Wastewater Gardens International

(WWG)

SUSTAINABLE WASTEWATER TREATMENT & MANAGEMENT

Constructed wetlands - Design & Construction



Tirta Gangga Royal Water Palace - 1/3 WWG treatment unit serving 300 visitors/day

TECHNICAL STUDY

INCLUDING CONSTRUCTION BILL OF QUANTITIES

Dar Illane SARL

REF: Jnane Tamsna

Douar Abiad
La Palmeraie
Marrakesh 40000
Moroccof

18 JANUARY 2019



Xpu-Ha Ecopark Restaurant

1/9 treatment units servicing 1500 people/day

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CONTACT SHEET

PROJECT NAME AND CONTEXT: **Jnane Tamsna**

Location: Douar Abiad
La Palmeraie - Marrakesh 40000

Country: Morocco

Project initiator:

Contact Name: **Meryanne LOUM-MARTIN**
Position/Title in the project: Principal
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Project partners: N/A
Position/Title in the project:

Contact N/A
Position/Title in the project:

Project Team: **Gary Martin**

Architect/s: N/A
Contact:
Project Manager/s: N/A
Contact:
Constructor/Builder/s - Name/s: N/A
Contact:
Project Manager N/A
Contact:
Landscaper/s: N/A
Contact:

WWG REFERENCE OF PROJECT: **Dar Illane SARL / Jnane Tamsna / WWG101352**

WASTEWATER TREATMENT DESIGN AND IMPLEMENTATION:

Designer/s: **Florence Cattin for Wastewater Gardens International (WWG) / Institute of Ecotechnics**
Project Management: N/A
Implementation and Construction: Due to the distance, not by WWG designer
Plant handling, landscaping and Plantation coordination: N/A

BASIS OF STUDY

. ENVIRONMENTAL DATA AND DEFINITIONS OF WASTEWATER TREATMENT FRAMEWORK

. PROJECT GENERAL DATA SHEET

. WASTEWATER EMISSION AND QUALITY OF EXCRETA AND NUTRIENTS

Name of Project: **Jnane Tamsna / WWG101352** Address: **Douar Abiad - La Palmeraie - Marrakesh 40000** Country: **Morocco**

ENVIRONMENTAL DATA

WEATHER Climate: **Continental subtropical desert** LOW Temperature - ºC: 6 - rarely 0 HIGH Temperature - ºC: 35 +

RAIN (millimeters)	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	August	Sep	Oct	Nov	Dec	YEARLY (mm)	Source of data
	Average	>31<35	>38<41	>38 <41	>39<41	>22<25	>5<6	<2	>3<5	>6<8	>22<25	>41<44	>31<34	248	www.weather-and-climate.com + https://fr.allmetsat.com/climat/maroc.php?code=60230

HIGH rain (mm/day): N/A AVERAGE rain (mm/day): N/A LOW rain (mm/day): N/A

Note:

TEMPERATURE (°C)	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	August	Sep	Oct	Nov	Dec	Source of data
	Minimum	6	8	9	11	14	16	20	20	18	15	10	7	www.weather-and-climate.com
	Maximum	18	20	22	24	27	31	36	36	32	27	22	19	

Potential EVP: AVERAGE Potential Evapotranspiration- PET (mm/day): 0.2-7.8* LOW PET (mm/day): N/A HIGH - PET (mm/day): N/A

Average Humidity rate: >50<80%

** Estimation spatialisée de l'Evapotranspiration des cultures irriguées par télédétection. Application à la gestion de l'Irrigation dans la plaine du Haouz (Marrakech, Maroc). Science et Changements Planetaires - Sécheresse vol. 20, n° 1:123-130, April 2009*

Saline water: No

SEWAGE TREATMENT DEFINITIONS AND FRAMEWORK

Definitions:

Black water: Water that has been mixed with excreta (faeces + urine) - Toilet water. In some cases toilet lavabo water and kitchen waters are also included in "Black" water.

Grey Water: Water coming from showers, bath, faucets, clothe washing, kitchen (* See "Black Water"), and sometimes pools (if they are not chlorinated).

Note: Kitchen wastewater, depending on quantity may require a grease trap. In some cases is integrated into "Black Water".

EH: Equivalent Habitant (number of person serviced)

Treatment system proposed: In agreement with international treatment legislations for secondary treatment (Please see corresponding Annex)

. Primary treatment: Separation of solid particles from the wastewater

BLACK WATER: Septic tank + Filter or similar

GREY WATER: Gravel filter or sedimentation tank - Large volumes of kitchen greywater: Grease trap (vermicompost or mechanical unit)

. Secondary treatment: Treatment of the sewage effluent

BLACK WATER: Sub-surface Horizontal Flow Constructed Wetlands / WWG unit

GREY WATER: In some cases is mixed with BLACK WATER but if not the water is going through a filtering stage followed by use for the landscaping

NOTE: **Primary and secondary treatment provided by a compact oxygenated (chlorinated?) mutliple-chamber system**

Drainage of treated effluents:

BLACK WATER: Return to the soil via subsurface drains calculated in accordance with "Standards Australia [2000], AS/NZS 1547: 2000 Onsite Domestic Wastewater". Management, NSW, in accordance or superior with worldwide standards. Ideally the drainage area will also be planted with non invasive rooted plants. On large scale plants, the treated water will be reused in fruit orchards or other types of agricultural activities; oxygenated pond systems are also appropriate.

GREY WATER: Various options possible: for example via subsurface drains filled with gravel or mulch filled plant clusters

Project Data

		Notes
PROJECT NAME AND LOCATION:	**Jnane Tamsna / WWG101352**	
City:	Douar Abiad - La Palmeraie - Marrakesh 40000	
Country:	Morocco	
Type of infrastructures:	**Hotel**	
Max Nˆ people serviced:	*60*	
Total Nˆ people serviced:	60	
Type of infrastructure:	Rooms / small villas	
	. Toilets	
	. Bathrooms with bathtubs	

Total Estimated max Amount of Wastewater to be treated: **12,000 Liters/day**

Environment: Notes

. Primary and secondary Treatment provided by compact aerated multiple chamber system

Source of Base data: **Gary Martin**

MAXIMUM ESTIMATED WASTEWATER EMISSION IN LITERS AND NUTRIENTS - PER DAY

Name of infrastructure	Maximum N° persons	Staff	GREY WATER				BLACK WATER		MAXIMUM TOTAL WASTEWATER	EXCRETA				
										NOTE: Because of transient nature of hotel guests, only 50% of quantities at full occupation indicated				
										Quantity		Nutrients		
			SHOWER + LAVABO	KITCHEN	LAUDRY	Total GREY water INCLUDING LAUNDRY	TOILET	TOTAL FAECAL WATER + KITCHEN WATER		Quantity URINE (Average in Liter)	Quantity FAECES (Average in Kg)	Total NITROGEN (Average in grams)	Total PHOSPHORUS (Average in grams)	Total POTASSIUM (Average in grams)
HOTEL WITH GROUPED ROOMS AND INDEPENDENT HOMES	60	N/A							12,000	33.00	8.10	432.00	45.6	93.6

TREATMENT CALCULATIONS

. CALCULATION RESULTS

Note for the designer and constructor:
1/ Level of water in the constructed wetland: 0.50 meters 2/ The filtering media here indicated is limestone (or similar porosity) gravel.

Infrastructure and activity serviced	Wastewater (Liters)							OPTION A: TREATING BLACKWATER AND GREYWATER SEPARATLY												OPTION B: ALL WASTEWATER INTO ONE TREATMENT						
								OPTION 1: TREATING BLACKWATER AND GREY WATER SEPARATLY: BLACK WATER: TOILET WATER ONLY								OPTION 2: TREATING BLACKWATER AND GREY WATER SEPARATLY: BLACK WATER: TOILETS + KITCHEN										
								BLACKWATER				GREYWATER				BLACKWATER				GREYWATER				ALL WASTEWATER						
									WWG		Drainage		WWG		Drainage		WWG		Drainage		WWG		Drainage		WWG		Drainage		
	BATHROOMS	KITCHEN	LAUNDRY	TOTAL GREYWATER (including laundry)	TOILET WATER	TOILET + KITCHEN WATER	MAXIMUM TOTAL WASTEWATER	Primay Treatment *Here septic tank* (*Inside volume in Liters*)	Secondary Treatment (WWG unit) - Surface in m^2	N° Plants	Loam (*Linear Meters*)	Barrel filled with gravel (Volume Liters) and/or Grease Trap (GT)	Secondary Treatment (WWG unit) - Surface in m^2	N° Plants	Loam (*Linear Meters*) / Light Clay (*Linear Meters*)	Primay Treatment *Here septic tank* (*Inside volume in Liters*)	Secondary Treatment (WWG unit) - Surface in m^2	N° Plants	Loam (*Linear Meters*) / Light Clay (*Linear Meters*)	Barrel filled with gravel (Volume Liters) and/or Grease Trap (GT)	Secondary Treatment (WWG unit) - Surface in m^2	N° Plants	Loam (*Linear Meters*) / Light Clay (*Linear Meters*)	Primay Treatment *Here septic tank* (*Inside volume in Liters*)	Secondary Treatment (WWG unit) - Surface in m^2	N° Plants	Sand (*Linear Meters*) / Loamy (*Linear Meters*) / Light Clay (*Linear Meters*) / Heavy Clay (*Linear Meters*)
HOTEL - 60 GUESTS AT MAX. OCCUPATION							12,000.00	N/A																N/A	90.00	225	96 / 212 / 384 / TEST or inverted leachdrain

NOTE: Note: 1/ This chart should be read horizontally, from left to right - 2/ As no soil tests have been carried out, indications are given for 3 kinds of common soils (Drainage section) - 3/ If volcanic gravel is readily available, the WWG unit surfaces can be reduced by 20%

CONSTRUCTION BILL OF QUANTITIES

. SUMMARY

. LIST OF WORKS AND CONSTRUCTION NOTES

CONSTRUCTION BILL OF QUANTITY AND CONSTRUCTION NOTES

PROJECT REFERENCE: Jnane Tamsna / WWG101352

BUILDING REFERENCE: Hotel - Grouped and independent rooms - 60 guests at maximal occupation
ADDRESS: Douar Abiad - La Palmeraie - Marrakesh 40000
COUNTRY: Morocco

SUMMARY OF SEWAGE TREATMENT PRINCIPAL PARAMETERS

	Notes	Yes	No
System separating black water from grey water:	Primary and secondary treatment is provided by a compact multi-chambered aerated system		X
System mixing all water:		X	
System treating only blackwater:			X
System treating only greywater:			X

Amount of water to be treated (Liter)/day	
Black water:	N/A
Greywater:	N/A
Total Sewage:	12,000.00

			Volume (m^3)	Surface (m^2)	Unit	Width (m)	Length (m)	Depth (m)
Mixed water	**Primary treatment**	Compact treatment unit						
	Secondary treatment	**Constructed Wetland (WWG Unit)**		**90**		**5**	**18**	**0.65**
		NOTE: Indicated depth is from the floor to the top of the surrounding soil - Not taking into consideration the additional depth from the gravity fall of incoming water						
		Water level inside the WWG unit						**0.5**
		Number of Plants			**225**			
		Deep rooted:			**75**			
		Medium rooted:			**75**			
		Light rooted:			**75**			
		WWG water level Control box (minimal inside dimensions)			**1**	0.4	0.4	0.8
		NOTE: The Control Box can also be round (pre-fabricated concrete ring); indicated depth is from the floor to the top of the soil; it includes +15cm lower floor than the WWG unit - Not taking into consideration the additional depth from the gravity fall of						
	Drainage of treated water (min. depth)	**Subsurface drainage trenches**		**SANDY SOILS**		0.3	**96**	0.5
		N° of lines:		6 of 16m each				
				LOAMY SOILS		0.3	**212**	0.5
		N° of lines:		14 ligns of 16m each				
				LIGHT CLAY SOILS		0.3	**384**	0.5
		N° of lines:		24 ligns of 16m each				

Construction notes for WWG designer:

Depth of water (meter): **0.5**

50-100mm gravel inlet + outlet of WWG (meter): 2.5

Type of gravel for the WWG unit: **Limestone**

NOTE: if volcanic rock is available, reduce the WWG unit surface by 20%

LIST OF WORKS

NO	WORK DESCRIPTION	NOTES	UNIT	WWG unit	Control Box (CB)	OTHER
A	**PREPARATION WORK**					
1	Water for Work			TBD		
2	Electricity for Work			TBD		
3	Cleaning and preparing the ground			TBD		
B	**PRIMARY TREATEMENT**					
C	**CONSTRUCTED WETLAND WORK (WWG) + Control Box**					
				WWG unit	**Control Box (CB)**	**OTHER**
EXCAVATION						
1	Soil excavation connecting primary treatment to WWG					
2	Soil excavation WWG	ADDED: +0.5m sides + 0.4m Depth (WWG) +0.6m Depth for CB *** NOTE: this is not taking into consideration additional depth from gravity drop	m^3	106.838	1.2	
PIPES & ACCESSORIES						
3	Pipes - PVC 100/110mm - 4"	Including pipe risers inside the system and CB + Inspection openings before and after systems; 4.3, 4.4, 4.5, 4.6 may not be used but are included as can provide useful. Extra pieces are included (ideally supplyer accepts to take unused ones back).	m	19		
4.1	Pipe accessories - PVC 100mm / 4": T		unit	9		
4.2	Pipe accessories - PVC 100mm / 4": Elbow 90º		unit	12		
4.3	Pipe accessories - PVC 100mm / 4": Elbow 45˚		unit	2		
4.4	Pipe accessories - PVC 100mm / 4": Elbow 30˚		unit	2		
4.5	Pipe accessories - PVC 100mm / 4": Y		unit	2		
4.6	Pipe accessories - PVC 100mm / 4": Union		unit	5		
4.7	Pipe accessories - PVC 100mm / 4": Caps		unit	10		
5	*Lay Pipes*					
GRAVELS						
6	Gravel - 10/20mm	LIMESTONE GRAVEL - Screened and clean	m^3	42.25		
7	Gravel - 50/100mm - 2.5m at the entrance and at the exit of the WWG system		m^3	16.25		
8	*Gravel - Laying*					
PLANTS						
9	Plants	Minimum 1/3 deep rooted + 1/3 medium rooted + 1/3 superficial roots	unit	225		
10	Plantation		ls	TBD		
VARIOUS						
11	Pump before		unit			
12	Pump box		unit			
13	Distribution box before		unit			
14	Sand to lay below pipes from primary treatment		m^3			
15	Water to test waterproofing		m^3	45		
16	Soil refill					
17	Take out excavated soil & cleaning					
Option 1: Waterproofing the tank in concrete (Note: Calculated with concrete hollow bricks)		N/A				
Option 2: Waterproofing the tank in concrete (Note: Calculated with a wood form)		N/A				

List of Works 2/2

NO	WORK DESCRIPTION	NOTES	UNIT	WWG unit	Control Box (CB)	OTHER
Option 3: Waterproofing the tank in membrane - Example: EPDM 0.045" / 1.1 mm - 0.040"/ 1.02mm						
C1_2a	Waterproofing membrane - 4 meters added on each sides to allow for a protective berm + burrying of the material on each sides	9 m X 22 m / If other shapes than square are chosen, recalculate with membrane specialst, keeping in mind the ideal ratio of 1L:3Width	m^2	198		
C1_2b	QuickSeam 3" Splice Tape or 6"		unit	1 meter		
C1_2c	QuickPrime Plus - 1 Gallon or 3 Gallon Pail	To fix the entrance and exit pipes	Gallon	Small quantity		
C1_2d	Compacted Sand bed to lay below the tank - 10 mm thick - or geotextile	Depend on substrate / TBD on-site	m^3			
C1_2d	Geotextile to protect the membrane from the ground		m^2	126.8		
C1_2e	Rock to cover the membrane border	46 linear meters	m^2	TBD		
C1_2f	Installation					
D	**DRAINAGE - 96 meters divided in 6 ligns of 16 meters long here instead of 15 meters**					
Option 1: Subsurface drainage via conventional trenches				**Sandy soils**	**Loamy soils**	**Light Clay**
EXCAVATION						
1	Soil excavation	Added +0.5m on the sides + N°of lines + 1m on length + 0.2m Depth *** NOTE: this is not taking into consideration additional depth from gravity drop	m^3	54.32	119.28	215.6
PIPES & ACCESSORIES						
2	Pipes - PVC 90mm - 3"	Including connection points + Inspection openings before and after each line. 3.3, 3.4, 3.5, 3.6 may not be used but are included as can provide useful. Extra pieces are included (ideally supplyer accepts to take unused ones back).	m	119	259	461
3.1	Pipe accessories - PVC 90mm / 3": T		unit	17	33	53
3.2	Pipe accessories - PVC 90mm / 3": Elbow 90°		unit	17	33	53
3.3	Pipe accessories - PVC 90mm / 3": Elbow 45°		unit	5	5	5
3.4	Pipe accessories - PVC 90mm / 3": Elbow 30°		unit	2	2	2
3.5	Pipe accessories - PVC 90mm / 3": Y		unit	2	2	2
3.6	Pipe accessories - PVC 90mm / 3": Union		unit	5	5	5
3.7	Pipe accessories - PVC 90mm / 3": Caps		unit	14	30	50
4	*Lay Pipes*					
GRAVELS						
5	Gravel 10-20mm	Low quality ok	m^3	14.4	31.8	57.6
6	*Gravel work*					
VARIOUS						
7	Geotextile or similar to lay on top of pipes: 0.3m width or around the pipes (better)		m			
8	Pump before		unit			
9	Pump box		unit			
10	Distribution box before		unit			
11	Soil refill					
12	Take out excavated soil & cleaning					
Option 2: Permaculture technique / Mulch pits						
END OF BOQ						