CTCN Technical Assistance

Response Plan

Country:	Georgia
Request Identification Number:	2016000043

Title:	Assessment of Suitable Flood Mitigation Measures in Tbilisi, Based on Dukniskhevi River Extreme Flood Analysis

Summary of the CTCN Technical Assistance

In the past, the City of Tbilisi was crossed by a number of small rivers and temporary streams. Currently the majority of these streams flow through artificial tunnels, culverts and pipes. The land above these buried river beds is occupied by residential houses and other infrastructure. Hydraulic capacity of the piped and closed river sections is insufficient to carry flood discharges. Flash floods and mudflows occurring on these small rivers as a result of heavy rains hit from time to time different parts of Tbilisi, causing heavy damages or even catastrophes with number of victims and big material losses.

This CTCN technical assistance relates to knowledge-based recommendations of appropriate actions preventing disastrous consequences of possible floods of Dukniskhevi River (known also as Krtsanisiskhevi or Tabakhmeliskhevi) within Tbilisi that will enable science-informed climate change adaptation actions. Proposed are mainly following analyses and services:

- Rainfall – runoff hydrological modelling of Dukniskhevi River catchment, based on analogical extreme rainfall from 2015 Vere River disastrous flood (similar neighbouring catchment). The aim of the simulation will be definition of the Dukniskhevi River extreme flood discharge. Evaluation of climate change consequences to extreme flood regime will be also studied.
- Hydrodynamic modelling flood water levels of Dukniskhevi River. The hydrodynamic model could be possibly calibrated on the basis of reconstruction of relevant historical flood event, where calibration parameters of model could be set to values which enable real representation of local conditions.
- Detailed field surveys and topographical measurements for parameters and data needed for both hydrological and hydraulic modelling in the Dukniskhevi River catchment.
- Detail flood mapping – production of flood hazard and flood risk maps of Dukniskhevi River floodplains in Tbilisi
- Evaluation of hydraulic performance of structures (bridges, piped sections, culverts), calculations of their safe dimensions based on hydrodynamic modelling of Dukniskhevi River, taking into account climate change effects
- Recommendations for eventual establishment of regular hydro-meteorological observations and monitoring in Dukniskhevi River catchment
- Proposal of Disaster Risk Reduction (DRR) and preventive measures (one of which could be flood forecasting and warning system) to prevent or mitigate further flood disasters on Dukniskhevi River, taking into account climate change effects

All these necessary actions regarding management of flood disasters in Dukniskhevi River basin, as well as evaluation of climate change impacts on extreme flood regime by the governmental order is the competence of the Hydrometeorological Department (National Hydrometeorological Service (NMHS) of the National Environmental Agency (NEA). It is also proposed that training and technology transfer is implemented to NMHS of NEA personnel, which will allow to perform similar hydrological and hydrodynamic modelling analyses on other rivers and streams within Tbilisi (other tributaries of the Kura River), or elsewhere in Georgia. Examples of such would include key analyses such as definition of flood discharges, flood hazard mapping, calculation and evaluation of hydraulic performance and capacity of bridges, tunnels and piped sections, evaluation of changes in catchment and climate change effects, study of the impact of climate change on other rivers and streams within Tbilisi (other tributaries of the Kura River), or elsewhere in Georgia with similar natural conditions.

1. Overview of the CTCN technical assistance

1.1 Technology aspects

The specific technologies recommended to address flood risks relate to modelling of hydrological extremes in water environments, namely those related to floods. These include:

- Data availability inventory, selection and description of methodology and technology for modelling and mapping of flood processes
- Hydrological rainfall-runoff modelling results (knowledge)
- Hydraulic modelling of water levels, hydraulic performance of hydraulic structures (knowledge)
- Mapping of flood zones (knowledge)
- Proposal of suitable flood mitigation and adaptation measures (knowledge-based decision support)
- Delivery of specialized software for flood modelling and mapping (technology transfer)
- Training on the technology application skills (such as modelling skills), using state-of-the-art specialized software for NEA experts (technology transfer, know-how, experience and practices)

Technology for flood modelling and mapping is important because without it, flood management and prevention follows only post flood experience and response of involved institutions and/or individuals. With proper suitable technology and specialized flood modelling software it is possible to simulate flood processes and to decide for adequate land development planning, flood prevention, mitigation and adaptation actions based, on flood modelling results. NEA has educated staff with theoretical knowledge in meteorology, hydrology and hydraulics, but with limited access to flood modelling and mapping technology and little practical experience with use of flood modelling software. Previous flood mapping efforts in Georgia were on rivers Rioni and Alazani, but in forms of drawings, based on estimations, historical experience and expert judgement, suffering from lack of technology and know-how. Technology and methodology proposed in the CTCN assistance will set NEA to higher level. Activities proposed in the project implementation will be in Georgia unprecedented composition of complex work on single river catchment from hydrological modelling, hydraulic modelling, to flood mapping and proposal of flood mitigation and adaptation measures.

1.2 Objectives (outcomes)

- In short term, the results of assistance will enable appropriate contingency planning for extreme flood events, based on actual flood hazard maps
- In close future, measures for extreme flood adaptation could be planned in detail and put in place
- In long term, proper spatial and land development planning, based on flooding maps, should mitigate flood risk
- Transferred technology (modelling software) and modelling technique skills of trained personnel will enable effective management of flood risk and modelling of various flood scenarios and land development scenarios in future, building local capacity to respond and readiness for flood events

1.3 Results (outputs expected from CTCN assistance)

- Knowledge of flood regime of the pilot river catchment, including climate change impact
- Identification of existing structures (culverts, bridges) with insufficient hydraulic performance
- Flood hazard maps
- Transferred technology of flood modelling and mapping software tools
- Trained NMHS of NEA professional staff

1.4 Expected use of outputs

Outputs of the project will contribute to flood mitigation and adaptation in Georgia. Knowledge of flood regime in the pilot catchment will enable to asses adequately flood hazard.
Produced flood hazard maps of the pilot river catchment in Tbilisi will be deployed to inform land development planning processes in areas of risk. The proposed flood mitigation and adaptation measures will in the future enable to reduce flood damages and consequences. Identification of structures with insufficient hydraulic capacity, often one of crucial flood problems, and proposed adequate dimensions of these structures, will help to reduce flood damages and to serve as an example for improved practice in design and construction.
Applied methodology, transferred technology in form of technical and scientific software tools combined with training of NEA (request proponent) professional staff, will in the future enable replication of the used approach, methodology and technology in number of flood mitigation and adaptation projects in other river catchments in Tbilisi and across Georgia. NEA is national agency with nation-wide operation activity and it´s trained professional staff will be in position to replicate the technology to other river basins.

2. Description of the Assistance

2.1 Activities

There are 4 main Activities, as detailed below. Aim of the first activity is to create an inventory of available data and selection of suitable methodology and technology for use in next activities. The second activity focuses on modelling of flood scenarios including influence of climate change. The third activity will propose suitable measures for flood mitigation and adaptation in the pilot catchment. The fourth activity consists of technology transfer, training, dissemination and propagation of results.

Activity 1 – Initial analyses and support

In initial phase of the project implementation, contact and base for cooperation between implementing organization, proponent and NDE in Georgia, will be set up. Kick-off meeting will be organized.
After detailed inventory of available data and field inspection of the pilot river catchment, suitable flood modeling methodology and needed technology will be defined and described in detail. Needed data will be collected. NEA professional staff will be actively involved in this activity. Outcomes of this activity will be used by other activities, but beside that, they can be partly replicated to other river basins, because the needed data structure and data availability for other river basins in Georgia can be similar, as well as choice of suitable modeling technology.

Activity 1.1 – Data acquisition

Aim of this activity will be field inspection of the pilot catchment and previous flood sites, definition of needed data, inventory of data available and specification of data which will be necessary to acquire to be able to undertake the necessary flood modelling and mapping. During the field inspection also ecological status of the pilot river basin will be assessed to cover the requirements on both EU WFD and Flood Directive. Such assessment is needed to avoid interferences in next activities as flood prevention measures. The missing data will be acquired from available sources also in the frame of this activity. The collected data (digitized, calculated, surveyed) will be stored by NEA and made available to implementing organization for all project implementation activities. No data collection infrastructure, instruments and devices will be installed in the frame of project implementation.

Activity 1.2 – Selection of suitable methodology and technology

Based on gained information about available data and information from site visits of pilot catchment, suitable methodology and technology for flood modelling and mapping will be selected and described. Selection of technology (modeling software tools) will reflect technical needs of the flooding problem in the pilot catchment, as well as need for compatibility with specific software tools already in use at NEA.

Activity 1 – Deliverables

Deliverables	**Delivery date**
Kick-off meeting (minutes from the meeting)	*Week 5*
Report on data acquisition	*Week 16*
Description of suitable methodology and technology for flood modeling and mapping	*Week 16*

Activity 2 – Modelling of flooding scenarios

Objective of this activity is to gain information and knowledge about flood characteristics of the pilot Dukniskhevi River catchment. Determined will be flood discharges, water levels and flooding extent for present conditions and for future conditions, accounting for climate change effects. Hydraulic performance of existing structures, such as bridges, culverts, tunnels, will be evaluated. Active involvement of NEA professional staff in this activity will be limited and is expected to be carried out by implementing organization. However, all the created and used numerical model set ups will be used in Activity 4 (training) together with NEA staff and after the project will all the models remain in possession of NEA.

Activity 2.1 – Hydrological rainfall-runoff modelling

During this activity, flood water discharges in pilot catchment will be determined. Hydrological rainfall-runoff model simulations will be used to calculate the river flow discharges for locations of interest along the Dukniskhevi River (present state). Flood discharges with 3 probabilities (or return periods), high, medium and small, will be defined.

Activity 2.2 – Climate change scenarios

Impact of climate change on hydrological regime of the pilot river catchment will be studied. Climate change scenarios will be defined and used for recalculation of flood discharges in the pilot Dukniskhevi River catchment (future flood flows accounting for climate change). Time horizon for projection of hydrological regime to future will be decided during project implementation.

Activity 2.3 – Hydrodynamic modelling

Hydrodynamic model of urban area of the pilot Dukniskhevi River catchment will be set up. Flood water levels for 3 different probabilities will be simulated using hydrodynamic modelling. Flood flows determined in Activities 2. 1 (present state) and 2.2 (accounting for climate change) will be used by hydrodynamic model as boundary conditions. Hydraulic performance of existing structures, such as bridges, culverts, tunnels, will be evaluated to understand the potential impacts of flooding.

Activity 2 – Deliverables

Deliverables	**Delivery date**
Report on hydrological modelling	*Week 30*
Report on climatic scenarios	*Week 30*
Report on hydraulic modelling	*Week 39*

Activity 3 – Adaptation measures

During this activity flood adaptation and mitigation measures will be suggested. Flood hazard maps will be created based on flood water levels modeled in Activity 2.3. Extent of flooding for present state scenario and for future scenario (accounting for climate change) will be determined. Flood prone zones and vulnerable objects will be identified. Suitable flood mitigation and adaptation measures will be proposed.

Activity 3.1 – Mapping of flood hazard

Mapping of flood hazard will be based on results of hydrodynamic simulations of flood water levels modeled in Activity 2.3. Extent of flooding and water depth for present state scenario and for future scenario (accounting for climate change) will be determined. Flood prone zones and vulnerable objects will be identified. Flood hazard maps of present state scenario will be created for 3 different probabilities (high, medium, low). The 3 different specific probabilities or corresponding return periods will be chosen during the project implementation. Flood extent and water depth for future scenario (accounting for climate change) will be determined for 1 chosen probability of occurrence (1 return period).

Activity 3.2 – Proposal of flood mitigation and adaptation measures

Based on knowledge about flooding extent and flood prone zones, various flood mitigation and adaptation measures will be considered, studied and proposed. A list of possible measures will be assessed and briefly evaluated. After evaluation, most promising measures will be described in more detail. The proposed measures will in the future, after more detail evaluation and design, enable to reduce flood damages and consequences. NEA professional staff will be actively involved in this activity. Outcomes of this activity can be partly replicated to other similar river basins in Tbilisi and Georgia.

Activity 3 – Deliverables

Deliverables	Delivery date
Report on flood mapping	*Week 43*
Flood hazard maps	*Week 43*
Report on adaptation and flood mitigation measures	*Week 48*

Activity 4 – Technology and knowledge transfer

Aim of this activity will be transfer of technology, tools, knowledge and skills defined and used in the project Activities 1, 2 and 3, as well as propagation and dissemination of project results. Technical and scientific software tools, used for modeling and mapping of flooding scenarios, will be delivered to NEA. The cost of software licenses will be covered by project budget and the licenses will be after the project in possession of NEA. Set of technical trainings for 3 to 5 NEA specialists will be organized. Project activities, results, outcomes and lessons-learned will be disseminated in form of leaflets (1000 pcs.) and presentations during evaluation and dissemination workshop. Final report of the project will be created and compiled from outcomes of all project activities. Results of this activity (the delivered specialized software and learned skills) can be used by NEA in other similar river basins in Tbilisi and Georgia.

Activity 4.1 – Specialized software delivery

Specialized scientific and engineering software tools which will be defined in Activity 1.2 and used for flood modeling and mapping, will be delivered to National Environmental Agency. Planned is delivery of specialized software for following purpose: rainfall-runoff modeling including climate change impacts (1 installation), hydrodynamic 1D and 2D modelling (1 installation). The cost of software licenses will be covered by project budget and the licenses will be after the project in possession of NEA.

Activity 4.2 – Training

Set of technical trainings for NEA specialists will be organized, both theoretical and on-the-job The aim of the trainings will be use of the delivered software tools. The trainings will address all relevant technologies and methodologies used in the project, namely hydrological rainfall-runoff modeling including climate change impacts, hydrodynamic 1D and 2D modelling, flood mapping techniques. Together 4 blocks of trainings with duration 3 days each will be organized. 3 to 5 participants from NEA will be trained during each of the trainings.

Activity 4.3 – Dissemination and propagation of results

Propagation leaflets (1000 pcs.) informing about the project implementation, used technology and results will be prepared, printed and distributed. Evaluation and dissemination workshop will be held with relevant stakeholders and organizations in Georgia (identified and contacted in cooperation with NEA and NDE) with the aim of creating awareness and knowledge of the technology transfer. Results of the technical analyses and modelling works will be presented. The workshop will include maximum of 25 participants for duration of half day. Audience for the dissemination workshop will be professional institutions (water management, hydro-meteorology, crisis management), municipality, media. Final report of the project will summarize implementation and results of all the project activities.

Activity 4 – Deliverables

Deliverables	Delivery date
Protocol about delivered software tools	*Week 48*
Technical training material and presentations	*Week 52*
Summary report and list of participants from trainings	*Week 52*
Summary report of evaluation and dissemination seminar	*Week 52*
Final report of the project	*Week 52*

2.2 Synergies and Baseline Setting

The project will use the results and outputs from the previous projects in the Caucasus region and in Georgia as follows:

- EuropeAid Project „Programme for the Prevention, Preparedness and Response to man-made and natural disasters in the ENPI East Region (PPRD-East)", 2010 -2014.
- CENN, Strengthening local capacity and developing structured dialogue and partnerships for mitigating natural disasters and reducing poverty in Georgia;
- CENN, Institutional building for natural disaster risk reduction (DRR) in Georgia;
- NATO, 2008. Project SfP 977991 "South Caucasus River Monitoring". Progress Report, Tbilisi;
- Tacis Project „Joint River Management Programme - Kura Basin". Final Report, 2004;
- UNDP/GEF "Reducing Transboundary Degradation in Kura-Aras Basin". Main Deposits, Useful Storage and Current Condition of Groundwater in the Republic of Armenia. Report, Yerevan, 2006;
- USAID South Caucasus Water Programme, Strengthen the Capacity of National Water Resources Management Agencies. Deliverables Report, 2006;
- USAID South Caucasus Water Programme, Strategic Water Monitoring Plan for Transboundary Rivers. Review Report, 2007;
- Adaptation Fund supported Project "Developing Climate Resilient Flood and Flash Flood Management Practices to Protect Vulnerable Communities of Georgia". The focus of the project was on the promotion of the most appropriate mix of structural and non-structural flood management measures. As one of the solutions was developed river basin livelihoods, the use of agroforestry etc. 2013;
- Slovakaid project „Support of the implementation process of the EU Directive on assessment of the flood risks into the legislation in Georgia", 2014.

Furthermore, it will be necessary to coordinate the activities of the project with projects that are planned to be carried out in the near future (UNDP/GEF, USAID, EU, etc.) to use the synergy effects. This will be achieved in cooperation with NEA and NDE, mostly in the frame of Activities 1 and 4.

2.3 Timeline

Activity	**Month**											
	1	2	3	4	5	6	7	8	9	10	11	12
1 Initial analyses												
1.1 Data acquisition												
1.2 Selection of suitable methodology and technology												
2 Modelling of flooding scenarios												
2.1 Hydrological rainfall-runoff modelling												
2.2 Climate change scenarios												
2.3 Hydrodynamic modelling												
3 Adaptation measures												
3.1 Mapping of flood hazard and flood risk												
3.2 Proposal of flood mitigation and adaptation measures												
4 Technology and knowledge transfer												
4.1 Specialised software delivery												
4.2 Training												
4.3 Dissemination and propagation												

2.4 Expertise required

Project activity	Required expertise and other resources
Activity 1	Initial analyses and support
Activity 1.1 Data acquisition	*Experts in hydrological rainfall-runoff modeling and hydrodynamic modeling with experience in various data sources and formats. Overall water status evaluation.* *Cooperation with relevant Georgian Institutions in data inventory and acquisition.* *Data analyses and processing skills, GIS skills* *Surveying skills: survey of about 35 cross-sections of river channel, historical flood marks, structure dimensions* *Events: Kick-off meeting, field inspection* *Input of experts: together 13 to 16 days*
Activity 1.2 Selection of suitable methodology and technology	*Experts in modeling of flooding processes and water modeling technologies: input 5 days*
Activity 2	Modelling of flooding scenarios
Activity 2.1 Hydrological rainfall-runoff modelling	*Expert in hydrological rainfall-runoff modeling* *Input: 40 to 45 days*
Activity 2.2 Climate change scenarios	*Expert in hydrological rainfall-runoff modeling and climate change* *Input: 20 to 25 days*
Activity 2.3 Hydrodynamic modelling	*Expert in hydrodynamic modeling, 1D and 2D hydrodynamic modelling skills, hydraulics of structures* *Input: 50 to 55 days*
Activity 3	Adaptation measures
Activity 3.1 Flood mapping	*Expert in flood mapping and GIS* *Input: 30 to 35 days*
Activity 3.2 Proposal of flood mitigation measures	*Expert in proposal and evaluation of flood mitigation measures, knowledge of flood forecasting and warning systems* *Input: 35 to 40 days*
Activity 4	Technology and knowledge transfer
Activity 4.1 Specialized software delivery	*Expert for modelling software technologies: input 3 to 5 days, software specification and ordering* *Software technology:* *Software for rainfall – runoff modelling: 1 installation* *Software for 1D hydrodynamic modelling: 1 installation* *Software for 2D hydrodynamic modelling: 1 installation*
Activity 4.2 Training	*Trainers with expertise in hydrological modeling and climate change, 1D and 2D hydrodynamic modelling , flood mapping* *2 trainers, number of man/days: together 30 to 35 (20 to 25 days trainings, 10 days preparation and materials), number of participants:3 to 5*
Activity 4.3 Dissemination and propagation of results	*Experience in stakeholder consultation and knowledge of institutional framework in Tbilisi and Georgia* *Verbal and writing skills in English* *Expected input: 35 to 40 days* *Material: Project information leaflet (1000 pcs.)* *Cooperation with Georgian specialists (local experts) on dissemination and propagation of results and measures, translation of final report* *Event: Evaluation – dissemination workshop, 20 to 25 participants,*

2.5 Main partners

Stakeholder	Role to support the implementation of the CTCN assistance
Ministry of Environment and Natural Resources Protection of Georgia	*National Designated Entity*
National Environmental Agency	*Request applicant*
Tbilisi Municipality	*municipality*
Emergency Management Agency under the Ministry of Internal affairs	*Emergency Management Agency coordinates nationwide activities on emergencies prevention, mitigation and elimination of their consequences.*

2.6 Indicative budget

Activities	Estimated Budget (USD)
Activity 1	35 000
Activity 2	60 000
Activity 3	41 000
Activity 4	90 000
Audit	2 000
Coordination, evaluation, quality assurance	19 000
Total	**247 000**

Implementation of this Response Plan will be led by the Climate Technology Centre (including selection, contracting, supervision and monitoring of implementation partners) in close coordination with the corresponding National Designated Entity and relevant national actors. Implementation will be led by an International Consortium or Network Partner of CTCN.

2.7 Gender considerations

Gender equality aspect will be considered in process of selection of NEA specialists with required skill and expertise for participation in the training programme and other project activities. Long term impact of the assistance will be reduction of flood damages, from which will benefit equally both gender.

2.8 Risk identification and risk mitigation

Risk	Consequence	Probability	Mitigation measure
Insufficient information and data from national monitoring system	Models and expert judgement will be used with uncertainties for flood assessment.	10 %	The use of remote sensing data and also information from previous projects.
Not clear identification of responsible bodies in flood risk management	Required information may not be adequately distributed to responsible institutions and local government.	10 %	Partner (NEA) and Ministry of Environment and Natural Resources Protection will be responsible for mapping of stakeholders to be involved.
Political stability and will to implement EU water policy in Georgia	Impact on the development of legal tools for implementation flood management.	10 %	Situation in Georgia is stable at this moment and also after signing Association Agreement with EU visible progress was made in the implementation of water policy. This aspect will be regularly discussed

			between contractor and partner.
Rate fluctuation between USD and EUR	Impact on the delivered results.	10 %	Contractor will regularly inform CTCN representative on the rate currency issue.

3. Long-term impacts of the assistance

3.1 Expected climate change-related benefits

	CTCN climate technology impact	Anticipated contribution from CTCN assistance
1	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in the requesting countries	The transferred methodologies and knowledge will be disseminated among the relevant institutions on local level based on the workshop and trainings.
2	New national Technology Needs Assessment (TNA) and Technology Action Plan (TAP) as a result of the response	The CTCN assistance methodologies and knowledge will contribute to the revision of the TNA in the future.
3	Progress made against mitigation objectives (i.e. energy and carbon intensity reduction) as a result of the response	The planned response will not have direct influence on carbon intensity reduction, however reduction of flood damages will contribute to energy efficiency and energy conservation
4	Progress made against adaptation or resilience objectives (e.g. climate vulnerability index improvement) as a result of the response	The methodologies and knowledge will contribute to development and adaptation of the flood mitigation measures.
5	New mitigation or adaptation technology projects/initiatives implemented as a result of the response	The results of the project will identify and suggest the flood mitigation measures in technical, structural and community levels.
6	New or strengthened policies/ laws developed, approved and enacted as a result of the response	The results of the project will contribute to implementation of the water policy (including flood management) in Georgia.
7	New policies/laws where climate change was mainstreamed as a result of the response	The methodologies and results will be used in the preparing the new legal documents (by law) in the flood management in Georgia.
8	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response	The CTCN assistance is in line with the National Flood Management and will contribute to the new flood management policies.
9	New or strengthened Public-Private Partnerships (PPP) created directly as a result of the response	It is possible that there will be private industrial or other private business purpose properties identified in zone with flood hazard. In that case strengthening of public and private partnership in area of flood management can be expected.

10	New or strengthened twinning arrangement created as a result of the response	The CTCN assistance will contribute to the relations with regional organisation as REC Caucasus, CEN and GWP.
11	Capacities to access and attract public and private finance increase to enable financing of technology deployment	Dissemination and propagation of project results (created flood hazard maps and proposed measures) can attract public and private finance increase into flood management.
12	Post-response intervention funding attributable to the response.	After the project, results can be presented to responsible bodies for post-response intervention (donors).
13	Framework and analysis of local production developed to enable deployment of national production of climate technologies	The methodologies and knowledge transfer will increase the capacity of NEA with regards the flood forecasting and management in Georgia. The results can be used also in other river basins in Georgia.

3.2 Co-benefits

	Sustainable Development Goal	**Contribution from CTCN assistance**
1	End poverty in all its forms everywhere	Reduction in loss of property and protection of life through floods.
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Reduction in crop losses.
3	Ensure healthy lives and promote well-being for all at all ages	Protection against flooding will affect positively the livelihood and wellbeing in the river basin.
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	Improved flood management will have positive impact on the sustainable use of water resources.
5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	Improved flood management will contribute to the development of the river basin.
7	Ensure access to affordable, reliable, sustainable, and modern energy for all	Improved flood management will contribute to protection and development of the infrastructure and manufacture.
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Flood management measure will contribute to safe and sustainability of the river basin.
10	Reduce inequality within and among countries	Improved flood management will considerably improve lives of people living in flood prone areas
11	Make cities and human settlements inclusive, safe, resilient and sustainable	The CTCN assistance will contribute significantly to the understanding of the climate change impact on the hydrological regime in the areas.
12	Ensure sustainable consumption and production patterns	

13	Take urgent action to combat climate change and its impacts	The methodologies on the flood regime will contribute to increase of aquatic ecosystem behaviour and riverine degradation.
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The project will interact will organisations and institutions to use synergy for flood protection and mitigation on national and regional level (REC Caucasus CEN).
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Improved flood management will have positive impact on the sustainable use of water resources.
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

3.3. Post-assistance plans and actions

Post-assistance plan consists of actions that should support and increase the ownership of the outputs of the project and using them in other river basins in Georgia and also in the Caucasus region. Following actions are included:

- The outcomes of the CTCN assistance will be an important step to contribute to the implementation of flood management measures and to increasing the ownership of the transferred methodologies in Georgia.
- The outcomes with knowledge and methodologies can be transferred into the similar river basins and relevant institutions with competencies in flood management in Georgia.
- The results will be as base for the development of the projects in the field of flood management and hazard management in Georgia in the future.
- Communication and project results discussion between local, regional and nationwide levels will significantly contribute to collaboration and implementation of the flood adaptation and mitigation measures.

3.4 Monitoring and Reporting of technical assistance results and impacts

Expected activities and deliverables are described in the chapter 2 of this Response Plan. Activity progress and deliverables will be monitored by the Project Manager and NEA management (Head of Department of Hydrometeorology) and reported to CTCN representative in accordance with timeline of the project (see chapter 2.3). At the end of each activity, email report will be sent to CTCN representative by Project Manager on progress, lessons learned and challenges. Main communication will be conducted via teleconferences and also it is expected to control the fulfilment of the tasks during the missions of experts in Georgia. Responsible for that communication will be CTCN contractor.

All changes in activities, processes and approaches as suggested in the project document will be in advance sent for approval to UNEP representative.

Performance indicators of CTCN Assistance				
Response output *(linking to sec 1.2)*	**How output will be used to ensure creation of result**	**Expected result**	**Expected outcome of result** *(linking to sec 1.1)*	**Anticipated impact that outcome will produce** *(linking to section 3)*
In short term, the results of assistance will enable appropriate contingency planning for extreme flood events, based on actual flood hazard maps	Data availability and capacity for using the transferred methodologies and technologies in flood assessment and sustainability is one of the crucial point in hazard management.	Data availability and engaged national staff and decision makers understanding the issue of the flood related impacts.	Training for the selected staff from relevant flood management institutions on the using methodologies and technologies transferred in Georgia.	Progress made against adaptation or resilience objectives as a result of the response
In close future, measures for extreme flood adaptation could be planned in detail and put into the practice	Increased knowledge and capacity of decision makers in the flood management is required to define and implement proper adaptation measures.	Increased focus on the proper planning of the flood management on local and district level.	Methodologies for the detailed planning of the adaptation measures to decrease the flood impact in the river basin.	Climate technologies adapted to national context are identified and prioritized to enable their deployment and transfer
In long term, proper spatial and land development planning, based on flooding maps, should mitigate flood risk	Enhanced knowledge and comprehensive approach with well-defined competencies of national institutions is a key issue in flood management.	Improvement of local governments on spatial and land use planning to mitigate the flood impact.	To increase access of the stakeholders to the information on the flood management.	Country integrating climate change mitigation and/or adaptation issues into its planning and policies as a result of the response
Transferred technology (modelling software) and modelling technique skills of trained personnel will enable in future effective management of flood risk and modelling of various flood scenarios and land development scenarios	Complex data on the river basins are critical for the sustainability. Furthermore, skill of the national staff to use technologies and methodologies in the future is also needed.	Stakeholders with and active and confident engagement in the CTCN assistance in terms of flood management and dissemination to the relevant institutions.	Technologies and methodologies for development of the extreme flood adaptation measures.	Climate technologies adapted to national context are identified and prioritized to enable their deployment and/or transfer in Georgia and Caucasian region

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Response Plan

4. Signatures

Signatures of the requesting country

NDE Ministry of Environment Protection

Name: GRIGOL LAZRIEVI
Title: Head of the Climate change unit
Date: 16.01.2017
Signature: /G. Lazrievi/

Request Proponent NEA

Name: George Kordzakhia
Title: Deputy Head of Hydromet Departme
Date: 16.01.2017
Signature: /G. Kordzakhia/

Signatures of the CTCN

CTCN Director

Name: JUKKA HOLKAINEN
Title: DIRECTOR
Date: 11-02-2017
Signature:

Climate Technology Manager

Name: JASON SPENSLOW
Title: CLIMATE TECHNOLOGY MANAGER
Date: 11/02/2017
Signature:

Annex 1: Response Log frame

Activity *(link to sec 2)*	**Description of sub-activities conducted by the CTCN**	**Output/ Deliverable** *(link to sec 2.1)*	**Expected Outcome** *(link to sec 3)*	**Main national partners involved**	**Objectively Verifiable Indicator** *(see Annex 5 guidance)*	**Means of Verification** (data source, method of collection, responsibility and periodicity)
Activity 1: Initial analyses	*Activity 1.1 Data acquisition* *Activity 2.1 Selection of suitable methodology and technology*	Kick-off meeting (minutes from the meeting) Report on data acquisition Description of suitable methodology and technology	Data will be ready for modelling and trainings. Suitable technology will be selected.	National Environmental Agency	Specification and quality of data collected. Suitability of selected technology and methodology.	Reported as part of the output. Responsibility: implementing organisation
Activity 2: Modelling of flooding scenarios	*Activity 2.1 Hydrological rainfall-runoff modeling* *Activity 2.2 Climate change scenarios* *Activity 2.3 Hydrodynamic modelling*	Report on hydrological modeling Report on climatic scenarios Report on hydraulic modelling	Flood modelling results ready for flood mapping. Models ready for more analyses and for trainings.	National Environmental Agency	Response implementer effort days. Level of detail used in modelling.	Reported as part of the output. Responsibility: implementing organisation
Activity 3: Adaptation measures	*Activity 3.1 Flood mapping* *Activity 3.2 Proposal of flood mitigation measures*	Report on flood mapping Flood hazard maps Report on adaptation and flood mitigation measures	Flood hazard maps will be used for contingency planning and in land development planning processes Proposed flood mitigation and adaptation measures will be ready for adoption into flood mitigation and adaptation strategy and for	National Environmental Agency	Flood hazard maps and proposed flood mitigation and adaptation measures distributed to decision makers	Reported as part of the output. Responsibility: implementing organisation

			practical deployment			
Activity 4: Technology and knowledge transfer	*Activity 4.1 Specialized software delivery* *Activity 4.2 Training* *Activity 4.3 Dissemination and propagation of results*	Protocol about delivered software tools Technical training material and presentations Summary report and list of participants from trainings Summary report of evaluation and dissemination seminar Final report of the project	Specialized software tools, gained skills and knowledge will be applied by NEA trained personnel in similar conditions in Georgia. Propagation of the project activities and results will increase awareness about CTCN assistance as well as about present flood hazard and possibilities for its mitigation.	National Environmental Agency	Specification and number of software tools installations. Number of training participants training days received. Post training evaluation by participants. Number of participants of Evaluation – dissemination workshop. Feedback from workshop participants. Results available to stakeholders.	Reported as part of the output. Responsibility: implementing organisation

Annex 2: Indicative list of performance indicators

Overall Activity	**Specific Activity**	**Indicator**
Capacity Building	▪ development and delivery of workshops ▪ development and delivery of trainings (e.g. webinars, e-learning, ad-hoc)	Number of participants trained or training days received; Post training evaluation and feedback (and minutes); CTCN Knowledge Management

Overall Activity	Specific Activity	Indicator
	▪ development and delivery of toolkits	System (KMS) users; Webinar content/minutes/feedback; e-learning content/feedback
Advisory	▪ development of needs assessment/ studies/ reports/ etc. ▪ establishment/development of recommendations	Diversity of sources used; Response Implementer efforts days; Recommendations; Scope of dissemination; Level of detail used; Feedback; Uptake of recommendations
Policy development	▪ development of strategy ▪ drafting of implementation plan ▪ formulation inputs to policy/ law	Strategy available and adapted to local context and national priorities; Number of interview/events conducted to developed the strategy/ plan; Strategy/Plan dissemination; Number of technologies recommended in the strategy/plan; Scope of changes recommended by the strategy/plan.
Project implementation	Mitigation ▪ Energy supply ▪ Energy use ▪ Industry ▪ Transport ▪ Agriculture ▪ Waste management ▪ Forestry Adaptation ▪ Water ▪ Infrastructure, transport and urban design ▪ Early warning and environmental assessment ▪ Coastal zones ▪ Agriculture and forestry ▪ Human health ▪ Marine and fisheries	Outputs available and adapted to local context and national priorities; Level of private sector participation; Planning/Outputs distributed to decision makers with feedbacks; Integration of outputs/outcomes into planning of host country; implementation of outputs/outcomes by host country or other multi/bi-lateral organization; Level of cooperation between Response Implementer, NDE and Response Proponent(s).
Development of a new	▪ Development/ Establishment of basis for Twinning ▪ Development/ Establishment of basis for PPP	

Overall Activity	**Specific Activity**	**Indicator**
partnership or strengthening of an existing one	▪ Development/ Establishment of basis for knowledge partnership	