Ministry of Rural Rehabilitation and Development

Design and Implementation of RuWatSIP GIS (RGIS)

Draft discussion paper September 2012

Capacity Building and Institutional Cooperation in the field of Hydrogeology for Faryab Province - Afghanistan

NORPLAN
Consulting Engineers and Planners

TABLE OF CONTENTS

COTS	– Commercial-Off-The-Shelf
DHCP	– Dynamic Host Configuration Protocol
DNS	– Domain Name Service
GIS	– Geographical Information Systems
GPS	– Global Positioning System
HTML	– Hyper Text Markup Language
IP	– Internet Protocol
J2EE	– Java 2 Enterprise Edition
LAN	– Local Area Network
ODBC	– Open Database Connectivity
OGC	– Open Geospatial Consortium
PDF	– Portable Document Format
SDI	– Spatial Data Infrastructure
SQL	– Structured Query Language
SVG	– Scalable Vector Graphics
TCP	– Transmission Control Protocol
WAN	– Wide Area Network
WFS	– Web Feature Services
WMS	– Web Map Services
WYSIWYG	– What You See Is What You Get
XML	– Extensible Markup Language

1 Introduction

The **design** of RuWatSIP GIS Unit (RGIS) focuses on the following main concepts:

- Organisational Design
- Data Design
- System Design

The implementation of the RGIS stresses partnerships. No single organization can build it by itself. The RGIS can become reality only through cooperation among entities being data sources, producers or users of spatial data. The various entities involved in this represent different interests and different ways of using data and looking at solutions for problems.

These entities also represent the fact that there is a lack of communication, double work and no standards. RGIS will bring the facilities needed for the entities to come together to help improve the access, sharing, dissemination and use of spatial data related to water resource points.

More about implementation strategies?

2 RGIS Design

2.1 Organisational Design

2.1.1 Definition of the RuWatSIP GIS (RGIS) Domain

Geographic Information may be used in nearly all aspects of public and private activities. We must, however, define a domain for the initial actions related to water resources to create RGIS in order to work within a manageable context.

The RGIS domain is defined to be broad enough to implement actions that have impact on the general GIS infrastructure at RuWatSIP, but narrow enough to be manageable. It will therefore be feasible to define an initial domain for the implementation of the infrastructure. Once well-functioning, the domain may be expanded, in particular to accommodate more of the user society.

- RGIS stakeholder is defined as entities with already established information system/GIS, contributing to and using RGIS data, and obliged to RGIS specification of dataset.

- Special entities of high demand on spatial data could also be defined as a stakeholder.

- The following stakeholders are proposed to be part of the initial establishment of RGIS:
  - Ministry of Rural Rehabilitation and Development
  - Ministry of Mines
  - Xxxx
  - Xxxx
  - Xxxx
  - Afghanistan Infrastructure Data Centre (AIDC)
  - Danish Committee for Aid to Afghan Refugees (DACAAR)
  - United Children's Fund (UNICEF)
  - United States Agency for International Development (USAID)

***Comment Frank**, input from Ramon:*
One should seek to assess the on-going initiative by the International Relief and Development (IRD). Funded by USAID they are working with Organization for Economic Growth and Development OEID to develop an online database/mapping system called the Afghanistan Infrastructure and Security Incident Cartography System (AISCS) - http://www.aidc.af/aidc/

This system is being shared by a consortium of ministries:

- *Ministry of Mines*
- *Ministry of Economy*
- *Ministry of Public Works*
- *Ministry of Public Health*
- *Ministry of Education*

This project has been going for the last two years and the volume of information they have is impressive. Notably, they are in the process of digitizing the Russian geological survey maps and they have some of the better datasets on wells, reservoirs, dams, and irrigation canals that I have seen.

They are also developing a parallel system tailored for monitoring programmes that uses smartphones to record and upload information to the system. These systems they are developing are "turnkey systems", meaning that they are able to be easily customised for other applications and uses - certainly, an option worth thinking about.

From my point of you this is a typical SDI (Spatial Data Infrastructure) initiative and should be followed up also in relation to the US Embassy initiative Svein mentioned.

2.1.2 The RGIS Unit

The RGIS Unit will be a service-provider for the stakeholders as well as its users. This role must be maintained irrespectively of the government organisation to which the Unit may be attached.

The Unit are to be located at the MRRD premises.

RGIS Unit roles:

- Define and specify data to be maintained by the Unit. Currently, this includes the on-going development of the WSG database, funded by UNICEF and the future Geohydrology database, funded by NORPLAN.
- Establish and maintain an online data service, included the Watertracker[1] for O&M, exchange of data and a web-map viewer. NORPLAN will define and implement services and applications for data exchange and a web-map viewer, while UNICEF will follow up the Watertracker potential.
- Be a training centre for the stakeholders

It is recommended that that the competence related to running the spatial data operation at the Unit is built up with local human resources.

[1] Funded and maintained by USAID up to 15 September 2012. Since July located at MRRD with one person employed.

Once the implementation structures are fully operational, there will be an extensive two-way flow of information between RGIS and the stakeholders involved. The roles mentioned above shows that there are major and complex tasks to be conducted by the personnel employed.

We propose that RGIS is manned with few, but well qualified personnel within their respective fields. To maintain a high level of expertise on data maintenance and data exchange services it is recommended that the RGIS Unit employees are given opportunities to attend training courses and well-reputed international conferences on a regular basis.

Initially, we propose *three* persons to be employed with the following brief characteristics:

Manager

The Manager of the RGIS Unit must be a person who possess strong vision on behalf of the MRRD in general and of the unit in particular, be strategic in the sense of developing the organisational and technical set-up to a sophisticated and well-functioning level, be highly knowledgeable in the concept of spatial data, be knowledgeable in the field of data exchange -and management, and have strong project management capabilities.

The person must be service oriented and able to assess the various requirements from Afghan CoI in general and from the stakeholders in particular. This must be a person with strong organisational abilities that are able to interpret inter-ministerial requirements and assess if specific requirements can be regarded appropriate to be part the RGIS data repository at MRRD.

Expert in Facilitating and Training

The Facilitator at the RGIS Unit must be a person who possess up-to-date knowledge on issues related to GIS and must be able to meet the organisation's needs for facilitating and coaching services and thus, be in possession of pedagogical abilities. The person will organise and co-ordinate all issues related to training and education. The expert should be able to understand and communicate specifically on matters related to data collection in the field and objectives related to hydrological and hydrogeological matters.

Application Developer/Database Expert

The Application Developers must be expert in developing software and functions to cover GIS-related needs, developing and maintaining web sites, data modelling and maintaining databases. The person must have up-to-date knowledge in the field of programming (included MS.NET and J2EE), data handling, data conversion, and exchange of spatial data.

There is an on-going process to employ the Manager of the RGIS Unit. The other two experts are proposed to be employed during the first half of 2013.

2.2 Data Design

2.2.1 Context

Figure 2-1 illustrates the main principles for population of the datasets into the RGIS Data repository along with the necessary main procedures to enable this along and the responsibilities for carrying out these procedures.

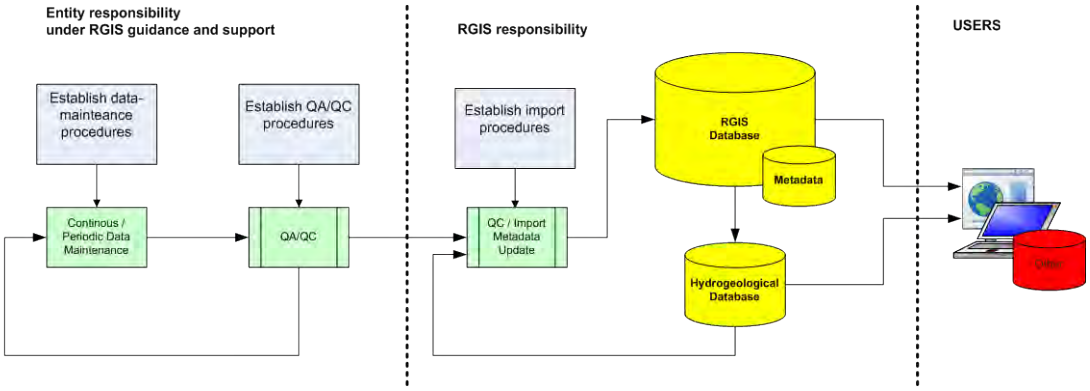

Figure 2-1: Data Population Principles

Currently, the **RGIS Database** named here is identified as the **WSG database**. This database is under assessment by a consultant funded by UNICEF. This will be the main repository in the RGIS Unit. A data model has to be developed by the consultant and be maintained by the RGIS Unit after the implementation. For the purpose of developing methodology and geographic information showing the potential water resources, which is the responsibility of NORPLAN, a subset of the RGIS repository is needed. The data is to be stored in a separate Hydrogeological database in order to support the methodology and also the geographical analyses needed to fulfil the needs. The result of the analyses is a dataset showing potential water resources. This dataset, included metadata, can be transferred to the RGIS database or kept in the Hydrogeological database as the original one.

If there is a need for data collection in relation to the establishment of the Hydrogeological database, the results are to be transferred to the RGIS database ASAP, but through the QA/QC regime. There might be need for information for the waterpoints that are necessary for the methodlogy and the analyses that are not defined as relevant in the RGIS database. This information will be kept in the Hydrogeological database.

For the water-point dataset be included in RGIS, a defined procedure for data maintenance should be established. The data may not initially meet the required quality and an upgrading is therefore required. The upgrade should in general not be required as a prerequisite for uploading the data to RGIS as even data with less quality or coverage than required may be of high use.

A set of export procedures from the entities GI-system (i.e. MRRD and DAACAR) and import procedures to the RGIS Data Repository must be established, including transfer

of metadata. These procedures may be automatic or manual – or a combination of these two, and vary whether the data is to be uploaded to the RGIS database.

The RGIS Unit will at its initial stage be responsible for the following dataset:

- General Technical Water Points (RGIS database)
- Potential Groundwater Resources (Hydrogeological database)

2.2.2 Dataset definition and conceptual model

Insert table; including definition, quality requirements and attributes to be included for the Hydrogeological database.

By David, Munir

Crucial INPUT to Ramond/Norplan while David is here!

WHY DATAMODEL (explanation from Frank)?

Each person or organisation often create their own subjective model of the real world, which can introduce element of constraint, as data compiled for a particular application may be less useful elsewhere. This is also the situation in MRRD. For example will water related data specified for one application usually not be usable for other applications.

One of the main objectives with the establishment of RGIS database is to develop common conceptual models of the real world to ease and enhance the data use. The arrangement of the common real-world model determines which data need to be acquired and how it should be described. The systematic structuring of the data determines its ultimate utility and consequently the success of the relevant GIS application depending on the RGIS repository.

Data collected and entered in a database must be processed and arranged to provide information that is meaningful for current use as well as for tasks still to be defined. Clearly, then, data modelling is essential. The data models must be independent of the software and hardware chosen among the RGIS stakeholders and other external users. In many ways, the problem is the converse of selecting software and hardware to suit the data model.

From my point of view, Ramond is doing the data modelling, securing the structure of the RGIS database, but we should provide input to his work, including attributes and definitions needed for the methodology to be successful.

2.2.3 Metadata

Metadata are “data about data”. Information about the geospatial data is stored in a database and intended mainly as a tool to enable users to find out which data are available, if suitable for the purpose intended, where the data are stored, whether there are any limitations linked to their access and use, and possibly, how the data be transferred to a suitable system. Meta-databases are intended to be an effective link

between producer and user but can also be useful for internal use by producers to enable them to maintain a view of their own data over time (to avoid work duplication, among other things).

All features in the RGIS Repository shall have a set of static common metadata. The following information shall be available[2]:

- Data source and representation of data
- General copyright and property information
- Citation and responsibly party
- Reference system

In addition to these common metadata, each feature and attribute has its own unique definition and content that also forms metadata.

This is the responsibility of the manager of the RGIS database. Metadata from the Hydrogeological database will be transferred when appropriate. If a metadata application is to be developed, this shall be executed by the manager of the RGIS database.

[2] Preferably refer to ISO 19115

2.3 System Design

2.3.1 Overall System Design

The System Design describes the requirements for the technical implementation of RGIS (software and hardware). The chapter describes the functional requirements for the system in order to meet the operational requirements of RGIS. General ICT operations (network, e-mail services etc) are assumed handled outside RGIS, and hence, not described in this context.

Figur 2-1: Overall System Design

The fully operational RGIS will consist of the following elements:

A data repository: A database capable of storing data effectively.

A set of services: Re-useable components, used as foundation for development of applications.

A set of applications: Firstly, it can be Web-based applications to be used by a broad-range of users within and outside the RGIS domain. Secondly, it can be specialised GIS applications to be used by the RGIS Unit staff.

Clients: Terminals to be used in the RGIS Unit and includes relevant peripherals

ICT Infrastructure: Generic infrastructure – foundation for all data exchange, e.g. network, access and authentication mechanisms

The elements are described on a functional level in the following sections. The descriptions are to be regarded as requirements to be met during acquisition.

2.3.2 System Architecture

Figure 2-2 shows the main components in the RGIS architecture. Each authority is expected to maintain data related to their specific business function. This is illustrated with a set of databases at the top. There may be entities that for practical reasons use RGIS as the technical storage for their original data, however, in principle, all entities are responsible and maintaining their own data.

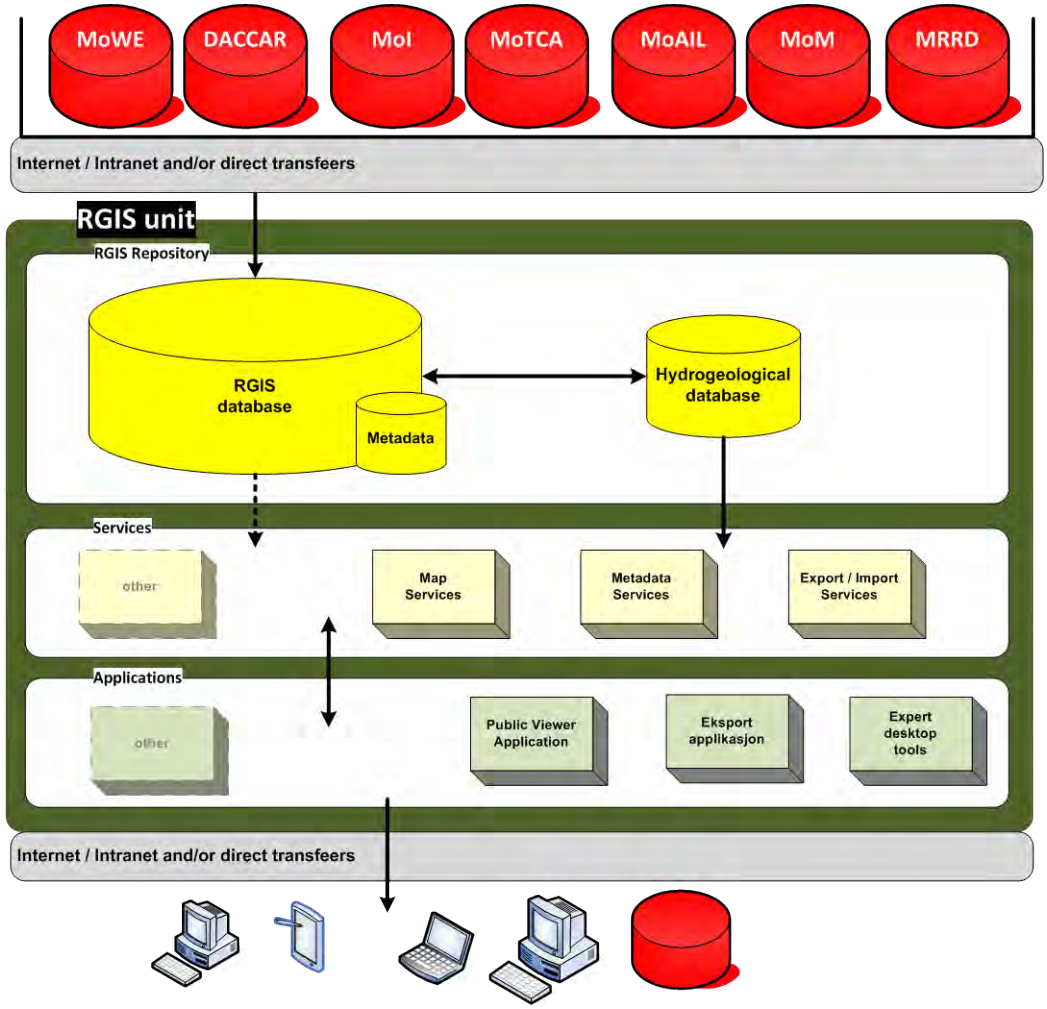

Figure 2-2: System Architecture

A subset of the authorities' data which is being required by other authorities and which there is willingness to share, shall be made use of in the RGIS Unit. This is indicated by an arrow from the authorities to RGIS.

RGIS shall serve as a Community of Interest within the field of geographic information, and make a set of web-services available, both for applications within the GIS CoI as well as for other CoI. This will allow multiple client solutions to use the data.

A limited number of users will be expert users with specific GIS applications locally installed. These will address the data in various manners; through web-services, by downloading data from RGIS or by direct access to the entities data.

2.3.3 RGIS Repository

The RGIS Repository shall be the main storage for common spatial data, including vector data, imagery and metadata. The success and usefulness of the infrastructure depends on the implementation of the database which will be “heart” of the operational RGIS.

The database shall be capable of:

- handle large amount of data, included imagery and DEMs
- handle simultaneous users of different categories (viewers, data analysts, data managers, database managers)
- respond quickly
- maintain data integrity
- be scaleable
- transaction logging, with reversible function
- 24*7*365 operation time

The database must be able to store attribute data in Pashto, Dari and English text and the interfaces must encode this in a standard way that can be decoded by the application layer.

Criteria	Requirements
Capacity	xx
Performance; Load *Load is the threshold for simultaneous requests that must be served without significant impact on the response times.*	xx
Performance; Response *Response is elapsed time between request and start of return of the answer (time to first byte). High throughput is expected for a moderate amount of data. If the answer to a request is a large block of data, expected throughput is specified.*	xx
Hardware	xx

The RGIS Repository shall be implemented on commercially available database solution with solid references to similar installation.

Tabell 2-1: Technological elements of relevance

Web Map Service (WMS)	The Open Geospatial Web Map Server Interface Specification specifies open protocols that provide uniform access by HTML clients to maps rendered by map servers on the Internet.
SQL	SQL is a standard protocol for connection to relational databases. Native SQL Clients, ODBC and JDBC are commonly used for application development. The database must provide a standard SQL interface with possibilities for tabular views of the data for convenience of application development and reporting.
Support for IT Operations	IT- operations is understood here as managing and securing the actual data instances. The database must have management tools and interfaces for tuning, monitoring, activity logging, online backup, unlocking "dead" object locks, etc.

2.3.4 SAN and Backup

All data in the Data Repository shall be stored in a Storage Area Network (SAN). The SAN can consist of a pool of storage units (hard drives) connected to servers. Servers allocate storage space from this pool. This solution allows for great flexibility and reliability as servers can easily expand storage space on a need basis.

SAN	
Criteria	**Requirements**
Storage capacity	7 TB Uncompressed (Terra Bytes)
Performance:	Online backup to avoid disrupting GIS systems. Full backup must be feasible within 48 hours. 200 GB/hr (Uncompressed)
Hardware	Tape Library with autoloader and Fibre Channel connection

A backup service shall be integrated in the data repository to ensure data security and recovery. The backup service shall consist of one centralised Tape Library directly connected to the SAN. The solution must be able to back up data not stored in the Storage Area Network using standard Ethernet and IP protocol.

Backup Service	
Criteria	**Requirements**
Storage capacity	7 TB Uncompressed (Terra Bytes)
Performance:	Online backup to avoid disrupting GIS systems. Full backup must be feasible within 48 hours. 200 GB/hr (Uncompressed)
Hardware	Tape Library with autoloader and Fibre Channel connection

2.3.5 Services

RGIS Unit shall provide a set of services to be utilised in various applications, including applications that belongs to other CoIs. The main concept of the services is to provide functionality in a generic and standardised manner for various applications that may benefit from spatial information or functionality.

The services shall utilise web-services as connection technology (SOAP – XML or http requests). The services shall utilise international standard interfaces, e.g. OGC WMS and WFS to the extend this is possible.

The number of services and their content is expected to increase over time as awareness of the RGIS possibilities is being built and spread. Three services are initially identified as services that can be developed:

- Map Service
- Metadata Service
- Export / Import Service

These services shall be well documented and discoverable, making them easy for other CoI to utilise and hence, spatially enable applications not primary related to GIS. The services do not necessarily be separated, but may be combined if applicable.

2.3.6 Applications

An application is described by its functional requirements and requirements to the architecture or method used to implement the application.

RGIS Viewer Application

The RGIS Viewer application is the main graphical interface towards Hydrogeological data. It is intended for external use, but might be for external use as well. The application shall be adjustable to various application-areas (data, functionality and interface) and by this support various business areas.

Before acquisition of a new browser the Consultant shall investigate the opportunity to use the Watertracker solution as the web interface to show information. If this technology supports the requirements mentioned here this solution can be used. If not, the Consultant shall assess need for upgrading/reprogramming of Watertracker before acquiring a new RGIS Views based on another technology.

The browser shall have an intuitive user interface, including at a minimum the following functions and descriptions:

- Zoom, pan, move to predefined region or area, set scale
- Print map with or without basic map elements like legend, grid etc. The user shall be able to define text on the map, header, comments etc.
- Identify features and their attributes
- Overview map
- Extensive search mechanisms (e.g. search by theme, search by keyword)

- Give predefined map views with symbolism and feature classes as well as the possibility of the user arranging this himself (restricted to qualified personnel)
- Let the user define his own cartography (colour and symbols – restricted to qualified personnel)
- Do simple analyses, such as group features by area or attribute value
- Do simple measurements, such as distance and area
- Draw simplified geometry (lines, polygons, points) and define colour and symbols
- Show coordinates of the cursor
- Provide statistical measurements

The RGIS Viewer shall have a management interface. The management interface is used for administrating the application by:

- Defining "map views". The map views are predefined views of spatial data, defined as content, structure and appearance. The appearance shall be defined with standardised cartographic elements through a WYSIWYG (What-You-See-Is-What-You-Get) interface. The management tool must be able to define and utilise map templates.
- Define new or other data sources, including external sources. Other sources might be based on WMS, WFS, SQL or other relevant interfaces.

Expert GIS application

Even though GIS is related to digital mapping on screen, the cartographic presentation of maps on paper and posters is still crucial. Necessary functionality to produce well-defined cartographic presentations is therefore critical.

A typical use of this application is adding new features, importing and adding as-built drawings, changing features and their attributes and deleting features. The application must ensure that only data the authenticated user is authorised to edit is editable.

Spatial analysis includes all of the transformations, manipulations and methods that can be applied to geographic data to add value to them, to support decisions, and to reveal patterns and anomalies that are not immediately obvious.

The expert GIS tool at the RGIS Unit shall be ArcGIS from ESRI.

2.3.7 Technical Infrastructure

Hardware and software is under constant development and specifications and performance is constant getting better. The project shall therefore acquire and provide hardware and software that enables the various functional requirements to be met, and in addition follow the following principles:

- All hardware and software shall be of well-known brand names with representation and service locally in Kabul.
- All hardware and software shall be of last released version of the product meeting the requirements.
- All hardware and software shall be well documented with specifications, user manuals, etc.

- For all hardware and software, a guarantee period of two years and relevant support shall be included.

Servers

A set of servers are required to operate the data repositories, services and web-based applications.

An outlined configuration is:

- One database server
- One file server
- One application and service server

As elaborated in section 2.3.4, a centralised storage area network with a common backup service shall be utilised for data storage.

The server architecture shall be designed with focus on:

- High reliability
- Easy administration
- Well arranged
- Component based – easy to change
- Redundancy

Other important features:

- USB / batteries for two hours operation if power failure
- Alarm services at major failures
- Possibility for remote access, however, this access shall be through specialised authentication and authorisation mechanisms
- Firewall with automatic updating
- Anti-virus software with automatic updating

Operating system: The operating system of the servers may be of either Microsoft or Unix, latest released version.

LIST/spesifications?

Terminals

The RGIS Unit shall be provided with terminals for their daily tasks.

Included on all terminal items:

- Productivity suite: MS Office (latest release). Word processor, presentation tool, spreadsheet, e-mail client, web browser, database (MS Access) and web publishing tool (MS FrontPage)
- Virus protection system
- Operating system: MS Windows, latest release

LIST/spesifications?

Peripherals

The RGIS Centre shall include a set of peripherals supporting their business.

Peripherals in this context include any computer device that is not part of the essential computer and is located outside the computer case, not including required computer equipment such as screen, keyboard or mouse, attached by a wired or wireless connection to a computer, to a server or directly to the network.

Each item shall include necessary equipment (e.g. cables, network card, etc).

Unless other stated, the number of the actual peripheral is one.

LIST/spesifications?
- Printer/scanner/Copymachine
- Plotter
- Large scale scanner?
- Multi CD / DVD burner
- Projector
- Paper/Millboard cutter
- Binding machine
- Fax machine
- Laminator

Network and ICT Infrastructure

The RGIS Unit requires an internal network with external connection, as well as generic tools such as e-mail to be operational.

The task of the local area network (LAN) in the RGIS Unit is to enable communication between terminals, peripherals, databases and to the outside in an efficient and secure manner. The LAN is to be considered as an integrated part of an office environment, in-line with other office infrastructures like power and air-condition.

We assume that the RGIS Unit connects to the Governmental network and utilises this for distributing data and services.

E-mail services and operating directory services are outside the scope of RGIS tasks. However, these services are important for the operation and access control of RGIS and the operational RGIS Unit depend on the implementation of these.

Licensing Policy

All software to be acquired shall be licensed according to the expected use (database software, operating system, applications, etc.) and necessary documentation included.

In addition, the following principles shall be used for acquisition:

- The number of end-users of web-based applications and services, as well as users of data in the databases shall not be regulated by licenses, meaning that adding one more user of these applications shall not require adding a new license of any type. This implies that license must be related to number of servers / CPU or preferable – to the RGIS Unit as an entity.

- For desktop applications, the licenses shall be related to the number of actual expected users. A flexible licensing policy is however preferred, meaning that

an application should be allowed to be installed on multiple computers as long as the number of licenses equals the number of expected users. Alternatively, a license counter may be used, but in such case, the counter must include functionality for allowing out-of-office use of the license (the license can be taken out of house for presentation- or training purposes).

- Licensing functionality that requires obtaining a specific key at the time of installation, either through internet or through phone shall be avoided.

- For all applications, licenses for training laboratory of minimum six persons shall be included.

2.4 Human Resources

It is recommended RGIS being a training centre for the stakeholders. It is assumed that the knowledge transfer to RGIS personnel will continue during the entire implementation period and that competence will be built gradually. During this period both vendor resources and Consultant resources should be used to support RGIS in solving their tasks and to transfer knowledge. External resources should be gradually reduced as competence is built in RGIS.

As described in chapter 2.1.2 we propose three positions in the RGIS Unit and that these persons be recruited and employed before any training can start. However, the software procurement packages shall secure training courses for all employees even though software in place before all employees.

In a short-term perspective, the training will be the responsibility of the Consultant and will be conducted during the Implementation period, either by conduction courses with internal staff or procure this competence. During this period, the Consultant will be responsible for training the RGIS staff in activities directly related to the deliverables and activities related to executing RGIS tasks. Entity personnel should be invited to attend the courses.

The training shall be categorized as follows:

- Training related to specific item/application
- Additional training courses

Specific training documents/manuals and data sets have to be prepared for the courses. In addition Product Declaration of Content, User Manuals and Routine Descriptions will be needed.

Preferably, many of the courses should be conducted at the RGIS Unit facilities.

2.4.1 Training related to specific items/applications

The Consultant is responsible for courses related to the following applications:

GIS Applications

These are specialised courses executed by the vendor on ArcGIS, geodatabases and Spatial Analyst. It is assumed that there is no need for the courses at the district- or provincial level during the implementation period.

The three courses shall be included in the tender process with the vendor when procuring software. There might be need for more training during the implementation and the agreement with the vendor shall provide a price for this.

Item	Description
Content	**ArcGIS 10.1 - Introduction**
Duration	3 days
Attendances	Max 10 - Staff at the RGIS Unit, MRRD, DACCAR
Premises	MRRD/DACCAR
No. of courses	2 - January 2013 and May 2013
Training Material	Training documents / Manuals

Item	Description
Content	**ArcGIS 10.1 - Geodatabases**
Duration	2 days
Attendances	Max 10 - Staff at the RGIS Unit, MRRD, DACCAR
Premises	MRRD/DACCAR
No. of courses	2 - January 2013 and May 2013
Training Material	Training documents / Manuals

Item	Description
Content	**ArcGIS 10.1 – Spatial Analyst**
Duration	2 days
Attendances	Max 10 - Staff at the RGIS Unit, MRRD, DACCAR
Premises	MRRD/DACCAR
No. of courses	1 - May 2013
Training Material	Training documents / Manuals

RGIS Viewer

Depending upon the assessment related to the technological capacity and functionality of the Watertracker, there shall be developed a Web Map Viewer / RGIS Viewer. The technology the viewer will be built upon shall be part of the training program. Initially we have proposed that Norplan will develop the viewer for the purpose of presenting information for our team members during project execution and also presenting information and maps on web both for MRRD and as a public viewer for others to use. The viewer will be with the logo of the MRRD.

The RGIS Viewer course is two-folded, one for the administrator of the system and one for the users.

Item	Description
Content	**RGIS Viewer - Administrator**
Duration	3 days
Attendances	Max 5 - Staff at the RGIS Unit, MRRD
Premises	MRRD/DACCAR
No. of courses	1 – November 2012

Training Material	Training documents / Manuals

Item	Description
Content	**RGIS Viewer - Viewer**
Duration	1/2 day
Attendances	Max 10 - Staff at the RGIS Unit, MRRD, DACCAR, UNICEF
Premises	MRRD/DACCAR
No. of courses	4 – November 2012, January 2013, May 2013, September 2013
Training Material	Training documents / Manuals

2.4.2 Proposal for Additional Training Courses

The additional training courses are more complex and broader than the application related courses. In the following, a proposal for the additional training courses is presented.

Overall Introduction the planned RGIS and GIS in general

This will be an overall introduction to the actual content in the RGIS set-up. It should be arranged at early as possible, but not before any useful applications and data sets are available for the users. It is proposed to provide a separate course for management and other users of the system.

Item	Description
Content	Overall introduction to the actual content in the RGIS design and GIS in general
Duration	1 day (included practical tasks)
Attendances	Max 10 - Managers and staff who wish to be introduced to the RGIS and GIS concept from MRRD, DACCAR, UNICEF
No. of courses	4 – November 2012 (managers), January, May and September 2013 (managers/users)
Training Material	Training documents

Data Management

This must be a comprehensive theoretical and practical course in data management, conducted for specialized and dedicated personnel. The course shall not be held before all three positions are in place at RGIS.

Item	Description
Content	This course should at least include comprehensive theoretical issues related to data management of spatial data. The course must cover topics related to standardisation and modelling specifically, and provide hands-on training.
Duration	1 week
Attendances	Max 5 - RGIS staff and selected MRRD, DACCAR and UNICEF personnel
No. of courses	2 – May 2013 and September 2013 (DACCAR/UNICEF)
Training Material	Training documents and prepared data sets

Data Capturing, Geo-referencing and Conversion

This course should introduce some personnel to the topics of data capturing, geo-referencing, and data conversion. It should concentrate on the theoretical topics, but also provide hands-on training. Preferably, this course shall be coordinated with the data collection procedures and/or training in which are designed as part of the methodology on hydrology and hydrogeology.

Item	Description
Content	Comprehensive theoretical training on topics related to data capturing, geo-referencing, and data conversion. Examples from hydrology and hydrogeology and hands-on training are preferable.
Duration	1 days
Attendances	Max 10 - Committed Managers, RGIS staff also at district level, DACCAR and UNICEF personnel
No. of courses	4 – May 2013, repetition as needed
Training Material	Training documents and prepared data sets

Cartography

This should be a comprehensive introductory course in topics related to cartography. It should at least include topics like communication, perception, scale, generalization, use of symbols, labelling, printing (included post script), and thematic mapping using cartographic tools in ArcGIS.

Item	Description
Content	Comprehensive theoretical training on topics related to cartography, included practical example and hands-on training.
Duration	2 days
Attendances	Max 10 - Committed personnel working with GIS analysis and map output at RGIS, MRRD and DACCAR
No. of courses	1 – September 2013
Training Material	Training documents and prepared data sets

2.4.3 RGIS on-the-job Training and Support

On-the-job training

In many cases it is necessary that the users can work with the GIS tools from day one and we have to make sure that there are enough professionals available to support the users of GIS during the Implementation Period.

It is assumed that the staff needs on average 4 - 6 months to be familiarised with the GIS software, and to be fully operational in their job. During this period, on-the-job training is needed. On-the-job training means that the staff should work on real tasks under supervision (transfer know-how) and the result quality controlled by professionals. During the Implementation Period this training will be the responsibility of Norplan.

Support

Operation and more general support are to be given to assist the users in their use of the deliverables and ensure that preventive and educative maintenance is given. The activity will ensure that all deliverables (Hw/Sw) function in accordance with their specifications and expectations throughout the project period and for the following year. Norplan will support the RGIS staff on these matters during the implementation period.

2.4.4 Study Tour

We propose a study tour to be arranged for the RGIS staff (maximum 6 persons), where information sharing, presentation and data maintenance of hydrological and hydrogeological data are dominant. Norplan shall plan and arrange this tour. The tour should tentatively last for five days.