Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region

Deliverable 8 (2016): Final Consultancy report

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PROJECT - Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region

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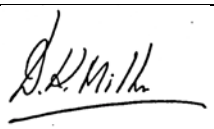
Checked by	David Milton		10/1/17
Approved by			

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1. Introduction

The main aim of this document is to describe final results from the 'Lead Flood Forecasting and Early Warning Expert / Lead Hydraulic Modeller' consultancy within the framework of the 'Integrating Climate Change Risks into Water and Flood Management by Vulnerable Mountainous Communities in the Greater Caucasus Region' project. The overall objective of this consultancy, as describe in the ToR, was to facilitate the implementation of a fully integrated flood early warning system for the project area, which links forecasting models to telemetered data as input and forecasting reporting and warning systems as output; to implement hydrodynamic models in the required catchments and to undertake flood hazard assessments. Capacity building activities were also very relevant.

2. Process

This consultancy consisted of four different contracts spanning from October 2013 until December 2016. During this time, the consultant has carried out several mission trips to Azerbaijan.

- First contract (2013): the consultant carried two different missions in order to get acquainted with the study area and with the different institutions,
- Second contract (2014): the consultant carried four different missions during this contract. In this missions the consultant visit the study area several times, especially the Turyanchay catchment, where activities were centred during this contract. During one of the visits, a workshop was held with all the different communities from all the study area in order to inform them of the design of the community-based early warning system. In subsequent trips, the consultant had individual meetings with communities in the Turyanchay catchment in order to get a better insight of the community needs and requirements and in also to discuss the design of the community-based early warning system.
- Third contract (2015): the consultant carried four different missions during this contract. In this case, the visits to the study area were more centred in the Kishchay catchment, with different workshops and meetings with local communities in order to discuss the implementation of the community-based early warning system in communities in this catchment. Also, the consultant carried out capacity building activities during his missions.

- Fourth contract (2016): the consultant carried four different missions during this contract. Several workshops were organised with the communities in order to hand them the equipment acquired within the framework of this project and in order to inform them of the different steps to follow in the implementation of the community flood emergency plan. More capacity building activities were undertaken with staff from the State Water Agency and the Ministry of Emergency Situations.

The consultant has addressed all the requested activities during his contract period.

3. Methodology

In order to address all the different and required activities, the consultant took the following methodological approach.

3.1 Terms of Reference for a Flood Forecasting System

The consultant prepared an institutional arrangement consultation plan, undertook the necessary consultations and presented an institutional arrangement plan to the relevant stakeholders.

3.2 Hydrodynamic Modelling

The implementation of a hydrodynamic model was required in order to properly assess the flood hazard in the study area. The implementation of the hydrodynamic model encompassed the following activities.

3.2.1. Model Conceptualisation and Hydraulic Modelling Selection

In the first stage the hydraulic model to be used in the flood hazard assessment was selected after a thorough evaluation. The strategy for the hydraulic modelling activity was defined during the conceptualisation stage. A 2D approach was selected due to data availability and the catchment characteristics.

3.2.2. Data Collection

All the required data was collected at this stage, including geometry data and any existing data available for calibration.

3.2.3. Modelling Implementation

The hydraulic modelling implementation was undertaken in close cooperation with staff from MOES in order to enhance capacity building activities. The hydraulic modelling implementation

was carried out using all the different data sources and based on the input from the hydrological model implemented in the same catchments.

3.2.4. Modelling Calibration and Validation

The hydraulic models were calibrated with all the available data. It should be noted that the lack of reliable data for calibration and validation is a significant issue. In order to minimise the uncertainty related to this, flood maps for different events were distributed among community members to ascertain the quality of the flood modelling results.

3.2.5. Flood Mapping

Flood Maps were issued using the results from the hydrodynamic modelling exercise for a series of design events.

3.3 Full Flood Forecasting Early Warning System

The implemented full flood forecasting early warning system had the following components:

3.3.1. Forecasting Platform

The consultant deployed the flood forecasting platform for the operation of the FFEWS. As stated in several reports, the forecasting platform chosen for this study is Delft-Fews.

3.3.2. Automatic Station Data

The consultant worked with MOES staff in ensuring that data from the stations is received operationally and imported into the forecasting platform.

3.3.3. Meteorological Models

Procedures for the acquisition of precipitation and temperature data from global implemented meteorological model have been developed.

3.3.4. Other Precipitation Sources

The use of satellite precipitation estimates sources into the forecasting platform has been explored. These data is being imported into the forecasting platform.

3.3.5. Hydrological Model

A dedicated hydrological model (HEC-HMS) has been implemented for the relevant basin. This model is linked to the forecasting platform. The data input required for this model is being processed in the forecasting platform. Also, the results from the hydrological model are being imported into the system.

3.3.6. Hydraulic Model

A dedicated hydraulic model (HEC-RAS) has been implemented. This model is linked to the forecasting platform. The data input required for this model is being processed in the forecasting platform. Also, the results from the hydraulic model are being imported into the system.

3.4 Community-Based Flood Forecasting Early Warning System

The community-based flood forecasting early warning system activities were undertaken in different stages.

3.4.1. System Requirements and Communities

During the first stage of the process, the system requirements for the system were identified. Also, the different communities to be part of this system were analysed and identified too.

3.4.2. Initial Design

An initial design of the community-based early warning system was presented to the different communities in order to gather more information about their needs and to know their thoughts about the system proposed.

3.4.3. Consultations with Local Communities

These consultations with local communities were undertaken through workshops but especially through individual meetings.

3.4.4. Final Design

A final design of the different systems was proposed once the information and recommendations from the different communities were incorporated into the system design.

3.4.5. Workshops

Different workshops were imparted in the study area in order to inform communities of all the different steps to be undertaken for the implementation of the community-based early warning system. During these workshops, the participation of the communities were encouraged, and different activities were organised in order to gather as much information as possible from them.

3.4.6. Implementation

In order to facilitate the implementation of the flood forecasting early warning system at community level, the implementation of a community flood emergency plan was depicted. Templates and examples were provided to the different communities in order to facilitate this.

Also, the communities were provided with the necessary equipment to undertake this implementation, including flood response equipment, leaflets and sirens.

4. Deliverables

The consultant has submitted the all the requested deliverables throughout his consultancy, including this one. The list of deliverables is shown below:

4.1 First Contract

During the first contract, the following deliverables were submitted:

1. Report detailing the existing flood forecasting systems in Azerbaijan, and in the study areas.
2. Report mapping existing institutional arrangements for FFEWS in Azerbaijan.
3. Preliminary report discussing data availability and advise/selection of appropriate modelling software
4. Hydraulic model conceptualisation, detailed approach to hydraulic modelling
5. Terms of Reference for a full FFEWS for the project basins.

4.2 Second Contract

During the second contract, the following deliverables were submitted:

1. Finalised Terms of Reference for a full FFEWS for the project basins
2. Identify the requirement for flood forecasting model(s) for project basins (considering all appropriate industry-standard software or bespoke software) and develop the scope for flood forecasting models, for a fully integrated FFEWS
3. Design of community-based FFEWS in consultation with local community
4. Consultation with communities on proposed schemes
5. Detailed Specification of equipment required for community-based schemes for the 3 pilot basins
6. Hydrodynamic Model development
7. Hydrodynamic Model calibration and sensitivity analysis
8. Generation and finalization of flood hazard maps

9. Flood risk modelling and mapping guidance document (catchment hydrological and hydraulic modelling guidance)

4.3 Third Contract

During the third contract, the following deliverables were submitted:

1. Design of community-based EWS for Kishchay basin in consultation with local community
2. Consultation with communities on proposed schemes
3. Details of equipment required for community-based schemes for the Kishchay basin
4. Hydrodynamic Model development for Kishchay basin
5. Hydrodynamic Model initial calibration and sensitivity analysis
6. Generation and finalization of flood hazard maps
7. Prepare training programme for Community EWS actors
8. Develop Training Plan and Materials for Flood Risk Modelling & Mapping Methods

4.4 Fourth Contract

During the fourth contract, the following deliverables were submitted:

1. Community-based implementation plan
2. Establishment and training of Flood Forecasting Unit within the MOES
3. Forecasting Implementation Report
4. Community-based implementation
5. Community-based training
6. MOES training plan
7. Hydrometric and Forecasting platform
8. Final Consultancy report

All the deliverables were revised by the Chief Technical Advisor of the project.

5. Issues, Recommendations and Lessons Learnt

The consultant would like to state some issues and recommendations regarding his consultancy and the future steps on the operation and maintenance of the FFEWS.

5.1 Issues

The following issues were encountered during the consultancy.

5.1.1. Data

Some issues regarding data availability occurred during the implementation, calibration and validation of the hydraulic model. The fact that the implementation of the hydrological model also had these very same issues should be noted too. The results from the hydrological model are key boundary conditions for the hydraulic model.

The lack of reliable data during the implementation of the hydraulic model may have a significant impact on the results, and therefore the results from this exercise should treated with caution.

5.1.2. Automatic Station Data

There have been several issues regarding the automatic stations in the study area.

- In the first place, the number of stations as stated in the project document was significantly reduced during the project implementation.This was due to funding constraints. The number of stations that have been fully acquired at this stage is two, one automatic weather station and one hydrological station. The procurement for some weather and hydrological stations have just been finalised. Some of these stations will be deployed in the study area.
- Due to procurement issues, the acquisition of the two stations noted above was significantly delayed in several occasions.
- There were some delays too in the deployment of the stations due to logistic issues and faulty equipment.
- There have been communication issues from the stations to the operational centre. This is probably due to the SIM card and the mobile coverage.

It should be noted that these issues have had a significant impact on the project activities and especially in the implementation of the flood forecasting early warning system.

5.2 Recommendations

5.2.1 Hydraulic Modelling

It is recommended that the hydraulic model results are revisited in the near future whenever more data becomes available. It would be advised to use the following data in the future model revisions:

- Structural data
- Cross section data
- Meteorological data
- Hydrological data

5.2.2 Technical Skills

In order to maintain the system, technical skills within MOES should be improved. A flood forecasting system would require the dedication of a team in order to ensure that the system is properly operated and maintain. Also, training of the dedicated staff would be required in order to familiarise themselves with the system operation.

5.2.3 Operational capabilities

In the consultant opinion, MOES has to improve its operational capabilities. At this moment MOES staff no experience in the operation and maintenance of a flood forecasting system, and therefore training in operational skills should be undertaken too.