BUREAU TECHNIQUE
POUR LE DÉVELOPPEMENT

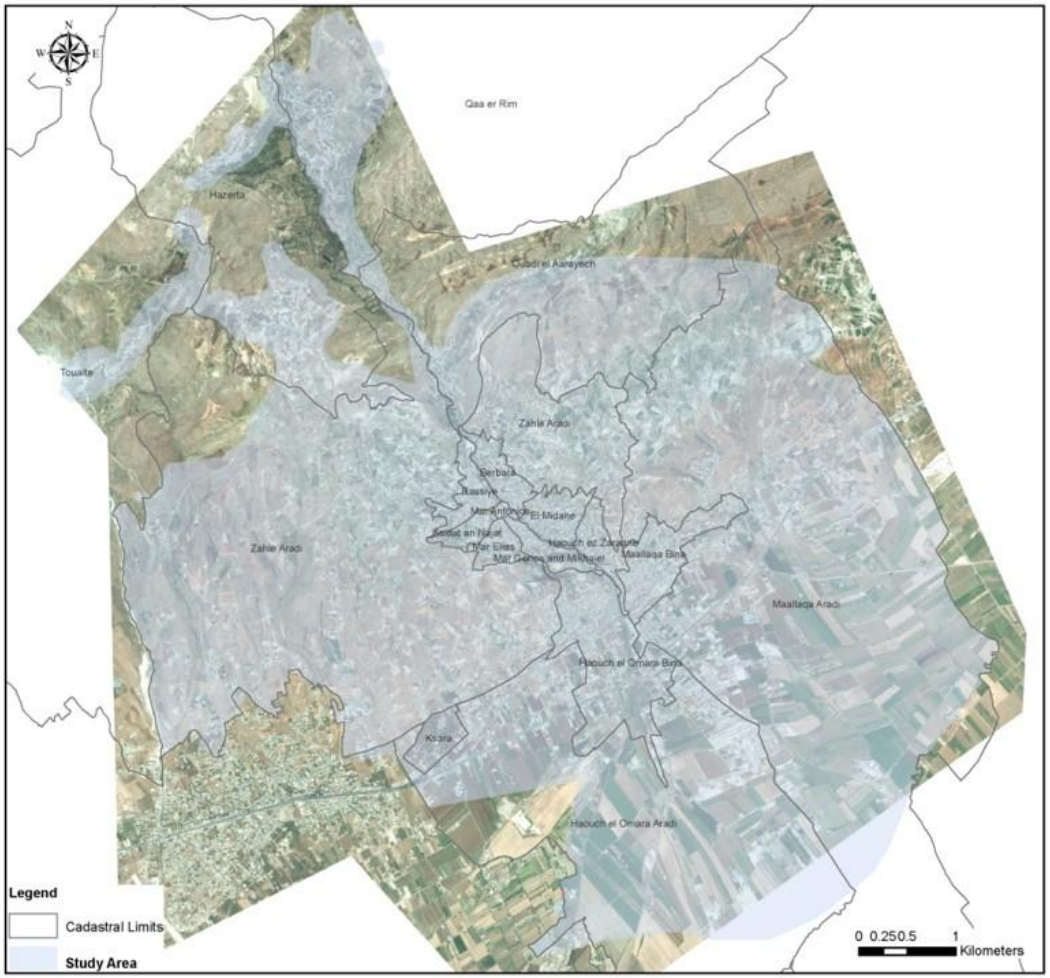
ZAHLE AREA WATER SUPPLY SYSTEMS

November 2020

I – INTRODUCTION

A – Project Area Boundary

- **The cadastral areas benefiting from the project include:**
  - **Zahle city (Berbara, El Midane, Haouch ez Zaraane, Mar Antonios, Mar Elias, Mar Gerios, Rassiye, Saidat an Najat…etc)**
  - **Ouadi el Aarayech**
  - **Zahle Aradi (Dhour Zahle and Zahle Eastern Area)**
  - **Haouch el Omara and Ksara**
  - **Maallaqa**
  - **El Karak**
  - **Qaa er Rim**
  - **Hazerta**
  - **Touaite**



II – CURRENT NEEDS CALCULATION

A – Population and Existing Resources

Below is the 2012 population for all zones

ID	Zone	Population 2012
1	Dhour Zahle (lower)	7328
2	Dhour Zahle (upper)	1940
3	El Karak (lower / upper)	9883
4	Haouch el Omara / Ksara	15806
5	Industrial Area	4024
6	Maallaqa	10644
7	Touaite	232
8	Water Treatment Plant Area	20904
9	Zahle Eastern Area (lower)	1591
10	Zahle Eastern Area (upper)	1127
	TOTAL	73479*

* in addition to the population of Qaa er Rim and Hazerta

Below is a list of the available water resources

Resource	Flow *(l/s)*	Flow *(m^3/d)*
Dhour Zahle 1 Well	17	1469
Lycee 1 Well	34	2938
Lycee 2 Well	18	1555
Yoyo Well	14	1210
Moustadirat Well	35	3024
Maallaqa 1 Well	20	1728
Maallaqa 2 Well	20	1728
Maallaqa 3 Well	18	1555
Ouadi el Aarayech 1 Well	20	1728
Zahle Old Spring	90	7776
TOTAL	286	24711*

* in addition to the water pumped to the villages of Qaa er Rim and Hazerta from El Berdaouni

II – CURRENT NEEDS CALCULATION

B – Evaluation of 2012 level of service

Below is the 2012 population for all zones

ID	Zone	Population 2012
1	Dhour Zahle (lower)	7328
2	Dhour Zahle (upper)	1940
3	El Karak (lower / upper)	9883
4	Haouch el Omara / Ksara	15806
5	Industrial Area	4024
6	Maallaqa	10644
7	Touaite	232
8	Water Treatment Plant Area	20904
9	Zahle Eastern Area (lower)	1591
10	Zahle Eastern Area (upper)	1127
	TOTAL	73479

Resource (8 hours pumping)	Flow (m^3/d)
Dhour Zahle 1 Well	490
Lycee 1 Well	979
Lycee 2 Well	518
Yoyo Well	403
Moustadirat Well	1008
Maallaqa 1 Well	576
Maallaqa 2 Well	576
Maallaqa 3 Well	518
Ouadi el Aarayech 1 Well	576
Zahle Old Spring	7776
TOTAL	13421

However, UFW=70% (30% Non-Dom, 40% Losses)

→ **30% of the water resources yield = 4026m³/d**

Level of Service: 55 L/cap/day

III – FUTURE NEEDS CALCULATION

A – Project Design Criteria

Design Criteria:

- **Domestic Water Needs:**
  - ❖ **Urban Areas: 180 L/cap/day**
  - ❖ **Rural Areas: 165 L/cap/day (Hezarta, Touaite and Qaa er rim)**
- **Non Domestic Water Needs: 30% of domestic needs**
- **Unaccounted For Water: 25%**
- **Growth Factor: 1.75%**
- **Project Horizon: 2040**
  - ➢ **Population (2012) = 80,186**
  - ➢ **Population (2040) = 130,889**

III – FUTURE NEEDS CALCULATION

B – Evaluation of Future Demand

Below are the current and future water needs (in 5-year increments) for all zones

ID	Zone	Needs 2012 (m^3/d)	Needs 2020 (m^3/d)	Needs 2025 (m^3/d)	Needs 2030 (m^3/d)	Needs 2035 (m^3/d)	Needs 2040 (m^3/d)
1	Dhour Zahle (lower)	2319	3020	3562	4201	4954	5843
2	Dhour Zahle (upper)	630	820	967	1140	1345	1586
3	El Karak (lower / upper)	3267	3714	4023	4358	4721	5114
4	Haouch el Omara / Ksara	4925	5674	6199	6773	7399	8084
5	Hazerta (lower)	720	828	904	986	1077	1175
6	Hazerta (upper)	513	591	645	703	768	838
7	Industrial Area	2868	3672	4286	5002	5838	6813
8	Maallaqa	3396	3694	3893	4103	4324	4557
9	Qaa er Rim (lower / upper)	748	860	938	1,024	1,118	1,220
10	Touaite	99	114	125	136	148	162
11	Water Treatment Plant Area	6538	6789	6950	7116	7285	7458
12	Zahle Eastern Area (lower)	512	675	802	954	1134	1348
13	Zahle Eastern Area (upper)	445	568	661	770	897	1045
		26980	31019	33955	37266	41008	45243

IV – WATER BALANCE

A – Available and Proposed Water Resources

Available water resources:

Resource	Flow *(l/s)*	Flow *(m^3/d)*
Dhour Zahle 1 Well	17.0	1469
Lycee 1 Well	34.0	2938
Lycee 2 Well	18.0	1555
Yoyo Well	14.0	1210
Moustadirat Well	35.0	3024
Maallaqa 1 Well	20.0	1728
Maallaqa 2 Well	20.0	1728
Maallaqa 3 Well	18.0	1555
Ouadi el Aarayech 1 Well	20.0	1728
Zahle Old Spring	90.0	7776
	286.0	24711

Proposed water resources:

Resource	Flow *(l/s)*	Flow *(m^3/d)*
Dhour Zahle 2 Well	20.0	1728
El Karak 1 Well	20.0	1728
Touaite Well	11.6	1000
Zahle Eastern Area 1 Well	11.6	1000
Zahle Eastern Area 2 Well	11.6	1000
Zahle Eastern Area 3 Well	11.6	1000
Zahle Eastern Area 4 Well	6.9	600
Other		
El Karak 2 Well	20.0	1728
Ouadi el Aarayech 2 Well	20.0	1728
Ouadi el Aarayech 3 Well	20.0	1728
	153.3	13240

IV – WATER BALANCE

B – Existing Water Balance

Below is a summary of the water needs

Zone	Needs 2012 (m^3/d)	Needs 2015 (m^3/d)	Needs 2020 (m^3/d)	Needs 2025 (m^3/d)	Needs 2030 (m^3/d)	Needs 2035 (m^3/d)	Needs 2040 (m^3/d)
All Zones	26980	28408	31019	33955	37266	41008	45243
All Zones (excl. Qaa er Rim and Hazerta)	24999	26320	28740	31468	34553	38045	42010

Below is a summary of the water resources

Resource	Flow (m^3/d)
Available Resources	24711
Proposed Resources	13240
Total	37951

The deficit appears as of year 2035, and is equal to 4059 m^3/d in year 2040

V – Proposed Works

A – Project Scope of Work

Proposed Works:

- The drilling of 7 water wells
- The construction and equipping of 10 pumping stations
- The rehabilitation and equipping of 1 existing pumping station
- The construction of 8 reservoirs
- The construction of 19 transmission lines
- The construction of 11 distribution networks

} Total Length= 340 km

V – Proposed Works

B – Progress of Works

Total Length= 340 km

- USAID: Haouch el Oumara → **51 km executed**
- MoEW: Zahle city → **43 km executed**
- CDR: The Rest → **244 km**
  In Octobre 2020, **70% is already executed**

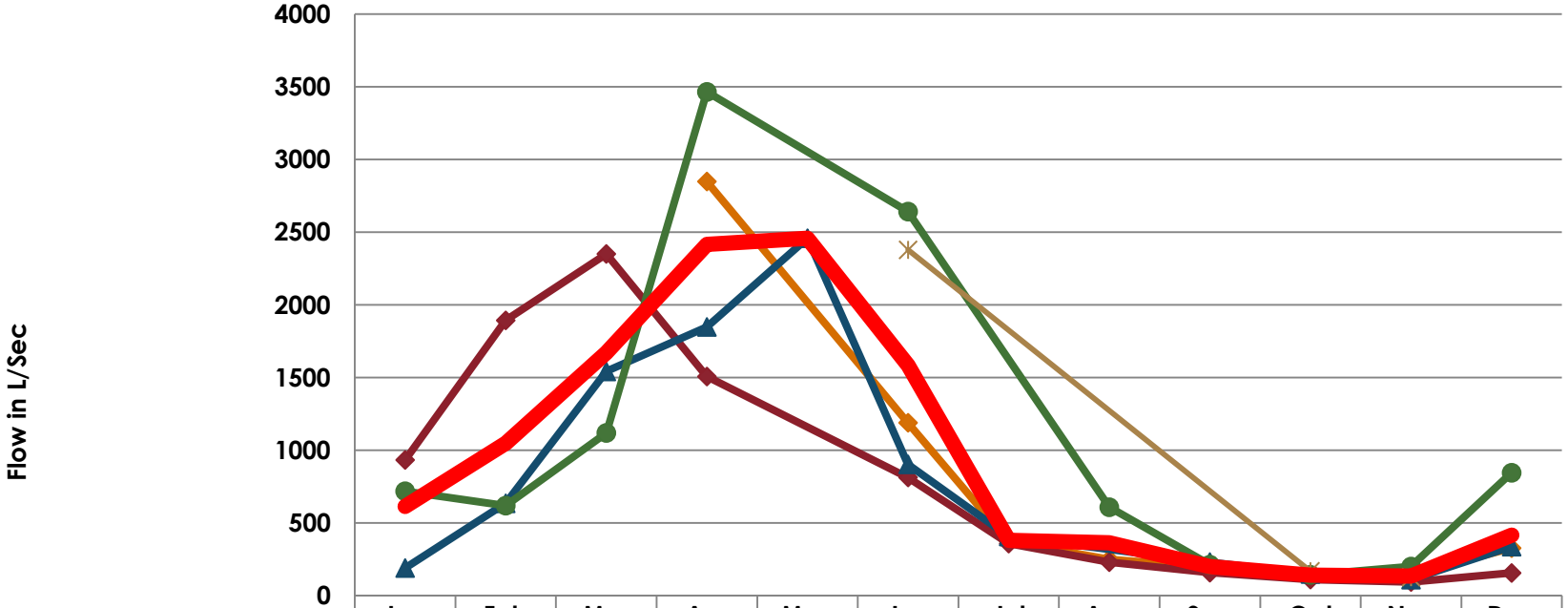
However, Not Yet Executed:

- The proposed wells
- The proposed pumping stations
- The proposed reservoirs
- House Connections
- Remaining 30% of the networks and transmission lines

VI – Proposed Solution for Water Deficit

A- Berdaouni Springs

Berdaouni Springs – Average Monthly Flow Chart (2009 – 2013)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2009 L/sec				2848		1189	374	250	197	136	147	327
2010 L/sec	933	1893	2350	1507		813	358	230	158	111	94	156
2011 L/sec	190	635	1542	1848	2458	903	407		231	149	110	337
2012 L/sec	718	619	1119	3464		2641		608	213	143	200	845
2013 L/sec						2378				168	127	
Average L/sec (excl. 2014)	614	1049	1670	2417	2458	1585	380	363	200	141	136	416

VI – Proposed Solution for Water Deficit

B – Proposed Solution

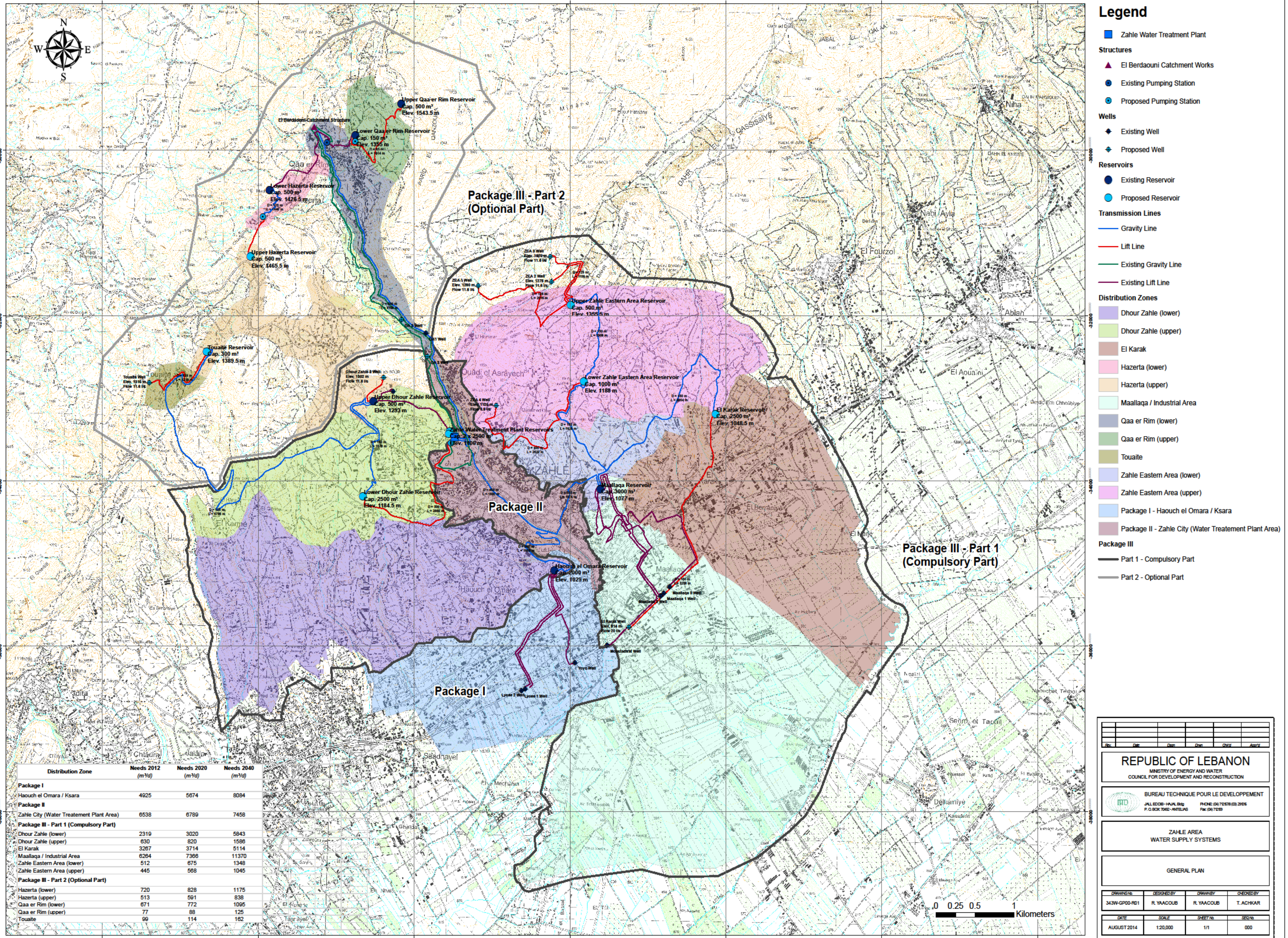
In addition to the above-mentioned resources, an excess water from El Berdaouni Spring Catchment Works can be used during the period extending from the beginning of February to the end of June (5 months).

This water is available according to the hydrograph on the previous slide.

The amount that is needed is equal to 15073 m^3/d in 2020 and 24979 m^3/d in 2040 or around 175 l/s in 2020 and 290 l/s in 2040.

This can help cut down the cost of pumping during this period and completely cover the deficit in 2040.

No water can be taken from El Berdaouni during the period extending from the beginning of July to the end of January (7 months).


Legend
Zahle Water Treatment Plant
Structures
El Berdaouni Catchment Works
Existing Pumping Station
Proposed Pumping Station
Wells
Existing Well
Proposed Well
Reservoirs
Existing Reservoir
Proposed Reservoir
Transmission Lines
Gravity Line
Lift Line
Existing Gravity Line
Existing Lift Line
Distribution Zones
Dhour Zahle (lower)
Dhour Zahle (upper)
El Karak
Hazerta (lower)
Hazerta (upper)
Maallaqa / Industrial Area
Qaa er Rim (lower)
Qaa er Rim (upper)
Touaite
Zahle Eastern Area (lower)
Zahle Eastern Area (upper)
Package I - Haouch el Omara / Ksara
Package II - Zahle City (Water Treatement Plant Area)
Package III
Part 1 - Compulsory Part
Part 2 - Optional Part
Package III - Part 2 (Optional Part)
Package III - Part 1 (Compulsory Part)
Package II
Package I
ZAHLE
Kilometers

Distribution Zone	Needs 2012 (m³/d)	Needs 2020 (m³/d)	Needs 2040 (m³/d)
Package I			
Haouch el Omara / Ksara	4925	5674	8084
Package II			
Zahle City (Water Treatement Plant Area)	6538	6789	7458
Package III - Part 1 (Compulsory Part)			
Dhour Zahle (lower)	2319	3020	5843
Dhour Zahle (upper)	630	820	1586
El Karak	3267	3714	5114
Maallaqa / Industrial Area	6264	7366	11370
Zahle Eastern Area (lower)	512	675	1348
Zahle Eastern Area (upper)	445	568	1045
Package III - Part 2 (Optional Part)			
Hazerta (lower)	720	828	1175
Hazerta (upper)	513	591	838
Qaa er Rim (lower)	671	772	1095
Qaa er Rim (upper)	77	88	125
Touaite	99	114	162

Rev.	Date	Dsgn	Drwn	Chk'd	App'd

REPUBLIC OF LEBANON

MINISTRY OF ENERGY AND WATER
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

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ZAHLE AREA
WATER SUPPLY SYSTEMS

GENERAL PLAN

DRAWING No.	DESIGNED BY	DRAWN BY	CHECKED BY
343W-GP00-R01	R. YAACOUB	R. YAACOUB	T. ACHKAR

DATE	SCALE	SHEET No.	SEQ No.
AUGUST 2014	1:20,000	1/1	000