw wastewater treatment with double stage reed bed

Population equivalent:
140
Daily loading rate:
20 m³

Pre-treatment:
N/A
Stage A reed beds:
3 x 70 m²
Stage B reed beds:
2 x 166.5 m²

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 10-2

Filtration of pond water with reed bed filter

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Short description:
Ornamental pond with
Reed bed filtration

Volume of pond:
165 m³

Filtration reed beds:
2 x 165 m²

Re-circulation pumps:
2 x 2.8 l/s (0.4 kW)

Reuse:
Reed bed filtered water is also used for filling watering holes

سفاري الشارقة
Sharjah Safari

Reed Bed System, Zone 18

Tanker sewage treatment with raw wastewater double stage Reed bed

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Population equivalent:
84
Daily loading rate:
12 m³

Pre-treatment:
Basket screen in discharge chambers

Stage A reed beds:
3 x 50 m²
Stage B reed beds:
2 x 100 m²

Reuse:
Direct reuse for tanker filling (Construction, road watering, irrigation)

سفاري الشارقة
Sharjah Safari

Reed Bed System, Elephant Pool 01 & 02

Filtration of elephant pool water with drum screen and reed bed filter

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Volume of lake:
EL-1: 1500 m³, EL-2: 490 m³
Daily turn-over:
100 % Reed Bed, 600 % drum filter

Pre-treatment:
Bar Screen, settling tank, drum filter

Reed Bed filtration:
EL01: 1470 m², EL02: 490 m²

Reed Bed sludge mineralization:
EL01: 300 m², EL02: 150 m²

سفاري الشارقة
Sharjah Safari

Reed Bed System, Elephant Pool -03

Filtration of elephant pool water with drum screen and reed bed filter

Client:
Government of Sharjah, H.H. Ruler's Office

Project Management and Consultant:
Spencer Project Management and Consultancy FZE

Specialized consultant:
Sievertconsult

Specialized contractor:
Reed Bed Contracting L.L.C.

Volume:
465 m³
Daily turn-over:
100 % Reed Bed, 600 % drum filter

Pre-treatment:
Bar Screen, settling tank, drum filter

Reed Bed filtration:
1 x 470 m²

Reed Bed sludge mineralization:
1 x 150 m²

Reed Bed System

Employer:
Desalination Partners S.L.
Calle Sobrado, number 2
C.P. 2850
Madrid

Main contractor:
Tiejun
Owner:
Marafiq Red Sea for Energy Company
Specialized consultant:
Blumberg Engineers &
Sievertconsult

Short description:
Two-stage wastewater treatment
plant for a tourist development

Population equivalent:
93.000
Daily loading rate:
16.000 m³

Pre-treatment:
Automatic screens
Grit Removal channel
Buffer tanks 6 x 1800 m³

Stage A reed beds:
96 x 1333 m²
Stage B reed beds:
56 x 1400 m²
Stage C reed beds:
8 * 3600 m²
TSE-Storage lagoons:
2 x 16000 m³

Reuse:
Irrigation of nursery and
Landscaping

	COD	BOD	NO_3-N	PO4-P	TDS	TSS	DO	VHO
	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	Oval/L
IN	873,2	268			607	283,6		
TSE-OUT		7	5,3	0,05	1469	5,6		0
RCER 2015		10	10		2500	10	-	< 0.1