

Sustainability and Recharge تغذیه و دوام دار بودن

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Translated by:
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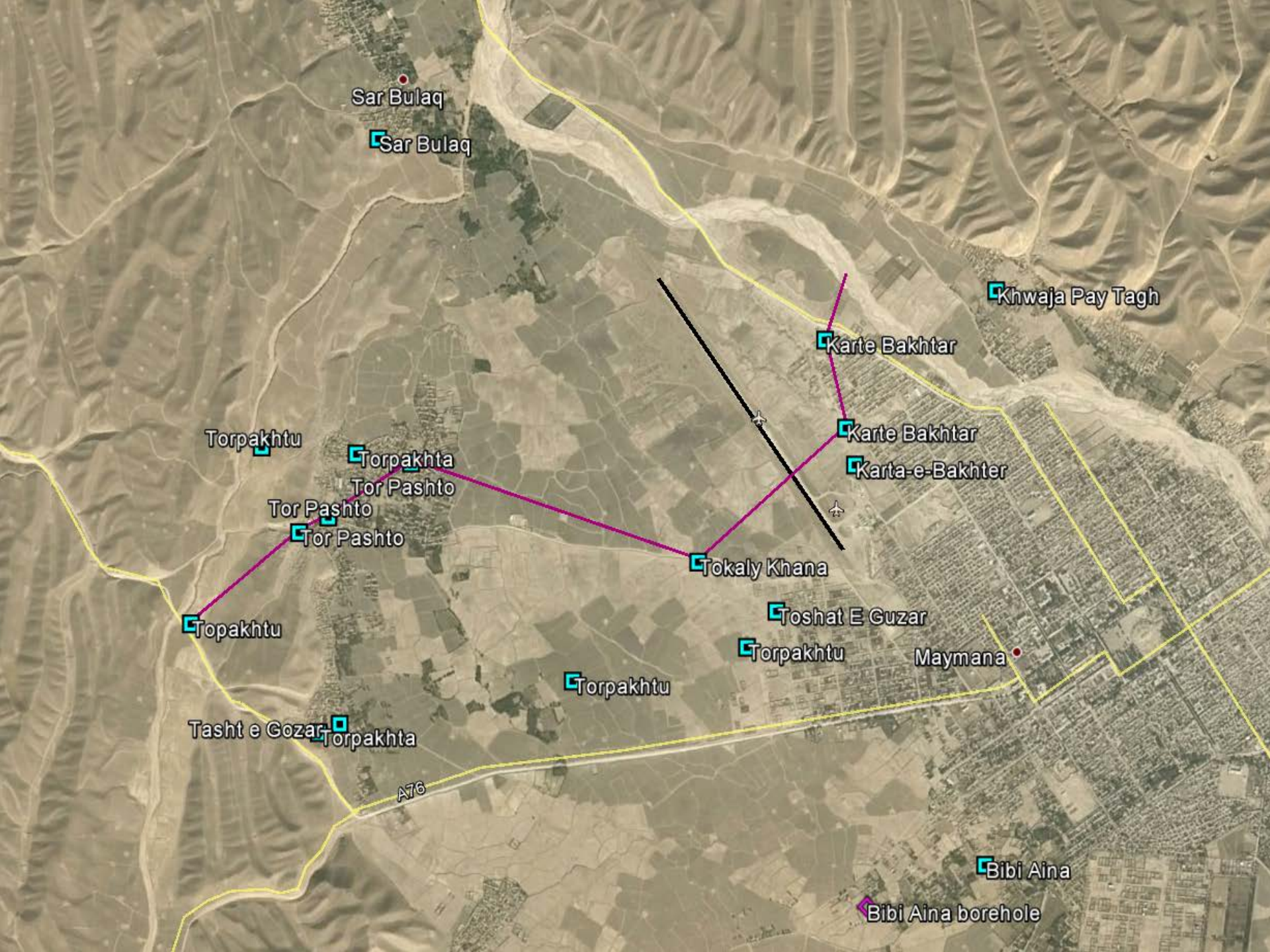
1989

2008

NORAD supported project in MRRD:
Capacity Building and Institutional Cooperation in the field of Hydrogeology for Faryab
Province , Afghanistan

Maimana Airport





Sar Bulaq

Sar Bulaq

Khwaja Pay Tagh

Karte Bakhtar

Karte Bakhtar

Karta-e-Bakhter

Torpakhtu

Torpakhta

Tor Pashto

Tor Pashto

Tor Pashto

Tokaly Khana

Toshat E Guzar

Torpakhtu

Maymana

Topakhtu

Torpakhtu

Tasht e Gozar

Torpakhta

A76

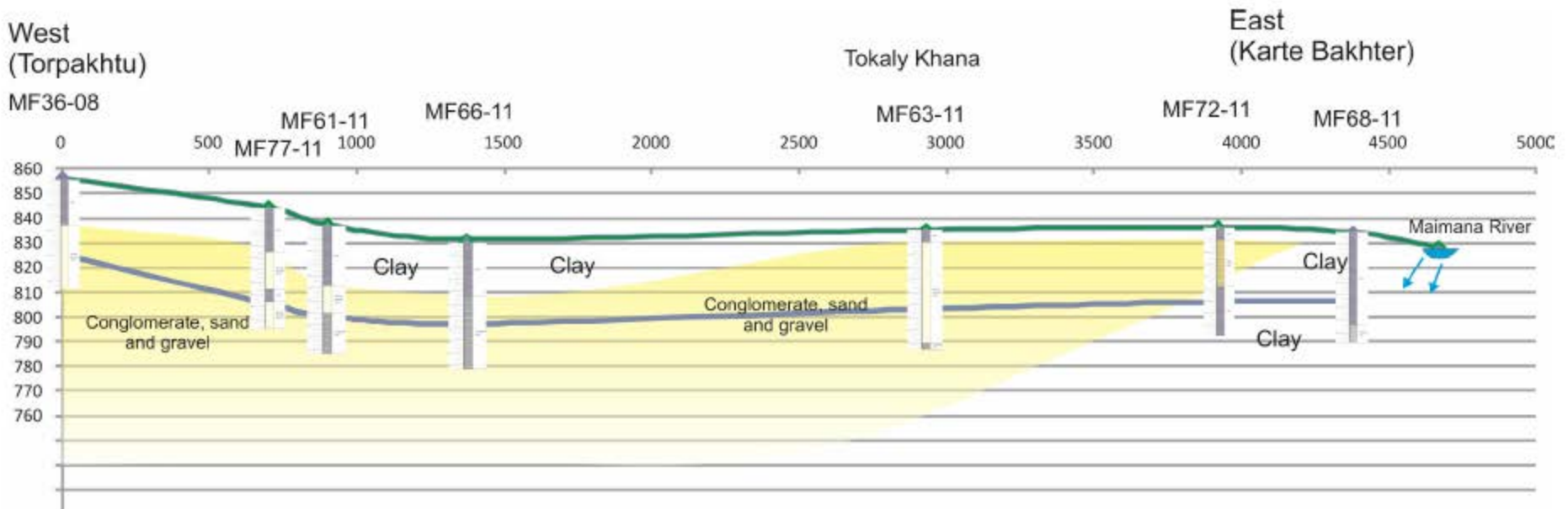
Bibi Aina

Bibi Aina borehole

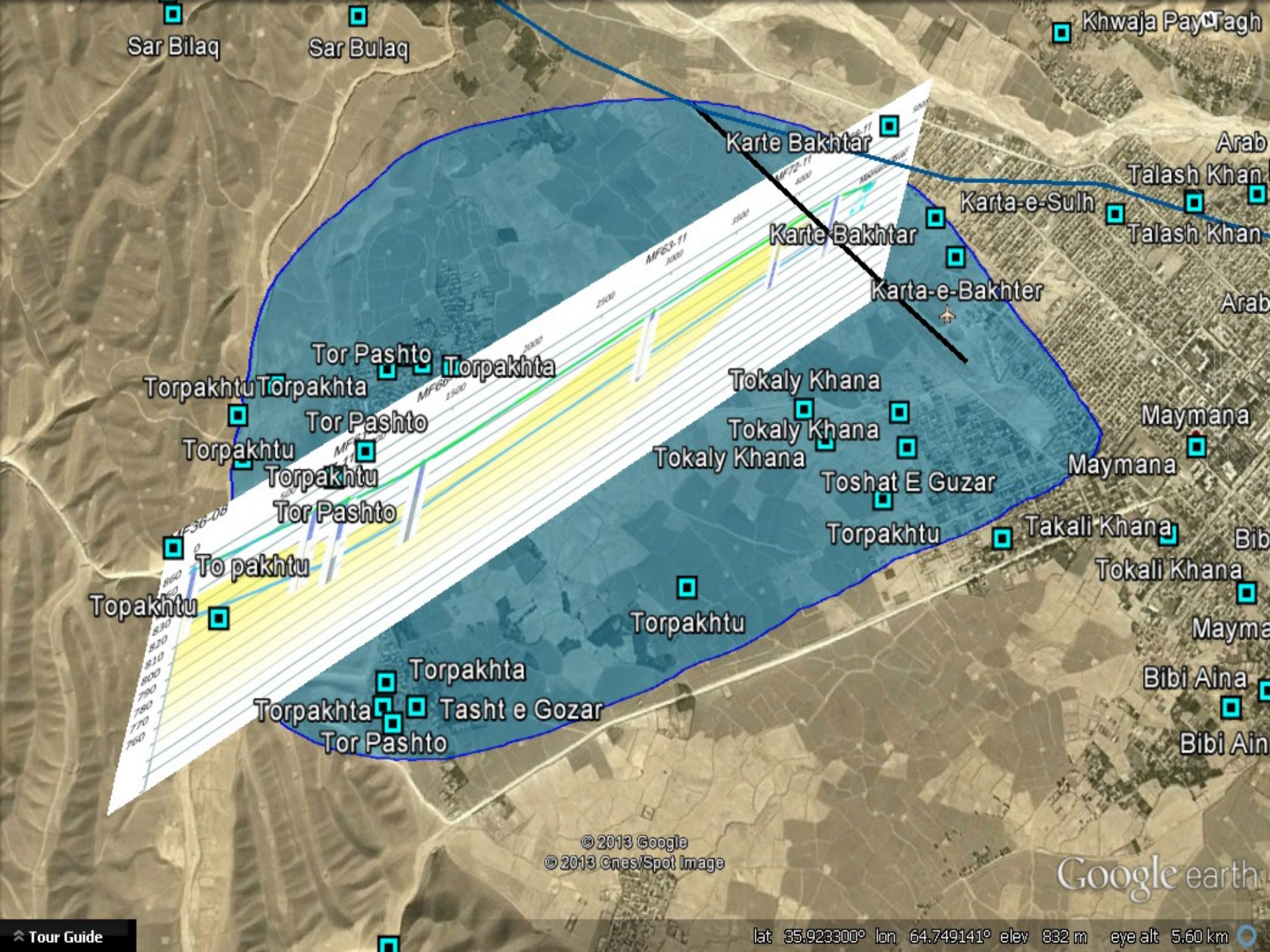
Maimana Airport (section 1)

(میدان هوایی میمنه (مقطع یک

Cross section 1



Groundwater level is below river level... سطح اب پایانتز از سطح دریا.



Sar Bilaq

Sar Bulaq

Khawaja Pay Tagh

Karte Bakhtar

Arab

Talash Khan

Talash Khan

Arab

Karta-e-Sulh

Karte Bakhtar

Karta-e-Bakhter

Tor Pashto

Torpakhta

Torpakhtu

Tor Pashto

Torpakhtu

Torpakhtu

Tor Pashto

To pakhtu

Topakhtu

Tokaly Khana

Tokaly Khana

Tokaly Khana

Toshat E Guzar

Torpakhtu

Maymana

Maymana

Takali Khana

Tokali Khana

Mayma

Bibi Aina

Bibi Ain

Torpakhta

Torpakhta

Tasht e Gozar

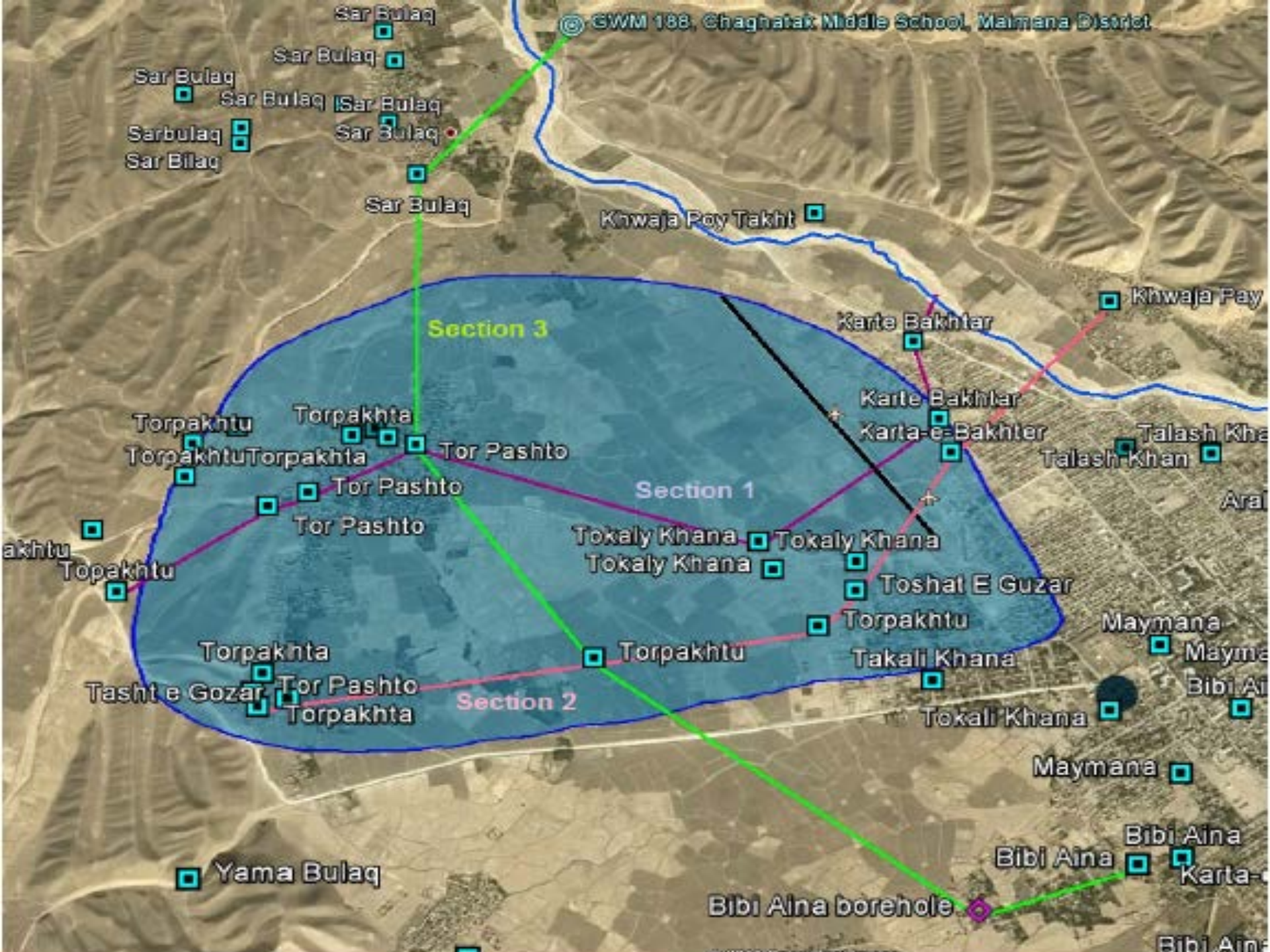
Tor Pashto

© 2013 Google
© 2013 Cnes/Spot Image

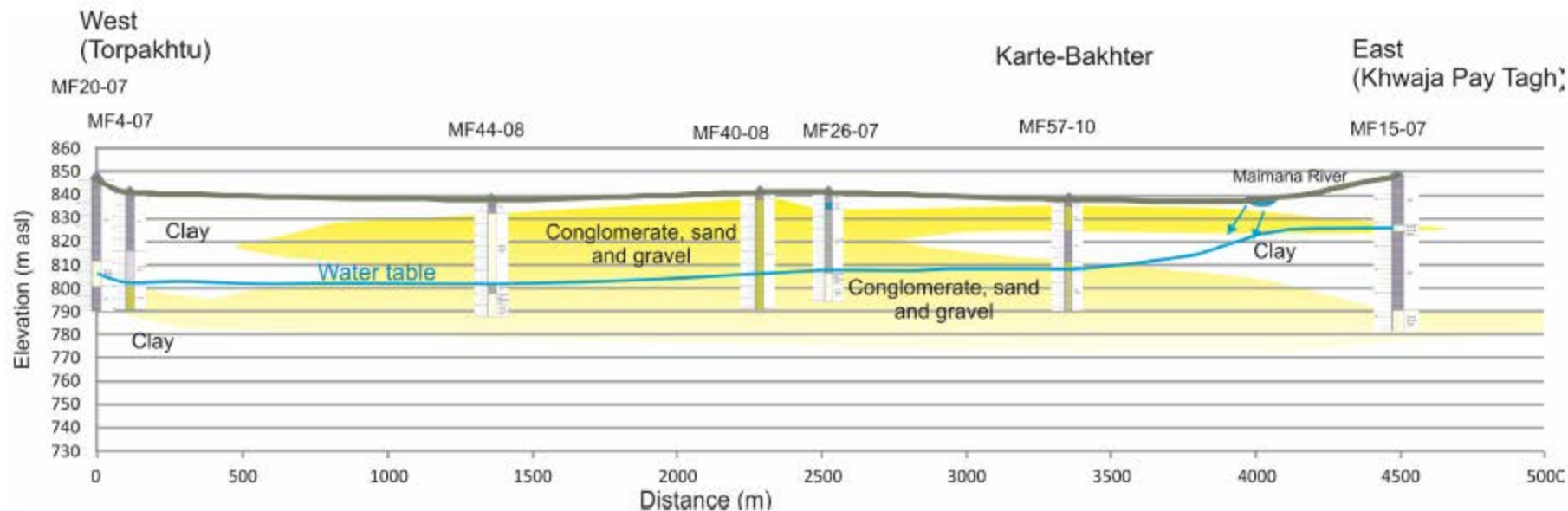
Google earth

Tour Guide

lat 35.923300° lon 64.749141° elev 832 m eye alt 5.60 km



میدان هوایی میمنه (مقطع 2) میدان هوایی میمنه (مقطع 2) (دوم)



میدان هوایی میمنه (مقطع 3) Maimana Airport (section 3)

(سوم)

South (Bibi Aina)

MF19-07

Bibi Aina

Torpakhtu

MF44-08

MF66-11

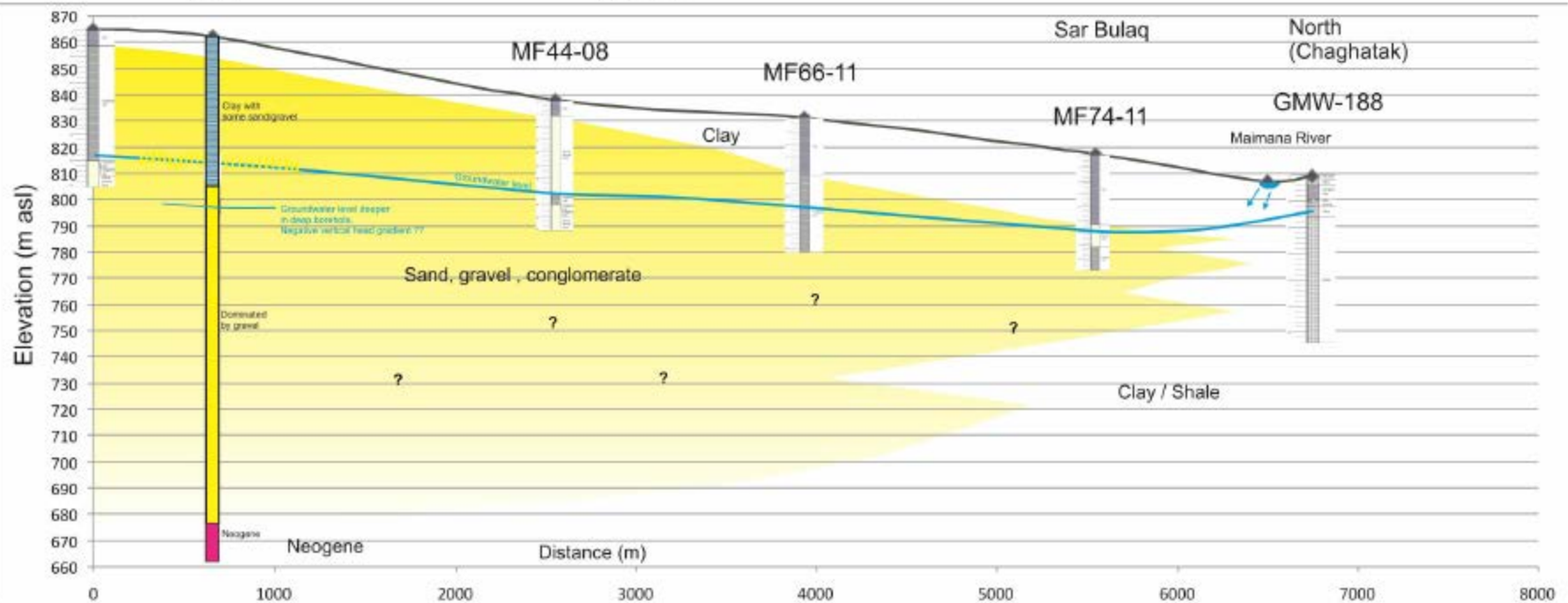
Sar Bulaq

North
(Chaghatak)

MF74-11

GMW-188

Maimana River



Conclusions خلاصه

Conclusions

There appears to exist a substantial aquifer storage of moderately fresh to brackish groundwater below the study area in a Quaternary alluvial sand/gravel/conglomerate unit of thickness at least 30-40 m.

If the Bibi Aina borehole is representative of the depth of the Neogene beneath the study area, then the aquifer thickness could be in excess of 100 m. The aquifer's indicative transmissivity at Bibi Aina is around $200 \text{ m}^2/\text{d}$, with hydraulic conductivity between 1 and 2 m/d on average.

The aquifer is overlain by clayey sediments ranging in thickness from a few metres to around 20 m.

The aquifer is underlain by Neogene lower permeability materials at 185 m bgl at Bibi Aina. The Neogene may be encountered at shallower depths beneath the study area depending on the basement topography.

The aquifer is generally unconfined with groundwater levels typically a little over 30 m bgl in shallow boreholes.

The aquifer systems seems to be characterised by downward vertical head gradients, with the Maimana River seemingly disconnected from regional groundwater heads and presumably with a tendency to infiltrate river water into the ground.

اما.....But

Where does the groundwater come from....?

• آب زیر زمینی از کجا می آید ؟

• The climate (and the clayey overburden) means that opportunities for direct recharge are very limited.

• اقلیم (گل مترسبه دامنه ها) معنی انرا میدهد ک تغذیه بسیار کم است

• The aquifer tends to be separated from the Maimana River by lower permeability clayey materials.

طبقه ابده بصورت جداگانه از دریای میمنه نسبت قابلیت نفوذ کم گلی بازهم در ارتباط با دریا است

Thus, a large question mark must be placed over the ultimately sustainability of a major groundwater abstraction from this aquifer.

باز هم سوالات است که در قسمت استخراج دوامدار ابهای زیرزمینی از طبقه ابده وجود دارد

How do we estimate recharge?

چطور ما اندازه تغذیه را تخمین نماییم ؟

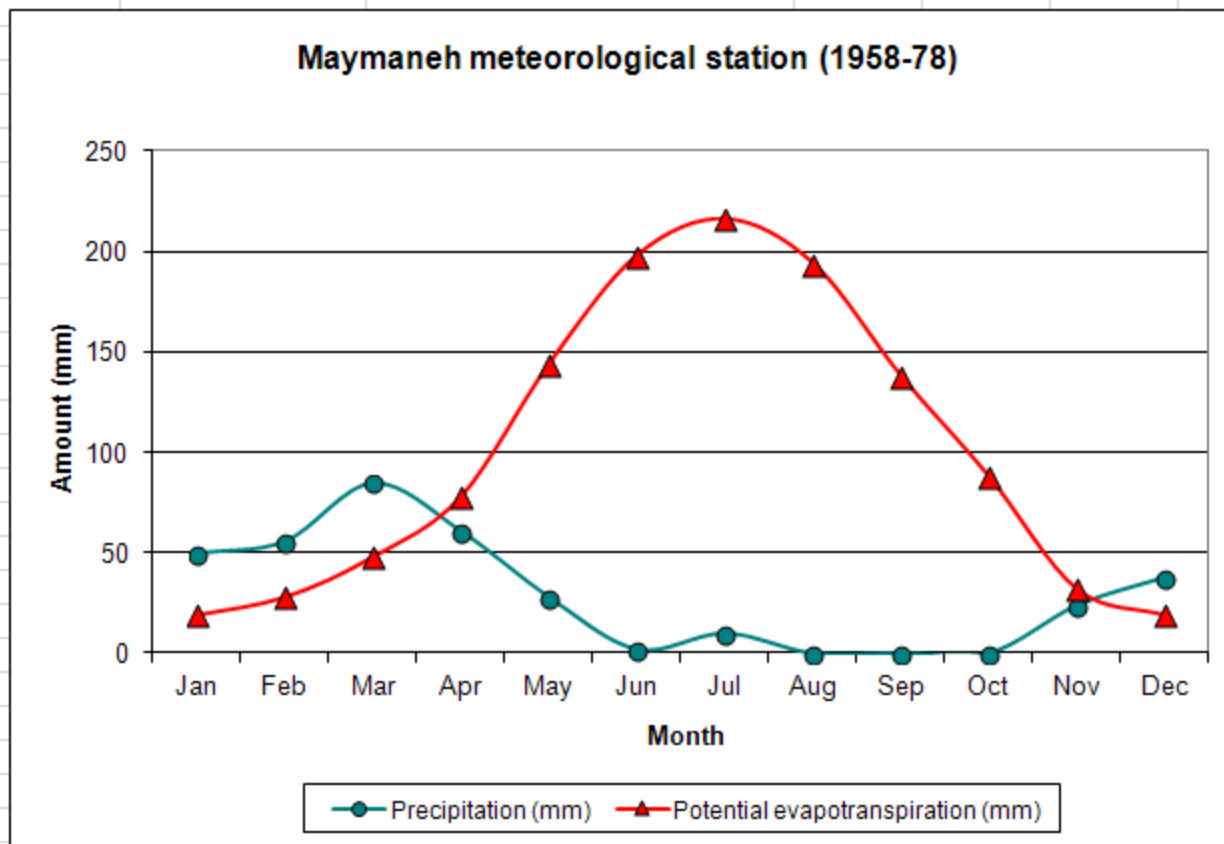
1. From meteorological data...از دیتای میتئورولوجی.

Require: ضرورت

- Daily data for precipitation دیتای روزانه بارندگی
 - Daily data for evapotranspiration دیتای روزانه تبخیر مجموعی
 - Data on crop / vegetation cover دیتای محصولات زراعتی / پوشش نباتی
- Some data on soil moisture deficit بعضی دیتای بالای کمبود رطوبت خاک

Even in Maymaneh....حتی در میمنه

Potential evapotranspiration is much greater than precipitation for most months of the year
تبخیز مجموعی در اکثر ماهها بمراتب بیشتر است از مقدار بارندگی



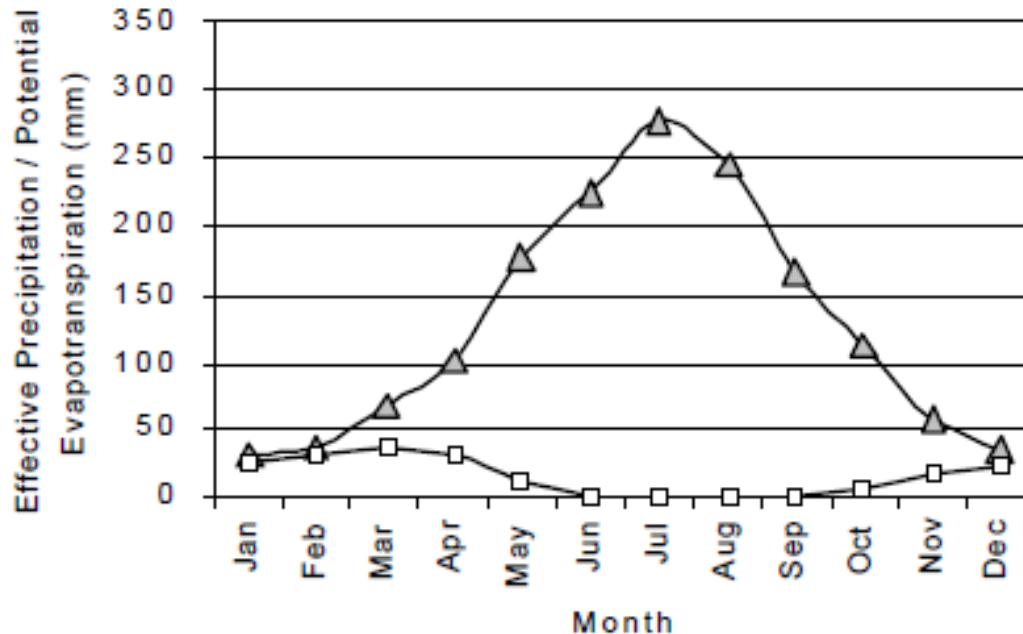
Precipitation 354 = mm (سالانه annual) بارندگی, potential evapotranspiration تبخیز
1202 = mm مجموعی موجوده

...and the further north you go

اگر به سمت شمال بصورت مجدد بروید ...

- The worse it gets.... شرایط بدتر را بدست می آوریم

Mazar-e-Sharif (12 yr record), 378 m asl



Very unlikely to be any direct recharge

برخلاف ویا هم معکوس و تغذیه مستقیم ناچیز

چطور ما تغذیه را تخمین کرده؟ How do we estimate recharge?

میتوانیم

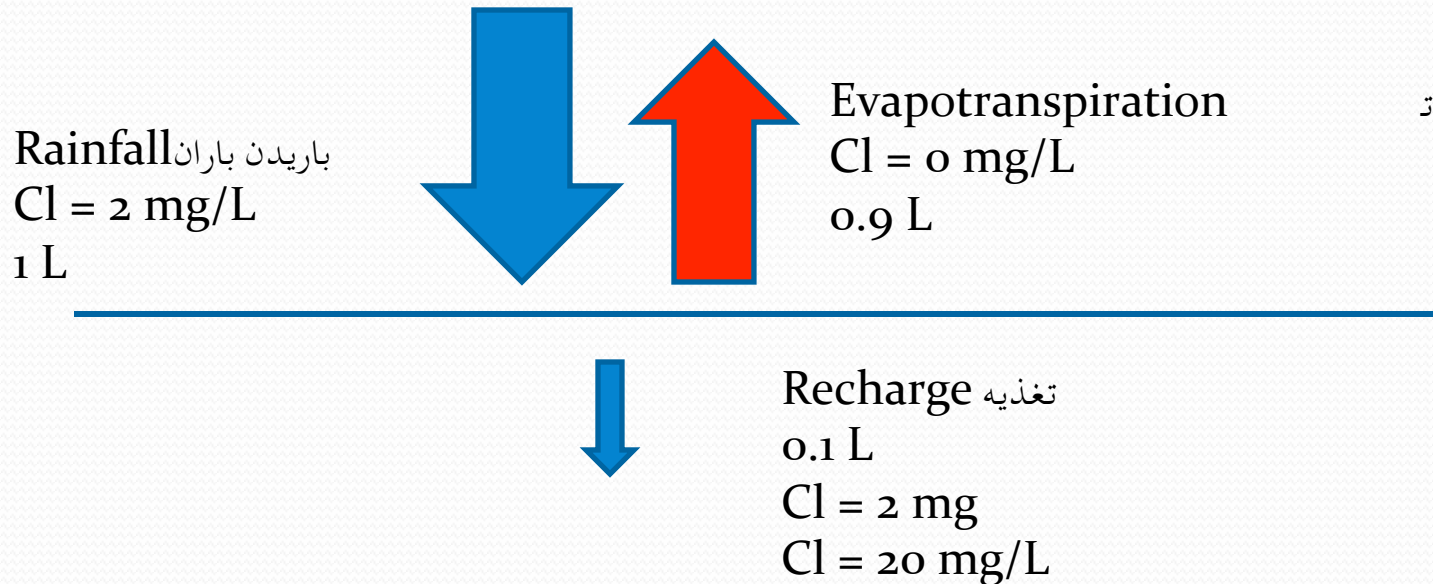
2. From water chemistry.... از کیمیای آب

Require: نیاز داشتن:

- Concentration of a conservative ion (chloride) in rainfall
- غ
- Concentration of a conservative ion in groundwater
- غ
- A lot of assumptions فرضیه های زیاد
 - that rainfall is the main source of recharge
باران منبع اصلی تغذیه
 - that there is no source of chloride in the aquifer
هیچ منبع کلوراید در طبقه ابده وجود ندارد
 - that there is no human source of chloride
هیچ منبع کلوراید از منبع انسانی وجود ندارد
 -

Evapo-concentration of rainfall

تبخیز-شدت باران



Chemistry کیمیا

- Groundwater آبهای زیرزمینی (mg/L)

- Precipitation ترسب (mg/L)

		Cl ⁻	SO ₄ =	NO ₃ ⁻
Maimana	snow	0.10	0.58	0.46
Maimana	Rain	0.48	3.25	1.67
Maimana	Rain	1.74	2.46	0.64
Gurziwan	Snow	0.60	0.75	0.38
Gurziwan	Rain	0.56	0.88	0.49
Andkhoy	Snow	15.6	25.1	16.4
Andkhoy	Rain	2.04	6.94	6.76
Andkhoy	Rain	1.36	3.91	1.04

		Cl ⁻	Up-concentration
Kohistan	Groundwater	Typically 2-5	4-9
Gurziwan	Groundwater	Typically around 20	30-40
Andkhoy	Groundwater	Typically 600-1000	300-500

If taken at face value....this could imply that:

اگر ارقام را پیش خود بگذاریم ان دلالت به این میکند

Rainfall recharge in Kohistan is

تغذیه باران در کوهستان 100-50 mm/a

Rainfall recharge in Gurziwan is c. 10 mm/a

تغذیه باران در گیرزوان . 10 mm/a

Rainfall recharge in Andkhoy is < 1 mm/a

تغذیه باران در اندخوی < 1 mm/a

Groundwater chemistry – Andkhoi

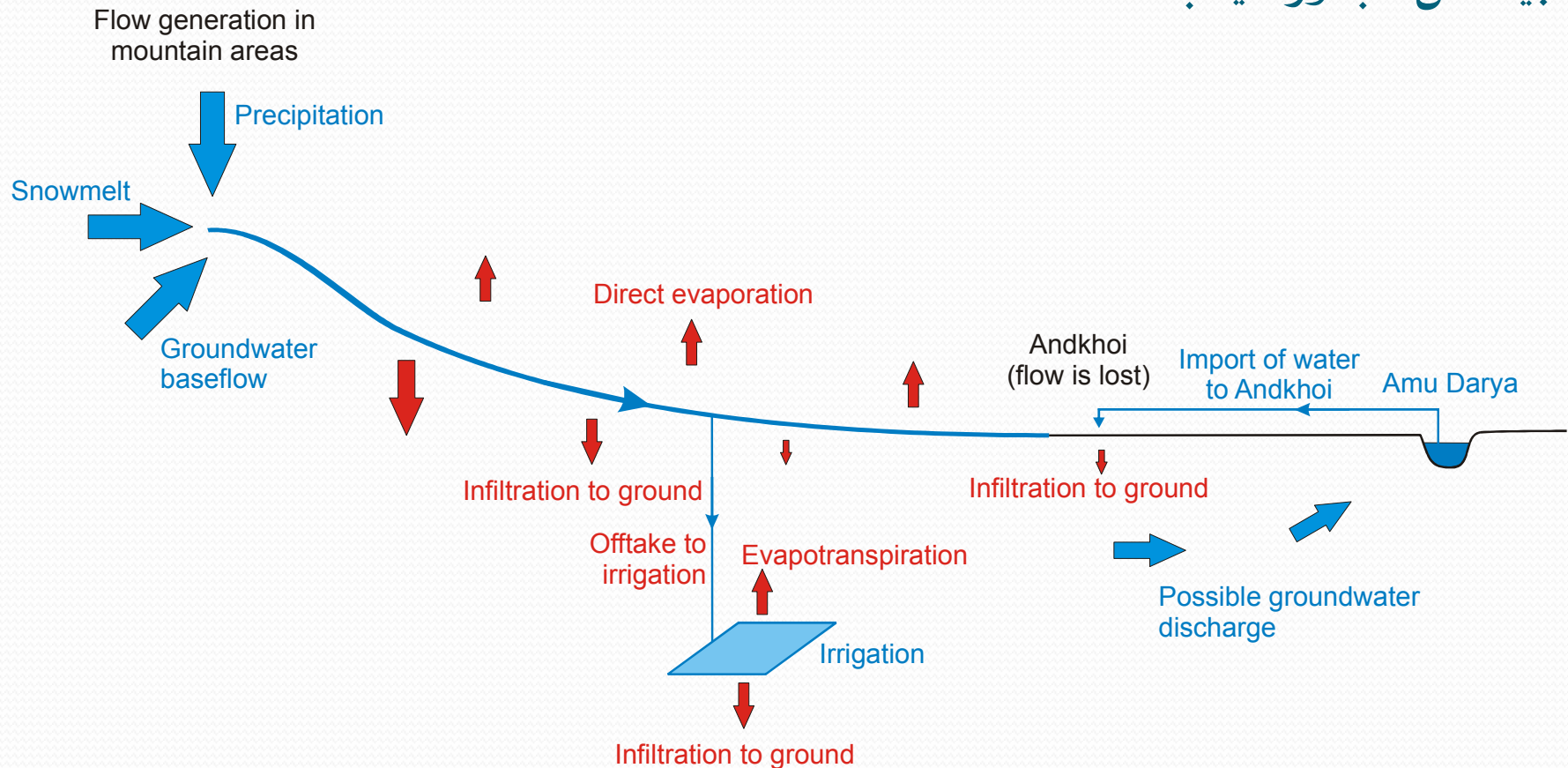
کیمیای ابهای زیر زمینی - اندخوی

	Ca	Mg	Na	K	HCO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	NO ₃ ⁻
	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹	meq l ⁻¹
NOR-QQ-01 F	11.532	12.831	29.561	0.517	10.538	17.800	23.967	0.125
NOR-QQ-02 F	13.668	16.024	35.846	0.472	11.835	24.584	30.304	0.146
NOR-QQ-03 F	8.568	20.501	39.361	0.495	12.703	21.036	35.425	
NOR-Qg-04 F	18.104	21.910	28.538	0.373	6.921	13.438	55.144	0.136
NOR-Qg-05 F	24.746	27.456	29.187	0.443	6.501	10.780	70.971	0.029
NOR-Qg-06 F	24.481	39.601	69.300	1.843	9.406	49.833	86.959	0.960
NOR-KB-07 F	7.221	12.159	22.053	0.606	9.067	12.873	18.233	0.360
NOR-KB-08 F	13.468	12.428	13.027	0.238	6.717	7.636	24.776	0.178
NOR-KB-09 F	11.033	14.667	26.429	0.501	4.866	18.817	27.978	0.022
NOR-KB-10 F	6.083	11.152	16.185	0.481	11.247	10.016	10.802	0.156
NOR-AK-11 F	20.120	16.592	26.894	0.675	5.862	26.932	30.870	0.809
NOR-AK-12 F	26.876	31.642	61.675	4.384	6.122	59.750	41.908	16.669
NOR-AK-13 F	11.417	22.475	30.261	0.656	8.990	27.751	25.237	0.625

How do we estimate recharge?

چطور ما تغذیه را تخمین نماییم

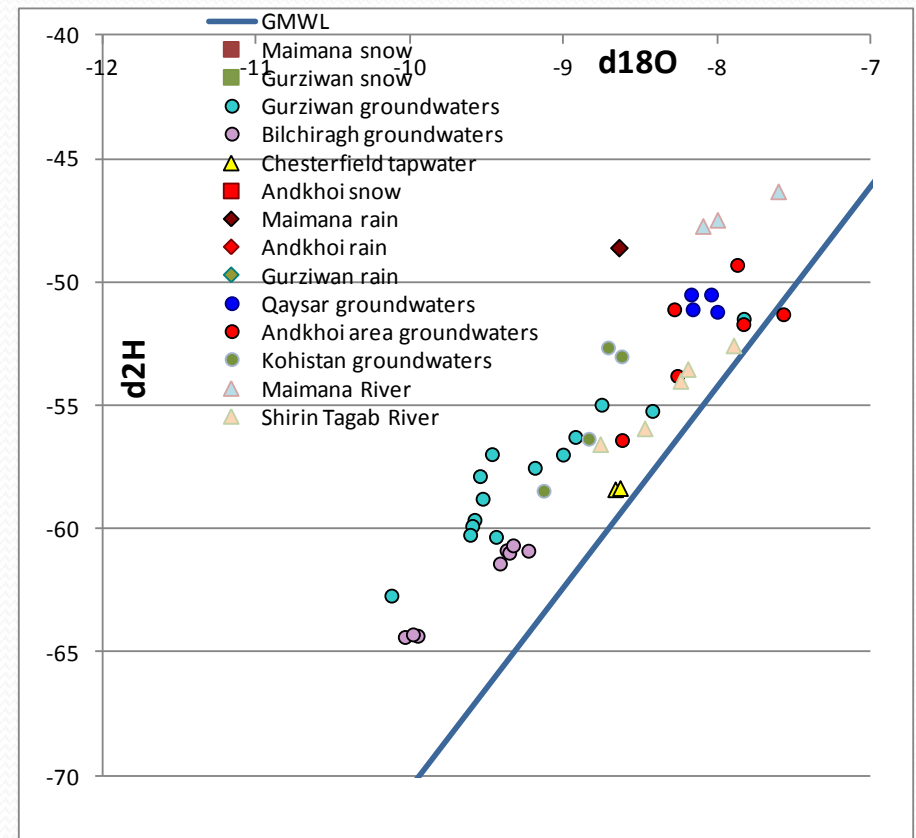
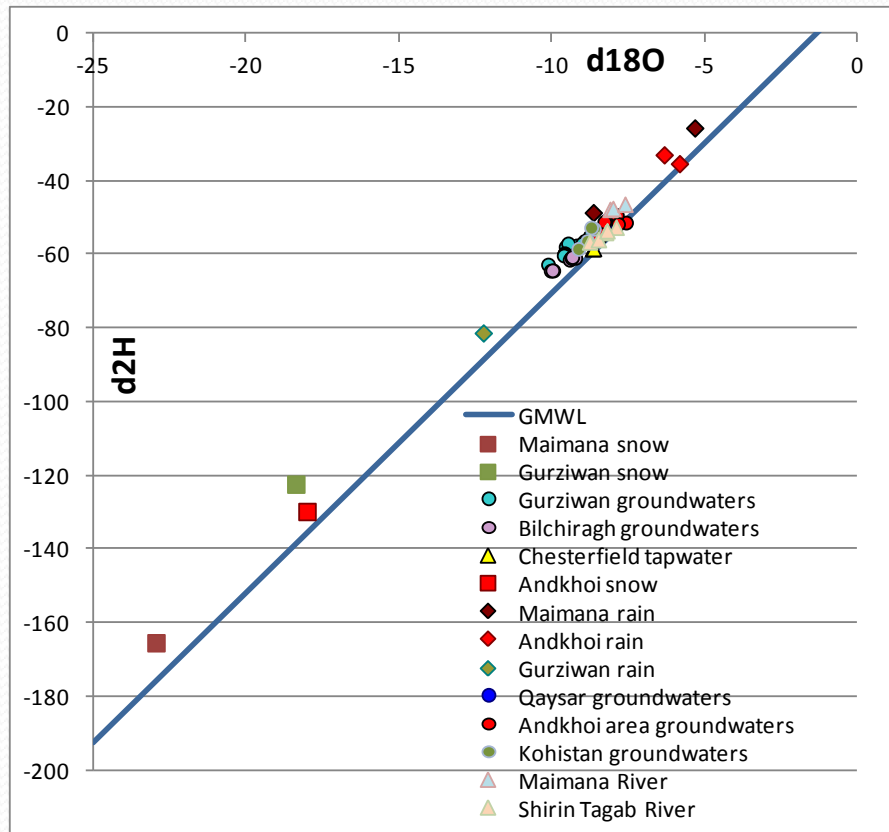
2. Water balance and tracers بیانس اب ورد یاب ها



Possible tracers ردیاب های ممکنه

- Stable ions, such as chloride, may be able to track evapotranspiration
-
- Stable isotopes (^2H , ^{18}O). These “heavy” isotopes become enriched by evaporation processes
(^2H , ^{18}O)
-

ایزوتوپ های پایدار Stable isotopes



All this is jolly interesting, Dave, but....what does it all mean?

تمام این ها خوش آیند است ،داوید، تمام اینها چه معنی دارید

- These studies give us a way into really understanding
- - - recharge mechanisms میکانیزم تغذیه
 - - salt accumulation in groundwater تراکم نمک در ابهای زیرزمینی
- In much of Faryab (Maimana and northwards), recharge is very limited (or non-existent!)
 -
- Sustainability is not guaranteed! د
- Be careful about planning large groundwater extraction schemes, you may be mining groundwater
- با احتیاط باشید در قسمت پلان گذاری شبکه استخراج زیاد اب ،شاید شما مقدار زیاد اب را استخراج کنید
- You may not be very popular with your descendants! ش
-



Thanks for your attention

