National Groundwater Monitoring Wells Network in Afghanistan"
From July 2007 to December 2010

April 2011

Paikob-e- Naswar, Wazirabad, PO Box 208, Kabul, Afghanistan
Phone: (+93)(020)220 17 50 Mobile (+93)(0)70 288232
E-mail: dacaar@dacaar.org Web site: www.dacaar.org

TABLE OF CONTENTS

ABBREVIATIONS

ACF	Action Contre La Faim
AGS	Afghan Geological Survey
BGR	Federal Institute for Geosciences and Natural Resources
DACAAR	Danish Committee for Aid to Afghan Refugees
DE	Deepened Well
DW	Dug Well
GAA	German Agro Action
GMWs	Groundwater Monitoring Wells
MMI	Ministry of Mines and Industries
MRRD	Ministry of Rural Rehabilitation and Development
MWE	Ministry of Water and Energy
SCA	Swedish Committee for Afghanistan
SDC	Swiss Agency for Development and Cooperation
TW	Tube Well
USGS	United States Geological Survey
WFP	World Food Program

1. INTRODUCTION

Afghanistan is covered by a river network in which most of the small rivers and streams only flow for 3-4 months during rainy period and then dry out in the other months of a year. The rainfall is also highly uneven with respect to time and space, which affects the availability of surface water during a year. Therefore groundwater is the major source of drinking water in Afghanistan. It does not, however, have a large potential for development as it is a finite resource and is also extremely vulnerable and sensitive to over-exploitation and contamination.

In Afghanistan, little is known about the geological setting, hydrogeological conditions and groundwater resources due to lack of qualitative and quantitative monitoring, management and protection as will as lack of information system. Commencing in March 2005, DACAAR has, to December 2010, selected, constructed and modified 142 Groundwater Monitoring Wells (GMWs) in 19 provinces of Afghanistan for annual and long term groundwater monitoring. The GMWs cover approximately 80 percent of the river basins of Afghanistan. The depth of these wells ranges between 12-65 m, and most are drilled in the Quaternary formation.

The groundwater level and electrical conductivity (EC) of each GMW was measured on a monthly basis (occasionally every 2 weeks). All the field water level and EC data from the GMWs network was corrected, revised, processed then recorded in the national groundwater monitoring database for storage, management, evaluation, visualization, mapping and reporting.

The water quality (physical, chemical and bacteriological) of the GMWs was sampled and analyzed every sixth months. All the water quality data from the GMWs was corrected, revised, processed then recorded in the Integrated Water Quality Data Management database (AquaChem) for data graphic analysis, management, evaluation, visualization, mapping and reporting.

Finding vulnerable areas from the integrated water qualitative and quantitative data management, evaluation and mapping is significant for innovation and improvement of relevant water policies, strategies and regulations in Afghanistan.

Reports were provided according to the GMWs network water qualitative and quantitative data analysis, management, assessments and mapping. Presentations were made to the Water Technical Working Group (WTWG), Water and Sanitation Sectoral Group (WSG), World Water Day and National Workshop on Water Quality Monitoring in Afghanistan held by UNICIEF and MRRD from 19-20 December 2010 for raising awareness and sharing information with water sector stakeholders in Afghanistan.

The results from the National GMW network data management, evaluation and mapping show that the groundwater storage in Afghanistan has progressively been depleted and there is increasing concern over water quality due to over-abstraction, low recharge, high evaporation and poor management and protection.

As the Afghan population continues to grow, there is increasing pressure to further exploit groundwater for various purposes, which is basically unsustainable due to low thicknesses and low productivities of the respective aquifers. The frequency of drought and impact of climate change, together with over-exploitation, fragmented institutional arrangement and poor policies and strategies and regulations will cause further negative consequence to the groundwater quality and quantity, further challenging social and economic well-being. The current vulnerability of the aquifers may not be reversible and future generations in Afghanistan will face a severe shortage of drinking water.

The Government of Afghanistan has yet to seriously address the serious deterioration in groundwater quality and lowering of groundwater levels There is an urgent need to improve groundwater resources by monitoring, management, storage and protection.

2. BACKGROUND

Since 1999 drought and excessive groundwater use for a variety of purposes (water supply, irrigation, industries, environmental security and others) have significantly lowered the groundwater table and depleted aquifers of their natural storage. As a result, most of the shallow wells, springs and karezis (traditional irrigation water supply system) have dried up and created concern regarding future reliability of sustainable use of groundwater resources. Therefore, key water sector stakeholders including MMI, MMRD, Kabul University, Polytechnic University, GAA, MWE, OXFAM, SCA, SDC, SOLIDARITY, US Embassy, USGS, USAID, Agromet, ACTED, ACF, AGS and WFP have committed to contribute towards the establishment of a national groundwater monitoring and management system throughout Afghanistan for effective and efficient use of groundwater resources.

DACAAR has taken the following steps for mitigation and improving the situation:

1. Collected and recorded water related historical data (drilled well logs, well hydraulic, properties, water quality, groundwater and surface water investigation, hydrological data, meteorological data and geologic and hydrogeologic characteristics).
2. Installed water points information system (WIS) database (1999)
3. Provided standards formats for data collection
4. Established water quality laboratory for physical, chemical and bacteriological analysis (2003)
5. Established National Groundwater Monitoring Wells Network throughout Afghanistan (2004)
6. Installed Integrated Water Quality and Quantity Data Management database (2008)
7. Improved and developed knowledge, technical and management capacity of groundwater monitoring staffs for data acquisition, graphic analysis, management, evaluation, mapping and reporting.

Now the National GMWs network, integrated water resources data management and its information systems (databases) are the only nation-wide significant data sources in Afghanistan. This GMW network has supported water sector stakeholders for efficient and

effective implementation of water supply projects and has also supported university students for bachelor and master degree research.

3. MAIN OBJECTIVE

1) Select, construct, modify and develop GMWs network within the main River Basins of Afghanistan.
2) Provide a long term period of record to assess the impact of sustained groundwater withdrawals.
3) Develop technologies and tools for GMWs network data acquisition.
4) Enhance water related technical and data management capacity, information sharing and dissemination and awareness raising.
5) Establish and develop water quality and quantity data management and information system (database) for groundwater data management, evaluation, mapping and visualization.
6) Collect historical and recent groundwater data for improvement of GMW data evaluation.
7) Provide geological and hydrogeological information.
8) Identify critical and vulnerable aquifers that require protection
9) Finding early warning signals and relevant policy options.
10) Identify problematic areas from a water quantity perspective that require further research to identify feasible alternative water resources.
11) Point out water related problems to support decision makers and policy makers for improvement of policies, strategic plan and regulation regarding groundwater resources development, protection and sustainability.

4. METHODOLOGY

From March 2005 to December 2010 DACAAR constructed, modified, installed and monitored 142 GMWs network within the River Basins of Afghanistan. An overview of the National Groundwater Monitoring Wells network is presented in Annex 1 and location and depth of each monitoring well is presented in Annex 2. The well locations were geo-referenced by GPS (Global Position System, see figure 1) for establishing a groundwater monitoring wells database that can be assessed through GIS maps.

Fig. 1, GPS (Global Positioning System)

The water level and physical parameters like Electrical conductivity, temperature and pH were measured on site on a monthly basis using pH/conductivity meter and water level indicator, SEBA and Diver devices (Fig.2)

Figure 2, Water table and physical parameters measurement devices

Divers or data loggers (Fig.2) are reliable instruments for automatic measurement and registration of the ground water level, salinity and temperature over a long time period. The Divers are installed in tube wells and after a while data are up-loaded to a Diver Mate, then downloaded from the Diver Mate to a PC.

The SEBA (Fig.2) water level recorder is a floater operated measuring instrument. The recorder is driven by clockwork using a small electrical motor and batteries. The SEBA water level recorder is a precise measuring instrument requiring careful placing and handling to guarantee long operation.

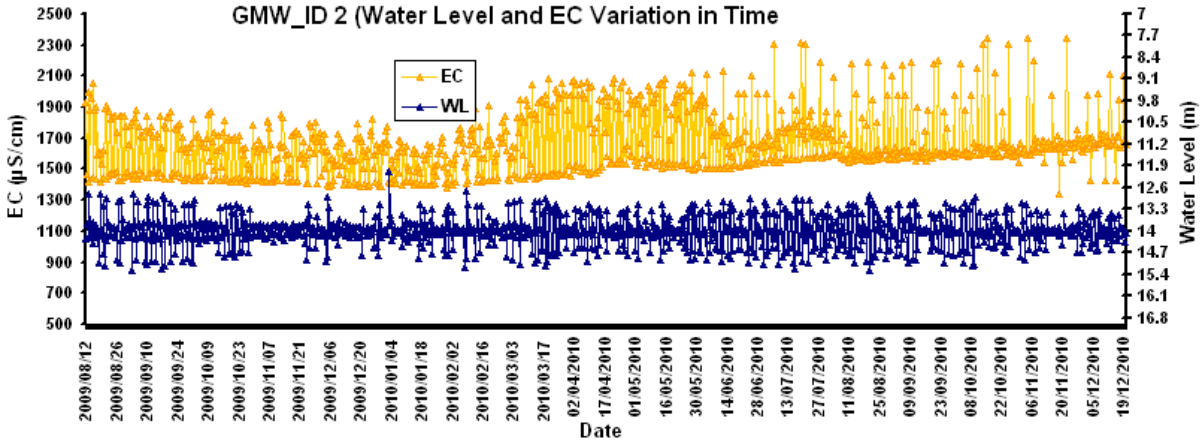


Figure 3, Water Level and Salinity (EC) variation in time graph (Divers or automatic measurement and registration of the WL and EC data)

The bacteriological properties of the groundwater monitoring wells were determined on site using a micro bacteriological field test kit (Fig. 4).

Figure 4 Bacteriological analysis devices

The chemical properties (parameters) of the groundwater monitoring wells were determined every six months using a Photometer 8000 (Fig.5)

Figure 5, Chemical analysis measurement devices

The water quality and quantity data (from GMWs, DACAAR's WASH projects and private sector projects) were recorded in the AquaChem and HydroGeo Analyst database for data management, evaluation, and visualization, mapping and reporting (Fig. 6 and 7)

The AquaChem database (Fig.6) was used for integrated water quality data (physical and chemical parameters) recording, management, analysis, interpretation and reporting.

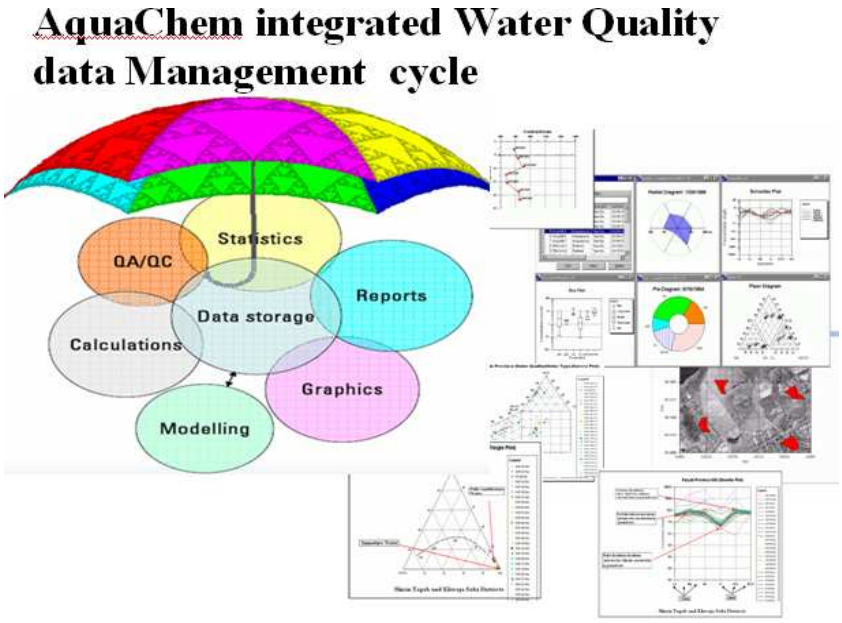


Fig.6, AquaChem or integrated water quality data management

The HydroGeo Analyst (Fig.7) database was used for integrated water quantity data management, graphic evaluation, mapping and reporting.

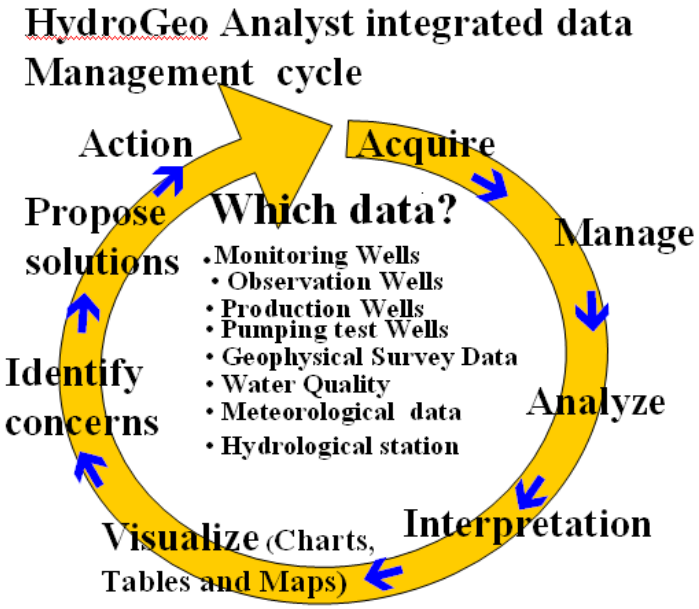


Figure 7, HydroGeo Analyst integrated data management cycle

5. DATA/INFORMATION COLLECTION EFFORT

1) Water quality and quantity data were regularly collected from DACAAR's GMWs network (2004-10)

2) Water quality data from DACAAR/WASH projects (DACCAR/WASH, 2004-December 2010)
3) Water quality data from private sectors which were analyzed by DACAAR's water quality laboratory (2004-10)
4) Primary groundwater survey data from Herat, Badghis, Faryab and Ghor provinces which were conducted by DACAAR (2004-08)
5) Well log design data which were drilled by DACAAR (2003-10)
6) Physical parameter (water level, electrical conductivity, pH and temperature) of 21,200 handpump wells data which were measured by DACAAR Handpump Inspection Teams.
7) Exploration wells water quality and quantity data which were drilled by Ministry of Mine and Industry (1973-81).
8) Production wells water quality and quantity data which were drilled by Ministry of Water and Power (1970-90)
9) Previous groundwater investigations which were carried out by different organizations in Afghanistan.

6. TECHNICAL AND MANAGEMENT CAPACITY BUILDING

DACAAR improved and developed knowledge, technical and management capacity of groundwater monitoring staffs for field data acquisition, analysis, management and evaluation.

6.1. TECHNICAL CAPACITY BUILDING;

6.1.1. PROVIDED STANDARD FORMATS FOR FIELD DATA ACQUISITION;

1) GMWs monthly report
2) New GMW selection
3) Water quality analysis
4) Well log design
5) Groundwater technical survey
6) River water measurement
7) Production and observation well pumping test

6.1.2. SUPPLIED MEASUREMENT ANALYSIS DEVICES:

1) GPS (Global positioning system) for Geo referencing.
2) Water level indicator, Diver/data logger and SEBA for Groundwater level measurement.
3) Turbidity meter for turbidity measurement
4) pH/Conductivity meter (Physical parameters measurement)
5) Digital Arsenator (Arsenic measurement)
6) Photometer 7000, Photometer 8000 and SpectroFlex 6000® Series Photometer (measurement of chemical parameters)
7) Bacteriology test Kits (single incubator and double incubator) for (microbiological determination)
8) SYSCAL pro resistivity (Geophysical investigation)

6.2. ENHANCED DATA MANAGEMENT CAPACITY

1) Established and improved National GMWs network database
2) Established and developed integrated water quality data management database by using AquaChem for integrated water quality data management analysis, evaluation and modeling

3) Established and developed integrated water quantity data management database (production well data, exploration well data, pumping well data, geophysical investigation, metreological station data and hydrological station) by using HydroGeo Analyst for water quality data (environmental data system) management, analysis, evaluation, mapping, visualization and modeling.
4) Established and developed Aquifer test software for production and exploration wells pumping test data graphical analysis and evaluation.
5) Updated and improved AquaChem and HydroGeo Analyst based on improvements and developments by the relevant company.

6.3. KNOWLEDGE AND SKILL CAPACITY

DACAAR facilitated training of staff in Afghanistan, India and the United Arab Emirates to enhance knowledge, skill and capability of GMW staffs for groundwater monitoring data acquisition, analysis, management, evaluation, mapping and visualization. The most significant of these training courses were:

1) Integrated water quality and Quantity data management, using HydroGeo Analyst and AquaChem, conducted by Schlumberger Water Services in Abu Dhabi, UAE February 4-7, 2008, participation by M.Hassan Saffi Hydrogeologist
2) Integrated Aquifer Characterization and Groundwater Modeling using HydroGeo, Analyst conduted bySchlumberger Water Services fromOctober 25-27,2009 in Abu Dhabi, UAE participation by M.Hassan Saffi Hydrogeologist)
3) Training program on Water quality evaluation Monitoring and Mapping drinking water source from Nov,25 to Dec, 24 2009 in Shriram Institute, Delhi India participation by Shir Habib.
4) Aquifer test for finding well hydraulic properties conducted by Schlumberger Water Services from February 4-7, 2008 in Abu Dhabi, UAE participation by M.Hassan Saffi Hydrogeologist)
5) Hydrogeology and groundwater concept from June1-5,2008, conducted by U.S Geological in Afghan Geological Survey Kabul Afghanistan participation by M.Hassan Saffi Hydrogeologist
6) GIS 9.3 and GIS 9.2 , Khawaran Institute in Kabul Afghanistan from2 April 2009- 04 June 2009 partacipation by M.Hassan Saffi Hydrogeologist)
7) Database(June1-5,2008, conducted by U.S Geological in Afghan Geological Survey Kabul Afghanistan participation by M.Hassan Saffi Hydrogeologist)
8) Map info and Arc GIS Training from 01 to 30 Dec 2009 in Geo Map Systems (P) Ltd in Somajiguda, Hyderabad, India participation by Ahmad Jawid Hydro geologist
9) Geophysics Training for investigation of groundwater in MRRD Kabul, Afghanistan on 01 to 30 April 2009 participation by Ahmad Jawid Hydrogeologist
10) Basic Hydrogeology conducted by Lars Matthes from Technical University Berlin, Invent 11-22 August 2005, Kabul University, Kabul Afghanistan

7. PROVIDED PRESENTATIONS AND REPORTS

7.1 PRESENTATIONS

The scientific presentations were provided from GMWs network integrated water quality and quantity data analysis, management, assessment and mapping. They are as follows:

1) Groundwater at risk in Afghanistan(May, 2007)

2) Fluoride Contamination in Afghanistan's Groundwater(April, 2007)
3) Arsenic Contamination in Afghanistan's Groundwater(December, 2008)
4) Application of Reverse Osmosis Desalination Plant for the areas where groundwater are saline (July, 2008)
5) Groundwater potential and water quality problem in Faryab province (November, 2008)
6) Water Quality concern in Afghanistan (March, 2010)
7) Water quality and quantity concern in Kabul Basin (May, 2010)
8) AquaChem or integrated water quality data Management cycle May, 2008)
9) HydroGeo Analyst or Integrated water quantity data management cycle (April,2008)

The above mentioned presentations ware presented in the Water Technical Working Group (WTWG), Water Supply and Sanitation (WATSAN) meeting, World Water Day and Water Quality conference.

The mentioned presentations are accessible in the DACAAR Web site: www.dacaar.org

7.2 REPORTS

The scientific reports were provided from GMWs network integrated water quality and quantity data analysis, management, assessment and mapping. They are as follow:

1) Groundwater resources at risk in Afghanistan(June 2007)
2) Occurrence of Fluoride contamination in Afghanistan(June 2007)
3) Water resources concern in Qala-i-Naw centre of Badghis Province (July 2007)
4) Groundwater natural resources and quality concern in Kabul Basin (May 2010)
5) Integrated Groundwater Study Approach in Astana valley, Shirin Tagab District of Faryab Province(June 2010)
6) Integrated Groundwater Study Approach in Jalaier valley, Shirin Tagab District of Faryab Province (June 2010)
7) Water quality concern in Afghanistan's groundwater draft report

The mentioned reports are accessible in the DACAAR Web site: www.dacaar.org

8. MAJOR FINDING OF WATER QUALITY AND QUANTITY PROBLEMS /POLICY RELEVANT OPTIONS

The major finding of groundwater quality and quantity problems (early warning signals) from groundwater monitoring wells network can support policy and decision makers to apply effective policies, strategic plans and regulations for sustainable development, management, development and protection of groundwater resources.

8.1. GROUNDWATER-QUANTITY PROBLEMS;

1) Progressively lowering groundwater level with time due to unsustainable use of groundwater resources
2) Progressive depletion of significant natural groundwater storage due to low recharge and over-exploitation
3) Water logging (changing saturation zones to unsaturated zones)
4) Drying up of Karezes, spring (traditional irrigation and water supply system)

8.2. GROUNDWATER-QUANTITY PROBLEMS;

1) Bacteriologicall contamination
2) Nitrate contamination
3) Fluoride contamination
4) Boron contamination
5) Arsenic contamination
6) Salinity contamination

As the Afghan population continues to grow, there is increasing pressure to exploit groundwater for various purposes which is basically not possible because of low thicknesses and low productivity of aquifers. This trend will cause further negative consequent to the groundwater quality and quantity that will challenge our social and economic well- being.

Current institutional arrangement and management tools may not meet emerging needs. It is urgently required to prevent all processes, activities that cause degradation of water quality and depletion of water natural storage through applying effective policies, strategic plans and regulations for Afghanistan's water resources management, development, protection and sustainability.

9. ACTIVITIES

The national GMW network activities are summarized in three time phases:

(1) March 2005 to 10th November 2006

(2) 11th November 2006 to 24th June 2007

(3) 24th June 2007 to 31st December 2010

9.1. ACTIVITIES FROM MARCH 2005 TO 10 NOVEMBER 2006

1) Selected and modified 76 water points (61 TW, 11 DW, 3 SEBA measuring instrument and one Diver or data logger instrument) in sixteen provinces (72 districts) of Afghanistan
2) Measured water table and physical parameters (Electrical Conductivity, pH, Temperature) of the modified GMWs on a monthly basis (for a short while measured two times a month)
3) Chemical and bacteriological analysis performed on GMWs on a six monthly period
4) Made National groundwater monitoring database for recording field data after revision and correction of data received from field
5) Recorded recent rainfall data in the national groundwater database which were received from Agromet (USGS)
6) Collected geological and hydro geological information around each monitoring water point and recorded in the national groundwater monitoring database

7) Modified GMWs-Diver, tools for transferring field data to the national groundwater monitoring database
8) Modified GMWs- SEBA tools for transferring field data from charts to the national groundwater monitoring database

9.2. ACTIVITIES FROM 11, NOVEMBER 2006 TO 24 JUNE 2007

1) Selected and modified 27 water points in Kapisa (GMW_ID 113, 114) Logar (GMW_ID 128, 142) Kabul (GMW_ID 1, 143) Baghlan (GMW_ID 115, 116, 117, 118, 119, 120, 121, 122 and 124) Kunduz (GMW_ID 129, 130, 131, 132, 133, 134 and 135) Hirat (GMW_ID 127, 126 and 125) Badghish (GMW_ID 139, 140 and 141) Provinces (Annex 1 and 2)
2) Selected and modified two groundwater observation wells in Baghlan and Logar provinces (GMW_ID 123 and 143) and installed two Diver mates (Automatic measurement instrument)
3) Performed chemical analysis of 104 groundwater monitoring wells according to the six month period
4) Organized two teams (one team in Kabul to keep GMWs operational and measure groundwater monitoring wells on a monthly basis in Kabul, Ghazni, Logar, Khost, Paktya, Laghman, Nangrhar, Kapisa, and Parwan provinces and one team in Herat to keep GMWs Operational and measured groundwater monitoring wells on a monthly period in Herat, Baghis and Ghor provinces
5) Measured all Groundwater monitoring wells water level and electrical conductivity on a monthly period
6) Recorded and analyzed field data of National GMWs network in the database
7) Evaluated groundwater monitoring wells water quality and quantity data and prepared report (Groundwater monitoring data evaluation report)
8) Collected geological and hydrogeological information for groundwater monitoring wells.
9) Recorded drilled tube wells strata data in database (1,100 drilled tube wells) drilled by DACAAR /WASH.
10) Selected 6 Observation Wells in Faryab province (Maimana, Dawlatabad, Shirin Tagab, Khwaja Subz Posh, Pashtun Kot and Khwaja Musa Districts) for installation of Diver mate. The drilling of three wells started in Faryab province for piezometric use only.
11) For more detailed report on activities done and interpreted can be found in (Groundwater Monitoring Data Evaluation Report of June 2007)

9.3. ACTIVITIES FROM 24 JUNE 2007 TO 31 DECEMBER 2010

1) The physical parameters (Groundwater Table, Electrical Conductivity, pH and temperature) of 142 Groundwater Monitoring Wells have measured in field on a monthly period.
2) Performed the physical, chemical and bacteriological analysis of water samples from 140 Groundwater Monitoring Wells Networks on the six months period
3) Recorded 142 Groundwater Monitoring Wells Networks field measurement data in the database after revising, analysing and correction which are received from field.
4) Established, used and developed AquaChem (integrated water resources water quality data management) database and HydroGeo Analyst (integrated water quality data management) database for data recording, analysing, evaluation mapping and reporting.
5) Established and developed Aquifer test software for graphical analysis and reporting of pumping test data. Aquifer test allows the calculation of well hydraulic properties (discharge, hydraulic conductivity, transmissivity and storability)

6) Recorded, analysed and managed 2,224 National Groundwater Monitoring Wells (GMWs) Network, Water Supply project improved water points and private sectors analysed water samples physical, chemical and bacteriological data in the AquaChem database for water quality data management, analysis, evaluation and mapping.
7) Provided presentation according to the GMWs network water quality data finding and presented in the Water Technical Working Group (WTWG), Water Supply and Sanitation (WATSAN) meeting, World Water Day and Water Quality conference. These presentations include:
    1) Groundwater at risk in Afghanistan
    2) Fluoride Contamination in Afghanistan's Groundwater
    3) Arsenic Contamination in Afghanistan
    4) Application of Reverse Osmosis Desalination Plant for the areas where groundwater are saline
    5) Groundwater potential and water quality Problem in Faryab province
    6) Water Quality concern in Afghanistan
    7) Water quality and quantity concern in Kabul Basin

   Finding vulnerable areas from the integrated water quality data management, evaluation and mapping are significant for innovation and improvement of water relevant policies, strategic plan and regulation in Afghanistan
8) Recorded, analysed and managed 2,482 Wells log Design Data (Geological and Hydro geological information) in the HydroGeo Analyst Database for evaluation, management and reporting of geological structure and hydro geological condition of groundwater system. The finding from this recording, evaluation and mapping is the significant figure for groundwater potential development technology in future.
9) Provided Faryab province Groundwater Capacity and Water Quality presentation according to the Faryab province water quality and quantity data management, analyzing, evaluation and mapping and presented for Faryab province GOs and NGOs staffs.
10) Provided a scientific research reports according to the Groundwater Monitoring Wells water quality and quantity data management, evaluation and mapping. These reports include:
    1) Groundwater resources at risk in Afghanistan
    2) Fluoride contamination in Afghanistan
    3) Water resources concern in Qala-i-Naw centre of Badghis Province
    4) Groundwater natural resources and quality concern in Kabul Basin
    5) Integrated Groundwater Study Approach in Astana valley, Shirin Tagab District of Faryab Province
    6) Integrated Groundwater Study Approach in Jalaier valley, Shirin Tagab District of Faryab Province
    7) Water quality concern in Afghanistan's groundwater draft report
11) 17 Observation Wells were selected, constructed and modified in Faryab (GWM_ID 144, 146, 147, 148, 149, 155, 162, 163, 164, 179, 180, 187,188) Balkh (GWM_ID 156,157) and Jozjan (GWM_ID 158,159) provinces. These wells were drilled in the public compound (schools) for sustainability of Groundwater monitoring. 17 Divers were installed into these Observation Wells for the measuring of water level, electrical conductivity and temperature, and after a while data were up-loaded from Diver to the Diver Mate, then down-loaded from the Diver Mate to PC. The Diver is a reliable instrument for automatic measurement and registration of the ground water level and temperature over a long time.
12) Selected and modified 11 wells in Herat (GWM_ID 151,165,167,168,175,181,182) Badghis (GWM_ID 150,152,154) and Ghazni provinces (GWM_ID 171) for the measuring of water level, electrical conductivity, pH and temperature.

10. MAJOR PROBLEMATIC WATER ISSUES

1) Poor coordination between water sector stakeholders (technology transfer, capacity building, information exchange, research development, sharing experience)
2) Lack of central integrated water resources data management
3) Lack of understanding of integrated approach to water resources, monitoring, management, development and protection.
4) Past emphasis on water supply development and no emphasis on water sources preservation, protection and sustainability.
5) Continuous lowering groundwater table and deterioration of its water quality.
6) Fragmented institutional arrangements.

11. ACTIVITIES PLANNED IN 2011

1) Make the existing GMWs network in the operational situation.
2) Perform physical, chemical and bacteriological analysis of 230 water samples from GMWs network.
3) Record physical, chemical and bacteriological analysis of 230 water samples from GMWs network in the AquaChem database (integrated water quality data management database)
4) Record 600 well log design data in the HydroGeo Analyst database
5) Construct, modify 40 new GMWs in Herat, Badghis, Faryab, Balkh, Panshir, Kabul, Logar, Nangarhar, Laghman, Parwan and Kapisa provinces.
6) Improve, develop and update GMWs tools and technology.
7) Prepare presentation from GMWs network findings and present in the Water Technical Working Group (WTWG) and WASH meetings.
8) Analysis, management, evaluation and mapping of GMWs network water quality and quantity data for providing presentations and reports.
9) Findings from the GMWs network from the integrated water quality and quantity data management, evaluation and mapping will be shared with water stakeholders and government for innovation and improvement of water relevant policies, strategic plan and regulation in Afghanistan

12. RECOMMENDATIONS

1) National GMWs network installation experiences, knowledge, technical and data management capacity, standards formats for field data collection, measurement tools and devices, water quality analysis tools and devices, integrated water quality and quantity data management, evaluation, mapping and reporting tools are significant water resources relevant efforts in Afghanistan. These efforts require more time, capacity and investment. Therefore, it is suggested to empower and expand the National GMWs network to be national wide GMWs networks and integrated water resource data management and information system.

2) Groundwater resources qualitative and quantitative findings (early warning signals) from National GMWs network can support policy and decision maker to apply suitable policies, strategic plans and regulation for groundwater resources management, development, protection and sustainability.

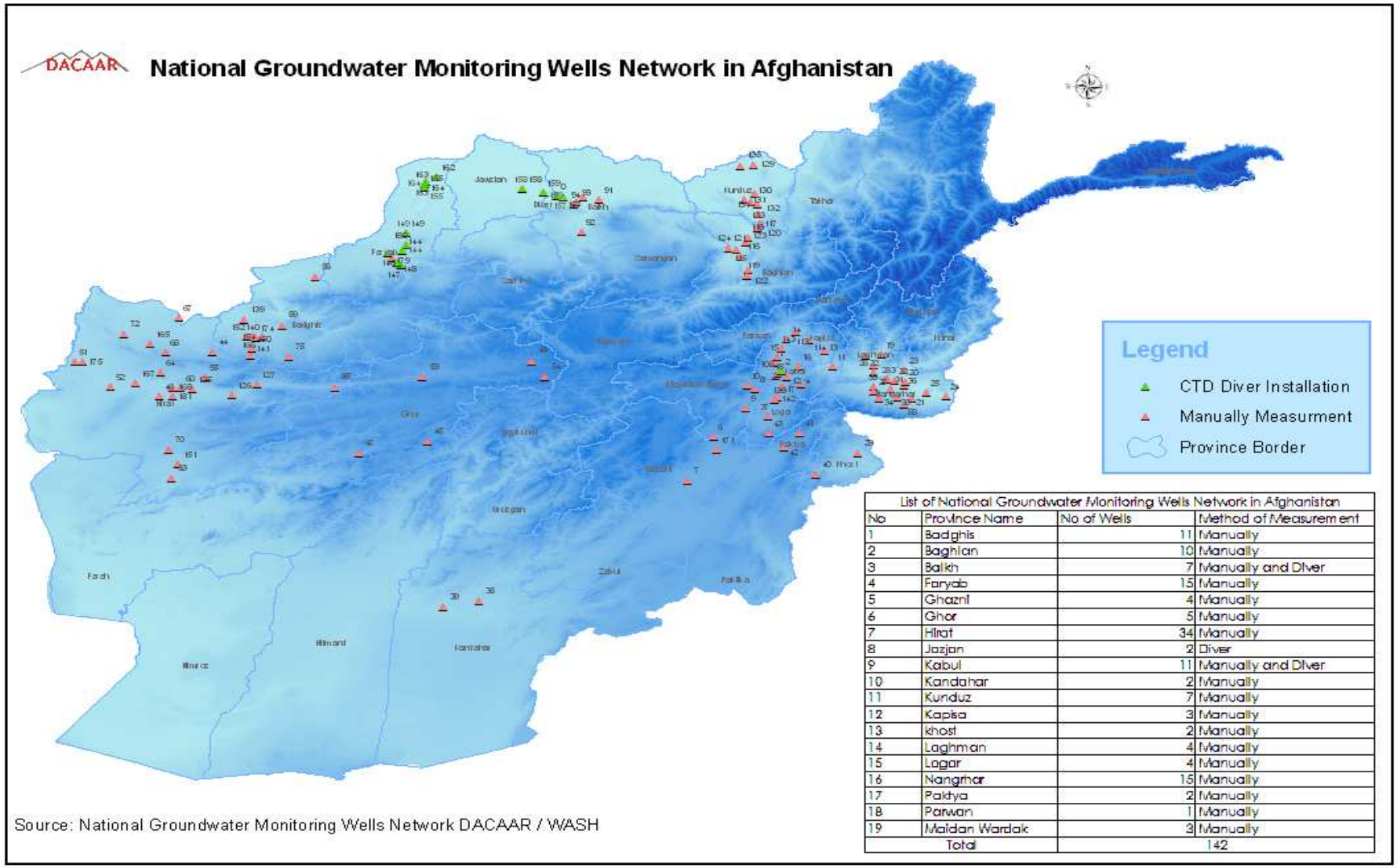
3) The National GMWs network database (A_wsg_SWL) framework shows that the water sector stakeholders contribute their efforts for efficient using of water resources through coordination, data collection, monitoring and management, sharing information, information dissemination and technology transferring. Now, the contribution and coordination efforts for efficient and effective using of water resources are very poor and a cause of failure of most water supply projects in Afghanistan. Therefore, it is suggested to strengthen the coordination and cooperation system for enhancing capacity building, data collection, monitoring and management, sharing information, information dissemination and technology for transferring through applying effective policies, strategies and regulation.

4) Improper and non technical construction of wells facilitates, contributes and promotes contamination of groundwater throughout Afghanistan. Therefore, it is suggested to provide a framework for construction of standard wells to prevent groundwater resources from further contamination.

5) GMWs finding shows that the groundwater natural storage has been depleted and water quality is deteriorating. There is also increasing demand due to population growth, agricultural needs, industrialization and socio-economic development and environmental security. Therefore, it is suggested to prevent groundwater resources from further degradation.

6) Coping strategies by the cooperation of national and international agencies to be developed for integrated water resources management, evaluation and mapping to adapt the climate change impacts.

ANNEX 1 GROUNDWATER MONITORING WELLS MONITORED BY DACAAR



List of National Groundwater Monitoring Wells Network in Afghanistan

No	Province Name	No of Wells	Method of Measurement
1	Badghis	11	Manually
2	Baghlan	10	Manually
3	Balkh	7	Manually and Diver
4	Faryab	15	Manually
5	Ghazni	4	Manually
6	Ghor	5	Manually
7	Hirat	34	Manually
8	Jazjan	2	Diver
9	Kabul	11	Manually and Diver
10	Kandahar	2	Manually
11	Kunduz	7	Manually
12	Kapisa	3	Manually
13	khost	2	Manually
14	Laghman	4	Manually
15	Logar	4	Manually
16	Nangrhar	15	Manually
17	Paktya	2	Manually
18	Parwan	1	Manually
19	Maidan Wardak	3	Manually
Total		142	

Source: National Groundwater Monitoring Wells Network DACAAR / WASH

12, Dec 2010

ANNEX 2 DETAILS OF GROUNDWATER MONITORING WELLS IN AFGHANISTAN
in conjunction with Annex1

Update List of Groundwater Monitoring Wells For The Month of Dec 2010								
GWM_ID	Province	District	Village	LON	LAT	Water Point Code	Point Type	Depth (m)
166	Badghis	Qala-e Naw	Airport	63.12270	34.99134	RRD-2002	DW	35
56	Badghis	Ghormach	Ab I Garmak	63.83602	35.73567	33	TW	22
75	Badghis	Qadis	Moqama	63.53416	34.73255	18	TW	29
141	Badghis	Qala-e Naw	Laman	63.10345	34.75230	PRT	TW	25
152	Badghis	Ab Kamari	Arbab Abdul Hamid	63.05374	34.99268	RRD	TW	37
154	Badghis	Moquor	Sanjitak	63.23637	34.98492	RRD	TW	26
140	Badghis	Qala-e Naw	First Area	63.12362	34.98465	SAUDI	TW	35
174	Badghis	Qala-e Naw	Qarghayto	63.15876	34.97461	Na	TW	35
139	Badghis	Moquor	Zir Tangi	63.02522	35.19443	org-year-code	DW	18
89	Badghis	Qadis	Darah Bom	63.46245	35.12768	43	TW	
150	Badghis	Qala-e Naw	Laman Zadshay	63.11654	34.83383	RRD	TW	30
Badghis		**6 Active** **5 Security Problem**						
124	Baghlan	Pul-e Khumri	Khwaja Alwan	68.55503	36.10606	UNHCR	TW	35
123	Baghlan	Baghlani Jadid	Baghlan Hospital	68.75075	36.18349	Observation Well	TW	32
122	Baghlan	Doshi	Dosti	68.76635	35.75794	NSP/AKF	DW	23
121	Baghlan	Pul-e Khumri	Poza Eshan Qul	68.65024	36.09195	ICCO/DACAAR	DE	15.8
120	Baghlan	Baghlani Jadid	Gelawgir	68.92041	36.41742	ICCO/DACAAR	TW	62
118	Baghlan	Baghlani Jadid	Pashaiha	68.78039	36.23768	388 APLO	TW	28
117	Baghlan	Baghlani Jadid	Gerdab	68.89073	36.36446	3 ACF	TW	42
116	Baghlan	Pul-e Khumri	Zaman khil	68.68722	35.99419	ICCO DACAAR	TW	27
115	Baghlan	Doshi	Calagi	68.78835	35.83504	ICCO DACAAR	TW	32
119	Baghlan	Doshi	Sangisurakh	68.76635	35.75794	NSP/AKF	DW	23
Baghlan		**10 Security**						
112	Balkh	Balkh	Center	66.89885	36.75699	10	DW	10
94	Balkh	Chimtal	Palo	66.79360	36.65803	79 FOCUS/OFDA	DW	42
93	Balkh	Balkh	Samar Qandyan	66.83037	36.69177	36	DW	26.2
92	Balkh	Sholgara	Qadim	66.88485	36.31964	Nil-RRD	TW	41
91	Balkh	Mazar-e-sharif	Baba Yadgar	67.08112	36.71851	5	TW	65
156	Balkh	Char Bolak	Baday Balkhi School	66.59397	36.77278	11	TW	52
157	Balkh	Char Bolak	Abo Shakor Balkhi School	66.67047	36.75317	9	TW	52

Balkh		**Sholgara GMW well was not monitored due to security problem**						
162	Faryab	Khan-e Charbagh	Khan-e Charbagh School	65.22091	37.00222	Observation Well	TW	45
164	Faryab	Qurghan	Abo- Yosof Andkhoye Primary School	65.09908	36.95268	Observation Well	TW	50
149	Faryab	Shirin Taqab	Fiz Abad Shamsudin School	64.87269	36.29333	Observation well	TW	51
180	Faryab	Khwaja Sabz Posh	Qara Shikhi Boy School	64.87395	36.14588	org-year-code	TW	50
163	Faryab	Qurghan	Qurghan School	65.09017	36.91920	Observation Well	TW	50
155	Faryab	Qaramqul	Qaramqul High School	65.08395	36.86487	Observation well 13	TW	53
144	Faryab	Khwaja Sabz Posh	Deh Now School	64.84024	36.07253	Observation Well	TW	55
146	Faryab	Pashtun Kot	Khwaja Musa School	64.66569	36.03494	Observation Well	TW	49.5
147	Faryab	Pashtun Kot	Jamshidi School	64.82450	35.88859	Observation well	TW	50.5
187	Faryab	Pashtun Kot	Deh Azizan Midal School	64.81830	35.91862	Observation well	TW	63
188	Faryab	Maimana	Chaqhotak Midal School	64.74659	35.95216	Observation well	TW	64
200	Faryab	Almar	Chaghatak High school			Observation well	TW	80
201	Faryab	Pashtun Kot	Arab Aqsay High School			Observation well	TW	73
148	Faryab	Maimana	Water Management Department	64.77408	35.91743	Observation well	TW	52.5
179	Faryab	Maimana	Kariz Qala School	64.71217	35.98633	org-year-code	TW	50
Faryab		**15 Faryab Active**						
7	Ghazni	Qara Bagh	Walikay	68.09195	33.16115	231	TW	56
6	Ghazni	Jaghatu	Qala-I-naw	68.39050	33.71292	21	TW	23.3
189	Ghazni	Ghazni	Deh-e Miskeen			0	DW	
171	Ghazni	Ghazni	Qarabagh Bus Station	68.41882	33.55265	45	DW	25
Ghazni		**2 Ghazni Active** **2 Ghazni Security Problem**						
45	Ghor	Pasaband	Astarghana	65.12406	33.65857	17	DW	81.2
54	Ghor	Lal Wa Sarjangal	Espideyual	66.45639	34.47528	8	DW	8
53	Ghor	Chaghcharan	Ahangaran	65.06780	34.47120		TW	46
47	Ghor	Taiwara	Shahr Sokhta	64.34017	33.50787	7	DW	9.9
48	Ghor	Lal Wa Sarjangal	Kara	66.31619	34.67457	17	DW	8.6
Ghor		**5 Ghor Security Problem**						
182	Hirat	Adraskan	Adraskan School	62.26706	33.64366	3 RRD	TW	35
181	Hirat	Gozara	Rawza Bagh	62.21219	34.23463	51	TW	45

85	Hirat	Chesht-e Sharif	Sargaz	64.05972	34.34393	31	DW	12.4
72	Hirat	Gulran	Kariz I Kar	61.65043	35.01271	9	TW	40.2
70	Hirat	Adraskan	Zulm Abad	62.15838	33.55578	1	TW	20.4
68	Hirat	Kushk-e Naw	Rabat Sangi	62.13460	34.79738	3	TW	
67	Hirat	Kushk-e Naw	Toraghundi	62.28473	35.23199	58	TW	31.7
183	Hirat	Zenda Jan	Deh Surkh	61.91280	34.38832	3 IRC	TW	33
64	Hirat	Enjil	Gandaw Parwana	62.08145	34.53142	53	TW	43
55	Hirat	Karukh	Agha Sahib	62.58609	34.47787	42	DW	
52	Hirat	Ghurian	Center	61.50554	34.35254	2	TW	27.5
51	Hirat	Kohsan	Kamisary	61.09056	34.66615	7	TW	29.8
46	Hirat	Gozara	Tezan	62.06575	34.22767	15	TW	
44	Hirat	Kushk-e Kohna	Shulyji	62.65620	34.78552	31	DW	11.3
125	Hirat	Karukh	Robate Saliman	62.44276	34.32581	42	DW	35
198	Hirat	Herat	Ten Area	62.18818	34.33616	0	TW	30
197	Hirat	Herat	First Area	62.17828	34.34866	0	TW	28
196	Hirat	Gozara	Qawashan	62.22144	34.25041	40	TW	45
195	Hirat	Enjil	Zaman Abad	62.23848	34.33257	40	TW	45
194	Hirat	Enjil	Qalwar	62.15604	34.33506	0	TW	30
193	Hirat	Gozara	Urdo Gah	62.21325	34.26608	0	TW	30
192	Hirat	Enjil	Qafasan	62.19362	34.30951	34	TW	35
191	Hirat	Enjil	Karti Sufla	62.19875	34.32457	0	TW	35
190	Hirat	Enjil	Qala-e Haji Yahya Khan	62.20037	34.28966	2	TW	28
60	Hirat	Enjil	Kahdistan	62.30587	34.34260	46	TW	
151	Hirat	Shindand	Mughulan	62.27296	33.37397	org-year-code	TW	30
184	Hirat	Ghurian	Shahbas	34.48943	61.38504	68	TW	60
126	Hirat	Pashtun Zarghun	Marwa1	62.89116	34.24895	82	DW	21.7
165	Hirat	Gulran	Qashawury	61.95979	34.89442	2005 DACAAR	DW	33
167	Hirat	Zenda Jan	Tahied	61.78894	34.39420	1897-Deep	DE	20
168	Hirat	Enjil	Pustay No 1 DACAAR OFFICE	62.21533	34.33501	1994 - DACAAR - Offi	TW	90
175	Hirat	Kohsan	Haji Alishir	61.19207	34.67484	14	TW	42
199	Hirat	Kohsan	Qala-e Mushi	61.22171	34.64518	0	TW	42
127	Hirat	Obeh	Hawashanasi	63.16942	34.38273	21	DW	46.5
Hirat		**30 Hirat Active** **4 Hirat Security Problem**						
159	Jawzjan	Faizabad	Nasir Shaid School	66.45372	36.81622	12	TW	46
158	Jawzjan	Aqcha	Qara Boyean School	66.21061	36.85057	10	TW	53

Jawzjan		**2 Jawzjan Active**						
17	Kabul	Char Asiab	Chaman	69.17281	34.35407	58	TW	26
143	Kabul	Qara Bagh	Qur Quol	69.16652	34.84225	01	TW	21
4	Kabul	Khak-e Jabar	Khurd kabul	69.38399	34.38887	1	TW	52
1	Kabul	Shakar Dara	Qala-e-Murad Biek	69.07902	34.65884	3	TW	23
11	Kabul	Sarobi	Naway Qala	69.74756	34.60645	2	DE	20
12	Kabul	Bagrami	Gul buta	69.22864	34.47863	45 DACAAR	TW	40.5
16	Kabul	Deh Sabz	Kata khel	69.35124	34.60985	9	TW	44.5
2	Kabul	Kabul	Kabul - DACAAR office	69.16004	34.55275		TW	14.6
170	Kabul	Qara Bagh	Masjed Omar Farooq	69.16601	34.88995	org-year-code	DW	25
15	Kabul	Mir Bacha Kot	Shekhan	69.12266	34.72940	9	TW	32
18	Kabul	Kabul	Char Qala	69.10533	34.48651	93	DE	30
106	Kabul	Kabul	Kabul University Engineering Faculty	69.12299	34.51930	No. 2	TW	
Kabul		**12 Kabul Active**						
39	Kandahar	Panjwai	House I Madad	65.30230	31.56131	99	TW	46
38	Kandahar	Kandahar	Loya Wialah	65.71470	31.63269	35	TW	41
Kandahar		**2 Kandahar Security Problem**						
13	Kapisa	Tagab	Firoz khel	69.65385	34.79947	118	TW	40
113	Kapisa	Mahmud-e Raqi	Dehbab Ali Bazar	69.33126	35.04328	52	DW	21.6
114	Kapisa	Mahmud-e Raqi	Qalae Jabar	69.47720	34.94423	101	DW	10.8
Kapisa		**3 Kapisa Active**						
29	Khost	Bak	Kot kay (Pasachagan)	70.04154	33.50895	120	TW	65
40	Khost	Speyra	Zanda taga	69.55567	33.23370	109	TW	41
Khost		**2 Khost Security Problem**						
133	Kunduz	Kunduz	Ortabulq Qaraqashlaq (Haji Naim)	68.88548	36.65820	NSP / GRSP	TW	31.5
134	Kunduz	Kunduz	Al Chin	68.86592	36.79553	CFA / UNHCR 12	DW	9.4
132	Kunduz	Aliabad	Hazara (Mohammad Husain)	68.90517	36.54100	ISAF	TW	35
131	Kunduz	Char Dara	Aq Saray	68.74655	36.72267	NSP / GRSP / MRRD	TW	30
130	Kunduz	Char Dara	Duwandi (Tajakan)	68.80779	36.69709	BPRM / CFA	TW	25
129	Kunduz	Imam Sahib	Kanam (Beshkapa)	68.84108	37.15388	SRCA / HRDE	TW	25
135	Kunduz	Imam Sahib	Qara Kuterma	68.69389	37.15000	ACTED / ECHO 74	DW	25
Kunduz		**7 Kunduz Security Problem**						

19	Laghman	Alingar	Qalatak(2)	70.30272	34.75413	2	TW	18.5
35	Laghman	Mehtarlam	Qaleh Akhund	70.21899	34.62350	6	TW	21
26	Laghman	Qarghayi	Farman khel	70.21006	34.53532	187	TW	45.8
22	Laghman	Alishing	Shama Ram	70.12511	34.73947	Nsp dacaar	TW	12.4
Laghman		**4 Laghman Active**						
37	Logar	Pol-e Alam	Oni sayedan	69.00556	33.97439	Unicef	TW	19
142	Logar	Muhammad Agha	Kotakay	69.11441	34.21964	Diver Ser No 77052	TW	53
43	Logar	Pol-e Alam	Jawzar	69.01970	33.77194	Unicef Jawzar School	TW	18.4
128	Logar	Muhammad Agha	Surkh Abad	69.08307	34.19126	0	TW	13.5
Logar		**4 Logar Active**						
3	Nangarhar	Surkh Rod	Musli khel	70.36052	34.43802	9	DE	17.4
28	Nangarhar	Surkh Rod	Sawz Abad	70.38820	34.44563	301	TW	19.6
36	Nangarhar	Behsud	Sammar khel	70.55787	34.37573	268	TW	12.8
33	Nangarhar	Surkh Rod	Fateh Abad	70.21406	34.35188	3	TW	42
32	Nangarhar	Jalalabad	Jalalabad	70.45117	34.43425	89	TW	14
34	Nangarhar	Pachir Wa Agam	Sabre Ulya	70.27873	34.20602	86	DE	41.6
88	Nangarhar	Kot	Pursha Khail	70.56300	34.12067	264	TW	23
30	Nangarhar	Rodat	Mazina	70.48627	34.21450	20	DE	38.5
31	Nangarhar	Chaparhar	Terelay	70.41271	34.31956	1	TW	34.8
27	Nangarhar	Khogiani	Babaker khel	70.22153	34.29006	685	TW	53
25	Nangarhar	Bati Kot	Ambar khana	70.81845	34.28256	4	TW	30
24	Nangarhar	Lalpur	Lal pur	71.04402	34.23229	19	TW	21.1
23	Nangarhar	Kuz Konar	Qalagay (Malakzai)	70.57033	34.55982	292	TW	15.5
21	Nangarhar	Kot	Jabeh	70.64901	34.20007	284	TW	41
20	Nangarhar	Kama	Qaleh yeAkhund	70.57511	34.41641	Unicef	TW	16.9
Nangarhar		**15 Nangrhar Active**						
41	Paktya	Sayyid Karam	Nora khel	69.37737	33.76376	21	DW	29.5
42	Paktya	Gardez	Khataba	69.19266	33.58677	151	TW	63
Paktya		**2 Paktya Active**						
14	Parwan	Bagram	Shahie ya	69.22398	34.96389	5	TW	34.5
Parwan		**1 Parwan Active**						
8	Wardak	Maidan Shahr	Shahabudin	68.86778	34.32021	57 DACAAR	DW	10
10	Wardak	Nirkh	Deh hayat	68.77547	34.36844	39 DACAAR OIDE	DE	42
9	Wardak	Sayyidabad	Shikh abdul	68.76060	34.08726	43 DACAAR	DE	25
Wardak		**3 Wardak Active**						