Field Surveys

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Hydrogeologist and thermogeologist

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

NORPLAN

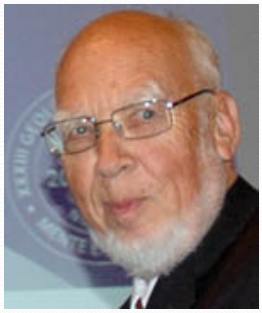
Do we need field surveys for a regional hydrogeological survey?

Not necessarily!

- Do we have "enough" data already from desk studies?
- Do those who are preparing the map have field experience from the area?
- How are the existing data distributed?
- Cost
- Security

How much data is "enough"?

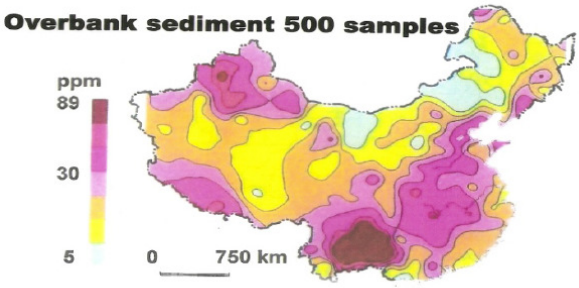
- The Norwegian geochemist "Bjørn Bølviken, hypothesised that, irrespective of size, to produce an adequate geochemical map of an area, you needed a given number of data points

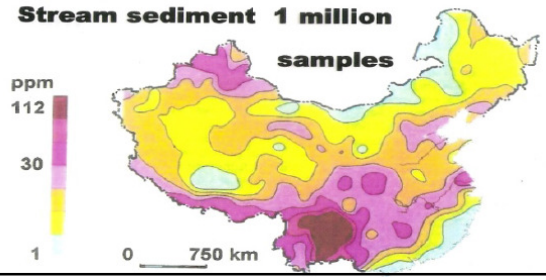


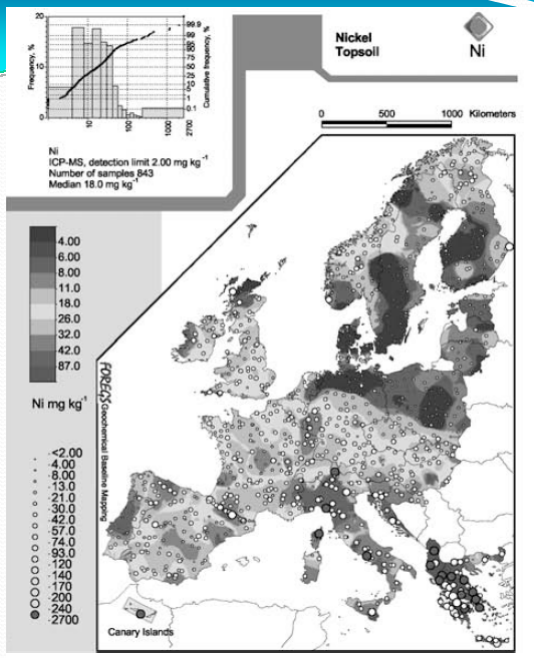
- 1 Bøl = 500 to 1000 data points
- (see Bølviken, B. *"Fractals in global geochemical mapping")*

- From Bølviken, B. *"Fractals in global geochemical mapping")*

Copper in China





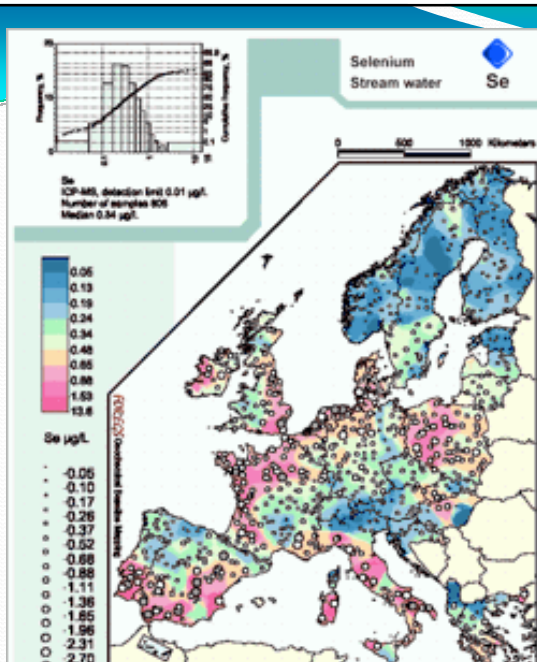


Nickel in topsoil, Europe

843 samples

Relatively even distribution of samples

From Reeder, S. *Global geochemical baselines.*



Selenium in stream water, Europe

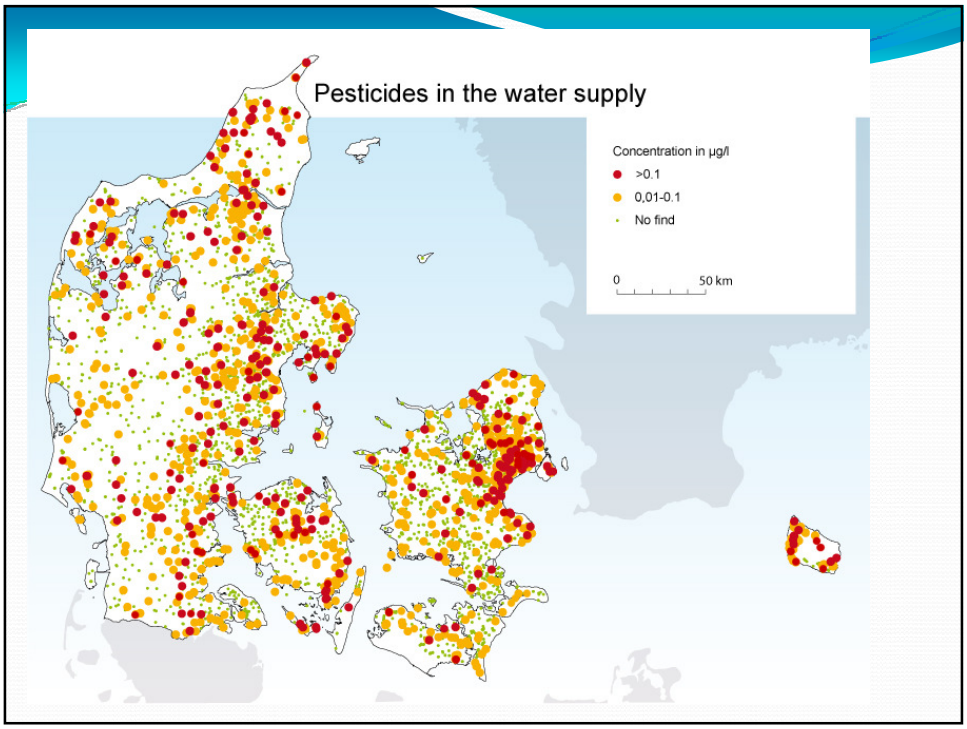
c. 900 ? samples

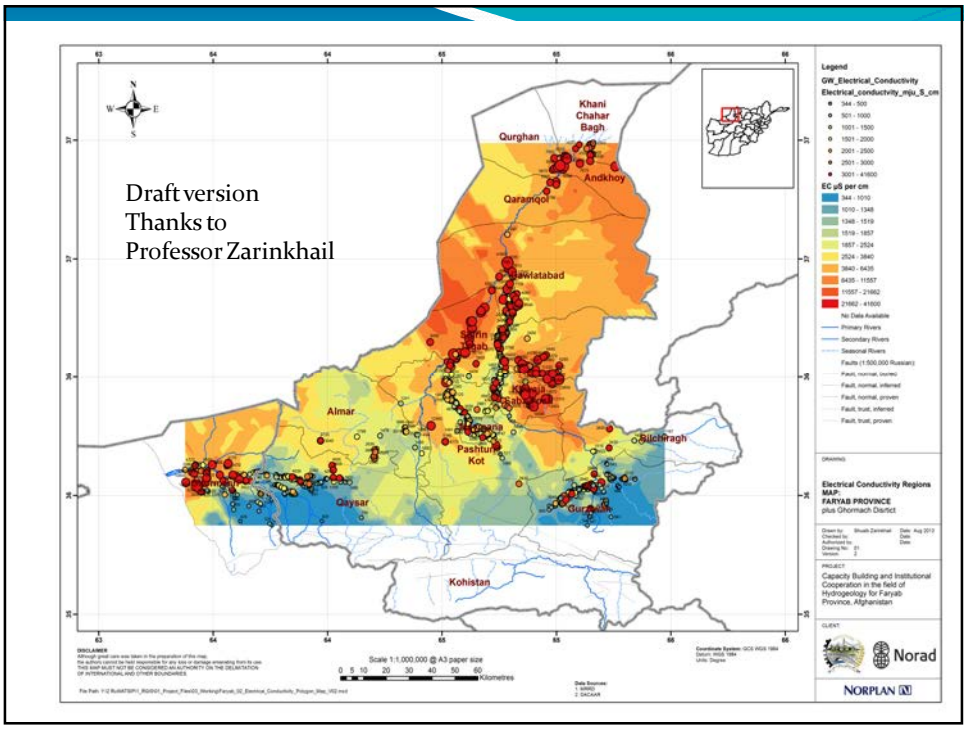
Relatively even distribution of samples

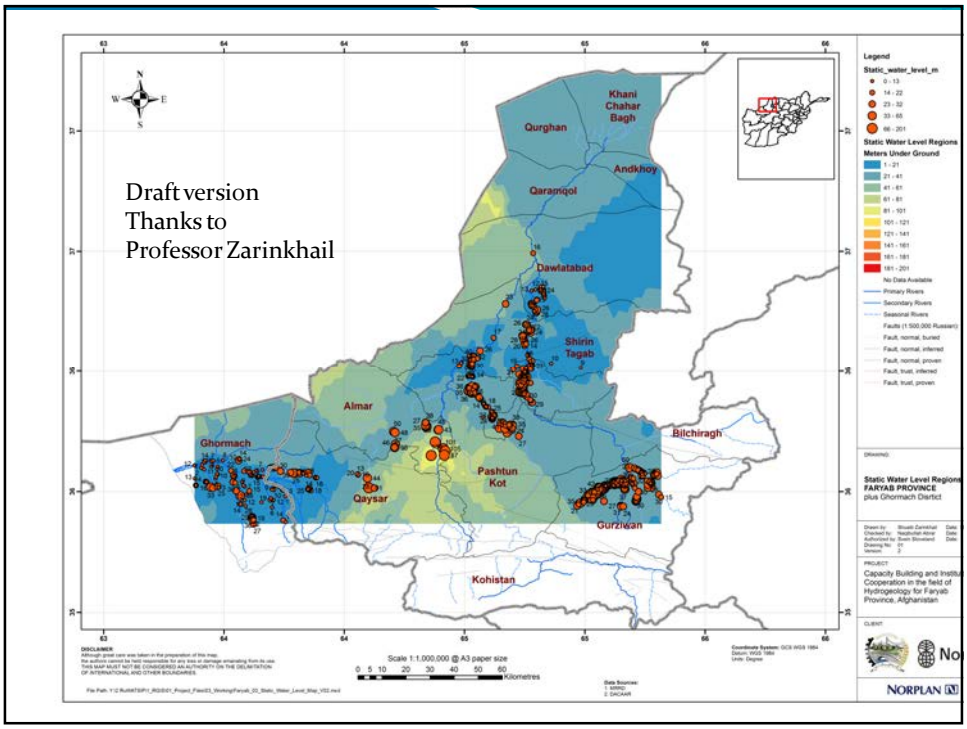
However.....

- Our data are seldom evenly distributed
- (...and hydrogeology is not geochemistry)

However, several hundred groundwater points with water level and basic water quality data are usually enough to construct a meaningful hydrogeological map.




Draft version
Thanks to
Professor Zarinkhail
Khani Chahar Bagh
Qurghan
Andkhoy
Qaramqol
Dawlatabad
Shirin Tagab
Almar
Ghormach
Pashtun Kot
Bilchiragh
Qaysar
Gurziwan
Kohistan
Legend
GW_Electrical_Conductivity
Electrical_conductivity_mju_S_cm
EC µS per cm
Electrical Conductivity Regions
MAP:
FARYAB PROVINCE
plus Ghormach District
Capacity Building and Institutional Cooperation in the field of Hydrogeology for Faryab Province, Afghanistan
Norad
NORPLAN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Gurziwan
Kohistan
Legend
Static_water_level_m
Static Water Level Regions
Meters Under Ground
Static Water Level Regions
FARYAB PROVINCE
plus Ghormach District
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2 Types of Field Survey

A. Supplementary regional field survey of existing wells / boreholes / springs / karezes in areas where there is little existing data
B. Site specific surveys (drilling / geophysics) in areas where there are no existing water points, or where there are specific hydrogeological uncertainties to be resolved

Field Surveys. A. Regional surveys

1. Rapid Groundwater Survey

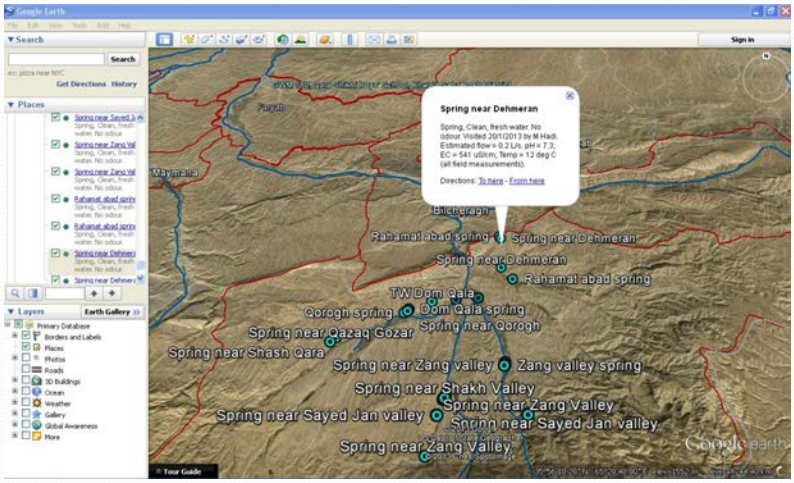
- Up to 200 new groundwater features registered.
- Springs/ karezes, wells and boreholes
- Water level, location, pH, temperature, electrical conductivity
- Performed Spring and Summer 2013
- Focussed on areas where existing data is sparse:
  - Gurziwan
  - Bilchiragh
  - Kohistan (springs)
  - Qaysar
  - Andkhoi / Qurgan / Qaramqol / Khani Char Bagh
- Every 3rd location sampled (60 mL, filtered at 0.45 um), and chemical analysis performed at BGS, United Kingdom
- Every 9th location sampled (15 mL, filtered at 0.45 um), and stable isotopic (^{18}O and ^{2}H) analysis performed at BGS, United Kingdom

NORPLAN	RAPID FIELD ASSESSMENT 2013 FARYAB PROVINCE		
Type of feature: Spring ☐	Dug well ☐	Drilled well ☐	Karez ☐
District:	Village:		Well or spring name:
Latitude/longitude (decimal):			
Approx. Elevation (m asl)	m above sea level (from GPS)		
(If karez, give reference of karez mouth and mark course of karez on sketch map)			
Use:	Public supply ☐ Private supply ☐ Institution (e.g. school or clinic) ☐ Irrigation ☐ Other:		
Type of pump:	Hand pump ☐ Electric submersible ☐ Bucket ☐ Other:		
If karez or spring, estimated flow rate			L/s
Diameter of well:			mm
Height of well top (flange) above ground level			cm above / below ground level
Casing material:			
Date of construction:			
Driller:			
NGO / implementing partner:			
Donor:			
Water appearance			
Visual:	Taste:		Odour
Field analysis (after 5 minutes pumping)			
pH	EC	Temperature	DO or Eh
	µS/cm	°C	mg/L or mV
Water sample no.			

Diameter of well:			mm
Height of well top (flange) above ground level			cm above / below ground level
Casing material:			
Date of construction:			
Driller:			
NGO / implementing partner:			
Donor:			
Water appearance			
Visual:	Taste:		Odour
Field analysis (after 5 minutes pumping)			
pH	EC	Temperature	DO or Eh
	µS/cm	°C	mg/L or mV
Water sample no.			
500 mL unfiltered for analysis at DACAAR ☐	60 ml filtered sample for chemical analysis in England ☐		15 ml filtered for isotope analysis in England ☐
Static water level			m below well top
Total depth			m below well top
Is the well working as intended? Yes ☐ No ☐			
If No, describe problem			
Is the there a community association managing the well: Yes ☐ No ☐			
If Yes, provide details			
Recorded by:	Date:		Time:
Name:			

1. Groundwater features

Purpose: To supplement existing data set in areas with poor coverage



Field Survey: 2. Precipitation Survey

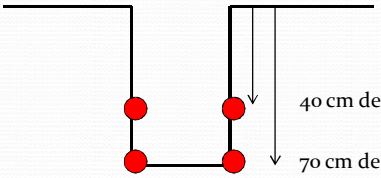
Purpose: To understand the isotopic signature and chemical composition of rainfall; thus to better understand recharge and salt accumulation mechanisms

- Ideally 3 stations (highland and lowland). In Faryab: Andkhoi, Maimana, Gurziwan
- Snowfall and rainfall (2-3 rounds for each station)
- Samples delivered for chemical and isotopic (^{18}O and ^{2}H) analysis at British Geological Survey

3. Soil Salinity Survey

Purpose: To clarify source of dissolved salts in groundwater in Neogene, loess and Quaternary aquifers

c. 8 pits: all to be described (logged) and photographed



3 on Neogene deposits
3 on Quaternary alluvial deposits
2 on loess deposits

3. Soil samples

At DACAAR laboratory, soil samples leached with distilled water to dissolve soluble salts.

Leachate analysed by British Geological Survey, UK

Completed

4. River Profile Survey

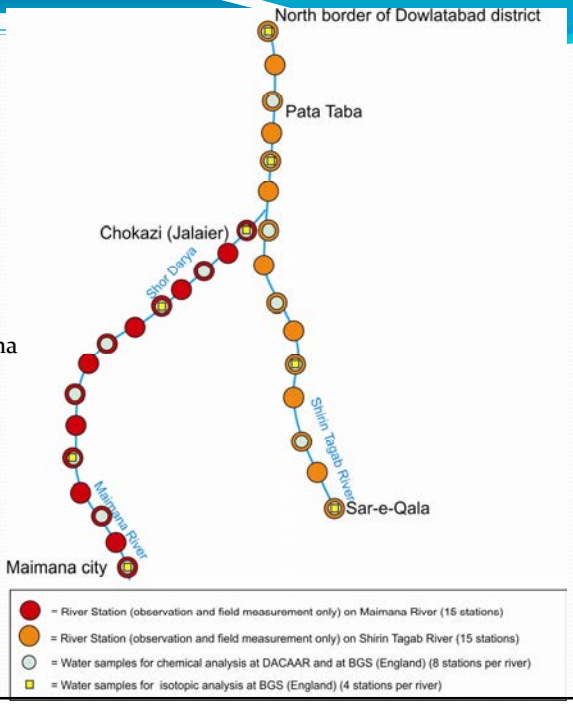
Purpose: To clarify the role of rivers in recharging the groundwater system

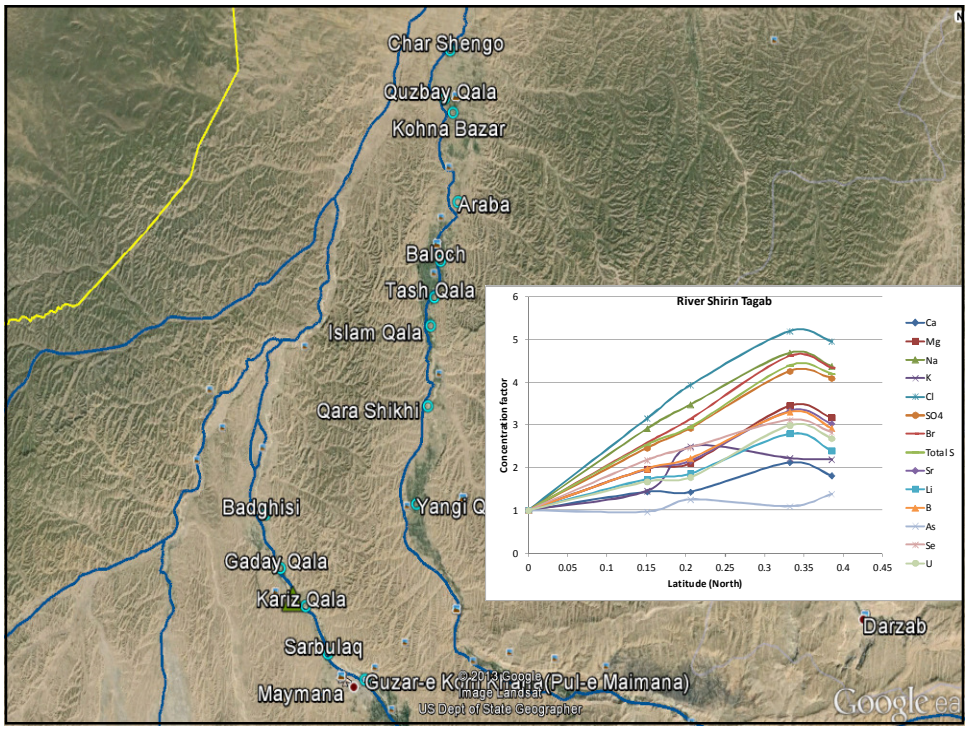
- Two profiles:
  1. Shirin Tagab River through Shirin Tagab and Dowlatabad Districts (70 km)
  2. Maimana River downstream from Maimana city
- Every 5 km: Photographic record, estimate of flow, EC measurement
- Every 10 km: Water sample for chemical analysis
- Every 15-20 km: Water sample for isotopic analysis

4. River Profile Survey

Largely completed.

Lower part of Maimana River not surveyed (security concerns)





Field Surveys B
Site-specific surveys

These should only be performed to fill a particular gap in our understanding.....It is proposed:

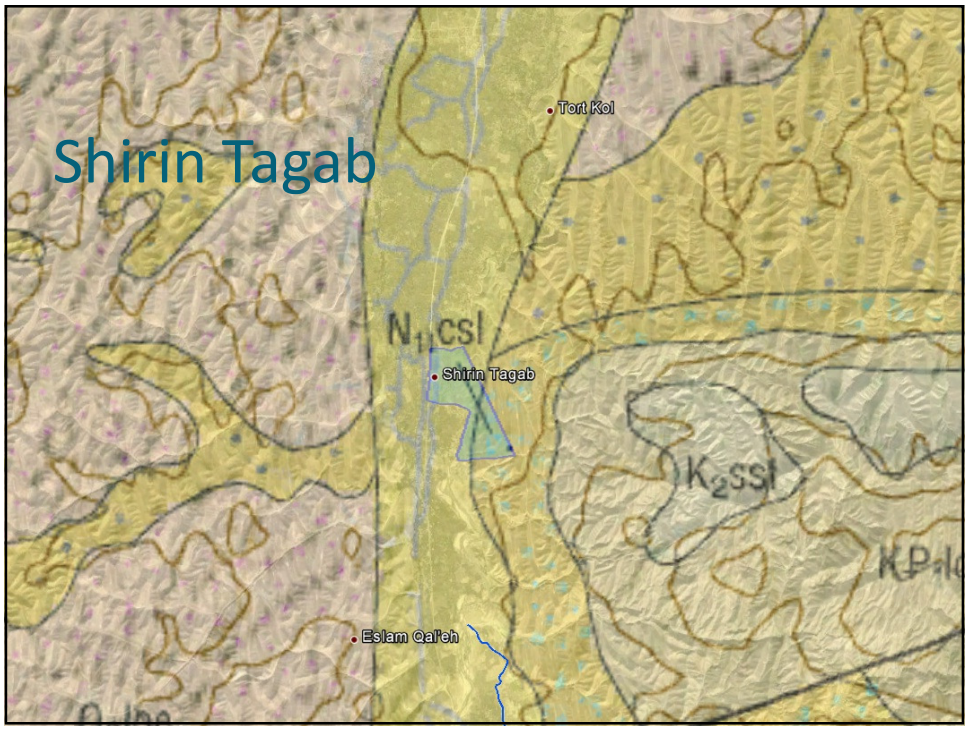
1. To drill 1 to 2 deep boreholes in Andkhoi, near locations where water is somewhat less saline, **to ascertain how groundwater salinity changes with depth and to ascertain whether potable resources exist.**
2. To drill a profile of piezometers perpendicular to the Shirin Tagab River, **to find out how the water quality changes with distance from the River and to clarify recharge mechanisms.**
3. To investigate a suspected significant aquifer resource near Maimana Airport. To evaluate its **size, productivity and sustainability.**

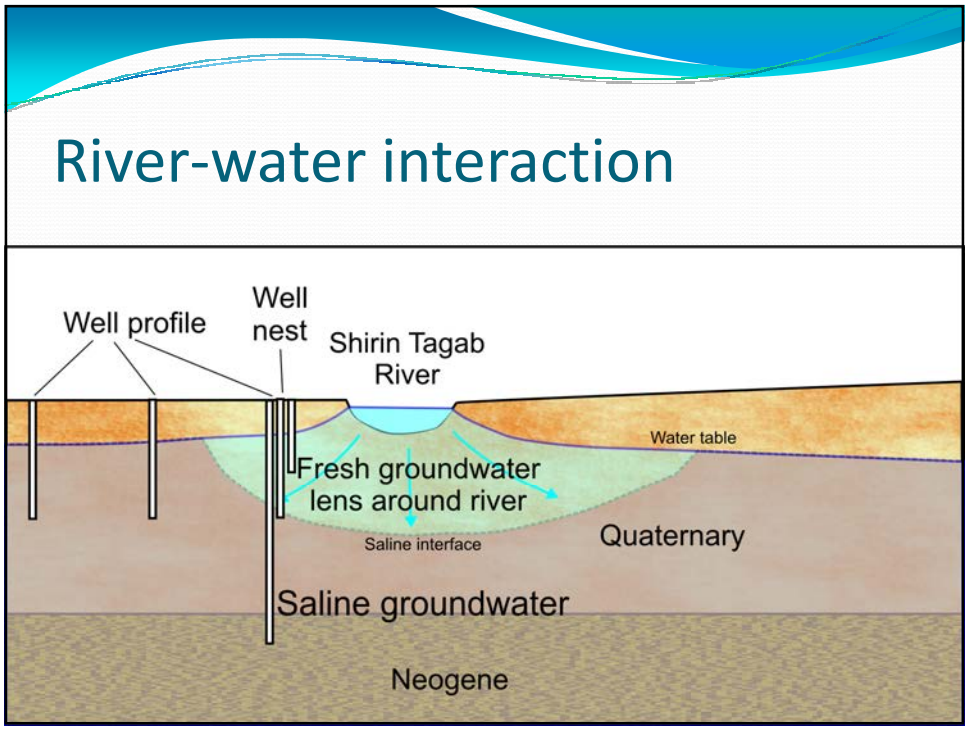
Methodology

1. Desk studies : (can be found in NOR1_1 Provincial hydrogeological mapping methodology D1.0 Part 2.pdf)
2. Plans for field work
3. Site survey (**should take place August 2013**)
   - Social / political engagement
   - Identification of drilling site and lines for geophysics
   - Water features survey / Pollution sources survey
   - Environmental impact assessment
   - Identification of monitoring network (possible installation of loggers)
4. Geophysical survey (**should take place September 2013**)
5. Geophysical report

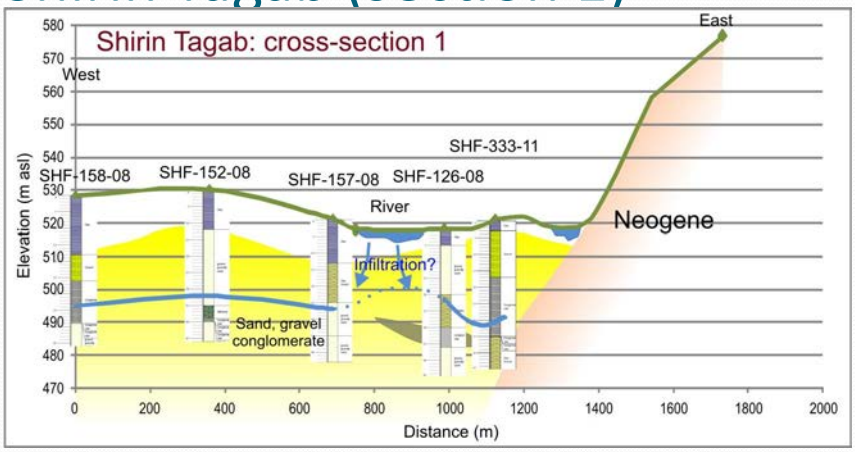
Methodology

6. Drilling of production borehole(s) and monitoring piezometers
7. Installation of monitoring equipment (loggers) in new boreholes, existing wells and river.
8. Geophysical borehole logging
9. Short term test pumping of *all* boreholes.
   - Sampling for chemical and isotopic analysis
10. Longer term test pumping of production boreholes / recovery test
    - Sampling for chemical and isotopic analysis
11. Closure of boreholes / conversion to potable wells / monitoring wells

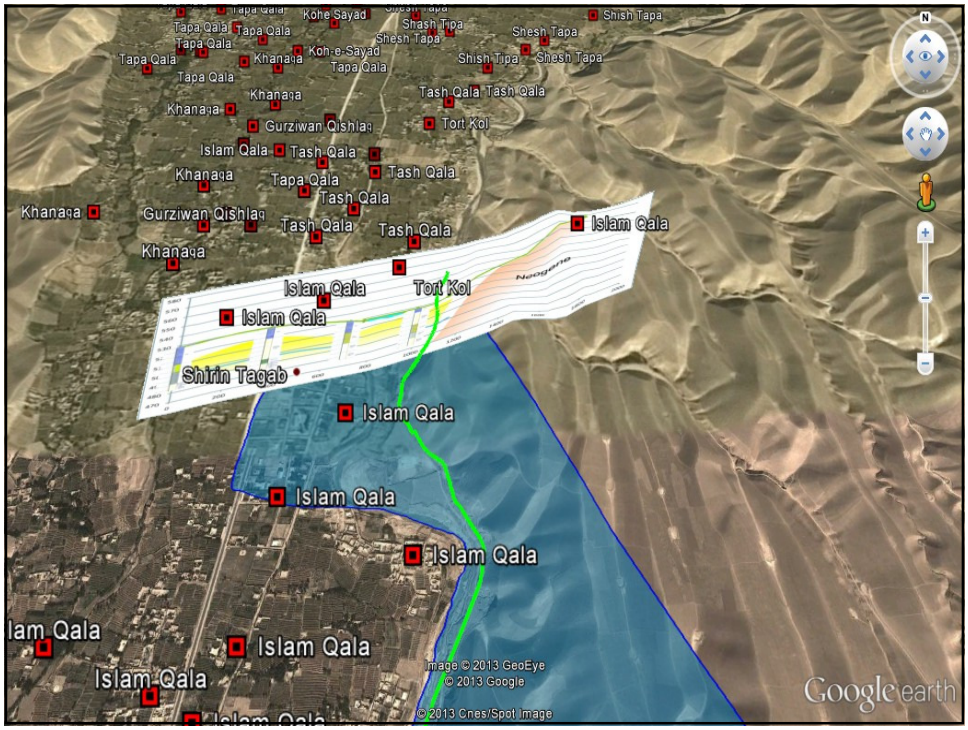

Shirin Tagab
Tort Kol
N_1csl
Shirin Tagab
K_2ss
Eslam Qal'eh


River-water interaction
Well profile
Well nest
Shirin Tagab River
Water table
Fresh groundwater lens around river
Saline interface
Quaternary
Saline groundwater
Neogene

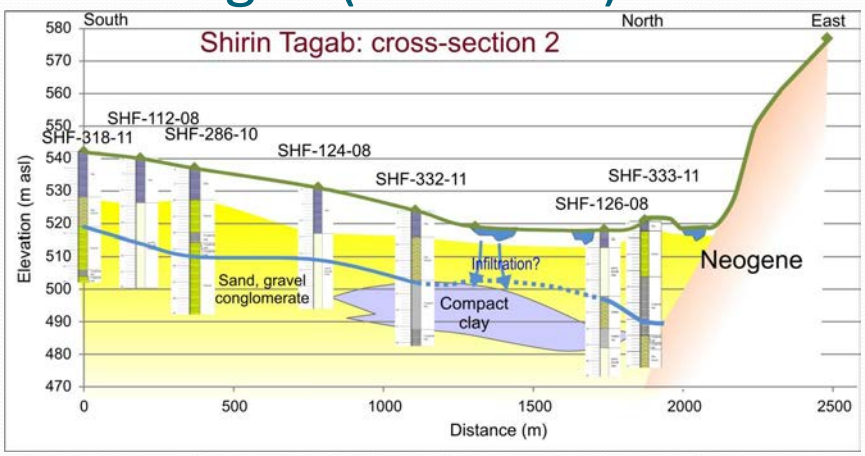
Shirin Tagab (section 1)



Possible recharge from River to aquifer....



Shirin Tagab (section 2)



Maimana Airport