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Организация
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منظمة الأمم المتحدة
للتربية والعلم والثقافة

联合国教育、
科学及文化组织

Executive Office of the Natural Sciences Sector

Adaptation Fund Secretariat
1818 H Street, NW
MSN N7-700
Washington, DC 20433
United States of America

5 August 2019

Ref. : SC/EO/19/247

Re: **Submission of UNESCO Proposal: Groundwater resources in Greater Mekong Sub-region: Collaborative management to increase resilience**

Dear Adaptation Fund Secretariat,

I am pleased herewith to submit a revised and updated edition of the above proposal, elaborated in accordance with the recommendations made by the Adaptation Fund further to the prior submission of the document in August 2017.

The attached document results from a comprehensive consultation and review process undertaken to ensure and fully reflect participating country ownership of the recommendations made by the Adaptation Fund in response to the 2017 edition of the proposal.

To ensure full compliance, UNESCO secured technical expertise on social and environmental standards, surveyed risks and mitigation approaches, and extensively revised the draft document. The attached revised proposal is thus the result of a collaborative effort by a specialized consultant working in close coordination with UNESCO programme specialists in Jakarta, Bangkok and Paris, drawing on inputs and guidance of the participating countries.

The drafting process was anchored in two consultative workshops organized by UNESCO. The first of these events was held in Bangkok, Thailand, during 11-12 June 2018; while the second was held in Hanoi, Vietnam, on 22 March 2019. Bringing together representatives of the Designated Authorities in the participating countries with UNESCO programme staff and regional experts from UNESCO's academic and practitioners' networks, the workshops were crucial in ensuring full compliance with the recommendations, and will serve as a foundation for the roll-out of implementation.

We hope the Adaptation Fund will appreciate UNESCO's commitment to this initiative, including our extensive work improving the previous edition of the document, the consistently consultative and participatory approach taken to its formulation, and our reliance on internal human and financial resources.

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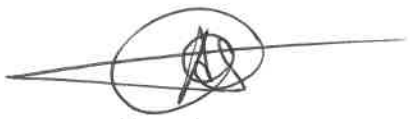
www.unesco.org/science/

With this letter, please find attached:

- The updated proposal document in final form, signed on behalf of UNESCO;
- Detailed budget and disbursement information (Excel format)
- Endorsement letters from the AF Designated Authorities in each of the five participating countries. For Myanmar, an additional letter of endorsement from the Ministry of Agriculture, Livestock and Irrigation (which will play a key role in the project) has also been included.
- A table summarizing the applicant's responses to AF reviewers' comments;
- The updated proposal document with new and re-written sections highlighted.

We look forward to your favorable consideration of the attached proposal.

Yours sincerely,



Abou Amani
Chief, Executive Office

Groundwater resources in Greater Mekong Sub-region: Collaborative management to increase resilience (submitted August 2019)

Summary of responses to the AF reviewers' comments from 2017 submission *(in italics)*

CR1	***Project Eligibility, Question 2: CR1: Addressed.*** *The measures will mainly consist of Managed Aquifer Recharge (MAR). This should be clearly specified under Table 2.* ➢ Reference is made to the sections of the proposal that describe and list the various activities to be undertaken. These comprise both generic project activities as well as more specific, tailored activities in the four pilot areas. Risk assessments and compliance with ESP principles have been thoroughly reviewed so as to be in line with the reviewers' comments. ➢ While table 2 (p.28) is not meant to include details of project activities, such details are now provided in part I, Section 3 (p. 23), and in Part II, Section A (p.34), with further details about the pilot areas in Annex I. ➢ A new Section, 2.3 (p. 20) informs about the contribution of the project towards the Sustainable Development Goals, while Section 1.7 (p. 17) provides further elaboration of activities and focus on activities promoting gender equality.
CR2	***Project Eligibility, Question 6: CR2: Not addressed****. The relevant standards mentioned are limited to EIA laws and guidelines. Other relevant technical standards are delegated to national ministries for compliance. There is no information to substantiate that this will effectively take place, and may constitute conflicts of interest.* ➢ See Part II, Section F. Part 1 (p. 54) discusses the issue of national standards, EIA laws and guidelines. This Section has been completely rewritten and now addresses national standards, EIA and compliance with the national regulatory frameworks. As detailed in the document, the compliance assessment presented is based on extensive consultations with experts, stakeholders and relevant government officials from the region, in combination with the expert judgement of the IE, EE and technical partners. ➢ At the latest consultative workshop (Hanoi, March 2019) with representatives from the (ground) water and climate change adaptation sectors of the five participating countries, consensus was expressed on the assessment made and the compliance approach proposed.
CR3	***Project Eligibility, Question 6: CR3: Not addressed.*** *Compliance with the ESP is limited to a statement of intent.* ➢ Compliance with the ESP is discussed in Part II, Section F, part 2 (p. 59). This Section has been completely rewritten. Results of the screening for potential negative impacts and risks are discussed. Also in this Section, the checklist with the 15 Environmental and Social Principles is discussed. ➢ The section documents the earlier proposal preparation work, and new additional preparations (consultations with sectoral experts in the five countries through questionnaires and workshops hosted by UNESCO with representatives from each of the 5 countries, technical partners and EE (CCOP).
CR4	***Project Eligibility, Question 13; CR4: Partially addressed****. The ESP categorisation has been changed to B. However, that conclusion is still based on the inappropriate categorisation as 'soft' and 'hard' activities, which is not in line with the ESP that requires that risks are identified for all activities and that the risk identification is evidencebased rather than the result of an unclear categorisation process of 'hardness'.* ➢ The issue of categorization is discussed in Part II, Section F, part 2 (p. 59). This section has been completely rewritten in line with the ESP. In this Section the results of the 'screening' for potential negative impacts and risks are discussed. Also in this section, the checklist with the 15 Environmental and Social Principles is discussed.

CR5	***Project Eligibility, Question 13; CR5: Not addressed****. Section III of the template, part 3, provides the opportunity to present the implementation arrangements for measures for environmental and social risk management. Table 11 (p. 65) in that section now does provide indirect risks identifications for the 15 ESP principles. However, these findings generally lack substantiation, and do not take into account the as yet unknown specific locations in which the activities will be implemented, pre-empting effective risk identification*. *The interpretation of most of the principles is not in line with the ESP. Specific guidance is available on the AF website.* ➢ *Table 11 (p. 65), indirect risk identifications for the 15 ESP principles;* The risk identification following the 15 principles is now presented in Part II, Section F-2. ➢ *The risk identification in relation to activities and locations of the project*: The proposal clearly indicates the proposed locations and activities in the four pilot areas. Most activities that are proposed are generic, i.e. similar in all four pilot areas, however fine-tuned for the specific location conditions. See the overview of the project Components & Activities in Part II, Section A (p. 34), and Annex 1: (Overview of Pilot Locations). Following this, the risk identification and assessment is presented in Section F-1 (p. 54) and F-2 (p. 59). ➢ *AF guidance on the ESP principles;* This was intensively used. Other (approved) AF proposals were studied for guidance
CR6	***Implementation Arrangements, Question 4: CR6: Not addressed****. The USPs have not been further identified. An ESMP is required, provided that the use of USPs is adequately justified, at the time of submission of the funding proposal but it is not provided.* ➢ *USPs (Unidentified Sub-Projects:* The proposal clearly indicates the proposed locations and activities in the four pilot areas. Please refer to the earlier clarification under CR1 and CR 5, and the relevant proposal sections about project activities (Part I, Section 3 (p. 23), Part II A (p. 34), and Annex I Overview of Pilot areas). The project will start with a regular inception phase in which the activity portfolio will be further detailed and prepared, but there will be no deviations from the basic premise of the proposal. ➢ *ESMP*: Part III, Section 3 (p. 91) has been completely rewritten and provides the project's Environmental and Social Management Plan (ESMP) and implementation mechanism. The ESMP guides further and continuous identification and assessment of ESP risks, in particular during the project inception phase (more detailed definition of activities) and continuously further on during project implementation.

ADAPTATION FUND

REGIONAL PROJECT/PROGRAMME PROPOSAL

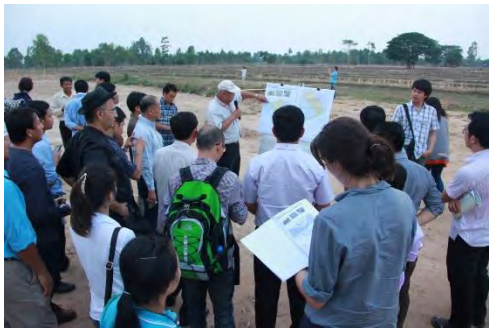
PROJECT/PROGRAMME INFORMATION (Summary)

Title of Project/Programme:	***Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience***.
Countries:	Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Vietnam
Thematic Focal Area:	Transboundary water management
Type of Implementing Entity:	MIE
Implementing Entity:	UNESCO
Executing Entities:	National Agencies, CCOP-TS, IWMI, IGRAC
Amount of Financing Requested:	**US $ 4,898,775**

Groundwater resources in the Greater Mekong Subregion

Collaborative management to increase climate change resilience.

A collaboration of the Kingdom of Cambodia, Lao People's Democratic Republic, the Republic of the Union of Myanmar, the Kingdom of Thailand and the Socialist Republic of Vietnam to increase climate change resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation.

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

IWMI International Water Management Institute

IWMI is a member of the CGIAR Consortium and leads the:

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

COORDINATING COMMITTEE FOR GEOSCIENCE PROGRAMMES IN EAST AND SOUTHEAST ASIA (CCOP)

igrac International Groundwater Resources Assessment Centre

Bangkok, July 2016; 1st revised version Jun 2017; 2nd revised version June 2018; 3rd revised version, April 2019; ©UNESCO

Contents

Abbreviations

ADB	Asian Development Bank
AF	Adaptation Fund
ASEAN	Association of Southeast Asian Nations
AVID	Australian Volunteers for International Development
AWP	Annual Work Plan
CCA	Climate Change Adaptation
CBDRM	Community-based Disaster Risk Management
CBNRM	Community-based Natural Resource Management
CBOs	Community Based Organizations
CCOP-TS	Coordinating Committee for Geoscience Programmes in East and Southeast Asia – Technical Secretariat
CoP	Community of Practice
DIWU	Department of Irrigation and Water Utilization (Myanmar)
DMH	Department of Meteorology and Hydrology
DRR	Disaster Risk Reduction
DWRPIS	Division for Water Resources Planning and Investigation in the South of Vietnam
GEF	Global Environment Facility
GGMN	Global Groundwater Monitoring Network
GGIS	Global Groundwater Information System
GMS	Greater Mekong Subregion
GW	Groundwater
GWES	Groundwater for Emergency Situations
IHP	International Hydrological Programme
IMS	Information Management System
INGO	International Non-governmental Organization
IGRAC	International Groundwater Resources Assessment Centre
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MAR	Managed Aquifer Recharge
M&E	Monitoring and Evaluation
MIE	Multilateral Implementing Entity
MONRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
MSL	Mean Sea Level
NAWAPI	National Center for Water Resources Planning and Investigation (Vietnam)
QGIS	Quantum GIS – Geographic Information System
SDGs	Sustainable Development Goals
TBA	Transboundary Aquifer
TWAP	Transboundary Water Assessment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WASH	Water, Sanitation and Hygiene
WRUD	Water Resources Utilization Department (Myanmar)

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Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience

PART I: PROJECT INFORMATION

1. Project Background and Context

1.1 Resource status: Groundwater in the Greater Mekong Subregion

The Greater Mekong Subregion (GMS) comprises the sovereign nations of Cambodia, Lao People's Democratic Republic (Lao PDR), Thailand, Myanmar and Vietnam. With a rapidly increasing population in the range of 250 million people, the region is experiencing more variable surface water flows, a prolonged dry season and intensifying droughts and a growing demand for water resources including groundwater. Despite relatively abundant surface water resources, a considerable number of low-income groups and urban/rural communities rely on low-cost groundwater for their domestic, agrarian and industrial use. Several groundwater reserves are transboundary and it is recognised that there is limited capacity to manage these shared resources and limited knowledge about the sustainable yields of these transboundary aquifers. This proposal seeks to address this institutional and governance challenge through implementing a transboundary groundwater collaboration. Recent and predicted population dynamics will put more pressure on limited water resources, accelerated by consumption and behavioural patterns, unless serious awareness, education, and science-based information flow will balance this trend. According to UN DESA[1], the population of the five member states has exceeded to >233 million in 2018, versus 62 million in 1950, and it will reach a total of >372 million people by 2050 and beyond, with only Thailand reaching population stability very soon. This means the total population increase is 600 % in only 100 years, and still increasing.

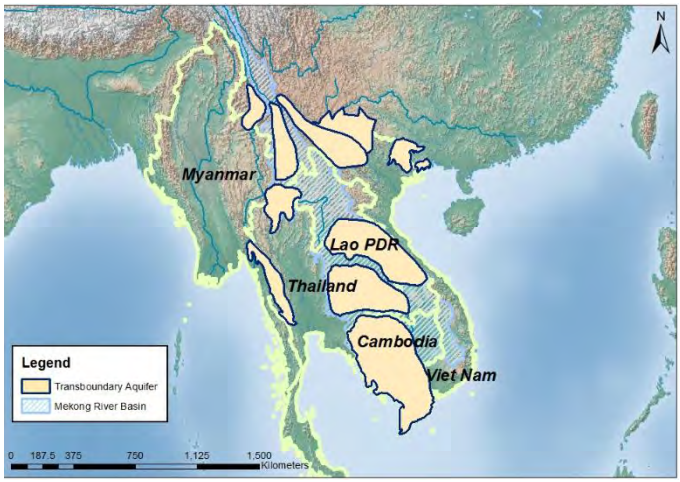


Figure 1: Overview of the main transboundary groundwater aquifers in the Greater Mekong Subregion; source IGRAC.

Throughout the GMS, complex relationships occur between upstream recharge areas and downstream aquifers. The total potential capacity of groundwater resources is estimated to be about 60 million m³/day. Important transboundary aquifers straddle the border areas and highlight the need for multilateral cooperation for effective management of shared resources (Landon, 2011[2]). Recent studies (i.e. Erban, 2014[3]; Wagner *et al.,* 2012[4]) illustrate the intensive use and economic significance of groundwater for both the Vietnamese and Cambodian part of the Mekong Delta. This also applies for the drought sensitive northeast of Thailand (the Isan region), adjacent parts of Lao PDR (Pavelic *et al*., 2014[5]; Vote *et al.,* 2015[6]) and Myanmar's central plain (McCartney *et al*. 2013[7]).

[1] https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/
[2] Landon. M., 2011; Preliminary compilation and review of current information on groundwater monitoring and resources in the Lower Mekong River Basin. USGS report to Mekong River Commission.
[3] Erban,L. S.M.Gorelick & H.A.Zebker, 2014;Groundwater extraction, land subsidence and sea-level rise in Mekong Delta, Environ.Res.Lett. 9.
[4] Frank Wagner, Vuong Bui Tran and Fabrice G. Renaud; Groundwater in the Mekong Delta: Availability, Utilization and Risks, in The Mekong Delta System, Interdisciplinary Analyses of a River Delta, Renaud and Kuenzer (eds.), Springer, 2012)
[5] Pavelic. P., O. Xayviliya and O. Ongkeo., 2014; Pathways for effective groundwater governance in the least-developed-country context of Lao
[6] Vote, C.,, J Newby, K Phouyyavong, T Inthavong and Eberbach, P. 2015; Trends and perceptions of rural household GW use and the implications for smallholder agriculture in rain-fed Southern Laos. International Journal of Water Resources Development, 02/2015; DOI:10.1080/07900627.2015.1015071
[7] McCartney, M.; Pavelic, P.; Lacombe, G.; Latt, K.; Zan, A.K.; Thein, K.; Douangsavanh, S.; Balasubramanya, S.; Rajah, A.; Myint, A.; Cho, C.; Johnston, R.; Sotoukee, T. 2013. Water resources assessment of the dry zone of Myanmar. [Project report of the Livelihoods and Food Security Trust Fund (LIFT) Dry Zone Program]. Vientiane, Laos: International Water Management Institute (IWMI); Yangon, Myanmar: National Engineering and Planning Services (NEPS). 52p

Groundwater is also an extremely important resource for crop irrigation, food production (notably in Myanmar, Thailand and Vietnam), industry (e.g. food processing, mining) and domestic supply for urban and rural communities. Due to rapid economic and population growth, pressures on groundwater in the region are increasing fast. Climate variability creates a more uncertain dimension of stress, with, for example, the recent El Niño related drought in Thailand leading to emergency measures involving the drilling of 900 wells for irrigating parched rice fields with unknown longer-term consequences (Bangkok Post, 23 June 2015).

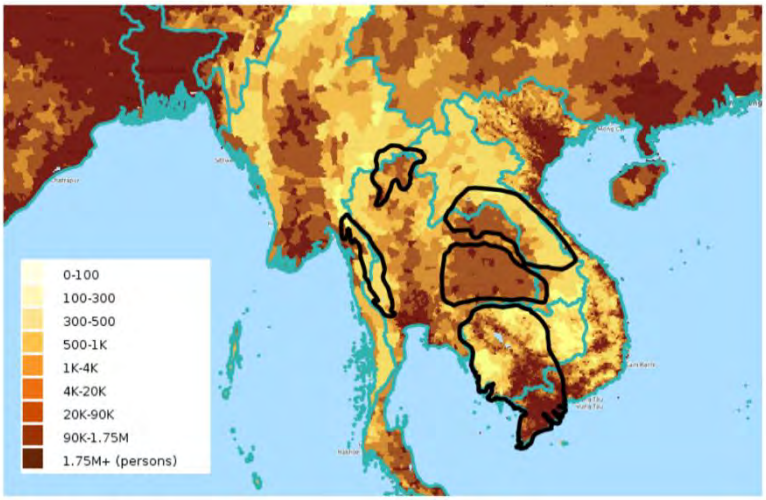


Figure 2. Main Transboundary aquifer (TBA) systems in the region and the population density in 2015 in the region (data: SEDAC: Socio-economic Data and Applications Center).

Population densities (persons/sq. km) vary quite significantly throughout the region but it can be said that in more densely populated areas there is a significant dependency on groundwater for agricultural (irrigation) water needs, rural and urban water supply for domestic needs, especially in more frequent and prolonged droughts.

1.2 Groundwater resources users and increased vulnerabilities

In the recent past over-extraction of groundwater for production of high-value crops, such as coffee, has caused a severe drop in groundwater levels in parts of the Vietnamese highlands. The same is happening in the upstream part of the Mekong Delta (Cambodia) were rice production for export causes unsustainable use of groundwater[8]. Intensification of irrigation to meet the food demand of growing populations rapidly increases use of groundwater in all countries in the region. In some areas such as southern Cambodia, parts of Lao PDR and the Mekong and Ayeyarwady Deltas, naturally occurring arsenic contamination is already exacerbated by increased groundwater use and higher pumping rates. Climate change adds additional factors of groundwater recharge limitations. Groundwater supports valuable ecosystem services by feeding wetland ecosystems, valuable habitats of fish and aquatic plants contributing to food-security.

Intrinsic linkages between surface water and groundwater exist, but are not always clear. Incidentally, the system connectivity between surface water ecosystems (rivers and wetlands), larger watersheds, land use practices and groundwater is being recognized. In this context, it is critical that climate patterns and climate change realities are considered. These must be studied and the results taken into account in water allocation planning. Further expansion of irrigation, land use changes (deforestation) in the highland areas, increase of domestic and industrial use in expanding cities (capital and in the provinces) of the GMS may result in significant depletion of groundwater resources in the future, leading to reduced water availability, higher pumping costs, saltwater intrusion in coastal areas, and loss of ecosystem services. These effects will be exacerbated by the impacts of climate change (increasing demand, potentially reducing recharge) throughout the GMS. The full impacts of climate change on groundwater availability are likely to be complex and require further investigation.

[8] Erban, L.E., S.M. Gorelick, 2016; Closing the irrigation deficit in Cambodia: Implications for transboundary impacts on groundwater and Mekong River flow. http://dx.doi.org/10.1016/j.jhydrol.2016.01.072

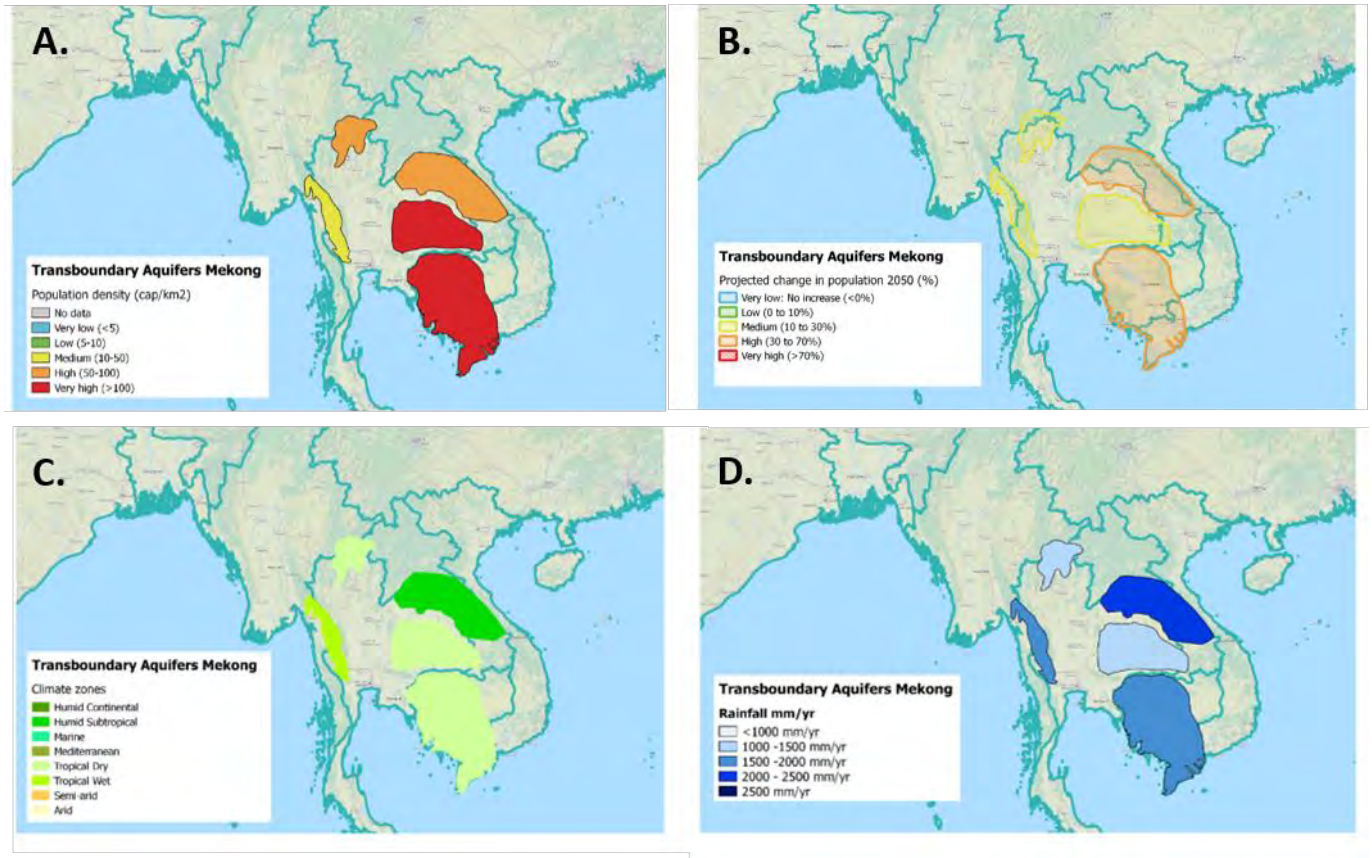


Figure 3: Overview of characteristics of the main Transboundary Aquifers located in the GMS and shared by Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. A. Population density; B. Projected change in population; C. Climate zones and D. Average annual precipitation. Data derived from the Transboundary Water Assessment Programme (TWAP), http://twapviewer.un-igrac.org).

Comprehensive groundwater management and specialized studies (dedicated monitoring, resource assessments) are a relatively new and underdeveloped domain, pertinently so in Lao PDR, Cambodia and Myanmar. In Thailand the Department of Mineral Resources-Division for Groundwater Management has, over the last decades, made substantial efforts to map groundwater resources (1:250.000 series hydrogeological maps / groundwater maps) throughout the country and conducted various regional and specialized studies. Besides major studies in the Bangkok metropolitan region and important work also was done in the drier northeast of the country (Isan region) where agriculture relies heavily on groundwater. In a similar mode, systematic groundwater mapping and studies in Vietnam have progressed since early investigations in Red and Mekong River deltas and development of expertise and capacity in central government agencies under the Ministry of Natural Resources and Environment (MONRE). Groundwater is now a recognized component in studies for provincial and municipal water supply and there is growing awareness on long-term supply and water quality issues (arsenic, salinity intrusion, pollution in urban areas). Unfortunately, the situation is very different in Lao PDR and Cambodia where groundwater is a rather neglected resource. Only gradually it is considered in national water, environmental and natural resources management policies and slowly some capacity is being developed.

Monitoring

The status of groundwater resources needs to be monitored regularly to provide a basis for their assessment and to estimate quantities and quality. Without appropriate data collection and assessment, there can be no effective groundwater management. Groundwater is monitored in many parts of the world by measuring its levels, abstraction rates, spring discharge and quality. Groundwater level point measurements are often interpolated and combined with other data (e.g. remote sensing and modelling) to assess the state of groundwater resources over a larger area. Increasingly, there is active involvement in groundwater monitoring by stakeholders and users (see for instance Akvo Flow; http://akvo.org/products/akvoflow/ for crowdsourcing approaches to data collection); this is of particular interest for this project. There is however, a lack of pertinent groundwater information at the regional and local scales, which hampers assessment and informed water management in general and the use and allocation of limited resources for specific purposes as intended in this project. Worldwide, organisations have taken up the challenge of setting up and supporting systematic collection of data and development of monitoring networks. One of these is the **Global Groundwater Monitoring Network** (GGMN) established and supported by IGRAC (www.un-igrac.org/ggmn).

The GGMN is an easy to use and versatile tool that provides access to and analytical capabilities for groundwater monitoring data. Groundwater data and changes occurring in groundwater levels (resource status) can be displayed on a regional scale. Additional data layers and information are available to understand the monitoring data in a broader water-related context. The web-based software application assists in the spatial and temporal analysis of monitoring data. The system is integrated with QGIS to process data offline. QGIS is an open source Geographic Information System that contains a variety of functionalities to analyse the data and create spatially interpolated GW level maps (see for instance: www.un-igrac.org/ggis). The tool can be used and filled with data for any specific area, and data analysis, output, maps and charts can be derived in accordance with user needs.

Ongoing groundwater and hydrogeological studies in the five countries by themselves are not sufficient to address water scarcity and food production vulnerabilities; a paradigm shift in groundwater management is required to come to a concerted effort to develop resilience based on comprehensively supporting supply-demand issues, both from resources (Supply perspective), as well as from water user and stakeholder perspective (Demand). Much more than in the past, groundwater experts need to be aware of user needs, and possibilities and constraints to sustainably use. At the same time, farmers, water supply managers, industrial plant managers and other users have to be informed and enabled about the (im)possibilities of groundwater use, surface- and groundwater co-management practices and other measures to support development of more resilient irrigation, food production and water supply systems. This paradigm shift can be illustrated on different levels, from very basic to strategic policy-making levels, by the use of more appropriate information products. Traditionally, hydrogeological or groundwater potential maps do not provide very clear or pertinent information to water users in different sectors (agriculture, industry, domestic water supply) who develop and manage water supply. In order to use the resource more efficiently, in view of increasing demand and scarcity, this can be improved. On a higher level, groundwater resources are now more commonly seen as an intrinsic part of the water system and correctly so; groundwater resources are of strategic importance for national agriculture and food systems, energy systems, ecosystem services, rural and urban water supply and obviously, evolving climate change adaptation (CCA) strategies. Hence, appropriate groundwater information is of strategic importance on a (supra)national level and particularly also for transboundary water issues (as in the GMS). In this project, focus will be on addressing water user needs in various sectors and jointly developing resilience measures, and on strengthening strategic groundwater management and transboundary cooperation.

Groundwater use

Across the GMS GW plays a major role to supply water for domestic, agricultural and industrial use, with a major share going to irrigation in rural areas and to industrial-domestic water supply in urban areas. Agricultural users commonly use surface water from streams and ponds as well as GW from shallow tube wells. GW is easily exploited by individual farmers due to general availability, quality and relative low development costs. Pavelic et al. (2015) describe different typologies of agricultural GW use in Myanmar Dry Zone; these are representative for the wider region.

- Deeper tube wells (larger farmers)
- Shallow tube wells and permanent (deeper) dug wells
- Seasonal dug wells in riverbeds
- Shallow dug wells and ponds for small extractions

Increasingly, GW is exploited, via deeper tube wells, in government-supported domestic water supply programmes for villages and smaller towns. These schemes are often hampered by poor management. Large scale irrigation schemes using GW have been developed with international technical assistance. Whereas normally large industrial water users would use surface water (sugar mills, cement factories), increasingly there are shifts to reliable, good quality GW.

1.3 Climate change scenarios and climate change impacts in the region

All GMS countries are vulnerable to the adverse effects of the existing climate and weather patterns; flooding and heavy monsoon rains are common but the region can also experience prolonged dry season droughts with pronounced and common water scarcity, with major impacts on the regional and national food security. The monsoon occurs from May to October, with heavy rains, high humidity and strong winds. From November to April is the dry season, with little rain, low humidity and not much wind. Total rainfall across the region varies from extremely high (up to 5000 mm annually) to a mere 700 mm per year in the central Dry Zone of Myanmar; with patchy evapotranspiration rates. These recurrent dry spells (in conjunction with population dynamics that happened already), constitute a constant threat to the livelihoods of the rural poor. The climate is influenced by the El Niño Southern Oscillation, which causes inter-annual variations, bringing warmer, drier winters in El Niño years and cooler than average summers in La Niña years. Temperature records show an increase in mean annual temperatures and the number of dry, hot days annually. Future projections suggest that these trends will continue, with the average annual temperature rising by 0.7-2.7°C by the 2060's and 1.4-4.3°C by the 2090's throughout the year (depending on the greenhouse gas emission scenario and the climate model used).

Climate models predict a minor increase in annual rainfall in the coming decades but with notable regional and seasonal differentiations. Generally speaking, it is expected that shorter and wetter rainy seasons will occur, with longer and drier dry seasons, and more anomalous seasonal events, such as the occurrence of short droughts during the rainy seasons. Together, these impacts mean increased uncertainty in the availability of water for domestic and agricultural users. Given that the climate will be increasingly variable, with more pronounced extremes, the impacts of climate change will be evident primarily through extremes in the water system, which have significant implications for different sectors and water users. (Johnston *et al*., 2010[9]).

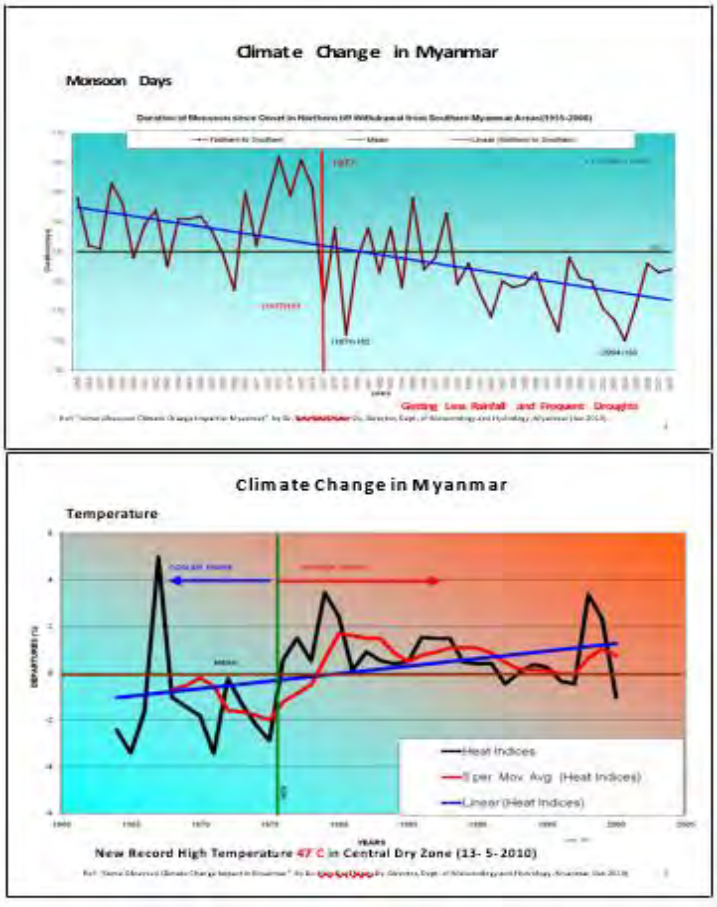


Figure 4: Climate change trends in Myanmar's Dry Zone: Rising dry season temperatures and shorter rainfall periods.

[9] Johnston, R., Lacombe, G., Hoanh, C.T., Noble, A., Smakhtin, V., Suhardiman, D., Kam, S.P. and Choo, P.S., 2010; Climate Change, Water and Agriculture in the Greater Mekong Sub-Region. International Water Management Institute Research Report 136

1.4 Transboundary resource management and regional cooperation

Climate change vulnerabilities are not bounded by national borders. Likewise, groundwater resources are crossing state borders, including in the GMS. Accordingly, both climate change related vulnerabilities and resilience measures involving groundwater resources have to be assessed and managed at the regional and aquifer-wide scale. Besides assessment of groundwater resources, the overall survey includes environmental, socio-economic and policy / institutional aspects. The proposed project, for shared aquifers, will foster information management, and international relationships, by initiating to set up an international cooperation mechanism.

Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, classifications, languages and/or technologies. Harmonized data and information should preferably be stored in an on-line Information Management System (IMS) along with outcomes of assessment and possible management scenarios. As such, it is a valuable tool in the joint, and science-based management of internationally shared aquifers. Moreover, contemporary IMS can easily store and combine info from various web-based sources, allowing analysis of GW resilience in a broader context of climate change (i.e. including surface water, land use, demographic predictions, etc.).

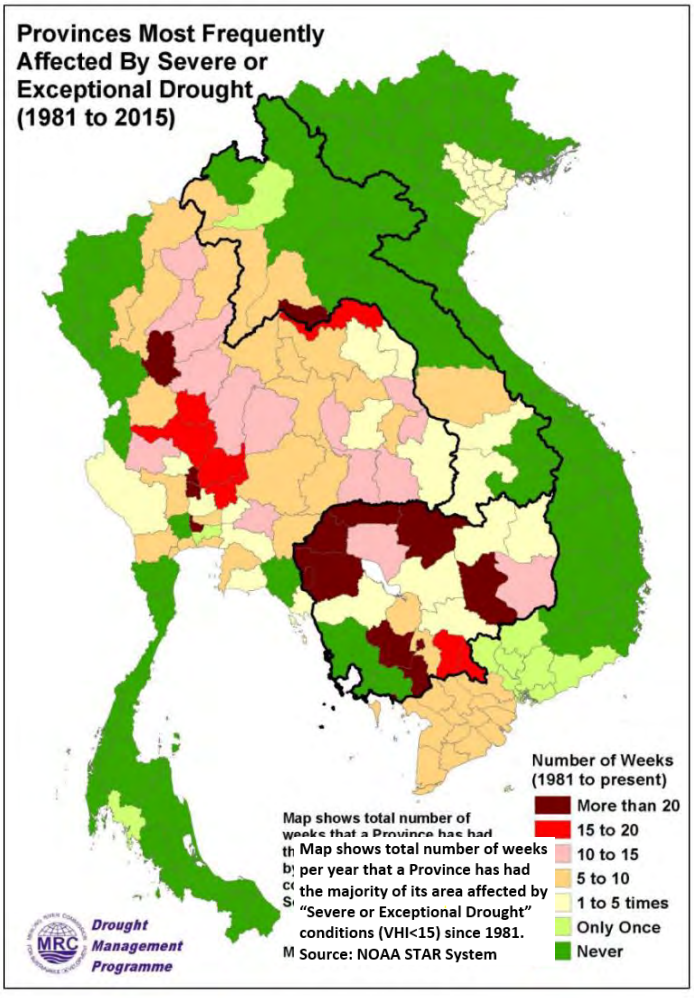


Figure 5: Regional impact of droughts (Source: MRC.org). With changing climate, the frequency of exceptional drought tends to increase (e.g. Vietnam's 2016 drought was recorded the worst drought in almost 100 years; (UNICEF, 2016[10])).

The project proposes to work in four pilot sites, including in the most vulnerable regions, such as the Vientiane Plains (Lao-PDR-Thailand, bordering Mekong River), the border area between northwest Cambodia and Thailand, the upper Mekong Delta region shared by Cambodia and Vietnam, and the Central Myanmar Dry Zone.

Role of Mekong River Commission

The Mekong River Commission (MRC) has built up a long track record in contributing to regional water resources management in support of broader socio-economic development and sustainable management of natural resources. The most recent MRC Basin Development Plans [11] provide a comprehensive, integrated water resources management-based framework. Unfortunately, with respect to groundwater issues the role and mandate of the MRC is less well documented.

[10] UNICEF, 2016. Vietnam, Humanitarian Situation Report #2, https://www.unicef.org/appeals/files/UNICEF_Vietnam_Humanitarian_SitRep_3_June_2016.pdf

[11] Integrated Water Resources Management-based Basin Development Strategy 2016-2020 For the Lower Mekong Basin, MRC.; http://www.mrcmekong.org/assets/Publications/strategies-workprog/MRC-BDP-strategy-complete-final-02.16.pdf

Logically, it could provide an initial platform for regional transboundary groundwater cooperation, for instance focusing on a number of priority issues, such as:

- Monitoring and data sharing
- Information sharing and a joint approach to deal with high arsenic and chemical element concentrations
- Inclusion of groundwater resource assessments and data monitoring in future Basin Development Plans
- Other associated and emerging challenges (groundwater, basin, eco-hydrology, resource management, population, SDGs etc.)

This project will develop the functionality and *modus operandi* that could, potentially, be transferred to MRC as a more permanent entity with a regional water resources advisory mandate in the GMS.

Integrated Water Resources Management-based Basin Development Strategy *(BDS)* 2016-2020 For the Lower Mekong Basin

Today, the LMB is home for 65 million people, 80% of whom live in rural areas dependent on agricultural livelihoods. Many are still poor, however, all countries are expected to have reached middle-income status by 2030. The Mekong contributes significantly to this growth through the opportunities it provides, including water and waste-water services, energy, agriculture, fisheries, transport and trade, and ecosystems services. However, without coordinated development and effective management, the Mekong can also threaten continued growth through the risks that it brings, including the risks of floods and droughts, the deterioration of water quality, the reduction of sediment loads, and the overall deterioration of ecosystem services and biodiversity. The BDS 2016-2020 recognizes these trends, takes a long-term outlook, and examines longer term water resources development needs. It is assessed that the current national water resources development plans are sub-optimal from a basin-wide perspective. These plans fall short in protecting key environmental assets and protecting millions of increasingly affluent people against major floods (and droughts and other climate change parameters). Finally, the distribution of the benefits, impacts and risks from planned basin development are not equitably distributed.

Figure 6: The recently published Basin Development Strategy (MRC, 2016) focuses on the Mekong River basin surface water resources, while there is increasing awareness that a significant share of water needs for irrigation agriculture, domestic and industrial water supply are met by supplies from groundwater sources. Obviously, surface and groundwater systems are intricately linked, in particular when it comes to addressing the impacts of climate change. This project aims to develop explicit resilience potential on the basis of improved groundwater management, in conjunction with the regional development ambition.

Even though the transboundary cooperation in surface water management has progressed, there is no common approach, recognition and cooperation for groundwater resources. The challenges in river management (resource sharing, impacts of river management and hydropower development, climate change, etc.) are equally valid for groundwater resources and their diverse users. The absence of a sizeable community and cooperative network of groundwater experts in the GMS severely hampers addressing these issues, in particular in Myanmar, Lao PDR and in Cambodia, where local capacity in hydrogeology is very limited. Regional cooperation in the ASEAN Economic Community offers an opportunity to tackle these challenges.

Information Management Systems for Transboundary Groundwater

The Global Groundwater Information System (GGIS) is an interactive, web-based portal to groundwater-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on groundwater resources and the sharing of this information among water experts, decision makers and the public.

IGRAC has provided Information Management Systems (IMS) to a variety of groundwater projects. Those IMS are designed to store interpreted and processed data from the assessment of the groundwater resources in order to be used as a tool to support decision makers and to create transparency between the (international) stakeholders. The project IMS can and will be set up in such a way that they facilitate sharing of data between project partners only, and/or with the general public.

A new IMS will be developed, and, pending on the outcome of member State discussion during a project validation workshop, as a stand-alone application or, if preferred, further integrated with existing modules available in the GGIS. This will allow for shared information systems among the participating countries (and observers). This, in turn, will facilitate joint management and better groundwater governance focused on coordination, scientific knowledge, social redress and environmental sustainability.

GGIS Portal capabilities:

1. Store variables, thematic maps and documents.
2. Visualize geospatial data and information in a map viewer.
3. Share and analyse results in a protected environment before making it publicly available.
4. Add map layers from external sources via web map services (WMS).
5. Generate new pieces of information by creating overlays of thematic maps.

Meta Information Module
Maps are an excellent tool to communicate spatial data and information, and metadata related to the map layers is of equal importance. Therefore, the GGIS also contains a meta-information module which allows uploading, storing and searching of additional information linked to the data presented in the system, like documents or references.

1.5 Knowledge and information gaps

There is limited and regionally incoherent information on groundwater resources of the GMS, in particular the kind of insight required to deal with pressing issues, such as:

- Extent and/or characteristics of superficial and confined aquifer systems, including useable resource volumes in aquifers systems in the GMS, existing and/or potential water quality threats.
- Current groundwater volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply.
- Relationships between recharge in highland (upstream) areas and resource potential in lowland (downstream) areas. This includes the groundwater dynamics of several important transboundary systems. Climate change, land use changes, watershed eco-system changes, demand changes, socio-economic changes including, and major interventions in the river systems (dam and reservoir construction, upstream water diversion and flow regulation) will affect these delicate balances in supply and demand. The relationships are not known.
- Sustainability (in view of increasing abstraction) of groundwater resources due to climate change and change factors (natural or anthropogenic).

To understand better the resource and resilience potentials and vulnerabilities of GW systems of the GMS, detailed hydrogeological investigations are required. Crucial groundwater monitoring data are needed to keep track of resource status and detect possible critical depletion, for developing and using regional groundwater information systems and for understanding transboundary groundwater flows. These regional (transboundary) models and information tools will help manage and conserve resources. It is therefore also necessary to:

- Visualize (in maps) regional and transboundary GW (recharge and extraction) systems and enable assessment of GW recharge rates from flooding and rainfall under the current and future climate conditions.
- Determine GW resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience.

1.6 Capacity building

The regional landscape of GW management capability and expertise is rather diverse. Especially in Lao PDR, Cambodia and Myanmar integrated and comprehensive GW management and specialized studies are rare, mainly due to a lack of well-trained and experienced experts. At the same time, the recognition of GW as a key natural resource is beginning to reach higher policy levels in government. Fortunately, the situation has been very different in Thailand and Vietnam where GW work took off decades ago and became part of natural resources and water agencies' mandates. Subsequently, also professional training and research activities took place. In Thailand, there is a fairly good understanding of the most important national GW resource systems, viz. those underlying the central-north Chao Praya plain and metropolitan Bangkok, and more diverse and problematic aquifer systems in the northeastern Isan region. In this region, irrigated agriculture relies significantly on GW and now there is a considerable number of well-trained hydrogeologists and irrigation experts that know how to deal with GW. In Vietnam, agricultural development work in Red and Mekong River deltas has resulted in a fair degree of capability in central government agencies in the north and south of the country. In a growing community of experts, there is increasing awareness on the need to develop expertise on a number of challenging issues, like long-term urban water supply and water quality issues (arsenic, salinity intrusion) and, more recently, integrated water resources management (IWRM) to ensure the sustainability of the highly productive agricultural systems in both the Red river and Mekong River delta. Both from government and academe in Vietnam there is ongoing and high-level awareness to further develop human resources capacity through higher education and participation in national and international research. There is also a willingness to engage and collaborate with neighboring countries.

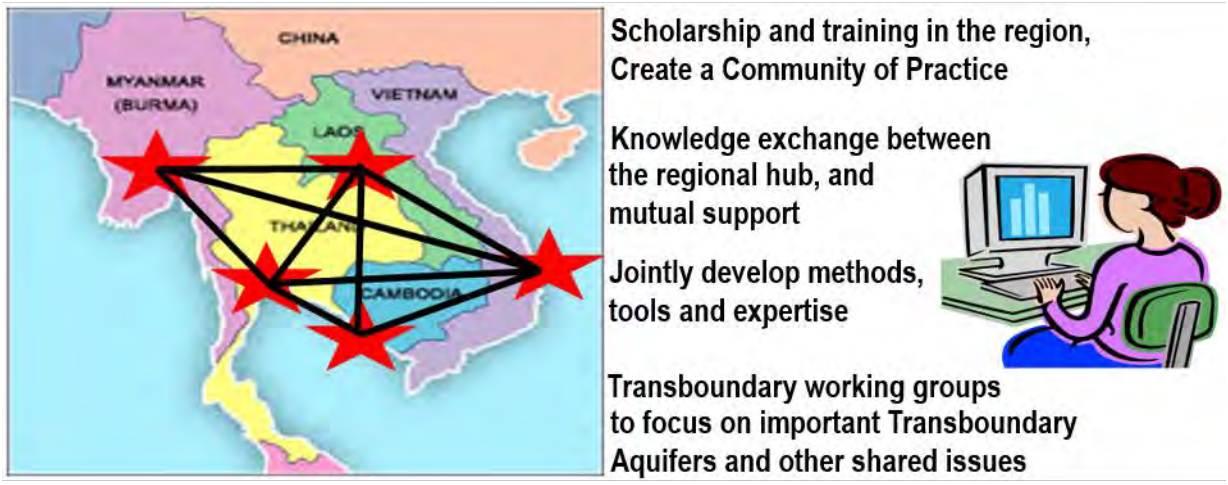


Figure 7: Regional cooperation will improve coherence, sustainability and embedding of project outcomes. It will also be the foundation for capacity building and knowledge transfer in the project.

This project will make use of the professional and political momentum (the processes that are part of the drive for ASEAN economic integration and cooperation) to build a GMS community of cooperation for capacity development in GW management. Strengthening of capabilities can take place throughout the region, but will be most explicit in the three countries most in need, i.e. Lao PDR, Cambodia and Myanmar. It will start with a verification and inventory of basic GW relevant skills and practical knowledge and general information on the size and qualifications of the practitioners, and their institutional context. Subsequently, capacity building efforts will be directed towards at least three generic issues:

1) Supporting capacity development of groundwater professionals towards better understanding and apprehension of new technologies that need to be engaged to ensure groundwater-based solutions and support for climate resilience. Examples are understanding and application of IWRM principles, (ground)water governance, groundwater monitoring and information systems, issues of transboundary groundwater management, new concepts and technologies like managed aquifer recharge (MAR), co-management of surface and GW, stakeholder involvement for data collection.
2) Enhancing the skills and understanding of GW stakeholders. GW professionals should practice and be aware

of the fact that the resource with many stakeholders; farmers need irrigation water, rural communities and towns need water supply for domestic use, industries and mining operations need process good quality water, and GW is intricately linked with other valuable ecosystem services. Comprehensive and good GW studies and management should cater to all these interests and wide diversity of stakeholders. All these stakeholder groups can also develop climate resilience measures through responsible and forward-looking GW use. This will be explicitly addressed in Components 2 and 5 of the project.

3) In order for this approach to be successful, it is also necessary to have better awareness and understanding at higher policy levels. First, an assessment will be undertaken of the basic responsibilities and tasks for GW management as an important resource are in place on national government level. Second, policy development and linkage to other sectoral policies can be supported and broadened to explicitly include issues of climate resilience, sustainability and vulnerability reduction through more active GW management. Political awareness will be built up.

The project will follow a regional approach so that countries with a relatively advanced position (viz. Thailand, Vietnam) can take a leading role, share experience and lessons-learned. Additional international expert support will be provided. The project will organize and conduct a number of training workshops, with regional participation (Component 5: Training Activities: see Part II, Section A, Component 5). The degree in which national and/or regional specialized training is available will be assessed and collaboration opportunities set up. Where useful training courses are offered, project participants will be selected and invited to enroll.

The project will generate important data, information, knowledge and linkages. It is intended to facilitate these functional linkages by means of an on-line knowledge management and information repository. First, the functionality will be built-in in the project website, but gradually expanded to become a dedicated information and resources sharing tool.

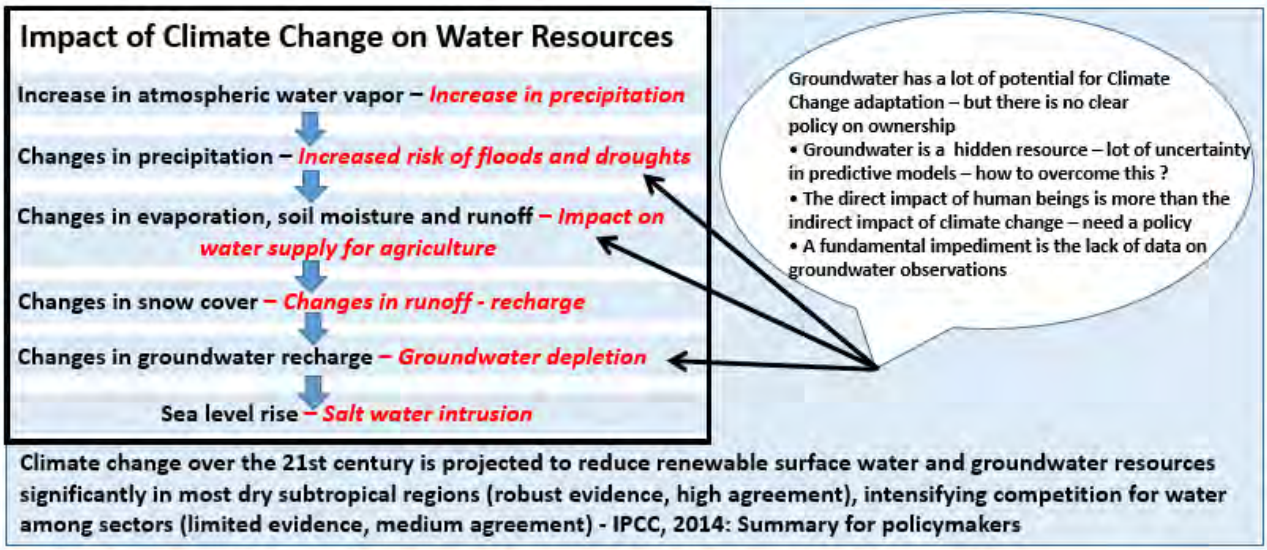


Figure 8: Earth and water resources systems are affected by the impacts of climate change. By virtue of its intrinsic properties the GW system has considerable resilience that can be developed and used to benefit water users and other stakeholders. This needs to be done with the utmost care, resource depletion following unsustainable use and mismanagement (because of a lack of guiding / monitoring data) are serious impediments.

1.7 Promoting gender equality

The project takes a pro-active approach to gender issues. This approach is reflected in the project design through the inclusion of activities that emphasize community engagement and participation, as well as knowledge sharing and exchange with communities and women's groups. Activities will be tailored to the specific context and needs in each of the pilot areas (pilot area-specific interventions). The project will maintain an active focus on SDG 5 (Gender Equality) targets, and will monitor progress as part of its Environmental and Social Management Plan (see Part III, Section 3).

Sustainable Development Goal 5: Achieve gender equality and empower all women and girls

The project makes a focused contribution to SDG5, in particular towards the following targets:

Target 5.4: aims to recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.

Target 5.5: aims to ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.

Target 5.7: aims to undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.

Target 5.8: aims to enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

Ensuring access to clean and safe water from groundwater sources for women and girls will significantly contribute to achieving the above goals and targets, especially in the participating Least Developed Countries (LDC) Cambodia, Lao PDR and Myanmar, where more than 25% of their population have limited access to basic drinking water and sanitation services; this percentage is higher in the selected pilot areas.

This proposal explicitly emphasizes the participation and accrued benefits of women and girls via active, engaged and balanced participation of women in all interventions suggested in this proposal, such as:

- Balanced participation of women during initial project workshops, and collecting input from women experts during the project inception phase.
- Pro-actively encouraging participating governments and national partners to include women in their project teams and in the communities of practice, both locally as well as nationally .
- Balanced women participation in project activities, such as setting up and managing the Information Management System IMS (IT capabilities), designing and carrying out groundwater and other field surveys/assessments (field work).
- Ensure participation of female experts in the project ICT and data components (user interfaces of IT systems, websites, data collection questionnaires, etc.).
- Ensure gender-balanced participation in expert meetings, advanced and community-based training sessions.
- Promote the recognition of (ground)water related work and services performed by women as an essential element of climate resilient water supply and use systems.
- Ensure gender-balanced representation in the project's Steering Committee

1.8 Outlook

Overall, the project aims to enhance the resilience potential of improved and regionally coordinated groundwater management and demonstrate that it can provide effective tools and capacities to reduce vulnerability. To enhance adaptive capacity and reduce climate change vulnerability for specific target groups, the project will focus on implementing the following activities:

- Use the upgraded collective expertise and awareness of the groundwater community regarding CCA and resilience strategies to ensure that further work in the groundwater sector better supports the needs of vulnerable user groups.
- Demonstrate, further develop and ensure that information is available on the 'resilience potential' of improved groundwater management and use (i.e. through collaborative transboundary aquifer management)
- Identify additional new vulnerability reduction options, develop these and share practices with relevant vulnerable groups (i.e. enhanced aquifer recharge practices that use wet season water surplus to create dry season reserves. These will be set up in cooperation with local stakeholder groups and under intraregional CCA initiatives).
- Ensure that new and innovative groundwater management information products specifically cater to the needs of the identified and targeted vulnerable groups (for instance using smart phone networks to distribute and collect information).
- Train a new generation of GW experts to think beyond the technical challenges of the physical GW system and ensure that they recognize and can respond to the multi-disciplinary and multi-sectoral nature of GW management, and are therefore able to engage with a wider range of stakeholder groups to resolve vulnerability issues and increase sustainable water use.

The project aims to enhance climate change resilience via better groundwater management, capacity, and sub-regional cooperation. This requires a range of mutually supporting interventions and activities at different levels. These include:

- Organize a regional project validation workshop and annual interim workshops to provide guidance for implementation and ensure effective feedback mechanisms;
- Set up groundwater monitoring systems in the four pilot areas;
- Develop a common approach to - and setting up - a Groundwater Information Management System (IMS)
- Implement surveys/assessments to collect data on groundwater and related topics;
- Establish education and information centers in each pilot area through which to provide expert training, and community group awareness activities; and
- Provide training on groundwater and nature-based solutions, including train-the-trainer, train-the-teacher, and community-based training in collaboration with relevant governmental bodies, local authorities and stakeholder groups;
- Carry out groundwater skills, knowledge and capacity inventories;
- Ensure sustainability of project results and deliverables by cultivating ownership and capabilities among local and national partners.

2. Project Objectives and Outcomes

2.1 Project objectives

The main project objective is derived from a sequence of relatively simple and straightforward concepts. In reverse hierarchy, these are:

- There are excellent opportunities for regional cooperation and coordination to address climate resilience and mitigate threats from droughts and water shortages for food security and rural/urban livelihoods
- Groundwater (a "hidden resource") as an important component and integral part of the water system but is insufficiently considered in general IWRM policies and national CCA strategies
- National groundwater management expertise (from capable to very weak) needs to be developed further. National expert groups in some countries are not yet specifically oriented towards the potential of groundwater to contribute to climate resilience and vulnerability reduction.
- There is a fundamental need to develop closer relationships between groundwater user groups and their urgent water needs for food production (irrigated agriculture), for sustaining rural water supply and other water demands, and the groundwater expert community in order to improve groundwater management and long-term sustainability and address priority needs from different end-user groups.

Bringing these considerations together, the following major objective is obtained:

Establish effective regional capacities, partnerships and network in the Greater Mekong Subregion (Vietnam, Lao PDR, Cambodia, Thailand, Myanmar) for the sustainable management and utilization of groundwater resources as an adaptation response to protect people, livelihoods and ecosystems from climate change impacts.

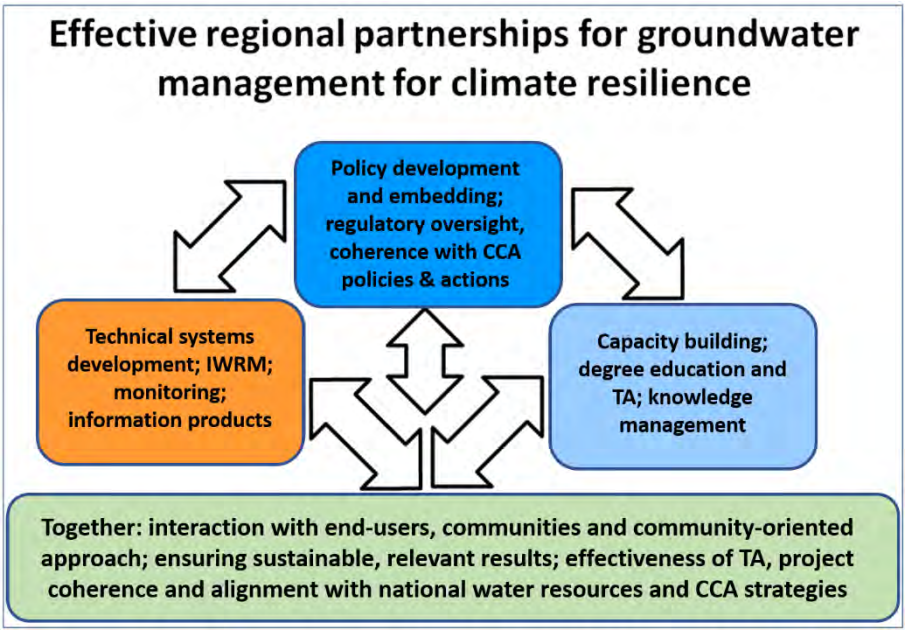


Figure 9: Departing from traditionally rather technical studies of the GW physical system (red box), with little awareness of the "demand" side (i.e. GW users), the project aims to connect GW professionals in the five countries with the current policy context of IWRM, integrated resource management, and resource use (blue box) to address sustainability issues and CCA – vulnerability reduction. In the GMS, there are excellent opportunities for collaborative capacity building and knowledge management (green-blue box to the right). The foundation for successful intervention and technical assistance (TA) lies in engagement with the GW end-users (bottom green box). Together with the different user groups (different users – different needs) CCA and resilience measures will be developed on the ground, and with recommendations for general guidelines and policy. Regional cooperation will also enable addressing transboundary issues.

Specific objectives are:

- Prepare an updated groundwater shared aquifer inventory for the GMS countries, develop resource management concepts and tools and a monitoring network for GW systems;
- Understand GW recharge processes and formulate recommendations for protection and long-term sustainable management;
- Address issues of transboundary groundwater management also as an incentive to develop collaborative solutions and;
- Increase participation of stakeholders by implementing principles of groundwater governance through 1) dialogues with users to assess groundwater use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, population);
- Develop and implement targeted groundwater vulnerability reduction measures, groundwater quality improvement, identification and protection of strategic groundwater reserves;
- Build capacity and raise standards for groundwater practitioners across the GMS countries and initiating regional water cooperation (diplomacy).
- Obtain high-level agreement on climate resilience through strategic planning for groundwater resources.

2.2 Project outcomes

The main project outcomes are defined in conjunction with the five main components:

Outcome 1: Groundwater resource assessment and monitoring: A regional GMS approach to address challenges of climate change and resilience is developed and operationalized, based on an information-based policy.

Outcome 2: Priority use and stakeholders: Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.

Outcome 3: Resource management, information tools and equipment: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized in a gender-balanced approach.

Outcome 4: Regional cooperation, coordination and information exchange: A regionally coherent policy for sustainable groundwater management in support of CCA is adopted, based on a level playing field among all users in the GMS.

Outcome 5: Capacity building and training: GMS stakeholders capably use project tools towards groundwater use for CCA and resilience.

These five outcomes will be achieved in the four pilot areas as a cross-cutting, transboundary result that will **significantly strengthen the local capacity of primary stakeholders to address climate resilience issues across the region**. Implementation of project activities in the four pilot areas will be guided by the project's cross-cutting objectives and will enable the joint generation of resilience deliverables on the ground.

2.3 Contribution towards the SDGs

The project makes a distinct and measurable contribution towards the 2030 Agenda and the Sustainable Development Goals. A particular contribution is made towards SDG13 on Climate, SDG6 on Water and Sanitation for all, as well as SDG5 (Gender Equality), SDG11 (Sustainable Communities) and SDG17 (Partnerships and collaboration). However, through the project's contribution towards improved management, data collection, capacity development, knowledge dissemination and community participation related to groundwater issues, climate change and ecosystem management, contributions are made across a broad spectrum of the Goals, as summarized below.

SDG 1 No poverty
The project contributes to reducing the number of people living in poverty, by enhancing clean water availability and food security, and providing water resources for economic purposes / livelihoods. The project contributes significantly to enhance resilience of communities in poverty to climate change-associated environmental shocks and disasters.

SDG 2 No Hunger
The project contributes to achieving food security by ensuring sustainable supply of groundwater for food production, domestic needs and livelihoods.

SDG 3 Good health and well-being
The project ensures improved standards for groundwater quality including monitoring on arsenic and other pollutants and by ensuring groundwater availability for domestic use to contribute to reducing threats of water-borne health risks.

SDG 4 Education
The project targets and supports community groups (women, men and young adults) to develop basic skills and awareness about groundwater/water use related topics. In the four pilot areas, a community-of-practice will develop and disseminate knowledge and guidelines for improved groundwater management.

SDG 5 Gender
The project fosters gender-inclusion and the empowerment of women and girls, as detailed under 'Promoting Gender Equality' (see section 1.7 above).

SDG 6 Water
The project contributes significantly to SDG 6 targets by enhancing the knowledge, skills and overall capacities (including resource assessment, policy development, training and demonstration) to manage groundwater and conserve resources for priority use, to reduce water wastage, stimulate water conservation and re-use, improve water use efficiency, reduce water scarcity and improve understanding of (ground)water-ecosystems linkages.

SDG 11 Sustainable Communities
The project contributes to more sustainable communities through awareness and involvement (participatory planning & management) in resource management and use.

SDG 12 Sustainable Production and Consumption
Project interventions contribute to ensuring that people in the pilot areas have access to relevant information and enhanced awareness for sustainable development and lifestyles in harmony with nature, including the management of groundwater resources.

SDG 13 Climate
The project significantly enhances resilience and adaptive capacity against climate change impacts at all levels through the full suite of project activities including training, knowledge availability and application of best practices, fostering the human capacity for climate-change-impact-reduction. Implementation of the project will not generate any negative climate impacts.

SDG 15 Life on land
The project contributes to improved understanding of fresh (ground)water-ecosystem linkages, engages in water-ecology assessments, wetland utilization (as protected recharge areas), develops and engages in conservation supporting measurers, and supports the application of nature-based solutions.

SDG 17 Partnerships for the Goals
The project contributes to the mobilization of financial resources and local partner commitment to regional cooperation to further the SDGs; it enhances south-south cooperation between five participating countries on

natural resources management and knowledge sharing; and promotes the transfer of environmentally sound technologies to low-income countries while focusing on vulnerable groups.

3. Project Components and Activities

3.1 Overview

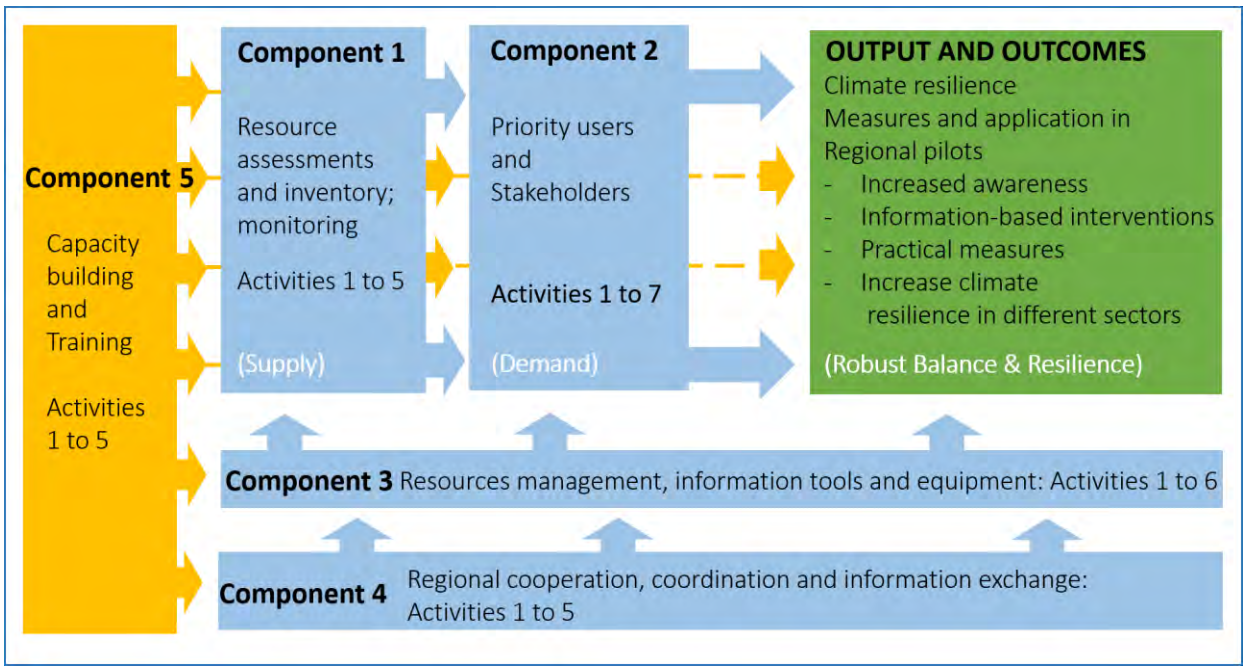


Figure 10: Schematic presentation of the project structure (four main "technical" components and one cross-cutting component for capacity building) and intervention strategy that will result in climate resilience in four regional pilots on the basis of a robust balance between groundwater supply and demand.

3.2 Regional pilots

The project activities as elaborated in the next sections will be implemented in four regional pilots. In each pilot, the same activity format will be applied, considering local circumstances. The aim of the project is to enhance climate resilience in all pilot areas. The results can be multiplied across the region and used as case studies, by the national Governments and/or the MRC. This is expected to generate a multiplier effect and long-term multilateral cooperation. The proposed pilot areas are:

1. Lao PDR – Thailand (Mekong river riparian aquifer systems (Lao PDR, Thailand, and possibly Cambodia); The Vientiane Plains, Lao PDR and adjacent aquifers in Thailand will be the priority area. Other areas like the Southern Lao PDR Pakse region (Lao PDR – Thailand – Cambodia TBA) can also be included.

2. Vietnam – Cambodia (Upper Mekong Delta Transboundary Aquifers. Mekong Delta aquifers in Vietnam are intensively used and contribute to the high productivity agri- and aquaculture systems in the entire Delta. It is assumed that major recharge takes place in the upper delta region in Cambodia, but this TBA system is poorly understood and there is little qualitative data.

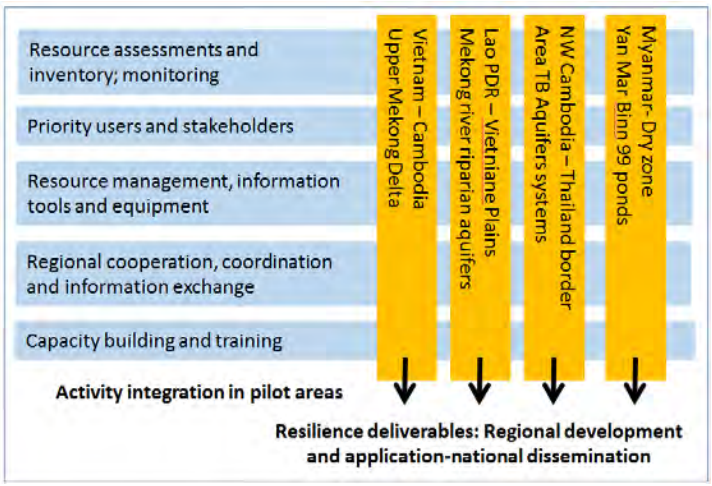


Figure 11: Project structure and activity integration in the proposed pilot areas.

3. Cambodia – Thailand (North-West Cambodia – Eastern Thailand border area)**.** Transboundary aquifers in drought prone area with vulnerable rural population. Groundwater potential is essential to support food security / rural water supply and demand from tourism sector.

4. Myanmar Dry Zone (Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area). The Dry Zone is one of Myanmar's most vulnerable areas to climate change. The selected area is characterized by intensive groundwater use, for both domestic and agricultural irrigation. There is increasing concern amongst farmers and water managers about availability of water, among others because of poor management.

Scope of Activities in the Pilot Areas

The activities proposed in the pilot areas are intended to deal with priority climate resilience issues in each area, and have a high degree of relevance to other areas with comparable physical and socio-economic characteristics in the region. Collectively, the interventions in the four pilot areas have been designed and will be further detailed to contribute to the five main outcomes of the project (1. resource assessments and information survey; 2. engagement with groundwater users, 3. IMS, inventories and tools; 4. regional cooperation, and 5. training & capacity building).

Pilot area 1 focuses on the Mekong River riparian and transboundary aquifers-Vientiane Plains, Lao PDR. In the first activity, a groundwater management plan would be elaborated. This would be the first for Lao PDR, capitalizing on the increasing interest in GW resources in the country. It will be one of the major tools to support planning and decision making for the pilot area and serve as a model for other parts of Lao PDR and possibly also adjacent parts of transboundary aquifers in Thailand. This activity is divided into various tasks: (i) carrying out an inventory of the existing wells and GW use across the various districts of the Plains; (ii) consultations with a broad range of stakeholders including government officials across relevant sectors, the private sector, NGOs, and the community; (iii) tailoring regulations in consultation with local authorities and other stakeholders and (iv) awareness raising through dissemination of project findings through communication material tailored to specific stakeholders. To better serve the planning, a numerical GW flow model would also be developed and validated with field measurements and used for scenario analysis. The model would explore a range of possible development scenarios including those identified by stakeholder consultations to ensure sustainable GW management can be achieved. The opportunities for so-called bottom-up approaches to GW management processes would be explored by assessing community perceptions and interest in participatory GW management and identifying relevant entry points to compliment traditional top-down approaches.

Pilot area 2 focuses on the Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia). The first activity would involve setting up a joint GW monitoring system between Vietnam and Cambodia. Through this collaborative exercise, the GW monitoring capabilities of the Cambodian counterparts in particular would be improved. An inventory of GW infrastructure would be prepared and GW use estimated for the various aquifer units and sectorial uses. The undertaking of these activities will form the basis for dialogue and awareness raising amongst the main stakeholders on key issues related to transboundary aquifer management and interactions between the surface water and GW systems. The information and discussion generated also serve to identify potential resilience enhancing measures in the context of transboundary integrated surface-GW management. For instance, 1) Who are the most important stakeholder groups that stand to benefit, in terms of climate resilience, from improved and more active GW management; 2) To what extent is serious GW depletion occurring and can this be reversed; 3) Would any GW vulnerability reduction measures (such as Managed Aquifer Recharge (MAR)) contribute to increase GW resilience effectively?

Pilot area 3 focuses on the Northwest Cambodia – Eastern Thailand border area. The first activity to be carried out would be a joint GW resource assessment, recognizing that greater efforts are needed on the Cambodian side where very little is currently known. From the Thailand side of the border, useful lessons-learned and existent GW management practices can be adopted. A basic monitoring system would be established and necessary training to relevant agencies provided to support improved GW management capabilities in Cambodia. Through dialogue with the main stakeholders, the potential to increase GW use in support of food production and rural water supply would be explored and the best possible evidence-based case for sustainable development determined. A joint

task force would be setup to develop resilience enhancing measures in the framework of integrated surface-GW management.

Pilot area 4 focuses on Myanmar: Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area where a GW resource assessment and study of the recharge dynamics would be the first activity leading to GW management planning (inventory of GW infrastructure and use, stakeholder consultations, GW regulations). These would dovetail into participatory-based planning and implementation of well capping and monitoring program in artesian areas to ensure the sustainability of supplies. When these initial stages have been completed, more advanced management practices will be introduced, very much like in the Lao PDR-Thailand pilot (see above).

Project activities will be implemented in each of the four regional pilots, applying the same activity format, adjusted to suit local circumstances.

Joint activities covering all pilot areas:

- Organize a sub-regional project validation workshop and annual interim workshops (for example within the Tonle Sap UNESCO Biosphere Reserve or other suitable locations in one of the pilot areas);
- Organize a sub-regional policy development meeting with five participating countries and possible participation by stakeholders as observers;
- Establish an Information Management System (IMS) for groundwater resources and groundwater use;
- Carry out data collection, analysis, reporting and entry into the IMS, ensure there is a plan to sustain its use after the project;
- Carry out groundwater skills and knowledge capacity inventories, needs assessment, and training;
- Hand-over the project from UNESCO to the national partners and possibly MRC after project completion.

Activities to take place in each of the pilot areas:

- Carry out groundwater surveys/assessments (and produce associated reports and maps);
- Carry out information surveys on (ground)water demand and use in different sectors (agriculture, domestic, urban, industry), and produce reports and maps;
- Provide training on groundwater monitoring, management and sustainable use, also covering concepts of recharge (MAR) and including train-the-trainer, dissemination to communities (all in close collaboration with relevant governmental agencies, local authorities and groups';
- Establish a simple groundwater monitoring system, in each of the four pilot areas, following a participatory approach and ownership by users.

Integration of all project activities in each pilot area will stimulate a balanced and output oriented way of working, without undue focus on specific studies or research. In each of the pilot areas the project will generate specific and stakeholder-oriented, practical climate resilience measures, such as increased public awareness, information on groundwater resource potential, and groundwater system data and monitoring information results, in order to propose tailored and information-based interventions (See also Annex 1, where the resilience measures are further specified). Three of the four areas will include working in challenging transboundary aquifer systems and developing bilateral or multilateral cooperation. The available information from the different regions indicates the anticipated climate resilience measures can be targeted to different sectors. In all pilot regions, stakeholders include a significant number of high-vulnerability groups.

3.3 Pilot areas description

The following section provides a general overview of the characteristics and salient properties of the proposed pilot areas. The project will focus on the stakeholder groups in these areas; farmers, groundwater users in villages and small towns, small industries or other activities that rely on groundwater. General information is provided in Table 2 and Annex 1. Project activities will be designed in such a way that vulnerabilities will be addressed and climate resilience strengthened in each pilot area and for specific stakeholder groups, as follows:.

- Local[12] authorities (village, municipal, district and provincial level)
- Local, regional and national groundwater specialists and professionals in government agencies and academia;
- Local, regional and national groundwater specialists and professionals in the private sector and agriculture
- Farmer's groups;
- Representatives from small or larger industries that operate in the area;
- Community groups, with representatives of ethnic minorities (if any), women and youth.

A more comprehensive elaboration of the problem analysis and intervention logic for each of the four pilot regions is provided in **Annex I.**

[12] "Local" refer to people from within the pilot area; regional: from within the pilot area and relevant adjacent locations

Table 1: Overview of pilot area characterization (see also Annex I).

	PILOT AREA 1 Lao PDR-Thailand	PILOT AREA 2 Vietnam-Cambodia	PILOT AREA 3 Cambodia-Thailand	PILOT AREA 4 Myanmar Dry Zone
Location	**Vientiane Plains** with the Mekong River riparian aquifer systems, including Lao PDR, Thailand, and Cambodia	**Upper Mekong Delta** transboundary aquifers in Vietnam and Cambodia	**North-West Cambodia – Eastern Thailand** border area	**Central Myanmar Dry Zone**
Precipitation /Climate zone	2,000 mm/yr Tropical Dry	1,700 mm/yr Humid Subtropical	1,400-2,000 mm/yr Tropical Dry	800-1,100 mm/yr Tropical Dry
Population density and projected growth	Average to high	Very high	Average	Average
Major land use	Paddy, vegetable crops, forest, urban	Paddy, vegetable crops, cities and villages	Paddy, vegetable crops, forest,	Paddy, vegetable crops (smallholders)
Aquifer type	Alluvium bounded by sandstone on margins and at depth	Alluvium, at depth older, semi-consolidated river deposits (sand and clay)	Thin alluvium, sandstones	Artesian system. Cemented sand and gravel overlain by sand to clay alluvium
Recharge rates	200-400 mm/yr (approx.)	Vietnam: 300 mm/yr Cambodia: not known	Thailand: 200 mm/yr Cambodia: not known	Not known
Interactions with surface water	Groundwater drains to rivers which are affected by hydropower schemes; infiltration from small reservoirs and ponds	Groundwater recharge from river channels with high/low seasonal flow; infiltration from small reservoirs and ponds	Recharge from small rivers, ponds, small reservoirs; Groundwater drains to rivers and Tonle Sap lake (UNESCO Biosphere Reserve)	Groundwater recharged from rainfall in ranges to west, and possibly seepage from Yama dam
Current abstraction	Relatively low (based on the available data)	High to extremely high, deep tube wells and shallow wells	Low (Cambodia) and modest to high in Thailand	High – >1,400 tube wells
Major purposes for abstraction	Domestic, emerging agriculture, small industry (packaged water, salt production)	Irrigation, village supply, city water supply, minor industry	Small scale irrigation, village supply	Irrigation, village supply
Water quality	Good; salinity (natural), some organic contamination	Good, some concern about arsenic levels, pesticide etc. pollution from surface water	Good, some concern about arsenic levels, microbial pollution at groundwater points	Generally good (possibly some problems with salinity in the upper aquifer)
Transboundary issues	Recharge from Mekong River and connectivity with adjacent Thai aquifers	Integrated resource management by Cambodia – Vietnam authorities; recharge from Mekong River (floods); pollution threats	Contrast between Thailand and Cambodia regions in utilization of resource; very limited management in Cambodia	There have been no dedicated studies for TBA assessment.
Major issues/threats groundwater for climate resilience	Expansion of groundwater use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifer	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.

Each of the four pilot areas is located in a transboundary and/or important groundwater region (Myanmar). Relevant statistics of these areas are provided in the table below. Based on these data, project beneficiaries number a minimum of 5 % and maximum of 10 % of the total population, adding up to a total of around 2 million people. This number of direct beneficiaries may vary across the regions. Clarification of column headers is provided on the next page, below Table 2.

Table 2: Relevant statistics for the pilot areas.

1. Pilot area	2. Provinces-districts	3. Population	4. No. of project beneficiaries	5. Vulnerable groups	6. Issues and threats	7. Economic benefits	8. Additional comments
1. Lao PDR - Thailand			Around 8-10 % 175,000	Mixed peri-urban and rural population; low & middle income households, farmers	Expansion of groundwater use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Improved access to water for domestic use→ lower cost of living; increased irrigated agriculture; → food supply ensured → higher incomes	Social benefits include reduced time spent by women & children in collecting water; environmental benefits for streams and wetlands supporting habitat and livelihoods
Lao PDR	Vientiane province	419,000					
	Vientiane Cap. Region	821,000					
Thailand	Nhong Khai	517,000					
2. Cambodia - Vietnam			Up to 10 %, mostly rural 878,000	Predominantly rural population; low & middle income households, farmers; water users in provincial towns	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifers	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	In Cambodia % of villages with access to water through tube/pipe water wells is 80 %; % of villages exposed to drought and/or food shortage in the five years prior to census was 38 %.
Cambodia	Takeo	845,000					
	Kandal	1,265,000					
	Prey Veng	947,000					
	Svay Rieng	483,000					
Vietnam	An Giang	2,143,000					
	Dong Thap	1,667,000					
	Long An	1,436,000					
3. Cambodia - Thailand			Up to 8 %, mostly rural 396,000	Predominantly rural population; low & middle income households, farmers	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	The area is prone to severe and prolonged drought and has relatively little surface water resources. Increasing groundwater demand for tourism in vulnerable areas.
Cambodia	Banteay Meanchey	678,000					
	Oddar Meanchey	186,000					
	Siem Reap	896,000					
Thailand	Sakeo	552,000					
	Buriram	1,579,000					
	Surin	1,392,000					
4. Myanmar Dry Zone			Up to 10 %, mostly rural 532,000	Predominantly rural population; low & middle income households, farmers	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured	Rapidly changing socio-economic context leading to higher demand; poor groundwater governance framework and little experience with local resource management
Myanmar	Southern part of Sagaing region	(5,325,000)					
	Other part of Dry Zone						
Totals			1,981,000				

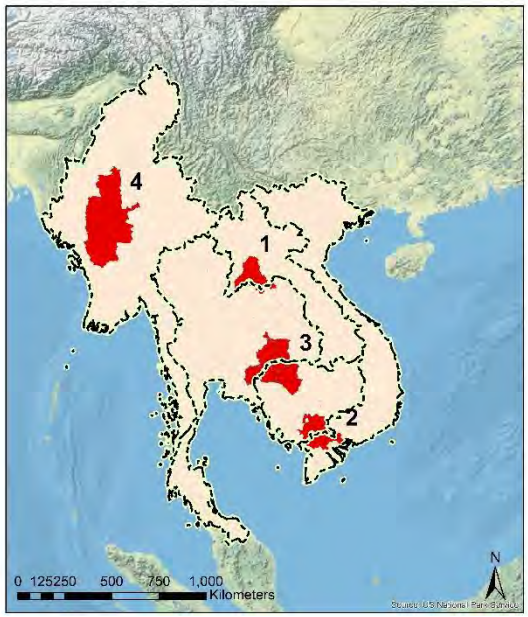
Clarification of column headers

1. No clarification needed.
2. No clarification needed.
3. **Population numbers**: Approximate total population numbers are given based on various documents and internet sources;
   Lao PDR: https://en.wikipedia.org/wiki/Provinces_of_Laos (2015 Census);
   Cambodia; Census of Agriculture report, 2015;
   Thailand: https://en.wikipedia.org/wiki/Provinces_of_Thailand & Thailand Human Development Report, UNDP (2014)
   Vietnam: https://en.wikipedia.org/wiki/Provinces_of_Vietnam; General Statics Office of Vietnam
   Myanmar https://en.wikipedia.org/wiki/Districts_of_Myanmar; Population and Housing Census of Myanmar, 2014, Summary of the Provisional Results, Ministry of Immigration and Population, Myanmar.
4. **No. of project beneficiaries;** between 5 and 10 % of the total population.
5. **Vulnerable groups;** where possible, listing of specific vulnerable groups is provided (as determined by the socio-economic and physical characteristics of the area); the project will always focus on the women, children and young adults segment of the general population (over 60 %). The proposed Cambodia provinces are among the poorest and most densely populated in the country (2015 Census).
6. **Issues and threats:** as summarized in the profiles of the pilot areas (Annex 1)
7. **Economic benefits;** not very different across the pilot areas, but since a majority of the population is rural, improved groundwater management will contribute to lower cost for domestic water, improved access to water for irrigated agriculture and hence higher incomes, improved capacity to absorb shocks in water supply in times of prolonged drought. For non-agricultural, (urban) stakeholders the project contributes to lower cost for water supply and savings for water purchase.
8. **Remarks**

In addition to the characterization of the proposed pilot areas in Annex 1, an overview of the selected provinces and districts, with population density information is provided on the following pages.

Figure 12: This and next page: Proposed pilot areas for the AF project “Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience”, a collaboration of Cambodia, Lao PDR, Myanmar Thailand and Vietnam to increase climate resilience in the Greater Mekong Sub-region through improved groundwater management and transboundary cooperation.

Pilot areas - Groundwater resources in the Greater Mekong Subregion



Legend

- 1. Vientiane Plain
- 2. Upper Mekong Delta Cambodia-Vietnam
- 3. NW Cambodia-Thailand
- 4. Myanmar Dry Zone
- Country Borders

Location of the proposed four pilot areas. The involved provinces

1.Vientiane Plain | Lao PDR - Thailand

Vientiane Cap. Region	(Lao PDR)
Vientiane province	(Lao PDR)
Nhong Khai	(Thailand)

2. Upper Mekong Delta | Cambodia - Vietnam

Takeo	(Cambodia)
Kandal	(Cambodia)
Prey Veng	(Cambodia)
Svay Rieng	(Cambodia)
An Giang	(Vietnam)
Dong Thap	(Vietnam)
Long An	(Vietnam)

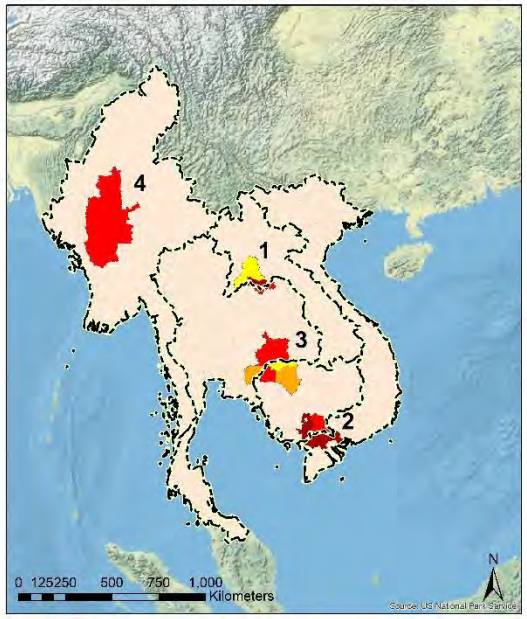
3.NW Cambodia - Eastern Thailand

Banteay Meanchey	(Cambodia)
Oddar Meanchey	(Cambodia)
Siem Reap	(Cambodia)
Sakeo	(Thailand)
Buriram	(Thailand)
Surin	(Thailand)

4. Myanmar Dry Zone

Sagaing region	(Myanmar)
Magway	(Myanmar)
Mandalay	(Myanmar)

Groundwater vulnerability: Population density in pilot areas

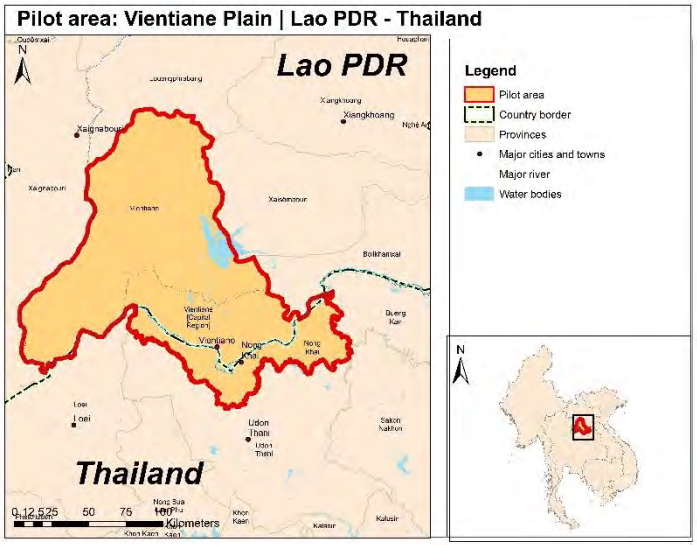


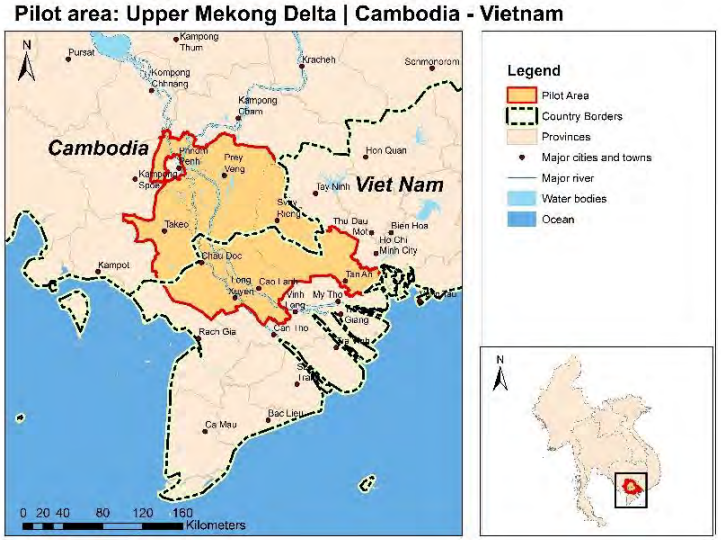
Legend

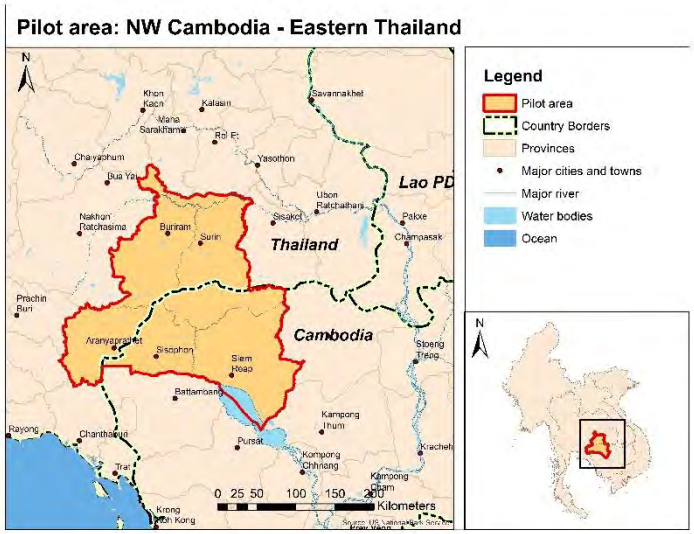
- 1. Vientiane Plain
- 2. Upper Mekong Delta Cambodia-Vietnam
- 3. NW Cambodia-Thailand
- 4. Myanmar Dry Zone
- Greater Mekong region
- Provinces

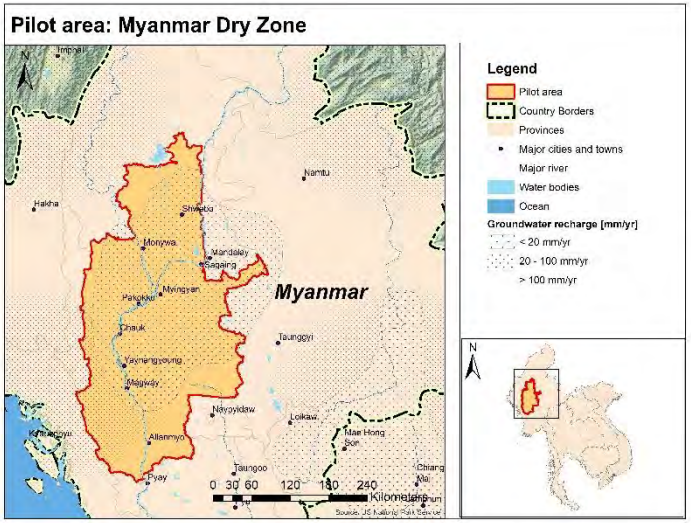
Population density (capita/km2)

- 25 - 50 (medium)
- 50 - 100 (high)
- 100 - 200 (very high)
- > 200 (very high)


Pilot area: Vientiane Plain | Lao PDR - Thailand
Lao PDR
Thailand
Legend
Pilot area
Country border
Provinces
Major cities and towns
Major river
Water bodies
Kilometers


Pilot area: Upper Mekong Delta | Cambodia - Vietnam
Cambodia
Viet Nam
Legend
Pilot Area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Kilometers


Pilot area: NW Cambodia - Eastern Thailand
Thailand
Cambodia
Lao PD
Legend
Pilot area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Kilometers


Pilot area: Myanmar Dry Zone
Myanmar
Legend
Pilot area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Groundwater recharge [mm/yr]
< 20 mm/yr
20 - 100 mm/yr
> 100 mm/yr
Kilometers

4. Resource Allocation and Project Finances

4.1 Resource allocation

Table 3: Principle overview of the project with resource allocation, activities and outputs - outcomes

Project Components	Activities	Expected Outputs	Expected Outcomes	Country
1. Groundwater resource assessment and monitoring (US $ 1,200,000)	Updated and harmonised regional groundwater resources and shared aquifer inventory; Groundwater vulnerability and resilience potential assessment; common groundwater systems monitoring network, with community of experts and on- line information systems are created.	Harmonised regional groundwater resource inventories are utilized to support regional GMS approach to address challenges of climate change and resilience; Information-based policies are enabled to manage resources and further develop new groundwater-based resilience strategies and practical interventions.	A regional GMS approach to address challenges of climate change and resilience is created, based on an information-based groundwater policy.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
2. Priority use and stakeholders (US $ 500,000)	Dialogues with groundwater users including women and vulnerable groups to assess groundwater use scenarios for different sectors; develop and provide custom-made practical guidelines, training to attain sustainable use.	Increased participation by groundwater users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.	Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and are able to participate in groundwater management.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
3. Resource management, information tools and equipment (US $ 1,000,000)	Compile and integrate all collected data into the online information portal; develop and implement best GW management equipment and measures to each pilot area for vulnerability reduction and/or GW supply improvement.	Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS region. Information-based measures to align GW management with broader climate change resilience measures and surface water management.	Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
4. Regional cooperation, coordination and information exchange. (US $ 500,000)	Review the groundwater policies and activities of the GMS countries; Organize regional workshop with GMS countries for TBA management; Develop and initiate institutional set-up and appropriate legal framework for TBA management in GMS.	A regional cooperative network is established for sustainable GW management in support of CCA, establish an information exchange mechanism and collaboration to address further challenges to go from data to information to policy to practice.	A regionally coherent policy for sustainable groundwater management in support of CCA is adopted based on a level playing field of all users in the GMS.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam

5. Capacity building and training (US $ 1,000,000)	Training workshops targeting to different groundwater users, communities and stakeholders are organized for technical and institutional supports; International conference and workshops are organized.	A groundwater community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.	GMS stakeholders capably use project tools on groundwater use and management for CCA and resilience.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
6. Project/Programme Execution cost, 8.5 % (CCOP-TS)				357,000
7. Total Project/Programme Cost				4,557,000
8. Project Management Fee 7.5 % charged by the Implementing Entity (MIE, UNESCO)				341,775
Amount of Financing Requested				**4,898,775**

Resource Allocation: although there will be a limited number of generic project activities the majority of the inputs will be dedicated to implement the project components in each of the four regional pilots.

A breakdown of cost items for activities versus project outcomes is presented in the detailed budget, **Annex II**.

4.2 Project Calendar

Table 4: The dates of important milestones for the proposed project are indicated.

Milestones	Expected Dates
Start of Project/Programme Implementation	January 2020
Inception Phase	January - May 2020
Start-up of four regional pilot programmes	June-September 2020
Mid-term progress workshops of regional pilots	December 2021
Mid-term Review (with Steering Committee)	Jan-March 2022
Regional project Conference and field visits	September 2022
Project/Programme Closing	December 2023
Terminal Evaluation	January - March 2024

PART II: PROJECT JUSTIFICATION

Introduction

This section of the proposal covers all items **A to L of the Adaptation Fund proposal format** checklist. If necessary detailed info will be provided in Annexes. Unnecessary overlap with previous sections is avoided.

A. Overview of project components

The project will consist of five interlinked components. For each component, we will define a limited number of specific activities with Results or Outputs. Outcomes (higher level results and/or impacts) as introduced in the previous section are defined at the component level. Under the five project components, each activity has a separate budget line and has inputs that include a number of cost items. Activities will be implemented at project level (generic, or GMS focus) or relate to project implementation in one or more of the four pilots in transboundary areas. The project is a collaborative effort of national groundwater agencies (and other contributing national parties) from the five participating countries with support from independent regional and international groundwater and climate change experts including IWMI and IGRAC.

Overall project implementation will be supported by CCOP-TS (project executive support), while project management, finance and administration are carried out by the UNESCO Regional Bureau for Natural Sciences in Jakarta, in close support and cooperation from UNESCO Office Bangkok, and further supported by UNESCO Headquarters Science Sector in Paris. Further details of project management are provided in Part III of this document.

The following is a summary introduction of the five main project components, with a first elaboration of the concrete activities. This project framework will form the basis for detailed work plans that will be developed at subregion level for each of the four pilots, during the Inception Phase of the project. This will be done in close collaboration with the national partners in each of the five countries.

Component 1: Groundwater resource assessment and monitoring

Outcome: A regional GMS approach to address challenges of climate change, sustainable water use and resilience is created for evidence based decision making and management.

Outputs: Harmonised regional groundwater resource inventories are utilized to support regional GMS approach to address challenges of climate change, sustainable water use and resilience; evidence-based policies are developed to enable and support management of integrated water resources and further contribute to development of new groundwater-based climate resilience strategies and practical interventions.

Major Activities

1. Updated and harmonised regional groundwater resources and shared aquifer inventory is created.
2. Groundwater vulnerability and resilience potential assessment is carried out.
3. Common groundwater systems monitoring network, with community of experts and on-line information systems designed and implemented.

Activity details for groundwater resource assessment and monitoring

1. **Groundwater resources inventory** on basis of published data and maps, set up database and GIS tool modelled after IGRAC's tools or using CCOP GIS tool; not necessary all data in it, but especially common approach and methodology; start with countries with a lot of data (possibly existing tools, Cambodia and Lao PDR may not have well developed data inventories.
2. **Monitoring resource status** (no data means no information and it is not possible to develop rational interventions); setting up minimum monitoring of selected aquifers (high potential, transboundary, vulnerable ones); Develop and agree on protocol to share monitoring data, select number of aquifer for active monitoring (should be active in year two to see trends year 2-3-4)).
3. **Aquifer status and vulnerability assessment;** exploitation history and trends, depletion indicators; document different examples from different countries, as examples.
4. **Resilience potential:** develop assessment framework, tentative resource classification in terms of resilience potential initially on basis of groundwater system properties. So where Activity 1-3 are fairly common groundwater resource studies, in Activity 4 we make the step towards climate resilience concepts and tools. Results will show either resilience potential (use groundwater to help farmers and other users to build resilience) or vulnerability or negative resilience potential, i.e., the resource status is such that it does not offer much to strengthen resilience, on the contrary, existing groundwater use, supporting some form of resilience, could be threatened because of depletion, pollution or other factors. When developing resilience potential always remember, (positive) resource value is different for every user group, depending on their capability or need. What is positive resilience potential for large industrial users could be negative or neutral for small farmers.
5. **Geographical coverage:** Indicated Pilot areas; selected, preferably transboundary areas with very pertinent, practical and end-user-oriented approach. These areas will also feature in the other components. On the basis of results from Component 2 (Priority use and stakeholders) define tailored information products, training and awareness activities, coaching and guidance (to farmers, vulnerable groups or intermediaries). Ultimately generate improved resilience for these areas and their inhabitants, whilst working with stakeholders who may take the findings and enable scaling up in other areas.

Groundwater resources inventory, organizing data collection, harmonization

Besides hydrogeological characterizations, groundwater assessment includes environmental, socio-economic and policy/institutional aspects. In the case of the internationally shared groundwater resources in the proposed pilot areas, information management and collaborative international work are two very important aspects to be taken up. Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, definitions, classifications, languages and/or use of different technologies. Therefore, one of the issues to enable collaborative management is to harmonize the hydrogeological information in the selected pilot areas. This will support a common regional view of the groundwater resources in the Mekong, providing a basis for collaborative actions, such as monitoring, pollution prevention and balanced use.

Aquifer status and vulnerability assessment

The transboundary aquifer assessment guidelines developed by IGRAC and UNESCO-IHP can be used for the groundwater inventory and aquifer vulnerability assessment process. The methodology covers hydrological, hydrogeological, socio-economic, environmental, legal and institutional aspects of the groundwater systems and transforms those into resource status and/or resilience indicators. These indicators can be used to facilitate communication between parties with very diverse levels of knowledge and professional backgrounds, one of the components towards collaborative management. The methodology also deals with challenges such as general lack of data, inaccessibility of groundwater information and harmonisation of data across borders. The assessment will provide the scientific and technical basis for actions and agreements, including to development of a specific action plan for the region. The methodology is based on a participatory approach to increase recognition, shared responsibility and transparency of the assessment processes. The collection, harmonization and analysis of the data on the transboundary aquifers should be carried out by a joint team of national experts from the involved countries. The joint assessment and fact-finding of the selected transboundary aquifers lay the first foundation for informed joint management.

Component 2: Priority use and stakeholders

Outcome: Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.

Outputs: Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.

Major Activities

1. Dialogues with GW users to assess GW use scenarios for different sectors
2. Develop and provide custom-made practical guidelines to attain sustainable use of groundwater

Activity details at the regional level (in the proposed four pilot areas)

1. Overview of most important GW user groups (user typologies); understanding user perspectives; defining further work packages to think about targeting different users in different ways.
2. Information dissemination on vulnerability issues; challenges for users, most vulnerable groups
3. What GW experts can do to support users; here the results of Component 1 come in: resilience potential. How is it appreciated by different users?
4. **Resilience strengthening pilots** for different users in different locations, resilience development and demonstration. The following options will be considered:
   a. Pilot for agriculture/farmers, using small-scale MAR (Managed Aquifer Recharge)
   b. Pilot for regional water-supply companies that use specific information in GW management tools, making use of tools to manage resources and understand vulnerabilities and information-based resilience options; further develop resilience options
   c. Dialogues with national policymakers and experts on strategic importance of GW resources in the overall CCA discussion
      - Improve general understanding of the transboundary system
      - Clarify roles and responsibilities of local institutions
      - Information, participation and dialogue between stakeholders on both sides of the border
      - Involve local and regional authorities
5. **Geographic coverage:** Work package to distinguish different users, at different GW management levels in small pilots, but also national strategic level, focus on pertinent, practical and end-user oriented outputs (information products, training and awareness activities, coaching and guidance (to farmers, or intermediaries).
6. Give examples in workshop with different sectors, i.e. examples of water supply companies on long-term strategy in Mekong Delta, i.e. how to ensure water supply in view of multiple threats, recharge depletion, salinity intrusion, pollution, etc.
7. **Resilience Agenda** for coming years; what do users need to do and consider (**Triple A** approach: **Agenda:** what are the issues, what has priority, when do we need to act: **Atlas/database**: where are our resources,

location issues, protection, overlapping claims): **interAction** Who is going to do what, how do we interact - rules of the game, who will decide? who will pay?

Active interventions

In order to have a tangible impact on the ground, the project's activity plans for the four pilot regions will focus on co-development with GW users of suitable interventions in support of sustainable use and vulnerability reduction. Foremost among these is using the wet season rainfall surpluses to resupply GW buffers to overcome dry season droughts, in other words – enhancing GW recharge. A range of technical options are available for stimulating GW recharge. Direct surface methods are among the most widely used and simplest. Depending on local conditions, water is simply spread over fields to percolate into shallow aquifers. Other methods include digging flooding pits or shafts; or 'injecting' water into aquifers through deep boreholes or tube wells from surface water bodies. GW recharge is often best accomplished as a by-product of integrated or 'conjunctive' management of reservoir and canal seepage, injection and infiltration of return flow from irrigation, enhanced infiltration of rainfall, or the simple levelling of fields or construction of small check dams. Technology aside, a managed recharge strategy strongly implies a shift to co-management of surface water and GW. These interactions are well understood in the scientific domain, but remain almost entirely separate domains in the day-to-day worlds of policy and water management authorities.

Groundwater storage and replenishment (through MAR) offers a number of unique benefits, including potentially wider, more equitable access. GW (as long as there is a source of it) is accessible to anyone with the means to dig/ drill a well; an attractive option where surface water management is often highly politicized. As a CCA measure, aquifers respond to droughts and climate fluctuations much more slowly than surface storage structures, and are more resilient buffers during dry spells. The approach borrows from extensive and successful experiences elsewhere, among others in India (Table below; Source: Shah, 2009).

Table 1: Climate change and water storage alternatives.

	Small surface storage	Large surface reservoirs	Aquifer storage (BAU)	Managed aquifer storage
1. Make water available where needed (space utility)	↑↑↑	↑↑	↑↑↑↑	↑↑↑↑↑
2. Make water available when needed (time utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
3. Level of water control offered (from utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
4. Non-beneficial evaporation from storage	↓↓↓↓	↓↓	↓	↓
5. Non-beneficial evaporation from transport	↓↓	↓↓↓	↓	↓
6. Protection against mid-monsoon dry spell (2-8 weeks)	↑↑	↑↑↑	↑↑↑↑↑	↑↑↑↑↑
7. Protection against a single annual drought	↑	↑	↑↑↑	↑↑↑↑↑
8. Protection against two successive annual drought	↑	↑	↑↑	↑↑↑↑
9. Ease of storage recovery during a good monsoon	↑↑↑↑↑	↑↑↑↑	↑↑	↑↑↑
10. Social capital cost of water storage and transport and retrieval structure	↓↓	↓↓↓↓↓	↓↓	↓↓↓
11. Operation and maintenance social costs of storage, transport and retrieval structures	↓	↓↓	↓↓↓↓↓	↓↓↓
12. Carbon footprint of agricultural water use	↓	↓↓	↓↓↓↓↓	↓↓↓

Table 5: The overview shows four possible storage and improved ground-water management alternatives.

The analysis assigns up to five benefits or five disbenefits to each of 12 resilience considerations. The first two options, small surface water storage facilities and large surface water reservoirs are quite well known, but provide little or negative resilience enhancement. The third option, aquifer storage, represents traditional GW use (Business as Usual – BAU), with mostly intensive exploitation (and depletion) of shallow aquifer storage, without any demand-side management or systematic strategy of enhancing aquifer recharge. The fourth option, managed aquifer storage, is not widely applied yet, and will require a radical shift in thinking. It recognizes that GW demand will and can increase, but, depending on a region's hydrology, aquifer storage can sustain this increase with proactive demand side management and a region-wide program of managed aquifer recharge.

Component 3: Resource management, information tools and equipment

Outcome: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.

Outputs: Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS. Information-based measures to align groundwater management with broader climate change resilience measures and surface water management.

Major Activities:

1. Compile and integrate all collected data into the online information portal for best information sharing and analysis
2. Develop and implement best groundwater management equipment and measures for each pilot area for vulnerability reduction and/or groundwater supply improvement.

Activity details:

1. Using the database and GIS tool; develop a number of specialised information products that can be derived from it.
2. Revisit resilience potential: what can user do with it; how to exploit this?
3. Pilots to confirm proper groundwater use is a resilience strengthening option
4. Identification of best practices of conjunctive management of surface and groundwater based on environmental and socioeconomic aspect of each pilot area
5. Resilience strengthening pilots for different users in different locations, resilience development and demonstration. The following options will be considered:
   - Pilot for agriculture/farmers, using small-scale MAR
   - Pilot for regional water-supply companies that use specific information in groundwater management tools, making use of tools to manage resources and understand vulnerabilities and information-based resilience options; further develop resilience options
   - Dialogues with national policymakers and experts on strategic importance of groundwater resources in the overall CCA discussion
   - Improve general understanding of the transboundary system
   - Clarify roles and responsibilities of local institutions
   - Information, participation and dialogue between stakeholders on both sides of the border
   - Involve local and regional authorities
6. Groundwater monitoring schemes; minimum requirements prescribed for general monitoring; for selected aquifer locations defining and agreement on monitoring set up; installation and using the first results

The collected and harmonized data and information for the GMS in general and for the four pilot areas will be stored in an online Information Management System (IMS) along with outcomes of assessment and possible management scenarios. IGRAC can provide the IMS that can operate as a data and information sharing platform between the countries and the various water sector and climate resilience actors and stakeholders, covering issues like groundwater resource availability, monitoring of changes and more (pro)active management supporting climate resilience. A dedicated IMS will be set up for each pilot study, and later these will be integrated into one 'Groundwater resources in GMS Portal'. Final output will be one information portal with an overview of the outcomes of the project and database on groundwater monitoring observations and other tailor-made tools.

In order to ensure tangible impact on the ground, the project's activity plans for the four pilot regions focuses on co-development with groundwater users of suitable interventions in support of sustainable use and vulnerability reduction. Resource conservation as well as supply augmentation will both be considered and evaluated on their merits. Pilot trials of demand management that can be built upon have started in pilot area 1. Opportunities to use wet season rainfall surpluses to resupply groundwater buffers to overcome dry season droughts will be identified - in other words, enhancing groundwater recharge through Managed Aquifer Recharge (MAR). A range of technical and social options are available for stimulating groundwater recharge. A staged, risk-based approach will be followed. Project team members have extensive experience in MAR in the region and globally. IWMI, working with national and international partners, have commenced a farmer-driven MAR pilot trial in the Central Highlands of Vietnam. This could potentially be linked to the pilot areas. A managed recharge strategy strongly implies a shift to

co-management of surface water and groundwater. These interactions are well understood in the scientific domain, but remain almost entirely separate domains in the day-to-day worlds of policy and water management authorities in the countries concerned.

The intervention above will be piloted in the target sites, with the objective of ensuring sustainable groundwater use and vulnerability reduction. Different measures for groundwater vulnerability reduction and water supply improvement will be implemented depending on the environmental and socioeconomic conditions of each pilot area. In the upper Mekong Delta, for instance, the different levels of understanding of the aquifer system between Cambodia and Vietnam have restricted strategic planning of groundwater resource management, thus extra attention will be paid to a systematic sharing of experience, in particular from Vietnamese Mekong Delta to neighbouring Cambodian Mekong Delta. Overexploitation of groundwater in the Vietnamese part of the Mekong Delta has caused several issues such as seawater intrusion and land subsidence, thus instrumental measures will be suggested and feasibility of the state-of-art technology. For example, MAR will be tested to increase aquifer resilience. For the Cambodia-Thailand TBAs, intensified development of groundwater resources is recommended to increase availability and ensure its sustainable use, particularly in dry periods. Thus, a joint assessment will be carried out, including the suitability of water recharge/storage methods. Groundwater monitoring network design and piloting is envisaged as well. (For more details, see **Annex I**).

The project's pilot areas are located in transboundary regions, areas where groundwater users are at risk from unsustainable groundwater supply caused by competitive groundwater use between neighbouring countries. Growing demands on water use and disagreements between neighbouring nations over resource state and development could exacerbate the potential threat of water conflicts, making groundwater users in these areas particularly vulnerable to groundwater shortages. The identification of project beneficiaries - groundwater users of four pilot areas with a special attention paid to marginalized/vulnerable groups, low-income rural communities and women – has been made in response hereto.

Component 4: Regional cooperation, coordination and information exchange

Outcomes: A regionally consistent policy and management of groundwater resources in support of CCA is adopted through effective stakeholder engagement in the GMS.

Outputs: A regional cooperative network is established to exchange information and collaborate on addressing climate change challenges from information-based policy making to collaborative management.

Major Activities:

1. Review and analyse current groundwater policies and activities of the GMS countries.
2. Establish and operationalise regional groundwater officials' group between GMS countries for implementing international consensus and guidelines concerning transboundary groundwater management.
3. Develop suitable institutional setup and appropriate legal framework for TBA management in GMS

Activity details for coordinating regional cooperation network

1. Document for all five countries the groundwater policies and groundwater management activities; what is there to learn from each other, why is it done the way it is done?
2. Focus on issue of transboundary aquifers: where, what? Are there common interests. Set up a task force to bring transboundary aquifer (water resources) management to a higher level?
3. At least two follow up workshops by making use of the results produced in the other project components (database, joint monitoring, etc.).
4. Elaborate transboundary regional cooperation for the four selected transboundary groundwater systems as case studies (1. Vietnam-Cambodia: upper Mekong Delta aquifer system; 2. Lao PDR-Thailand: riparian Mekong aquifers (Vientiane plains); 3; Eastern Thailand – NW Cambodia border region aquifers, 4. Myanmar Dry Zone aquifers).
5. Establish two working groups on sharing and co-development of tools and on national/regional policy and strategy.

These activities will be facilitated through a high-level joint assessment mechanism coordinated by UNESCO through its Regional Sciences Bureau for Asia and the Pacific as MIE.

Harness multilevel stakeholder engagement for the transboundary aquifers

Depending on the outcomes of the groundwater inventory, appropriate institutional setups and/or appropriate legal frameworks for their joint and sustainable management need to be developed. Once the interdependence of these countries has been recognized and accepted, the next step consists in establishing contact between them, both technical-regional as well as strategic-national-regional (diplomatic) level. This step allows the exchange of viewpoints, the development of confidence and solidarity measures, the sharing of information, and the coherent, pragmatic and progressive implementation of the various operational tools. The experience of UNESCO especially through established workshop mechanisms such as the Potential Conflict to Cooperative Potential (PCCP), *Groundwater for decision-makers* training materials will be helpful for assisting in harnessing regional cooperation, by providing their specific advice and assistance, and by encouraging the development and implementation of international consensus building and guidelines concerning transboundary groundwater management.

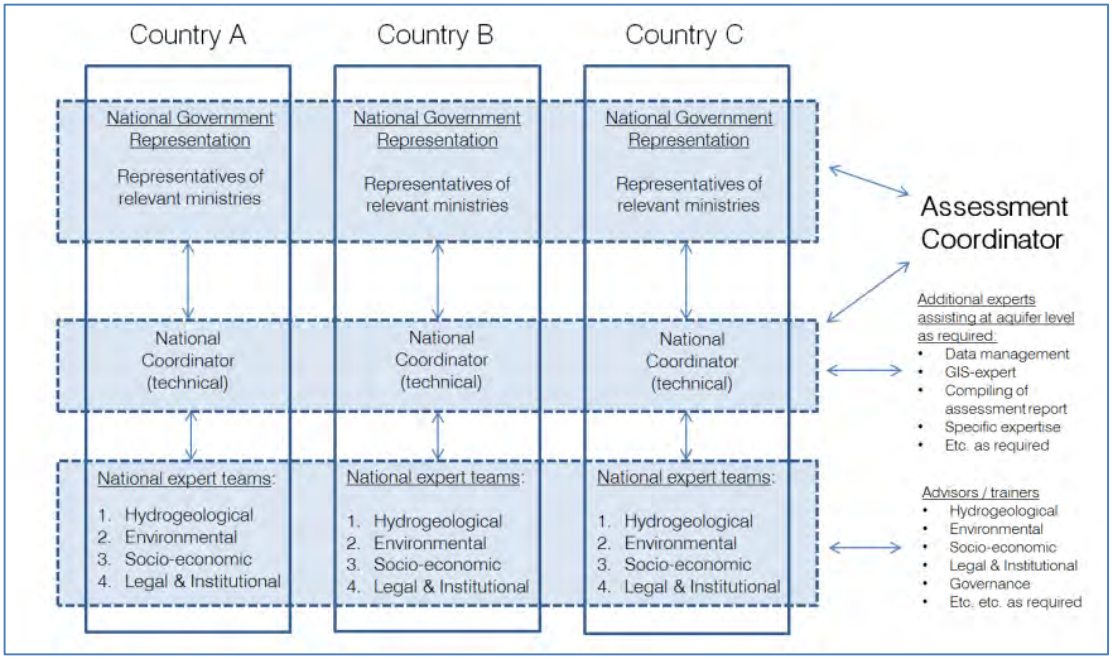


Figure 13: Example from the TBA Collaborative Assessment Methodology. Executing a joint assessment will bring together experts and government officials from pilot regions as well as national levels to help build consensus mechanisms for standardisation leading to climate change resilience. In this project, in order to improve the understanding of the shared aquifer systems as well as the collaborative management, the involved countries should progressively develop groundwater management network. Technical experts and stakeholders network will be established by bringing national as well as local officials together in regional workshops, focusing on the four pilot regions. Official meetings serve to create dialogues between the ministries from various countries to share knowledge, agree on common objectives, discuss stakes and (economic) benefits, ideas on collaborative actions and mechanisms and possibly financing issues. Source for graphic: IGRAC & UNESCO-IHP (2015).

Component 5: Capacity building and training

Outcomes: GMS stakeholders capably use project tools on groundwater use for CCA and resilience.
Outputs: A groundwater community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.

Major Activities:
1. A number of training workshops targeting to different GW users, communities and stakeholders are organized to provide different technical and institutional supports.
2. International conference and workshops are organized to disseminate the results of the project

Programme details for capacity building and training:

Training programmes Subcomponent

1. Training workshops (Information on the tentative scope of the training courses provided in textbox below)
   a. MAR, ASR and other storage and groundwater potential strengthening techniques, connected to pilots
   b. Training workshops on transboundary aquifer management; training programme (IGRAC)
   c. GGMN – the next level for the GMS; training and learning-by-doing (IGRAC)
   d. Conjunctive-management of surface water and groundwater; training workshop with MRC experts
   e. Community Dialogue (CD) training/workshops on participatory groundwater monitoring, developing monitoring with support of user groups and to increase groundwater user engagement in management of resources.
2. **Support formal training programmes**: Support to existing and/or new formal training programmes at institutes in the region covering aspects of groundwater management for resilience
3. Information and resources sharing and cooperation on formal training programmes in institutes, recognition of each other certificates, etc.

Learning and knowledge management Subcomponent

4. **Information repository and Sharepoint.** The Sharepoint facility will be a publicly accessible database (Data repository) where all available data and information is stored and can be accessed. It will support taking stock of the current levels of understanding, research focus and management of groundwater, to assess the status of groundwater policies with respect to the existing and further developing knowledge base (see for instance: www.kindraproject.eu)
5. **International Conference** to disseminate the results of the project.

Figure 14: Myanmar: Discussion with farmers on the use of tube wells for irrigation water supply. The project will be working with GW experts at various levels, but will also focus on direct interaction with stakeholder groups to extend GW use practices for climate resilience.

a. Training/workshops on transboundary aquifer management
The workshop on transboundary aquifer assessment and management will provide national experts with guidance and tools to execute the assessment in a systematic way. The workshop follows a participative approach in which the regional experts will start the joint–fact finding. Joint-fact finding assists in opening discussion, increased knowledge-sharing, and overall transparency of the assessment processes. These components are all important to reach a common understanding and to enable collaborative management. The training programme will specifically deal with and will be tailored to the selected transboundary aquifer system (one of the three pilot areas).

Content of the training

- Transboundary aquifers and their management
- Guidance for data collection and harmonization
- How to go from data to knowledge?
- Training to work with the Information Management System
- Transboundary Dialogue on GW issues and Joint Cooperation mechanisms

b. Training/workshops on advanced groundwater monitoring and analysis
The purpose of the training course is to train a group of GW professionals on GW monitoring networks, setting up monitoring network, and basic information on processing of the information. The second part of the training would provide the local technical consultants/researchers with modern technical skills in the use of Global Groundwater Monitoring Network (GGMN) and GW modelling tools. The GGMN provides an interactive portal for storage, processing and dissemination of GW data. The training participants will have the opportunity to acquire an active role in the GGMN Network and to continue to use the GGMN interactive portal.

Content of the training

- Groundwater monitoring objectives and monitoring network types
- Procedures and methods of setting-up a groundwater monitoring network
- Groundwater monitoring equipment
- Open source and freely available groundwater software tools
- GGMN Portal (Database and information management)
- Time series analysis
- Spatial interpolation in QGIS
- FREEWAT software (open source GW modelling tool in QGIS)

c. Training/workshops on conjunctive management of surface and groundwater; training workshop with MRC / National Mekong Commission experts
IGRAC will provide content for this training targeted to staff from the Mekong River Commission and National Mekong Commission members with a focus on 'Integration of Groundwater Management into Transboundary Basin Organizations'. The training course will be tailored for the GMS, and partly based on the manual on 'Integration of Groundwater Management into Transboundary Basin Organizations', developed in corporation with IGRAC, Cap-Net, Germany's Bundesanstalt for Geowissenschaften und Rohstoffe (BGR), IWMI, AGW-Net/UNDP and the former GW-MATE team of the World Bank. The manual is designed to help develop capacity within the river basin organizations to include and manage (transboundary) GW issues. A community of experts affiliated with the Mekong River Commission and National Commissions in the region provides an initial platform for transboundary GW cooperation.

Furthermore, the project will engage in ***Community Dialogue (CD) meetings***

The Community Dialogue meetings will serve to increase awareness and capacity for groundwater management at community level are key to achieve long-term sustainability of groundwater use under changing climate in the GMS. In order to promote capacity building of local people in response to groundwater related issues, this project will implement a community level learning programme and awareness raising meeting, particularly focusing on ensuring human rights to clean water access, livelihood improvement potential of new development, responsible groundwater management and gender equality. For the most effective delivery of the project's outputs and

outcomes to local communities, this project will consider a variety of communication/learning channels, reflecting socio-economic and indigenous contexts of the region.

UNESCO, as a specialized agency of the UN with a mandate in education, natural and social sciences, culture and communication, will apply an intersectoral and integrated strategy that encompasses both natural and social and human sciences components, by emphasizing the linkage between evidence-based groundwater solutions and its realization at community level. UNESCO adopts a human rights based approach as a normative principle, through which protection of human rights for the vulnerable groups in GMS will be further promoted. A close partnership with CCOP, IWMI, IGRAC, national agencies and local authorities will facilitate effective and efficient implementation of the strategy.

Content of the workshops/meetings would likely include:

- Community dialogue meeting to gain insights into local problems and priorities and to raise awareness on sustainable groundwater use and protection
- Community dialogue meeting on building resilience tools on climate change water-related disasters (drought) based on groundwater resource availability and socio-economic status of local communities
- Community learning to promote clean water/sanitation access for women and girls in unsafe environments

These events will be undertaken with the participation of key stakeholders from the water, agriculture, energy, health, environment sectors at the local level to build integrated capacity and ensure effective linkages are made with existing policies and plans.

B. Innovative solutions to climate adaptation

The project includes new and innovative solutions to climate change adaptation, in particular the following:

1. **Climate resilience and added value of regional approach, Greater Mekong Subregion transboundary collaboration**

By introducing and stimulating robust methods for resource assessment and collaborative principles for sustainable groundwater use, valuable water resources can be more effectively allocated for strategic and emergency purposes, thereby enhancing resilience in water supply and food production. Climate resilience is based on a broader suite of options, including limited surface water and groundwater, and overall use efficiency is stimulated.The regional approach creates significant efficiency gains in development of resource management concepts, tools and supporting systems and in developing the required regional human resources capacity. By developing regional regulatory guidelines for appropriate groundwater use, unsustainable practices are prevented equally across the region (also creating a level playing field), instead of pushing communities to compete with each other.

2. **Sustainability assessment of limited and valuable groundwater resources**

To increase resilience and reduce vulnerability it is essential to assess sustainable groundwater extraction rates under various current and future land use conditions, develop with users “low vulnerability” land use and identify solutions to overcome high vulnerability cases, assess impacts of the current and likely future climate change conditions on the groundwater resources; create awareness on the potential depletion of limited groundwater resources; and develop fall-back options and water use efficiency measures that have a direct impact on the ground.

3. **Innovative solutions to climate change adaptation; a regional approach and cost-effectiveness**

The development of groundwater MIS for the region will provide ample opportunities to introduce innovative ICT supported data collection, information sharing and training. Direly needed groundwater resources monitoring in collaboration with well owners and water users provides excellent opportunities for data collection through crowdsourcing, which also strengthens stakeholder involvement.

The programme connects to national priorities for CCA, i.e. groundwater conservation and sustainable use, as included in respective national CCA policy documents. The programme partners are already working on related studies in the region; this earlier and ongoing work will pave the way for this new and challenging regional project.

4. **An IWRM approach including groundwater and focused on farmers perspectives and needs.**

Unlike many other studies and projects dealing with water resources management this intervention will apply IWRM from a groundwater system perspective, based on the fact that farmers and other water users almost always use (complementary) groundwater to cover seasonal water needs. This applies to farmers producing food and market crops, but more strongly to a large number of rural water users for domestic purposes. Groundwater is nearly always a reliable source for low-cost and relatively good quality water. In applying IWRM principles specific attention will be paid to user perspectives, matching needs from different user groups and developing insight in what ways groundwater can contribute to increased resilience. This is not only different as compared to integrated (surface) water studies, but also requires a bottom-up (from the users’ side) perspective on groundwater resources, versus a more traditional top down (from the resource assessment side) perspective.

It is believed that especially this innovative approach will generate significant, tangible and acceptable climate resilience support to primary stakeholders in the countryside and rural towns.

C. Project economic, social and environmental benefits

Positive environmental and social impacts, a balanced intervention with sustainable results

The project will mitigate climate change impacts on food production and water supply, based on the better use of empirical data, for the groundwater system and environmental parameters, the socio-economic system (groundwater users) and the governance context. Actual and potential future socio-economic risks for rural communities caused by the impacts of climate change will be reduced via better access to irrigation water for food production and for domestic use (WASH). The funding requested is allocated to carry out data analysis (existing data and collecting new data on climate, watershed system, ecohydrology, ground-water availability in space and time, and the monitoring of groundwater quality related parameters (multi-element analysis, arsenic content, water-flow-rates and water-consumption carrying capacities). The project is unique in the sense that it will set up these activities with a groundwater-user based perspective, and in a participatory manner, involving local communities and primary stakeholders. The activities in the pilot areas will deepen the knowledge base on the groundwater system and vulnerabilities. Increased knowledge and related information will be shared with stakeholders - men and women - and a network of a sub-regional community of experts will be established to advise the end-users on best practices.

Positive social impacts:

- To stimulate sustainable use of groundwater resources, select the best crops for irrigation, and avoid over-utilization, depletion and salinization of aquifers.
- To stimulate nature-based solutions, and the recycling and utilization of waste-water in order to reduce the pressure on ground-water, for specific domestic purposes, such as washing, flushing, irrigation.
- To support approaches to ensure equitable access to water for food production and domestic use. It will enable conservation of scarce water resources for low-income groups.
- Enabling regional discussion on shared groundwater resources, climate, eco-hydrology, and responsible consumption and production in support of the targets of several SDGs.

Positive environmental impacts:

- Avoid depletion of aquifers and allow for continuous water-consumption based on aquifer carrying capacity
- Avoid salinization and increase of chemical particles (cadmium, arsenic, manganese; multi-element analysis and monitoring) via monitoring and respecting carrying capacities.
- Enhance nature-based solutions, which in turn, have a positive impact on biodiversity conservation.
- Enrich the selection and variety of food crops following best practices in time and space.
- Enhance wind-breaks, hedges and rows of trees towards agro-forestry and enriched cultural landscapes, generating better long-term man-made ecosystem functioning when compared with mono-specific agricultural schemes.
- Enhanced environmental awareness and community knowledge on eco-system functioning, ground-water recharge capacity, climate patterns and its relation to ground-water flow, nature-based solutions, and waste-water recycling.

Beneficiaries of the project

Indirectly, the project benefits the lives and livelihoods of around 300 million people that reside in the GMS, by enhancing their water-security, food-security, and food-commodity-production capacities in consideration of climate change factors.

It also benefits indirectly people purchasing agricultural crops that are being produced in the GMS, via generating a more sustainable crop-production capacity in times of increased climate issues.

The project directly benefits all people living in the four pilot sites, via enhanced climate resilience skills related to water availability, water management, agricultural practices, nature-based solutions, and more responsible consumption and production.

Principally, the proposed interventions support the people living in the pilot areas by contributing to achieve the listed SDGs and their specific targets via scientific research, knowledge enhancement, knowledge sharing, cross-border resource management, demonstration and training.

The communities in the pilot areas where the project will take place will benefit from better information and understanding about the importance of groundwater, eco-hydrology, climate issues, and the SDGs and how it affects their livelihoods, via specific training, based on scientific research, monitoring, and best practices, including in schools. The information generated from the project, communicated via train-the-trainer, train-the –teacher, and community outreach programs, will directly help local farmers, water resource managers, agricultural extension staff, water user organizations, well drillers and potable water suppliers including men and women from vulnerable groups, communities and schools including teachers and young people, to better understand water as a crucial resource and its importance for sustainable human living, and it is connected to climate-surface eco-hydrology, water-shed systems, and human dynamics and interventions.

Another important group of beneficiaries from the project will be project partners from the five countries and the stakeholder groups at national, provincial, district and local levels tasked with managing the groundwater. We aim to build capacity for central (national) level managers through to field-level technicians from government agencies in relevant sectors along with staff/students from universities that are engaged in this project.

Vulnerable groups
In the pilot areas are certain groups of people that are specifically vulnerable to climate change issues. The groups include resident ethnic minority goups as well as those resettled from mountainous areas voluntarily or as a result of government policy. Rural women and children incur much of the burden of fetching domestic water from groundwater wells in villages situated remote from clean and reliable surface waters, particularly in the more remote inland areas. Many of these communities still lack clean and reliable supplies and adequate sanitation. Using gender analysis and vulnerable group experts as well as local authorities, the socio-economic background and status of marginalized/vulnerable groups in the region will be identified in detail during the Inception Phase and will be monitored through the project implementation period. These groups will receive special attention with a focus on training and interventions that will reduce their burden, for example through and training and application of Green Academy aspects (rain-water; grey-water, black-water management; clean energy; youth groups engagement). By identifying women, young people and ethnic minorities as some of the key users and local champions for groundwater, the project will give particular emphasis to ensuring ongoing and improved rights to access groundwater. Consultations and training will involve women, young people, and marginalized communities engaged in or aspiring to make use of groundwater for domestic supplies and crop or livestock production.

Low income rural population:
Traditionally, groundwater is already an important source for water supply for agricultural and domestic purposes for low-income rural population, not connected to piped water systems or irrigation schemes. This project will improve the knowledge for long-term availability, carrying capacity, and sustainability of groundwater supplies to strengthen the better management and avoid over-utilization of groundwater wells.

Gender and youth considerations: From rural population groups, female and youth stakeholders will be specifically targeted in accordance with their traditional roles in food production for households and domestic water. Within the project a gender platform will be established with predominantly female members who will actively engage on enhancing women's and young people's skills on groundwater issues, and related factors, including climate change, ground-water management, eco-hydrology, and rural and domestic water consumption related aspects. Best practices from previous initiatives in the region and beyond will be reviewed and adopted where applicable[13].

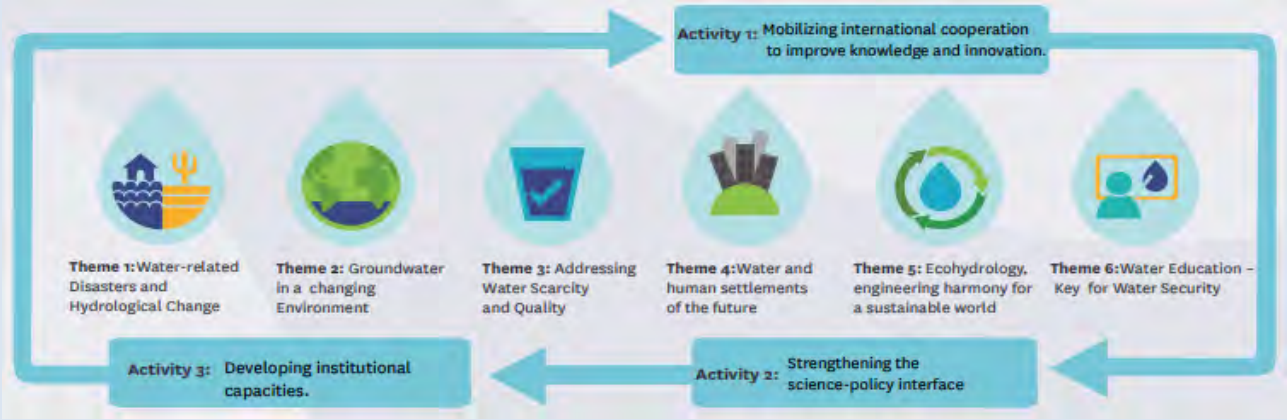
[13] *See for example (Calisesi, F., B. Böer & E. Kumfa 2016: Guidelines for UNESCO Green Academies in Africa – globally applicable. Internal and external guidelines for an innovative UNESCO Pan-African initiative. UNESCO Addis Ababa Liaison Office with the African Union Commission and UNECA. 91 p.).*

Among others, IWMI experts have shown that gender-sensitive approaches to groundwater development and management[14] help secure and protect access and use for women and the rural poor. Gendered water rights determine access and control over groundwater resources. Men and women differ in their needs and technological preferences for groundwater extraction and are affected differently when groundwater development interventions are introduced.

Reference is also made to UNESCO's (including IGRAC) support for gender equality in relation to groundwater management and use. See: http://GWportal.org/focal-area/gender .

In the project, a proactive gender approach will be undertaken (see also Part I, Section 2) throughout the project implementation in the four pilot areas along the lines of these best practices via training, application and demonstration. The workforce of this project will be comprised considering the gender balance and youth involvement via schools and community outreach.

UNESCO-IHP (International Hydrological Programme) advocates for more equitable water resources management and human development opportunities for both women and men (see for instance: https://unesdoc.unesco.org/ark:/48223/pf0000233579 or https://en.unesco.org/genderequality).



Gender equality is one of UNESCO's global priorities, with a commitment to promote equality between women and men across the Organization's mandate. Gender equality is not only a fundamental human right, but a necessary foundation for the creation of sustainable and peaceful societies.

Women represent at least half of the workforce in agriculture and food production, and often bear the daily burden of carrying water to their families. This issue has been reduced in the past few decades, but it is still an issue and needs investigation. Although women play such a pivotal role in water resource management, sanitation and hygiene (especially in rural areas), gendered water data are among the least available of national level indicators, and 45% of countries do not produce any gender statistics related to water. Climate change, inadequate access to water, and poor water quality negatively affect women's and girls' health, education, employment, income, and empowerment in ways that are distinct from their male counterparts There are corresponding risks to both local and global food production and the care of livestock. Additionally, in academia, women are under-represented in hydrogeology studies mainly because of the structure of academia and historically low numbers of women entering the field.

International Hydrological Programme

[14] *IWMI training programme: Gender and Institutional Approaches to Groundwater Development Management, MODULE 6: GENDER MAINSTREAMING IN AGRICULTURAL WATER MANAGEMENT;* http://publications.iwmi.org/pdf/H042180.pdf , and http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/Module6.pdf

D. Cost effectiveness

Cost effectiveness through national agency and stakeholder contributions
The project will be implemented in close partnership with national agencies mandated with groundwater management and involved in supportive groundwater studies. Through these, there will be substantial in-kind contributions and spin-off of regional collaboration (better exchange of information, sharing of experience, joint studies, etc.). The resilience pilots will be multiplied and extended across the national territories of the five countries. Furthermore, for various proposed pilots and implementation activities there will be contributions from stakeholders, communities and local government. Although this kind of operation is organisationally complex there will be significant cost reductions and, importantly, increased ownership and awareness. For example, stakeholders and groundwater users will be invited to propose case studies and practical cases in which climate resilience measures will be applied and tested-demonstrated.

Cost effectiveness of technical assistance and leverage
The executive model set up for the project emphasizes regional (from the five participating countries) sourcing of many inputs for activities, and regional coordination and support from CCOP-TS. CCOP-TS has been able to organize and implement regional collaboration projects that have shown high cost-effectiveness by making use of technical support and contributions from national government agencies. Additionally, the use of peer-support and local experts from the different expert communities is foreseen.

It is anticipated that the project and its executive proponents CCOP-TS, IWMI and IGRAC will be able to leverage additional support from partners that are active in the region and the subject matter. For instance, there is current support from Australia's DFAT (Department of Foreign Affairs and Trade) for IWMI's groundwater work in Lao PDR, and for climate adaptation and resilience in the Mekong Delta.

1. CCOP-TS has longstanding and active cooperation with BGR. There are currently activities in Vietnam, Lao PDR and Myanmar.
2. CCOP-TS has a long standing and active cooperation with JICA of Japan. Further cooperation in this project is envisaged.
3. There is active cooperation on groundwater management and CCA with KIGAM, Republic of Korea (Korea Institute of Geoscience and Mineral Resources). Recently, and in preparation of this proposal, a workshop was convened with representatives of all partners from the region (*CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and Groundwater Resources in the Mekong River Basin", Sihanoukville, Cambodia, 1-4 June 2016).* An earlier workshop also served in preparation and inspiration for this proposal *(CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.* Further support from KIGAM and Korea International Cooperation Agency (KOICA) is envisaged.

The component for hardware and equipment is relatively small, and the items purchased will be for long-term use; upon completion of the project ownership of equipment will be transferred to the national agencies.

Cost effectiveness in project operations
The project *modus operandi* will be 'implementation by the stakeholders, for the stakeholders'. This means limited technical assistance support will be mobilized to develop, organize and implement activities (especially in the pilot areas) with and for the primary stakeholder, the actual and potential users. This will be a cost effective approach, as only overhead costs and limited time inputs will be incurred.

A similar principle will be adopted for activities on higher policy and institutional levels as it is believed that the main objectives of the project will feed directly into the main policy and operational tasks of the involved national partner agencies. It is expected that the strategic support the project can offer will leverage internal resources and create a win-win situation for the project and the national contributors.

Alternatives to the proposed solutions
The following three features are considered key to the cost effectiveness of the proposed approach and envisaged solutions. It is argued that possible alternatives, as suggested below are less cost effective.

1. A regional approach and transboundary cooperation: Alternative: a specific country focus, or specific, and different interventions in different countries.

2. Accent on bottom-up, in pilot areas, with local stakeholders and national agencies, setting up of activities and generating results and impact followed by extrapolation to policy level and possibly national application: Alternative: a top-down approach, starting with policy issues at a multilateral level.
3. Strong role of national cooperating partners and modest support of international technical assistance: Alternative: explicit external and international technical assistance support.

Ad 1. We believe the regional approach generates considerable multiplier effects and synergies. It comes at an appropriate time and connects both to the underlying theme of transboundary groundwater management, as well as to the active CCOP-TS and UNESCO network of groundwater professionals in the region. In the incipient ASEAN Economic Community, despite some traditional controversies and disputes, the region is coming together more and more. Expected efficiency gains are:

- Sharing of information, dissemination of best-practices and project results across five countries
- Identification and elaboration of comparable groundwater management challenges, use of similar tools and application of comparable solutions
- Closer cooperation in capacity development and formal training across the five countries, whereas otherwise it would be done in five relatively small groundwater Communities of Practice (CoP)
- Region-wide distribution and multiplication of integral project results, if relevant translated into national languages. Alternative, country-focused approaches would be far less ambitious and would have a relatively low impact (larger cost/impact ratio).

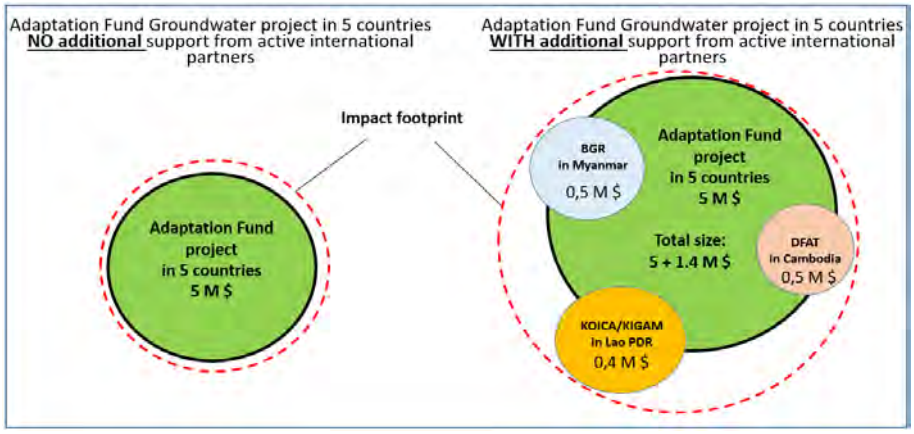


Figure 15: Leverage from AF funds to stimulate further regional and collaborative groundwater *management for strengthening climate resilience. The project could form the core of an even larger GMS programme, with a concerted effort significantly enlarging impact (NB; figures indicated in the right part of the figure are hypothetical. Real spending by these organisations during the last 5 years has probably been higher.*

Ad 2. We believe an alternative top-down approach would certainly contribute to improved groundwater management at national levels, meeting new and more appropriate natural resources management targets (in a context of CCA). But there would be a strong risk of not achieving substantial climate resilience impacts for the primary stakeholders. Our regional experience also confirms the higher effectiveness of local farmer, and/or other actors-based interventions and innovations versus government-introduced measures (top-down). By following the bottom-up approach we also aim to steer the national partners towards generating impact on the ground, in provinces, and not instead to sticking to traditional but often ineffective work processes aimed at meeting national statistical targets.

Ad 3. With increasing costs of international technical assistance both CCOP-TS and UNESCO are increasingly aware that significant cost savings can be achieved by working with national advisors and experts from within the region. This is challenging and requires strong coordination and some guidance, but can still generate impressive impacts. Furthermore, this *modus-operandi* is nowadays far more appreciated in ASEAN. We see that other projects easily involve two to three long-term international experts where this project proposes one Coordinating Technical Advisor. By more substantially involving national partners (five countries) we achieve significant cost savings while aiming for high impacts.

We are working on developing further collaboration with other potential donors (introduced above), where the rationale is that this project can act as a core project, with affiliated supporting initiatives. If this leverage is successful, the effectiveness of the allocated Adaptation Fund support would be substantially enlarged.

E. Consistency with national or sub-national sustainable development strategies

Economic growth and food security have been important objectives of the governments of Vietnam, Lao PDR, Cambodia, Thailand and Myanmar. Over the last decade water resources management policies also have evolved in the countries towards more integrated management and in awareness of making use of finite resources in support of achieving the MDGs, and more recently the SDGs. In Vietnam, for instance, this has resulted in the adoption of a new Law on Water Resources (2009), recognition of IWRM principles and the setting up of River Basin Management approaches for the integrated management of surface and groundwater resources.

In Lao PDR donor support (ADB, DFAT/AusAid) and international cooperation (GIZ, IWMI) have supported development of IWRM based policies and capacity at policy and operational level (National IWRM Support Programme, ADB, DFAT/AusAid and associated programmes). Although these policies and operational practices are far from mature, there is growing awareness, understanding and political ambition to strengthen natural resources management including groundwater in support of societal needs and in recognition of vulnerabilities of low income groups like small farmers. There is also a firm understanding that the impacts of climate change are not to be underestimated. In the Lao PDR the **National Adaptation Programme of Action to Climate Change (2009)** includes two main action points on groundwater. These are well aligned with this proposal.

For **Thailand**, the project will closely align its initiatives with the Ministry of Natural Resources and Environment and the Office of Climate Change Coordination, Office of National Resources and Environmental Policy and Planning (ONEP) as the focal point for the **Thailand Strategic Plan on Climate Change**. For the specific interventions it will coordinate with the sectoral agencies mandated to address CCA. The AF project is anticipated to contribute to the strategic objectives shown in Table 6.

Table 6: Thailand's Strategic Plan on Climate Change main strategies and anticipated AF project impact.

	Plan Strategy	**This AF project's impact**
1	Build capacity to adapt and reduce vulnerabilities to climate change impacts	Focus on pilot areas to build capacity for stakeholders and institutional partners
2	Promote greenhouse gas mitigation activities based on sustainable development	Developing sustainable use of natural resources
3	Support research and development to better understand climate change, its impacts and adaptation and mitigation options	Resource assessments, study and inventories of transboundary groundwater systems, assessing potential for resilience measures
4	Raise awareness and promote public participation	Focus on pilot areas and preparation of targeted information products
5	Build capacity of relevant personnel and institutions and establish a framework of coordination and integration	Build capacity for institutional partners, stimulate intra-institutional cooperation (interaction MONRE – Agriculture)
6	Support international cooperation to achieve the common goal of climate change mitigation and sustainable development	Regional cooperation, information sharing, intra-regional capacity building

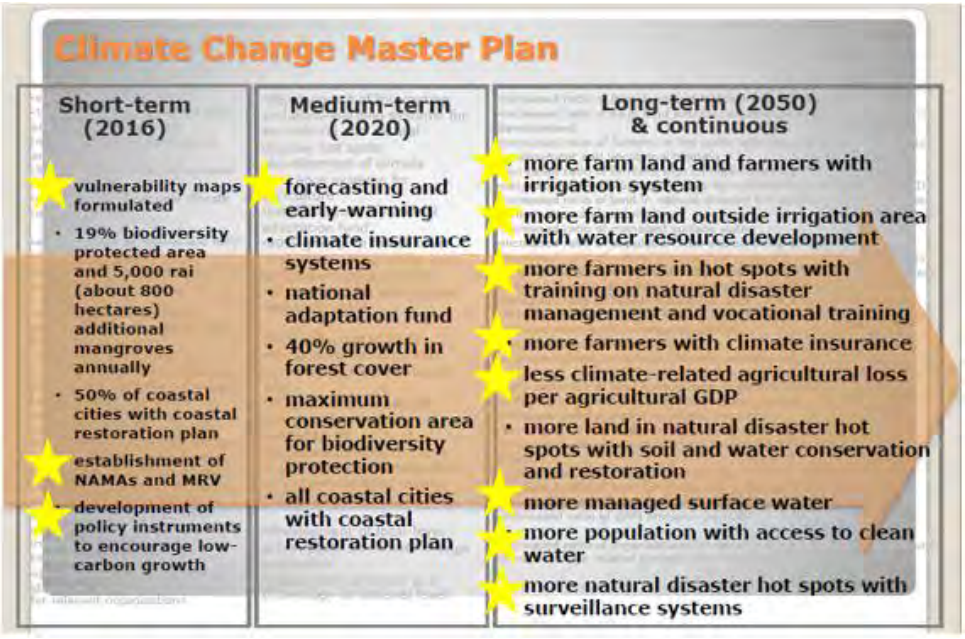


*Figure 16: Alignment of the AF project to **Thailand's Short. Medium and Long-term objectives of the Climate Change Master Plan**. The yellow stars mark the partial objectives on which the AF project will have an impact.*

For Vietnam we also refer to the national CCA agenda under its main proponent, MONRE, viz. **National Strategy on Climate Change**, period 2011-2020, (issued by Prime Minister Nguyen Tan Dung, 139/QĐ-TTg, December, 2011), http://www.chinhphu.vn/portal/page/portal/English/strategies/strategiesdetails?categoryId=30&articleId=10051283

Its main policy objectives include prioritization of integrated water resources management to meet water needs on river basin level. Furthermore, the project closely aligns with strategic national development objectives as also supported by Vietnam's international development partners like ADB and the World Bank and for instance documented in ADB's **Environment and Climate Change Assessment for Vietnam (2013)** http://www.adb.org/sites/default/files/institutional-document/33916/files/viet-nam-environment-climate-change.pdf

Further alignment with Vietnam's national policies and sectoral needs is documented in recent documentation on ADB's work in Vietnam.


PROJECT RESULT / CASE STUDY

July 2016

Project Strengthening Water Management and Irrigation Systems Rehabilitation Project

In Viet Nam, Some Farmers are No Longer at the Mercy of the Monsoons

New laws, policies, training centers—and plenty of infrastructure upgrades like water pumps and irrigations systems—are helping Vietnamese farmers deal with the challenges of weather, geography, and climate change.

Viet Nam is helping farmers respond to climate change to protect their harvests and their livelihoods.

Figure 17; In Vietnam, ADB support work by water resources management experts (central government, local agencies) to work with farmers in the country-side to address water management issues and apply IWRM principles to respond to the effects of climate change and develop measures to sustain farmers' livelihoods.

In Cambodia the Cambodia Climate Change Strategic Plan (CCCSP)[15], 2014-2023 (2013) has laid the foundation for integration of climate change and climate resilience issues into national and sub-national level planning. The development of climate change strategies, action plans and financing frameworks are among the priority actions undertaken as defined in the National Strategic Development Plan Update (NSDP) 2009 – 2013. The development of the CCCSP was a significant step towards embedding climate change in the NSDP 2014 – 2018 and in sector development plans of all relevant ministries. The CCCSP will guide national entities and assist non-governmental organizations and development partners in developing concrete and appropriate measures and actions related to adaptation and greenhouse gas mitigation, which were the supportive pillars for the achievement of the Rectangular Strategy and Cambodia Millennium Development Goals.

This project, within its modest operational domain covering availability of water resources and sustainable use of strategic groundwater potential, will support these initiatives. Furthermore, it will connect directly to most of the eight strategic objectives of the CCCSP, as summarized in Table 7. The implementation schedule of this project will generate results that will directly feed into the medium-term implementation of the CCCSP, and further support its long-term (2021-2050) ambitions, in particular contributing to the following stated response measures:

- Poverty alleviation; as more than 80% of the population depends largely on subsistence agriculture, floods and droughts could push large numbers of people below the poverty line;
- Management of water and fisheries is the lifeline of the Cambodian people. Changes in hydrology as a result of climate change may have adverse effects on water resources and fisheries;
- Expansion of capacity for provision of water and sanitation, particularly to rural areas.

*Table 7: Eight strategic objectives of **Cambodia Climate Change Strategic Plan**, 2014 – 2023 and alignment with this proposal.*

Eight strategic objectives of Cambodia Climate Change Strategic Plan, 2014 – 2023		**Connection with this AF proposal (+ = weak, +++ = strong**	**Potential Impact of this proposal to the strategic objective**
1	Promote climate resilience through improving food, water and energy security;	++	+++ : food, water security
2	Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts	+	+ : working with low-income groups, water supply for domestic use
3	Ensure climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites;	++	++: sustainable management of groundwater in the pilot areas
4	Promote low-carbon planning and technologies to support sustainable development;	-	-
5	Improve capacities, knowledge and awareness for climate change responses;	++	+++: strong knowledge and capacity building impact, awareness and climate resilience measures
6	Promote adaptive social protection and participatory approaches in reducing loss and damage due to climate change;	+++	+++: working in 2 pilot areas, participatory approaches and climate resilience measures
7	Strengthen institutions and coordination frameworks for national climate change responses; and	+++	+++: Transfer of pilot area and regional experiences to institutions and coordinated efforts
8	Strengthen collaboration and active participation in regional and global climate change processes.	+++	+++: transboundary collaboration and dissemination of results, international TA support.

For Myanmar, the project connects to the five thematic areas from the **National Adaptation Programme of Action (NAPA;** https://unfccc.int/resource/docs/napa/mmr01.pdf **),** namely (1) agriculture and forestry, (2) biodiversity, (3) water resources, (4) energy, transport and industry and (5) public health. Specifically, our project will support the

[15] http://www.cambodiaip.gov.kh/DocResources/ab9455cf-9eea-4adc-ae93-95d149c6d78c_007729c5-60a9-47f0-83ac-7f70420b9a34-en.pdf

stated need to *"climate-proof rural water management, safeguard agricultural output from flooding and drought, combat erosion, and rehabilitate degraded lands".*

In addition, the project is aligned with the National Sustainable Development Strategy (NSDS) (NCEA, 2009) which aims to achieve sustainable management of natural resources, integrated economic development, and sustainable social development. The NSDS proposes a number of actions that would improve the resilience of people vulnerable to climate change including increasing water availability by harnessing seasonal water flows and improving storage capacity and improved water application techniques at the farm level. In our project we will specifically develop the potential to use groundwater and develop underground storage to provide for dry season water needs. Our approach to develop a more water-user oriented groundwater management practice is also in line with Myanmar's National Action Plan (NAP) under the UN Convention to Combat Desertification (UNCCD) that states the ambitions to develop more sustainable environmental management "with full participation of the local people in order to achieve indirect benefit for their present and future generations", "increase seasonal income" and "transfer the technologies to the farmers". Specifically, it will help Myanmar to:

- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;
- Reduce the proportion of the population without sustainable access to safe drinking water and basic sanitation.

Institutionalization

Our strategy focuses on strengthening the capabilities and potential within the extended groundwater community to support CCA. The focus of the initiative will be on the national agencies and their networks (associated government entities and other ministries, the national policy level), and towards local managers and groundwater users in different sectors (local to provincial; farmers and industry, water users). We aim for important institutionalization gains at 1) the higher policy levels ("Improved groundwater management is an important climate resilience tool)" and 2) at grassroots, end-user level, capabilities are embedded to use groundwater as a resilience enhancing strategy.

F. Compliance with relevant standards and with ESP of Adaptation Fund

In this first part of this section, relevant national standards are discussed and it is explained how the project will meet and abide by these standards and regulations. The second part explains how the proposed project will comply with environmental and social principles as provided in the AF Environmental and Social Policy. Screening of the project and proposed interventions leads to a categorization of the project as "B"; It is discussed how this categorization is reached. Further elaboration on project impact and risk management (as part of the ESMP) is provided in Part III, Sections 2 and 3.

F-1. Compliance with technical standards at country and regional level

The implementation of the project at country and regional level relies on approval from and falls under the responsibility of the respective line ministries (and, where relevant, international agreements) related to climate change adaptation, natural resources management (including groundwater) and rural development. Project activities have been assessed by the national partners to ensure compliance with the relevant sectoral policies and national technical standards; this is further elaborated below. The remainder of this subsection (F-1) details the national technical standards in each of the five GMS countries. The compliance assessment presented here is based on a extensive consultations with experts, stakeholders and relevant government officials from the region, in combination with the expert judgement of the IE, EE and technical partners (see section I for further details).

Sectoral (water, groundwater) policies and technical standards

The project deals with natural resources management policy issues specifically relating to groundwater and will comply with all relevant groundwater management guidelines and technical standards established by and applicable in the participating countries. Within each country, the relevant ministries will rely on their line- and technical agencies. The institutional and regulatory frameworks in the five participating countries are quite heterogeneous, representing a broad range in terms of regulatory development, complexity and degree of enforcement. In Thailand and Vietnam, groundwater policy and management regulations are quite well developed. In Lao PDR, Cambodia and Myanmar a detailed regulatory framework for groundwater is virtually absent. The project makes a contribution towards the further development and improvement of these regulations while at the same time aims to ensure that the associated climate change adaptation regulatory context and resilience development is strengthened. Preparing for this project, the following has been focused on and considered:

- General ownership laws on water and underground resources (where groundwater is sometimes classified as a "mineral resource")
- Restrictions on groundwater extraction and depletion (such as for construction of drilled wells).
- Guidelines and/or restrictions on groundwater recharge (relating to quality and pollution controls).
- Regulations concerning water quality protection and pollution control (such as the application of pesticides and fertilizers that may pose a serious threat to groundwater quality).
- IWRM guidelines applied in river basins, as well as guidelines concerning the relationship between surface- and groundwater (relating to issues such as natural recharge, base flow, springs, etc.).

For the five countries, the following policy, legal and regulatory documents are of particular relevance to the project [16] (See Table 8 for further detail):

- **Thailand:** IWRM Policy and Plan [17], 9th National (Water) Plan; Groundwater Act (1977) [18] and amendments, Groundwater Fund; Institutional Adjustments
- **Vietnam:** General Law on Water Resources (2012, Order No. 17/2012/QH13, additional regulations like Decree No. 179/1999/ND-CP (1999) and several supporting decrees and regulations. A more comprehensive overview of relevant legal and regulatory issues is provided in Nguyen (2012)[19].The

[16] This is not intended as a comprehensive overview, only the most relevant laws/regulations are mentioned here.

[17] Thailand Environment Monitor, Integrated Water Resources Management : A Way Forward (June 2011) http://documents.worldbank.org/curated/en/367151468303847751/pdf/633680ESW0P1080RM00June020110Final0.pdf

[18] Thailand Groundwater Act (1977): http://www.krisdika.go.th/wps/wcm/connect/93a892004e2b8774998bfb798fdc4669/Groundwater+Act%2C+B.E.2520+%281977%29.pdf?MOD=AJPERES&CACHEID=93a892004e2b8774998bfb798fdc4669

[19] Nguyen, T. (2012). Legal framework of the water sector in Vietnam: achievements and challenges. *Journal Of Vietnamese Environment*, *2*(1), pp. 27-44. http://dx.doi.org/10.13141/jve.vol2.no1.pp 27-44

water regulatory framework in Vietnam is quite extensive, including for groundwater. However, the degree of enforcement is variable.

- **Cambodia:** Law on Water Resources Management, 2007; Law on Environmental protection and Natural Resources Management (1996); Sub-decree #27 on water Pollution Control (1999); Overall and in practice, there are only few regulations concerning groundwater use and management.
- **Myanmar:** Laws and regulations related to the development, management and use of groundwater resources, in particular:
  - The 'Conservation of Water Resources and River Law, (2006)
  - Environmental Conservation Law (2012), pertaining to water quality standards
  - Environmental Impacts Assessment (EIA) Procedure (2015)

  Responsibility for groundwater in Myanmar straddles two government ministries. For day-to-day operational guidelines the Ministry of Agriculture addresses groundwater-related issues (in particular the use of groundwater for irrigation); while general regulatory issues for groundwater fall under the Ministry of Natural Resources and Environment, as do issues relating to climate change adaptation. Additional, more contemporary legislation is being developed, as discussed in an April 2018 news article on the preparations of laws concerning groundwater management[20].
- **Lao PDR:** Water and Water Resources Law (1996, 2017) and Environmental Protection Laws (1999, 2015); these recently adopted documents contain only limited references to groundwater (protection). More recently, a National Water Resources Strategy and Action Plan (2015) and a National Groundwater Action Plan have been formulated. Both regulations remain under development and are pending approval; In terms of active application and enforcement of relevant regulations for groundwater, progress in Lao PDR has been limited to date.

Taking note of the particular context in each country, the project aims to further strengthen the practical implementation of groundwater-related regulatory and governance legislation and guidelines by offering training and building capacity among key line ministry officials and staff of agencies.

During project implementation, compliance with existing and relevant guidelines and standards will be ensured through the full engagement of national partner agencies. To ensure there will be no conflicts of interest, a verification and review of the compliance assessment will be conducted by the technical implementing partners (IWMI and IGRAC, as well as key international agencies such as MRC). The project will in this way ensure that national partner agency compliance is verified, reviewed and assured through the expertise contributed by the partnering technical institutions. Furthermore, where clear local/national regulations and standards are missing, the project will support their introduction and application. It must be stressed however, that the application of the label "technical standards" for many of the existing regulations and guidelines is not entirely accurate. Technical guidelines exist in all five participating countries, but these are fairly general in nature, often not quantitatively defined, and their implementation in some cases weak or non-existent. The project will make a targeted contribution towards addressing this gap.

By virtue of 1) its regional approach, and 2) its focus on sustainable and responsible groundwater management, this project will strengthen and widen the availability, awareness and application of such technical standards and guidelines. Based on the initial assessment of the regional institutional context and consultations with the relevant actors and stakeholders (see the overview provided in Section II. H), no compliance issues with currently active laws, standards and regulations issues are anticipated.

Table 8 below gives an overview of the relevant country ministries and technical agencies and departments from which relevant standards and guidelines apply to the project. For groundwater-related capacity building and training, the project will work with the regional hubs for education and training i.e. the leading national institutions as summarized below. The project's capacity building, training and knowledge transfer activities will be reviewed and endorsed by these institutions.

[20] https://www.mmtimes.com/news/law-drafted-save-underground-water.html

	Countries: Ministries (Policy level)	Country Agencies / Departments (Technical)	Educational / Capacity building
	Cambodia Water Resources and Meteorology; Environment; Mines and Energy; Agriculture, Forestry and Fisheries; Rural Development	**Cambodia** Department of Geology; Climate Change Department; Department of Environmental Impact Assessment	**Cambodia** Royal University of Phnom Penh; Institute of Technology of Cambodia
	Lao PDR Natural Resources and Environment; Energy and Mines	**Lao PDR** Division for groundwater Management (DGM); Natural Resources and Environment Institute (NREI)	**Lao PDR** National University of Laos, Faculty of Water Resources
	Myanmar Agriculture and Irrigation Water Resources; Public Works; Natural Resources Environmental Conservation	**Myanmar** Water Resources Utilization Department	**Myanmar** Yangon Technical University
	Thailand Natural Resources and Environment	**Thailand** Department of groundwater Resources (DGR); Groundwater Research Centre	**Thailand** Groundwater Research Centre, Khon Kaen University
	Vietnam Natural Resources and Environment; Agriculture and Rural Development	**Vietnam** National Center for Water Resources Planning and Investigation (NAWAPI), DWRPIS (Ho Chi Minh City)	**Vietnam** Hanoi University Water Resources; Vietnam National University - HCMC

Table 8: Overview of the participating country ministries and technical agencies and departments from which relevant standards and guidelines will be used, and with which cooperation will ensure compliance with the relevant laws and regulations.

Environment Impact Assessment (EIA) Standards: The five participating countries have established EIA practices and apply national EIA standards (Table 9). The EIA frameworks adopted by the participating countries employ a similar assessment approach involving screening, scoping, impact assessment, approval and post-decision implementation. Implementation of EIAs in the GMS countries is mandated under the relevant ministry (e.g. Ministry of Environment in Cambodia) in coordination with other relevant ministries (e.g. agriculture, natural resources, health, etc.).

The proposed project will be implemented in close partnership with relevant national authorities; accordingly, vulnerability reduction measures in the proposed project will be designed to be consistent with national EIA standards (principles of precaution and prevention, public participation in preparation and monitoring stages, conservation of biodiversity, effective compliance, etc.). Beyond the EIA, the proposed project will also give strong emphasis to potential social issues such as gender and equality. This will ensure that social and environmental safeguards are fully in place. If - despite this approach - issues arise, measures from the ESMP can be applied, and a grievance mechanism can be activated (see proposal Part III, Section 3).

Countries	Environmental legislation & EIA guidelines
Cambodia	Law on Environmental Protection and Natural Resources (1996); Sub-decree on EIA Process (1999); Prokas on EIA General Guideline (2009)
Lao PDR	Environmental Protection Law (No. 29/NA 2012); Environmental Impact Assessment Guidelines (2012, MONRE)
Myanmar	Environmental conservation Law (No. 50, 2014); Environmental Impact Assessment Procedure (No. 616, 2015)
Thailand	Enhancement and Conservation of National Environmental and Quality Act (1992); Environmental Impact Assessment in Thailand (2013)
Vietnam	Law on Environmental Protection (No 55/QH13, 2014);

Table 9: EIA laws and guidelines in the GMS countries.

Climate Change Adaptation: The main goals of the proposed project (increasing resilience of communities to climate change via capacity-building, improved management and groundwater vulnerability reduction measures) are in line with climate change policies and the national climate change adaptation strategies in each country, as follows:

- *Cambodia Climate Change Strategic Plan* 2014-2023:
- *Promote climate resilience through water security*; National Adaptation Programme of Action of Lao PDR: *Strengthening human resources capacity related to water resources management*;
- Myanmar's National Adaptation Programme of Action: *Reduce climate change vulnerability in rural area*
- Thailand Climate Change Master Plan: *Water, flood and drought management*;
- Vietnam National Climate Change Strategy 2011-2020: *Water resource security*.

Furthermore, the principal activities of the proposed project (such as improved TBA inventory and formulation of sub-regional/international networks) are also strongly aligned with the national development strategies in the GMS. Several aspects hereof are included in the Strategy on Water Resources 2025 in Lao PDR (2015), Myanmar Water Resources Policy (2014), Master Plan for Groundwater Management in Thailand (2011).

Under these conditions, all project activities and outputs will fully comply with the prevailing policy, laws and technical standards at the country level, in terms of policy, legal and technical frameworks. The project will establish close partnerships with the relevant institutions within these frameworks and optimize national ownership of project implementation, outcomes and results. The project has been designed to ensure that ownership rests firmly within the five participating countries, while at the same time supporting and actively seeking validation against relevant regulations and standards. This may also imply the provision of assistance towards preparing and introducing - in an advisory capacity - new guidelines or technical standards, in countries or for specific technical subjects where these are not available.

It is important to note that strengthening compliance, support and general and specific interventions as outlined in this proposal towards enhanced groundwater resilience remain the overall aim of the project; the preparation and introduction of detailed and technically specified groundwater management regulations is not. However, contributions towards the elaboration of such guidelines will be undertaken where sustainable and comprehensive groundwater management has proven its worth as a climate resilience strengthening option. Hence, emphasis is placed on collaborating with national partner agencies, transferring expertise and strengthening capacity, including the development of relevant and applicable technical standards. The project will in particular facilitate the sharing and dissemination of successful examples among the participating countries, organizations and communities.

At the technical level, project activities and outputs will as a minimum meet the technical standards prevailing in water and natural resources management in the participating countries. This is achieved by ensuring that the design, implementation and monitoring of project activities involves technical groundwater agencies from the five participating countries and/or their local/provincial representatives in the four proposed pilot areas. The project will also make full use of guidelines and other documents produced by partners and projects working in the participating countries. For example, UN-Habitat has developed a Manual on Drought Prevention in Myanmar[21] in consultation with experts from government ministries, UN agencies, INGOs and NGOs. This Manual - which has particular relevance for the Myanmar Dry Zone pilot - will be consulted as relevant in the other pilot areas as well.

In terms of the project's engagement with legislative frameworks in the participating countries, meeting the prevailing groundwater and natural resources management standards and regulations is not expected to represent a highly significant challenge. As discussed above, in Lao PDR, Myanmar and Cambodia these regulations are fairly general and in some respects poorly or not at all defined. Rather, the greater challenge will be to develop new and innovative practices and interventions that - once proven useful - may be the subject of new or revised and improved regulatory guidelines and standards (that also meet and include climate change adaptation concepts) formulated and adopted by higher policy levels. This will be done in close collaboration with the project's stakeholders and national participating agencies (Table 9).

[21] See: http://www.fukuoka.unhabitat.org/programmes/ccci/pdf/ASSESSING_CLIMATE_RISK_IN_MYANMAR_Summary.pdf

Also in this regard, the regional cooperation aspect of the project will serve as a source of guidance. In Thailand and Vietnam, regulations are more developed and application has penetrated further. Hence, the project's regional scope adds value by mobilizing and making use of expertise from the more advanced groundwater management and extension centres in the region to ensure that relevant standards and guidelines are shared and applied in a similar way across the region. Both UNESCO and CCOP-TS can make us of a rich and diversified experience in other countries from which best-practices and relevant track record can be obtained.

Summary of March 2019 survey and workshop feedback
Assessment of and compliance with national standards, guidelines and ESP Principles

In March 2019, representatives of the Adaptation Fund Designated Authority in each participating country took part in a consultative workshop to review and respond to the comments made as a result of the Adaptation Fund review of the proposal document. In addition to the workshop itself, representatives of the five countries were requested to provide feedback through a questionnaire circulated in advance. The questionnaire introduced and requested input relating to the following issues:

1. A further assessment on the risk of causing detrimental effects, for instance in relation to any of the 15 environmental and social principles.
2. How to ensure a gender balanced or gender positive approach and outcomes; possible additional measures.
3. Will proposed activities in the indicated pilot area require an Environmental Impact Assessment (according to government's regulations)?
4. Consultations with stakeholders in the pilot regions, additional stakeholder groups (e.g. farmer groups, local water managers) that should be consulted?
5. The most urgent adaptation challenges and vulnerabilities
6. Project management and implementation set-up and capabilities; (is it adequate to monitor for, identify and mitigate possible negative effects of this project)?

Below, a concise summary of the questionnaire responses is presented, with particular emphasis on new and complementary information.

Questionnaire responses (a selection)

1. **Myanmar:** our assessment is that this project will not cause detrimental effects
   Cambodia: The proposed activities do not cause detrimental effects to any of the Adaptation Fund environmental and social principles.
   Vietnam: The proposal does not violate any of the proposed principles, but mainly brings practical benefits to participating countries. The first is for the lives of people living and directly affected around the Mekong River basin. Then, it is necessary for the countries to participate in improving the capacity of managing groundwater issues, ensuring the security of groundwater sources which are increasingly polluted and exhausted.

2. **Myanmar:** Institutional strengthening on the issue of gender balance
   Cambodia: we suggest mainstreaming the importance of groundwater resources and its conservation and protection in women and community educational programmes.
   Vietnam: The proposal addresses the enhancement of interactions and allows women to benefit from the proposal that is entirely consistent with the social policies in Vietnam on gender equality.

3. **Cambodia:** for this project's activities no EIA is required in Cambodia.
   Myanmar: In Myanmar, groundwater laws and regulations are not designated yet, but project activities will require an environmental impact assessment in accordance with government's regulations.
   Vietnam: In the indicated pilot area of the project Environmental Impact Assessment is required in accordance with our government's regulations base on Law on Environmental Protection (No 55/QH13, 2014).

4. **Cambodia:** Consultation may be conducted with the line ministries related to the consumption and protection and conservation of water resources that include the Ministry of Environment, Ministry of Water Resources and Meteorology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Rural Development, Ministry of Mines and Energy, and the Ministry of industry and Handicrafts. Consultation can also involved the local authorities such as provincial departments and communities in the pilot areas in each province.
   Myanmar: stakeholder groups have little knowledge of groundwater management, while they see it is a valuable resource; hold meetings with villagers and water user groups sharing awareness of groundwater in the pilot regions.
   Vietnam: several methods are proposed for stakeholder consultation: 1. Question - Answer; 2. Obtain consultations through the internet (website - consult; Social media, 3. By documents and official letters are sent to grassroots levels for consultation.

5. **Vietnam:** The most urgent challenges and vulnerabilities in our country's pilot area are: 1. Uneven population distribution, low awareness of water resources protection, indiscriminate exploitation of underground water. mainly depends on demand, not interested in potential; 2. The network of water resources monitoring and supervision is not fully synchronized to fully assess the quality and quantity; The current situation of exploitation and use is still inadequate. **Cambodia:** A regular monitoring program should be established and groundwater information should be available to local groups; Important issues are: Access to and uncontrolled use of groundwater and tube well installation, over-pumping; resources assessment: Quantity and quality of groundwater: How much groundwater is available?; location of suitable recharge zones, protection and conservation of recharge zones. **Myanmar:** Groundwater laws and regulations; in Myanmar groundwater laws and regulations are not designated yet; need a strong groundwater data exchange programme among institutions. 6. **Vietnam:** The project management and implementation set-up can deliver the expertise and capability to monitor for, identify and mitigate possible negative effects of this project. **Cambodia:** The management and implementation setup is very appropriate for this project; All expertise and capability are included. **Myanmar:** There is no missing expertise
Consultation workshop on the AF reviewer's comments and improvements to the project scope, risk assessment and environmental and social compliance issues. Hanoi, March 20-21-22, 2019, Vietnam; With representatives of Myanmar, Thailand, Lao PDR, Cambodia and Vietnam (from the groundwater and climate change adaptation sector), technical partners and external experts.

F-2. Compliance with the ESP of the Adaptation Fund

1. Accreditation

As accredited organization with the Adaptation Fund, UNESCO has undergone the required assessments to make sure that sound standards are adhered to and that effective social and environmental safeguards are applied to identify any project risks in advance, prevent any harm and improve the effectiveness and sustainability of results. Towards this commitment, UNESCO will, as IE for the project, rely on its environmental, social, ethical and gender principles, standards and policies – principles that are essential not only for the present project, but for UNESCO's entire body of work.

In line with its Constitution, UNESCO works with its member states and civil society to strengthen the foundations for lasting peace, the eradication of poverty, sustainable development and intercultural dialogue. The ESP of UNESCO (see: https://unesdoc.unesco.org/ark:/48223/pf0000260723) states that UNESCO is committed "to further universal respect for justice, for the rule of law and for the human rights and fundamental freedoms, which are affirmed for the peoples of the world, without distinction of race, sex, culture, language, religion or sexual orientation." The projects/programmes implemented by UNESCO shall be designed to meet the environmental and social principles, including *Compliance with the Law, Marginalized and Vulnerable Groups, Human Rights, Gender Equality an Women's Empowerment, Core Labour Right and Working Condition, Indigenous People, Protection of Natural Habitats, Conservation of Biological Diversity and Sustainable Management of Living, Natural Resources, Land and Soil Conservation, Land Acquisition and Involuntary Resettlement, Climate Change, Pollution Prevention and Resource Efficiency, Public Health, Safety and Security, Pest Management and Physical and Cultural Heritage*[22].

Consequently, UNESCO is firmly committed to abide by the internationally set environmental and social policies and standards of the AF, ensuring that - in furthering the Fund's mission of addressing the adverse impacts of climate change - projects and programmes supported by the Fund do not result in unnecessary environmental and social harms.

2. Screening for potential negative Impacts and Risks

For the proposed project, UNESCO as IE and CCOP-TS as Executive Entity have carefully considered all ESP compliance issues. In collaboration with country partners, the initial project scope and technical activities have been screened for unwanted environmental and social effects. The initial preparatory screening analysis of the proposed

[22] Statement on UNESCO's Environmental and Social Policies (2016), http://en.unesco.org/sites/default/files/statement_on_ unesco.pdf.

project has been carried out through a) workshop consultations with regional experts, sectoral officials from the five countries and stakeholders, b) communication with officials and experts on groundwater management, c) gender and water governance experts. Summarized below in Tables 10-11 are the results of the initial screening analysis, including an indication of where action will be taken and where further assessment is needed. Further details are also available in the summary of March 2019 survey and workshop feedback (p. 57).

Table 10 provides an overview of major potential risks, screening procedures and mitigation measures for project implementation in the four pilot areas. During the Inception Phase of the project, when more detailed workplans are developed and activities defined (i.e. exact locations, target groups, types of groundwater use), additional risk screening and (when required) mitigation measures, can be applied as part of the ESMP (see Part III, Section 3).

Potential Risk	Screening/ Monitoring	Mitigation/ruling out
Proposed groundwater resilience measures and approach is not recognized as a useful Climate Change Adaptation measure	Dialogues and communication from primary stakeholders to higher governance levels to signal issues.	When CCA interventions prove effective in the pilot areas, efforts will be made to ensure these are recognized and approved as formal guidelines. Good practices will be documented extensively and can be formalized as 'standards' or guidelines and form the basis for changes in regulatory framework. Worldwide, there are now many groundwater-based adaptation measures that have proven effectiveness and that can be introduced.
Project and anticipated overall improvement of groundwater management can lead to significant increase in extraction.	The course of the project can be adjusted when intermediate results point towards this risk (ESMP element progress evaluation and interactions with Steering Committee)	This is a genuine risk, but also the core ambition of the project. Possibly, GW extraction can increase, but with the additional water resources forming a buffer to mitigate effects of climate change (drought). Key is not to exceed the limits of sustainable use and to disseminate understanding that also groundwater is a limited resource.
Project introduces untested practices with detrimental effects	Careful screening of activities in Inception Phase and early phase of the implementation.	The project's international and regional expert pool has considerable experience in the region, and sustainable groundwater management is advanced in Thailand and Vietnam. In the project ESMP there are several safeguards to mitigate these potential effects
Resilience measures increase inequity in communities	Screening trough liaison with local farmers', women's and other community-based groundwater user groups	Local level implementation through farmer and other groundwater user groups will ensure that resilience measures are demonstrated on the basis of participative processes that are gender-sensitive and enable participation of vulnerable and marginalized groups.
Endangering of natural habitats	Screening of pilot areas for critical national habitats	Activities will not take place in critical national habitats.
Insufficient trust among aquifer sharing countries in pilot area	Screening/monitoring and trust-building via participatory activities of riparian/aquifer sharing countries	The project will follow a step-by-step approach, with trust-building and joint fact finding to gradually develop more complex and higher impact (positive) practices.
Bilateral stress and lack of consensus	Monitoring of feedback from stakeholders and partners in bilateral working groups, periodical project result evaluation	The project specifically aims to deliver positive transboundary impacts. Introduction of trust-building measures and demonstration of positive effects of interventions and project impacts. Partner organization IGRAC has accumulated significant international experience in transboundary issues.
Resilience measures increase gender inequity in communities	Screening trough liaison with local farmers', women's and other community-based groundwater user groups	By identifying women who are key users and beneficiaries of groundwater, the project prioritizes understanding of their access to, use and management of groundwater. Women and vulnerable groups will be identified in the inception phase and

		the gender component will be monitored throughout the project implementation phase. The training will also include a component on awareness raising among local stakeholders, with emphasis on women and marginalized communities engaged in or aspiring to be engaged in groundwater use for domestic supplies, crop production, issues related to groundwater use and protection, and means to access necessary technology, markets, and community-based monitoring and management.
Resilience measures affect water quality and energy efficiency	Implementation of applicable standards of energy efficiency use	The pilot projects will be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use and the production of waste, and the release of pollutants (not expected).
Loss of ecosystem services and biodiversity	Monitoring ecosystem services (supporting, regulation, provisional and cultural)	Relevant authorities at national and site level, supplemented by Environmental NGOs with a local presence will assess any significant potential changes to ecosystem services and biodiversity, and provide guidance on project design to ensure that these are effectively mitigated.
Focus on groundwater versus more integrated approach; too narrow ?	Project progress monitoring and evaluation with technical partners and regional Steering Committee; contact with MRC and independent external evaluators..	As argued in the introduction part of this proposal this approach is necessary to ensure groundwater is taken into account sufficiently and adequately, as part of an IWRM approach. In may countries this is not the case – groundwater issues are not considered for the bigger water picture.

Table 10: Overview of major potential risks, screening procedures and mitigation measures for the four pilot areas.

3. Screening of 15 Environmental and Social Principles

Development and dissemination of climate and groundwater information, sharing of knowledge and capacity building activities that are the core of the project will be carried out in a manner that respects the principles of compliance with the law, human rights[23] and gender equity, access and equality. The approach and activities will be sensitive to the needs of marginalized and vulnerable groups, and will be implemented according to the applicable risk mitigation measures in the pilot areas (see Table 10 above).

For example, by identifying women who are key users and beneficiaries of groundwater, the project prioritizes understanding of their access to, use and management of groundwater. The design of training activities will include awareness raising among local stakeholders with emphasis on women and marginalized communities engaged in or aspiring to be engaged in groundwater use for domestic supplies, crop production, issues related to groundwater use and protection, and means to access necessary technology, markets, and community-based monitoring and management.

The checklist provided in the Adaptation Fund guidelines for Environmental and Social Policies has been reviewed in detail with responses provided below.

[23] UNESCO's procedure for dealing with alleged violations of human rights (2016), UNESCO, Available at http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ERI/pdf/BrochureProcedure104_2016EN.pdf

	Checklist of environmental and social principles	Potential impacts and risks	Further assessment procedure and possible preventive and measures
1	Compliance with the Law; Projects/programmes supported by the Fund shall be in compliance with all applicable domestic and international law.	The project's intervention and impact addresses this principle. Compliance issues depend on the applied groundwater vulnerability reduction measures. Accordingly, an EIA at each pilot area will be carried out as a principal activity of the project, in compliance with national environmental laws.	Relevant national authorities were consulted during the proposal development process to ensure compliance with all relevant laws. Pre-project assessments indicate the proposed interventions meet EIA regulations and do not generate negative impacts. TBA management will operate within prevailing laws and regulations in the participating countries as well as any applicable international laws. In case of potential conflicts or unclear laws and regulations, the project will recommend clarifications and consensus seeking measures. Training on applicable laws and regulations will be provided to project partners in the participating countries to facilitate and ensure compliance.
2	Access and Equity; Projects/programmes supported by the Fund shall provide fair and equitable access to benefits in a manner that is inclusive and does not impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights. Projects/ programmes should not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups.	The project's intervention and impact directly addresses this principle in a positive sense.	Access to low-cost and stable water supply for primary livelihood and WASH purposes will be supported for all with priority given to vulnerable and low-income groups. Planned activities will be scrutinized in semi-annual workplans and closely monitored. In order to prevent exacerbation of existing inequalities, the project will analyse existing inequalities and identify vulnerabilities and potential risks during the Inception Phase. During implementation, project impact on vulnerable and marginalized groups will be closely monitored and reported.
3	Marginalized and Vulnerable Groups: Projects/programmes supported by the Fund shall avoid imposing any disproportionate adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, tribal groups, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS. In screening any proposed project/ programme, the implementing entities shall assess and consider particular impacts on marginalized and vulnerable groups.	The project's intervention and impact indirectly addresses this principle.	A needs assessment will be carried out to identify the most vulnerable communities within the pilot areas. Vulnerable groups will be supported in their access to low-cost and stable water supply. Project documentation will be provided and community awareness meetings will be held to ensure consultation and compliance. For social risk assessment for vulnerable groups, see the additional comment under 2: Access and Equity Principle.

4	Human Rights: Projects/programmes supported by the Fund shall respect and where applicable promote international human rights.	The project's intervention and impact addresses this principle.	The fundamental human right to water as a source for basic livelihood will be strengthened. Although adverse impacts are not expected, this aspect will be closely monitored to ensure that a human rights-based approach is followed throughout project implementation.
5	Gender Equity and Women's Empowerment: Projects/programmes supported by the Fund shall be designed and implemented in such a way that both women and men (a) have equal opportunities to participate as per the Fund gender policy; (b) receive comparable social and economic benefits; (c) receive comparable social and economic benefits; and (b) do not suffer disproportionate adverse effects during the development process.	The project's intervention and impact addresses this principle.	During the project design phase, workshop discussions (see Section F-1 above) focused on gender and the role of women in relation to the possible project interventions. The project will pursue and support gender equity and women's involvement in all activities through its core approach to direct stakeholder involvement in resource management. This aspect will be closely monitored for positive impacts and will be considered and comprehensively reported as one of the outcomes of the project. In order to prevent possible exacerbation of existing gender inequalities, the project will further assess potentially critical gender-related issues during the Inception Phase and will monitor these closely during project implementation.
6	Core Labour Rights; Projects/programmes supported by the Fund shall meet the core labour standards as identified by the International Labour Organization.	The project's intervention and impact indirectly addresses this principle.	Project implementation will to some extent rely on collaboration with local staff and workers. ILO labour standards will be respected, and adherence to prevailing national labour rules and standards.
7	Indigenous Peoples: The Fund shall not support projects/programmes that are inconsistent with the rights and responsibilities set forth in the UN Declaration on the Rights of Indigenous Peoples and other applicable international instruments relating to indigenous people.	The project's intervention and impact indirectly addresses this principle.	The GMS region is home to a number of indigenous peoples. During the consultation workshops, it was confirmed that project intervention measures have been designed so as to guard against any effect on rights, property, and settlement, natural and cultural heritages of indigenous peoples. UNESCO's policy on engaging with indigenous people [24] will be consulted and applied in all relevant contexts. The project will in addition build awareness on indigenous peoples' rights as applicable to this initiative, and document mutually accepted outcomes.

[24] UNESCO policy on engaging with indigenous people (2017), UNESCO, Available at http://unesdoc.unesco.org/images/0024/002477/247738e.pdf or https://en.unesco.org/indigenous-peoples/policy

8	Involuntary Resettlement; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids or minimizes the need for involuntary resettlement. When limited involuntary resettlement is unavoidable, due process should be observed so that displaced persons shall be informed of their rights, consulted on their options, and offered technically, economically, and socially feasible resettlement	The project's intervention and impact does not address this principle.	The project neither requires, necessitates or encourages resettlement of any community or population. The project will ensure that any groundwater use and conservation related activities will not require, recommend or necessitate resettlement measures.
9	Protection of Natural Habitats: The Fund shall not support projects/programmes that would involve unjustified conversion or degradation of critical natural habitats, including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognized as protected by traditional or indigenous local communities.	The project's intervention and impact indirectly addresses this principle through the identification and enhanced protection of natural habitat areas with the potential to serve as locations for groundwater storage and recharge. Conversion or degradation of natural habitats for commercial and/or agricultural purposes to non-sustainable crops will neither occur or be promoted or encouraged in the context of this project.	The project will prioritize conservation of natural habitats when these contribute to groundwater recharge processes and storage (ecosystem services). The project will encourage and promote the reinforcement of natural habitat safeguarding through the development of stronger linkages between natural habitats, water conservation, sustainable use and groundwater recharge. These aspects will be closely monitored during the project implementation.
10	Conservation of Biological Diversity: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species.	The project's intervention and impact indirectly addresses this principle in a similar way as Principle No. 9.	In accordance with the project's objectives, a contribution will be made towards the conservation of biodiversity (viz. by enhancing the protection of wetlands, forested recharge areas, land use planning supporting recharge, etc.). Interventions and proposals for future action developed in the context of project implementation will be examined for any possible adverse effects on biological diversity in the GMS region, and shall be designed to avoid any such detrimental effects. Where relevant, the project will engage UNESCO-designated sites within the pilot areas (notably the Tonle Sap Biosphere Reserve and Angkor World Heritage Area in Cambodia).
11	Climate Change: Projects/programmes supported by the Fund shall not result in any significant or unjustified increase in greenhouse gas emissions or other drivers of climate change.	The project's intervention and impact indirectly addresses this principle.	Project implementation will not result in any increase in greenhouse gas emissions or other drivers of climate change. Interventions and proposals for future action developed in the context of project implementation will be examined for any possible contributions towards climate change drivers, and shall be designed to avoid any such contributions. This aspect will be closely monitored, in compliance with national environmental laws (EIA) and national climate change strategies.

12	Pollution Prevention and Resource Efficiency; Projects/programmes supported by the Fund shall be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.	The project's intervention and impact indirectly addresses this principle.	Resource use and aquifer recharge measures will be developed in an energy-efficient manner and by taking utmost care for protecting existing resources from pollution. Interventions and proposals for future action developed in the context of project implementation will be reviewed and designed to ensure maximal energy efficiency, minimal resource use and waste/pollution release. This aspect will be closely monitored for compliance with national environmental laws (EIA).
13	Public Health: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids potentially significant negative impacts on public health.	The project's intervention and impact indirectly addresses this principle.	Although adverse impacts are highly unlikely and not expected, this aspect will be monitored during project implementation in compliance with national environmental laws (EIA) and other relevant guidelines (e.g. drinking water standards, groundwater quality). UNESCO policy prescribes that projects do not use or promote use of any substances listed under the Stockholm Convention on Persistent Organic Pollutants, or any other substances known to pose a risk to the health of people, biodiversity or the environment. This principle will be strictly adhered to.
14	Physical and Cultural Heritage; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids the alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Projects/ programmes should also not permanently interfere with existing access and use of such physical and cultural resources.	The project's intervention and impact addresses this principle, in particular in the context of the Angkor World Heritage site in Cambodia and associated cultural heritage sites in the area.	Groundwater management at the Angkor World Heritage site is extremely important in view of the high demand (tourism) and the detrimental effects of large extractions on the site (notably land subsidence/settlement issues), which have been linked to structural damage at the property. The project will dedicate specific attention to support the mitigation of these risks throughout consultation with governmental bodies and other relevant stakeholders. UNESCO, as the only UN agency with a mandate in the field of culture and with a long-term on-site field presence at the Angkor World Heritage site, will engage in inter-sectoral and multi-stakeholder collaboration to ensure prevention of damage to cultural heritage sites and the maximization of project benefits towards the sustainable management of cultural heritage in all participating countries. The project will in this context draw from UNESCO's unique expertise in managing disaster risk at cultural heritage sites.

15	Lands and Soil Conservation; Projects/programmes supported by the Fund shall be designed and implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services.	The project's intervention and impact directly addresses this principle.	The overall aim of the project is to support the conservation of soil and lands that provide valuable ecosystem services, such as groundwater recharge. Project implementation is not expected to have adverse impacts on the conservation of lands and soil. Interventions and proposals for future action developed in the context of project implementation will be reviewed and designed to ensure that soil and land degradation is avoided. Although adverse impacts are highly unlikely and not expected, this aspect will be monitored during project implementation in compliance with national environmental laws and other relevant guidelines.

Table 11: Checklist of project's potential impacts conform guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy.

Based on a comprehensive screening, none of the proposed activities in the pilot areas will generate negative impacts or pose risks in Category A of the Adaptation Fund's impact classification. Project activities with potential (limited) adverse impact are small scale, mostly community-based and very localized. They will be co-managed by local communities where possible. Communities will have a stake in avoiding negative environmental and social impacts, which will contribute towards ensuring that the risk of any unintended negative impact is small and localized and can be rapidly mitigated in the context of project implementation. Given this, cascading or cumulative negative impacts are highly unlikely. Proposed activities requiring additional environmental or social screening represent a minor part of the project. Where and when applicable or needed, mitigation measures will be integrated into the project implementation stage, as part of the ESMP and progress monitoring process, as further detailed in Part III, Section 3.

Based on our assessment of the impact of and risks associated with the proposed interventions as outlined above, the project is classified as "B" in accordance with the Adaptation Funds impact classification.

G. Duplication of other initiatives or ongoing projects

The project is the result of an intensive regional consultation process, described under Section J (below) with participation of representatives from the five countries and international experts active in the region. The groundwater community is not too large, but the network includes experts with different affiliations (government organisations (different ministries, such as natural resources, agriculture, water, environment and climate change policy), R&D institutions, universities, etc.). In this setting there is a good oversight of comparable or related initiatives. There are national or more localized projects, targeting small and specific stakeholder groups, but to our knowledge there is no existing or planned regional and multifaceted programmes as described in this proposal and thus currently no potentially overlapping initiatives.

Earlier initiatives with a somewhat comparable focus included a launch workshop in 2011 by the Asia Pacific Water Forum (APWF) for a regional knowledge hub for groundwater management, with support of the Institute for Global Environmental Strategies (IGES, Japan), ADB, Department of Groundwater Resources (DGR), Thailand Asian Institute of Technology (AIT), and other knowledge hub partners (see: https://www.iges.or.jp/en/natural-resource/groundwater/index.html . The meeting had three main objectives:

- Discuss and explore ways to highlight and prioritize groundwater issues on main water agenda and identify feasible actions for sustainable development of resources;
- Clarify importance of groundwater in the time of global change to address food and water security and suggest ways to safeguard its strategic resource value from emerging challenges;
- Facilitate partnership with clients, partners and relevant organisation working in the field of groundwater and dig into opportunities to synergize efforts being taken in different corners of the region.

But this project lacked concrete interventions on the ground due to poor financial support and after the launch workshop there was no further follow-up.

A more successful example of a past initiative is TWAP https://apps.geodan.nl/igrac/ggis-viewer/viewer/twap/public/default . This is now being set up as an independent project and is financially supported, but has no explicit Mekong Region focus.

About TWAP

Recognizing the value of transboundary water systems and the fact that many of them continue to be degraded and managed in fragmented ways, the Global Environment Facility Transboundary Water Assessment Programme (GEF TWAP) was developed. The Programme aims to provide a baseline assessment that identifies and evaluates changes in these water systems caused by human activities and natural processes, and the consequences such have on dependent human populations. The project is the first truly global comparative assessment for transboundary aquifers, lakes, rivers and large marine ecosystems, as well as a thematic evaluation of the open ocean, through institutional partnerships that hope to seed future global assessments. The project results are envisioned to assist the GEF and other international organizations in setting priorities for supporting the conservation of transboundary water systems. More information on TWAP including final reports can be found on www.geftwap.org

The portal gives access to the map based results from the groundwater component of the Transboundary Waters Assessment Programme. The data shown in this portal have been made available by national experts from countries involved in the TWAP groundwater project. It also includes the results from scenario analyses using the global WaterGAP model (University of Frankfurt, Germany) and a study on groundwater systems of small island developing states, also called SIDS (Simon Frasier University, Canada). More information on TWAP groundwater, including reports on methodology and outcomes, can be found on https://isarm.org/twap/twap-groundwater

H. Learning and Knowledge Management

Learning and knowledge management is one of the key components of the project (under Component 5); capacity building, training and knowledge dissemination are firstly directed at the CoP of groundwater workers, who need to be better equipped with proper management tools and supported with relevant expertise, and secondly, at groundwater end-users and stakeholders who need to be more aware and supported with technologies and information to use groundwater to increase resilience. Hence, the learning and knowledge development and management outcomes for the project have been defined as:

"Internal capacity in the GMS to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups "

The proposed regional approach will ensure involvement and results for five countries and operational and resource efficiency. Activities to capture and disseminate lessons learned include:

- A series of training workshops with participants from the groundwater CoP from the five countries
- Dissemination of relevant expertise and skills to end-users in resilience pilots. In these practical, hands-on demonstrations we will exploit various learning tools, such as: news items in local media, public and school presentations, water management briefings with local community groups, awareness actions for private sector, short training workshops and courses on climate change. Information and supporting guidelines will be consolidated in policy briefs for national decision makers, best practice guidance materials and tools.
- Collaboration with the training institutes in the countries to adapt and improve formal training programmes and promote increased participation by women in the sector.
- International conference

A more detailed work plan for the proposed activities will be developed during the Inception Phase of the project.

The first challenge of the learning and knowledge management component of the project is to address a number of knowledge and information gaps; it is of critical importance that knowledge and learning development starts from the correct foundations and proper understanding. The following are important and basic resource management concepts that need to be addressed: (between brackets the project component/activity in which the issue will be addressed):

- Extent and/or characteristics of superficial and confined aquifer systems, including resource volumes in aquifers systems in the selected pilot areas, existing and/or potential water quality threats (Component 1).
- Current groundwater volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply (Component 2)
- Relationships between recharge in highland areas and resource potential in lowland areas. This includes several important transboundary systems. Climate change and land use changes will affect these delicate balances in supply and demand (Component 1).
- Sustainability (in view of increasing abstraction) and vulnerability of riparian groundwater resources to climate change induced changes in precipitation and changes in river flow regimes, be they natural or anthropogenic (Component 1).
- To understand better the resource and resilience potentials and vulnerabilities of groundwater systems of the region, detailed hydrogeological and geophysical investigations are required. A crucial monitoring network is needed to monitor resource status and critical depletion, and for developing and using regional groundwater information systems and groundwater flow models. These regional (transboundary) groundwater models and information tools will help manage resources. It is therefore also needed to visualize (in maps) regional and transboundary groundwater (recharge and extraction) systems and enable assessment of groundwater recharge rates from flooding and rainfall under the current and future climate conditions. (Component 3).
- Determine groundwater resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience. (Components 1, 2 and 3).

Learning, knowledge development and sharing of expertise are key elements of the program; the more advanced groups (Thailand, Vietnam) will contribute to this process by helping their less advanced colleagues in Lao PDR, Myanmar and Cambodia. In comparison with isolated single-country interventions this is much more cost effective. The bulk of the technical support work can be done by regional experts.

Capacity building to form a regional community of experts and address societal needs: Sustainability aspects are highly dependent on the human resources capacity dimensions. With a strong focus on human resources development a new generation of better skilled and equipped groundwater experts will engage with pertinent challenges of the coming decades. They can do this better in a concerted manner, with common tools and data. Sustainability is also enhanced by closely linking groundwater resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional CoP will be fostered, building upon efforts previously undertaken by the project partners. This CoP will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies. The opportunities for regional cooperation are being greatly strengthened in readiness for the establishment of the ASEAN Economic Community later this year.

Finally, the project will benefit for proposed project partners' (IWMI and IGRAC) dedication to knowledge development and sharing, such as IWMI's global GRIPP initiative. GRIPP would provide a useful vehicle for knowledge sharing at the regional and global levels.

GRIPP: Groundwater Solutions for Policy and Practice
GRIPP is a global level, multi-partner initiative of the IWMI working closely with IGRAC and a host of other partners. Its aims are to '*secure Groundwater resources for livelihoods, food security, climate resilience and economic growth while sustaining the resource for future generations*' by:

a) creating long-term partnerships
b) sharing lessons
c) scaling-up successes
d) filling knowledge gaps

Thus GRIPP brings in tested success stories, new technology, and innovative policy and institutional approaches for groundwater management in order to achieve the SDGs related to climate resilience, food security, and sustainable water management. As this global mandate conform closely with those of this regional project, it is anticipated that the inception phase of this project will enable close interactions and linkages to be developed to enable two-way feedback and learnings to better address these contemporary groundwater management challenges. For further information visit: http://gripp.iwmi.org/

I. Project consultation process

The consultation process for the preparation of the AF project proposal has been guided by UNESCO and CCOP-TS with external support of IWMI and IGRAC, in close contact with national partners in the five countries. Crucial element in this process has been the possibility to obtain first-hand information, experience and input from local stakeholders through earlier and ongoing work in the five countries. This proposal is largely the result of this ongoing presence in the region and the approach underwrites the long-term engagement with the subject and, increasingly, also the awareness on significant vulnerabilities. Although the engagement of CCOP-TS and UNESCO with the groundwater CoP has been successful in its own right, the need was felt to raise the stakes and bring the challenge of CCA and supporting resilience to the forefront. Hence, this is one of the objectives of this AF project. In these project preparation workshops (listed below) also discussions were dedicated to the challenge of how to interact with stakeholders in such a way that vulnerable groups and women are prioritised. Consensus was made by all participants that girls and women in unsafe/polluted environment of GMS suffer from lack of fresh water access, sanitation problems and increasing vulnerability to water-related disasters. Special emphasis should be placed on sustainable groundwater supply to the rural poor, women in the vulnerable working environment and girls in unsafe conditions through continuous consultation and close collaboration with local community/NGOs/governmental bodies. In the characterization of the four proposed pilot areas (Annexed) further supporting information is provided as to the role of potential beneficiaries, vulnerable groups and groundwater users.

A summary of relevant activities of the international consultation process is provided in the table below:

Consultation	Date/Place	Participants	Objective
Vietnam, Mekong Delta Participation in research workshop of Rise & Fall research on groundwater and land subsidence in Mekong Delta (https://www.uu.nl/en/futuredeltas/project-rise-and-fall	March 2015, Can Tho, Vietnam	National and regional experts, international researchers, representatives from regional government agencies Mekong Delta	Dissemination of approach for and results of groundwater studies and climate adaptation approach, data collection, discussion on groundwater management in the delta provinces.
Consultations with village authority and households on community managed water supply for domestic use and agriculture.	April-September 2015; Ekxang village, Phonhong District, Lao PDR	Households comprised of ethnic minority groups, household heads, village authorities	Discussions to establish how communities self-manage groundwater supplies to reduce vulnerability to extreme seasonal water scarcity.
CCOP-KIGAM-UNESCO-DGR workshop on Sustainable groundwater Management in Mekong River Basin	May 2015, Bangkok, Thailand.	KIGAM, CCOP-TS, DGR (Groundwater Agency) staff, international and national experts, representatives of regional stakeholder groups	Discussions on regional cooperation for groundwater management, effects of climate change; Status reports on groundwater management practices in the countries; Discussions on the project concept.
Multiple meetings and workshops on development of Lao PDR groundwater policy, management and capacity development	April-September 2015, Vientiane, Lao PDR	MONRE officials Lao PDR, national groundwater experts, provincial officials and community representatives	Discussions on development of Lao PDR National groundwater Action Plan, Climate Adaptation & resilience measures; Discussions on the project concept.
Meetings on regional cooperation groundwater management	September 2015, Bangkok and Khon Kaen, Thailand	CCOP-TS, DGR (groundwater Agency) staff, experts of AIT, Chulalongkorn University, groundwater Research Centre Khon Kaen University	Discussion on technical issues (groundwater monitoring, data collection capacity development and regional cooperation).
Village consultations under Myanmar Healthy Rivers Initiative (IWMI)	November 2015 – ongoing; Six villages in Myanmar	Villagers (farmers and fishermen) and community representatives (including women's groups), local government officials	Ongoing project on water use and access in rural villages, and community priorities and concerns (with specific consideration of issues of women and the poor); includes consideration of use of surface vs groundwater resources.
Regional workshop on groundwater management BGR-NAWAPI	January 2016, Can Tho, Mekong Delta, Vietnam	National groundwater experts, provincial officials and community representatives; farmers groups and village people	Sharing experiences and practices on groundwater management, climate adaptation and resilience, discussions on the project concept
UNESCO-IGRAC workshop groundwater Monitoring Workshop for South-East Asia;	March 2016, Bangkok Thailand.	National groundwater and hydro met experts, provincial officials and community representatives;	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation
CCOP-KIGAM training workshop on sustainable groundwater resource management with partner agencies from the Mekong region.	May 2016, Daejeon, Korea	National groundwater experts from Mekong region countries, provincial officials and national groundwater researchers in Mekong region	Discussions on groundwater status in each country and training on prediction and management of groundwater security.
CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and groundwater Resources in the Mekong River Basin".	June 2016, Sihanoukville, Cambodia	National groundwater experts, provincial officials and community representatives; community representatives	Proposal preparation of this proposal, with representatives of all partners from the region
Farmer Consultation on Community scale groundwater irrigation	August 2016 Phousan village, Phonhong District, Lao PDR	Women and men farmers, agricultural extension officers, district officials	Consultation with farmers and other stakeholder on the viability of community scale groundwater irrigation based in initial results of a pilot trial
ACIAR-MAF Policy Dialogue	October 2016 Vientiane, Lao PDR	Vice Minister, Department Heads, government officials, researchers	Policy-science discussions on the potential role of groundwater-for-irrigation for small for agriculture in Lao PDR
UNESCO-IGRAC workshop on Monitoring for Regional and Transboundary groundwater Management for Vietnam	October 2016 Hanoi, Vietnam	National groundwater experts, provincial officials and international groundwater specialists	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation
IWMI – MOALI workshop on groundwater in Myanmar Dry Zone	November 2016, Napyitaw, Myanmar	National groundwater experts, Ministry officials, international groundwaterspecialists	Discussion on availability and access to hydrogeological data in Myanmar, and Ministry priorities for groundwater resource assessments.
Participation in workshop of SALINPROVE project on Mitigating groundwater SALINity impacts for	28 November – 2 December, 2016 Tra Vinh , Viet Nam	National and regional experts, international researchers representatives from provincial	Discuss the overall outcomes of the project, the activities and work plan for 2016/2017, the involvement of the

imPROVEd water and food security in coastal areas under socio-economic and climate change		government agencies Tra Vinh, Mekong Delta, Vietnam.	stakeholders, and the data requirements and acquisition strategy.
Participation in workshop of Project on Adaptation to groundwater vulnerability of Asian cities to climate change: developing capacity to bridge the science and policy interface.	Asian Institute of Technology (AIT), Thailand 13-14 December, 2016	National experts from Thailand, Vietnam, Pakistan, and Indonesia; international researchers from Asian Institute of Technology (AIT), Institute for Global Environmental Strategies (IGES)	Shared a draft of methodology of groundwater vulnerability assessment and adaptation options and its application; Presented the overall status of groundwater resources in their respective cities and then prioritize major issues; Prioritized the groundwater vulnerability issues and indicators using multi-criteria decision-making and identify suitable set of indicators for vulnerability assessment, and finally prioritized potential adaptation measures.
Consultations and meetings on the use of groundwater for water supply in Lao provinces	Late 2016 and ongoing, Lao PDR	ADB, Lao PDR national groundwater experts, officials Ministry Public Works, Dept. Water Supply, provincial officials and community representatives (water supply sector);	Sustainable and responsible use of groundwater, resilience measures, capacity development, monitoring and data collection
Consultations on the AF reviewer's comments and improvements to the project scope, risk assessment and environmental and social compliance issues.	Hanoi, March 20-21-22, 2019, Vietnam	Representatives of Myanmar, Thailand, Lao PDR, Cambodia and Vietnam (from the groundwater and climate change adaptation sector), technical partners and external experts	Collect information on the issues and discuss ESMP and other measures to ensure compliance with the Principles; review the general scope of the project and its activities and assess it meets national standards and objectives.

Table 12: Overview of consultations and technical workshops with stakeholders groups, groundwater community experts and government agencies on issues relevant for the scope of the project, regional embedding and alignment. Directly and indirectly, the results of these consultations have fed into this proposal.

UNESCO coordination and consensus building role builds on established experience in diverse programmes on environment and natural resources management, both in and beyond the region. UNESCO, through its diplomatic and official network, has access to, and is able to mobilise high-level political and institutional offices and support in the region. In this way, UNESCO was able to muster support for this proposal and this will be the way UNESCO will support during implementation. On the one hand disseminating information on the project status, objectives and progress, and on the other hand seeking for confirmed political support, assistance (if needed) and promoting acceptance and embedding of verified project results.

CCOP-TS executive support: The CCOP-TS approach is such that progressively regional collaboration takes place without much external technical assistance; CCOP-TS has nearly 60 years of experience with keeping regional cooperative networks alive in this way.

In preparation of the proposal, important support was also gathered in the following consultative meetings:

1. CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.

CCOP Technical Secretariat, in collaboration with the Korea Institute of Geoscience and Mineral Resources (KIGAM), the UNESCO Bangkok Office and the Department of Groundwater Resources (DGR) of Thailand, co-organized this workshop on 19-20 May 2015 in Bangkok, Thailand. This meeting is within the framework of the five-year CCOP-KIGAM Project "Solutions for Groundwater problems in the CCOP region" funded by KIGAM since 2013.

The meeting was attended by 26 participants (45 % female) from CCOP Member Countries, Cambodia, Republic of Korea, Lao PDR, Myanmar, Thailand, Vietnam, international resource persons and CCOP-TS staff.

It was recognized from the presentation of country reports that Cambodia, Lao PDR and Myanmar have limited information available on groundwater resources and lack any mechanisms to regularly monitor groundwater for

quality or quantity. On the other hand, Thailand and Viet Nam have adequate monitoring data at the national level. To address this dearth of information on groundwater and encourage collaboration in its management, a proposal was made during the workshop for the creation of a groundwater monitoring network and to provide technical support to countries in need of developing sustainable management plans for this resource.

Figure 18: Participants of the May 2015 workshop (not all shown in the picture)

2. UNESCO-IGRAC workshop, Bangkok, March 2016

UNESCO-IGRAC workshop Groundwater Monitoring Workshop for South-East Asia; On 15-16 March 2016, the workshop was held in Bangkok Thailand. The workshop was organised by UNESCO Bangkok Office, DGR and the IGRAC under the framework of the Global Groundwater Monitoring Network (GGMN) programme. In total 45 groundwater specialists from six countries (Cambodia, Iran, Malaysia, Myanmar, Thailand and Vietnam) attended the workshop.

Workshop objectives
The purpose of the workshop was to bring together national and international groundwater experts to review the state of groundwater monitoring in the region, to introduce the GGMN programme and its possible role in Southeast Asia. The workshop was also intended to build synergies and strengthen international water cooperation.

Results and Contributions
Presentations were given by country representatives to share experiences on the current state of groundwater monitoring, information management and future challenges. The GGMN was introduced followed by a live demonstration of the GGMN Portal. Participants explored the functionalities of the GGMN Portal to become familiar with the GGMN Programme and the GGMN Portal functionalities. There was an interactive session to identify the bottlenecks for proper groundwater monitoring and translate some of those into additional developments for the GGMN Programme.

Professor Yangxiao Zhou (IHE Delft Institute for Water Education) provided a presentation on groundwater monitoring in the Netherlands and the use and application of time series analysis for groundwater monitoring data. Afterwards, participants learned how to work with the time series analysis tool available in the GGMN Portal and how to create spatially interpolated groundwater maps using the GGMN Portal. Sangam Shrestha (Asian Institute of Technology) presented the recently published book: 'Groundwater Environment in Asian Cities: Concepts, Methods and Case Studies'. Dutch experts affiliated with IGRAC introduced the use of remotely sensed data for monitoring and the role of information technology and big data in groundwater research and management.

3. CCOP-KIGAM-UNESCO workshop Sihanoukville, Cambodia, June 2016

A workshop on *"Climate Change and Groundwater Resources in the Mekong River Basin"* was convened in preparation of this proposal, with representatives of all partners from the region (Sihanoukville, Cambodia, 1-4 June 2016.

CCOP-KIGAM-UNESCO-MME Workshop
"Climate Change and Groundwater Resources in the Mekong River Basin"

Date: 1-4 June 2016
Venue: Sihanoukville, Cambodia
Host: CCOP, KIGAM, UNESCO, and MME
Participants: Vietnam, Lao PDR, Cambodia, Thailand, Myanmar, China, Republic of Korea and international experts

Background
Groundwater is a valuable natural resource and one of the primary sources of water in Mekong River countries. Global climate change is expected to affect availability and sustainability of groundwater resources by altering hydrological cycles and groundwater recharge in the face of human activities (higher demand). Despite its importance, the impact of climate change on groundwater resources has received inadequate attention in Mekong River countries. The communication and collaboration between countries are required (1) to more urgently assess climate change effects on groundwater, and (2) to mitigate the impact of climate changes to the water resource supply in the Mekong River Basin.

Aims of the workshop
The objectives of this workshop were to promote sharing information and best practices among Mekong countries for assessing availability of groundwater resources under climate change and to support member countries to prepare for sustainable groundwater management. The key players of each country in the Mekong River Basin addressed major issues and status of groundwater management with changing environment. Strategies to enhance collaboration between neighbouring countries and to adapt to future climate change were discussed. The workshop provided opportunities to further understand the dynamic relationships between climate change and groundwater and to provide strategies for sustainable groundwater resource management in the lower Mekong River Basin.

In all, the sequence of regional meetings and workshops laid the foundation for the project concept and consensus on priorities and opportunities. The meetings were well attended by a regionally representative assemblage of groundwater experts, policy-makers and government officials responsible for natural resources management and CCA policies. The network has multiple important functions:

1. Share ideas and information on the status of groundwater resources management and alignment with national and regional government policies
2. Provide an opportunity to assess the status of national capabilities and mandates
3. Support regional cooperation, capacity building and knowledge exchange. The regional network is complemented and supported by international experts.
4. Identify opportunities and priorities for regional cooperation and increasing the impact of the sector.

It is believed that the series of workshop and bilateral meetings has resulted in a shared vision and ambition to use groundwater expertise and potential not just as an additional natural resource, but as a strategic asset, that, when used sustainably and responsibly, can make a significant contribution to climate resilience and livelihood improvement.

Until this stage, vulnerable groups and groundwater users in the five countries and proposed pilot areas have been involved indirectly in the proposal consultation process. The process of consultation will continue during the Inception of the project, and during project implementation, with direct consultations between the project team and national implementers and stakeholders in the pilot areas.

Because of the open and participatory nature of the mentioned consultation workshops (and characteristic for the approach of CCOP-TS and UNESCO in their programmes) the consultation and technical discussions are fruitful in bringing to the fore specific and/or new concerns from country representatives. As a result, this proposal incorporates and prioritizes some of those concerns, in particular **the engagement of groundwater experts and the groundwater CoP directly with stakeholders and groundwater users**. This approach is now much more at

the core of the project. (Traditionally and very often discussions in groundwater expert group workshops, conferences, etc. deal with very specific technical and details and the workings of the physical groundwater system, and not so much with the interests of vulnerable groups). Primarily, in the consultation process, participants from the region, with firm connections to the "local" issues and groundwater users in the provinces, were able to specifically present their views and experiences. So, with participating international experts who work in the region, and groundwater workers from the five countries attending there was a strong link from groundwater users and vulnerable groups and their concerns to project conceptualization.

- (Inter)national experts and groundwater workers from the region involved in proposal preparation are actively working on the ground and have a strong link with groundwater users and stakeholder groups in the countries and in the proposed pilot areas
- Issues discussed and inserted into the project concept primarily reflect concerns of user groups and stakeholders, although these groups and their interests will be more specifically framed during project implementation, when we will bring on board experts in gender analysis and on regional indigenous communities

J. Justification of funding

The project focuses on building climate resilience on the basis of "hidden" and poorly managed groundwater resources in particular for vulnerable rural communities, and other low-income users in cross-border regions of Lao PDR, Cambodia, Thailand, Myanmar and Vietnam.
The overall justification of the project lies in the potential to use groundwater, always a reliable and "safe" resource for low-income groups to provide water for food production, domestic use and production processes. This potential remains undeveloped in large parts of the GMS for a number of reasons. The project will address the following:

- Poor information on and confirmation of resource potential: The project will prepare an updated groundwater inventory of shared aquifers in border regions (four pilot areas), develop resource management concepts and tools, and set up a much needed monitoring network for groundwater systems.
- Regional collaboration will enhance understanding of groundwater recharge processes and formulate recommendations for protection and long-term sustainable management.
- In the general approach and in the pilot areas issues of transboundary groundwater management will be addressed. Taking up transboundary challenges will also form an incentive to develop collaborative solutions.
- In addition to making use of the available national capacities, the project will aim for intensive participation of local stakeholders by implementing principles of groundwater governance through 1) dialogues with users to assess groundwater use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, domestic water supply).
- On the basis of improved information (supply/demand assessments, climate vulnerability profiles) the project will develop and implement targeted vulnerability reduction measures, groundwater supply quality improvement measures, and identification and protection of strategic groundwater reserves. Implementation of different project activities will be integrated in the four pilot areas and will generate resilience deliverables on the ground.
- On the medium and longer-term the investments in training, capacity building and raising standards for the groundwater CoP across the GMS and initiating regional water cooperation (diplomacy) will generate long-term benefits.
- Strategic planning for groundwater resources will support high level policy consensus and regional cooperation and make significant contributions to climate resilience of low income and rural population.

In the following summary, for each main project component a justification of the funding is given, followed by a concise reflection on Adaptation alternatives. (Table on the following pages)

<table>
<tr><td colspan="4">Component 1: Groundwater resource assessment and monitoring: to obtain and use a harmonised regional groundwater resource inventory supporting regional GMS approach to address challenges of climate change and resilience, and enables an information-based policy to manage resources and further develop new groundwater-based resilience strategies and practical interventions.</td></tr>
<tr><td>Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.</td><td>Baseline (without AF project)</td><td>Additional (with AF project)</td><td>Justification</td></tr>
<tr><td rowspan="4"></td><td>Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment.</td><td>A comprehensive overview of regional GW resources (quality, quantity) is included in a easily accessible inventory (GIS, database).</td><td rowspan="4">It is essential to prepare a thorough inventory of available GW resources. But this should not be an academic or stand-alone investment. The resource potential should be made in close connection with a comprehensive assessment of water user needs (for different sectors: rural food production/agriculture, domestic water needs and small town water supply). Without proper understanding of the resource availability GW can still be used as a resilience (as is done in many places), but issues of sustainability and depletion of scarce resources will crop up.

By combining expertise from within the region with modest Technical Assistance support in a focused and coordinated intervention valuable and relevant resource availability information will be prepared and made available in formats that improve use by stakeholders and users. It will be possible to level regional differences

Adaptation Alternative? Information on GW resources is available especially in Thailand and Vietnam, but much less so in Myanmar, Lao PDR and Cambodia. This unbalanced information base is not supportive to sustainable resource use and developing fair and equitable resilience measures, forms a challenge especially for proper management of transboundary aquifer systems. Existing GW information lacks detail and quality due to a low level or absence of monitoring, especially so with respect to GW management in border regions. So it would be difficult to work on the basis of existing information and not possible to achieve the set objectives.</td></tr>
<tr><td>There is some GW-related info, but hardly used for this purpose.</td><td>GW information forms the basis for specific climate resilience measures.</td></tr>
<tr><td>Groundwater is seen as a static resource (basic inventories) and no to little data on temporal changes (or depletion)</td><td>Monitoring system and information operational and used for periodic updates.</td></tr>
<tr><td>Currently, GW information is hardly used.</td><td>Clear and consistent reference to GW in support of climate resilience development.</td></tr>
</table>

Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.			
Outcome 2: GW users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Farmers and other users deplete GW resources regardless of CCA challenges.	Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.	Due to the scientific and academic character of GW studies, also a somewhat neglected chapter not really part of water resources management and neither at the core of natural resources management, the results of GW studies were always a bit out of reach for many GW user groups. By addressing this, the project will deliver tangible results to different water users so that a) climate change resilience is strengthened, and b) limited but critical GW resources are not depleted. This will be done in close consultation with the stakeholders, in all parts of the proposed pilot areas. From the local pilots, the project will reach for higher institutional and policy levels, to ensure recognition of GW as a resource that can contribute to regional resilience. **Adaptation Alternative?** Working in the traditional manner will bring the risk of not reaching the target groups, or maintaining the mismatch and poor coordination between the GW CoP and the user sectors. The project workplan allows for flexibility and adaptation (to be used during the Inception Phase) to specific require-ments to generate results in the pilot areas.
	Information on GW potential is not tangible enough to motivate users to adopt and apply.	Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.	
Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology support better transboundary GW policies that are more robust and climate change ready.			
Outcome 3: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use of specific measures to support resilience.	Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.	On the basis of improved information (supply/ demand assessments, climate vulnerability profiles) the project will develop and implement 1) targeted vulnerability reduction measures, if necessary aimed at meeting the needs of specific or vulnerable groups, 2) GW supply quality improvement measures,m 3) identification and protection of strategic GW reserves. Ad 1-2: For each of the pilot areas a critical analysis will be prepared of vulnerabilities for agricultural production, domestic (rural) water supply and possibly other major water users (industry like food processing). Other sectors/stakeholders are not excluded. This will clarify the main climate change related vulnerabilities and stakeholder groups. We will focus on vulnerabilities that have potential to be mitigated on the basis of improved and responsible GW management. Such practices could include: seasonal withdrawals for specific purposes,
	No transboundary cooperation, incompatible resource inventories, no communication.	Joint and coordinated efforts to use information and tools (monitoring) to develop and apply GW management	
	Only very basic, general information is available	Comprehensive information, tools and methods	

		developed and applied; resilience measures developed and applied (related to the physical GW system, governance of water resources or adaptation of user needs).	in combination with recharge measures, adaptation of user needs (different crops or income generating activities), governance and administrative arrangements (allocate limited shallow GW for low-income users), diversification of GW based water supply (deeper aquifers, new well fields), quality treatment of surface- or GW to make it suitable for specific user needs; technical improvements of extraction wells. Increases in extraction should be accompanied by resource conservation (elsewhere) or increase in recharge. Ad 3: Vulnerability mitigation should be accompanied with a careful assessment of water needs versus water sourcing options (surface water or GW). Improved understanding of the GW system (Component 1) supports a better assessment and quantification of the available resources and possibly specific constraints in further use. Vulnerable high quality resources (i.e. for drinking water supply) may need to be protected. GW use options could be adapted (i.e. strategically located deep GW extraction cold replace vulnerable shallow extraction). Basic monitoring of GW dynamics is needed to be able to match regional extraction volumes/rates to regional recharge rates. All measures rely on support from and awareness in stakeholder/user groups, which is in itself already a vulnerability reduction result. Implementation of different project activities will be integrated in the four pilot areas and this will generate resilience deliverables on the ground. The project will provide farmers and rural communities and village water user groups in the pilot areas with awareness, understanding and skills to manage limited GW resources to overcome climate-change induced perennial droughts and water shortages. **Adaptation Alternative?** One of the fundamental questions is the use of surface vs. GW. In principle, similar resilience levels could be reached with the use of surface water, commonly available in the proposed pilot areas (but not in drought periods). However, the investments needed to ensure availability of surface water and the complexities involved in management give low-income user and rural communities poor leverage and little influence. Surface water, originating outside the area, and destined for other users downstream, is not really an alternative for the “hidden” resource underground. Our approach complements other interventions that deal with surface water management.

Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for CCA through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.			
Outcome 4: A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Despite common CCA challenges countries in the region do not optimally share practices, knowledge and resources.	Regionally coordinated GW use contributes to regional, cross-border climate resilience for food production, rural water supply, etc.	In the provinces, when discussing GW resources for use in agriculture or for domestic purposes, few people realize the resource is not simply available from an underground (limitless) source, but forms part of a complex system with recharge areas, GW flow in complex aquifer systems, interaction with surface water and sometimes is affected by large scale spatial and long-term temporal dynamics. A similar misunderstanding is encountered among higher policy levels. Our approach for regional and transboundary, joint development is aimed at overcoming these misunderstandings. This justifies a fair amount of bilateral and five-country meetings and workshops, to create a joint understanding, both on advanced technical levels, as well as on policy coordination and complex cross-border cooperation. **Adaptation Alternative?** From a GW management perspective, there is no real alternative; if there is no real cross-border coordination resource depletion will take place in the medium- to long-term, and communities on both sides of the border will suffer.
	Vulnerable groups in the region and cross-border suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.			
Outcome 5: GMS stakeholders capably use project tools on GW use for CCA and resilience.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	Community of Practice of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	The project investments in training, capacity building and raising standards for GW CoP will use within-the-region training. There is a high (double) return on investment as both the participants as well as the host institutions will benefit. The programme will offer fertile training grounds for a new generation of experts, in a learning-by-doing approach that will cover practical, on-the-ground issues in the pilot areas, but also higher policy levels. New and innovative subject matter and policy context will be injected to give more relevance to the sector. The project will be implemented with limited international TA and build on existing networks. **Adaptation Alternative?** The direction of development is really set for further ASEAN
	Although there are regional network meetings there is little coordinated effort to improve overall impact level.	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level	
		Groundwater CoP is regionally active	

		and able to contribute effectively to different GW system, sustainability or CCA challenges.	cooperation for and coordination of important policies in the region. It is an option to implement the project with experts from advanced countries in the GMS region (Thailand, Vietnam). But this will lead to unsustainable results in the priority areas and for priority low income groups in Myanmar, Lao PDR and Cambodia. The underdeveloped GW management capacity in these countries is a challenge and an opportunity to develop greater climate resilience. Bringing in more international TA will substantially raise the interventions costs, as would training in leading institutions outside the region.

Table 13: Summary overview justification of funding and adaptation alternatives, with for each main project component a justification of the funding, followed by a concise reflection on Adaptation alternatives

K. Sustainability of outcomes

Project sustainability is highly dependent on human resources capacity dimensions. With a strong focus on human resources development, a new generation of better skilled and equipped female and male groundwater experts will be supported to engage with pertinent challenges of the coming decades. Project outcomes will allow for this process of capacity development to proceed in a concerted manner, with common tools and data. Sustainability of outcomes will also be enhanced by closely linking groundwater resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional community of practice will be fostered, building upon efforts previously undertaken by the project partners. Working in a more concerted manner, this groundwater community of practice will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies; this will generate long-term benefits to the sector and enhance sustainability. Finally, the project's engagement with community-level organizations in the pilot sites will strengthen the position of communities as resource owners and custodians.

The proposed implementation partnership, with UNESCO, CCOP-TS as executive partner and technical support from IWMI and IGRAC forms a solid foundation for outcome sustainability. All partners have a long time presence in the region and are dedicated to continue their activities, in close cooperation with the national partners. The envisaged project cooperation will simulate stronger and more effective intraregional cooperation in the future, and provides a collaboration model that makes more effective use of support from partners outside the region (like JICA, AusAid, KOICA, BGR, global funds and other development initiatives).

Project outcomes will be shared and made available for uptake by relevant regional organisations such as MRC and Climate Change coordination focal points under ASEAN. On the national level, national Mekong River Commissions will be engaged.

L. Environmental and social impacts and risks

As further elaborated in Part III, project management, Section 2 and Section 3, the proposed project seeks to fully align with the Adaptation Fund's Environmental and Social Policy (ESP). Table 10 (in Section III.3 below) summarizes the initial analysis that has been carried out to evaluate environmental and social impacts of the project versus the AF policy. Also, it indicates where steps will be taken and where further assessment is needed (in those domains were positive impacts are anticipated). This will be done as part of the project monitoring and evaluation effort.

Activities under Component 1 to 5 are all 'knowledge' activities that are community focused, and nearly all with explicit stakeholder participation, they are also limited in spatial scale and impact (no or very limited physical construction or disturbance), and can easily be adapted, changed or reversed. According to the Adaptation Fund's Environmental and Social Policy, "Projects/programmes with potential adverse impacts that are fewer in number, smaller in scale, less widespread, reversible or easily mitigated should be categorized as Category B." (Source: Adaptation Fund Environmental and Social Policy document.). Therefore, no serious environmental and social risks, whether direct, indirect or cumulative are envisaged to arrive as a result of any of the proposed activities under Components 1 to 5. In a proactive manner, the project Environmental and Social Management Plan will be applied. (see Part III, Section 3).

As elaborated throughout the proposal the project specifically aims to deliver positive transboundary impacts.

The miscellaneous field activities that will be formulated in detail for the implementation of the designated pilot areas need to be scrutinized more closely. Some of these may be considered 'hard' activities, and as such have the potential, without environmental and social safeguarding and mitigation measures, to have minor negative environmental and social impacts. However, in our assessment, none of the proposed activities is expected to be in Category A of the Adaptation Fund's impact classification. This is because this project proposes potentially 'hard' activities that are small scale and very localized, and co-managed by local communities where possible, who have a stake in avoiding negative environmental and social impacts. This means that the potential for direct impacts is small and localized, that there can be few indirect impacts. Given this, cascading or cumulative negative impacts are also unlikely.

Sections 2 and 3 of the Management Part III below deals with potential financial risks and environmental and social impacts. The project did not, at this stage, identify explicit or implicit environmental and/or social risks other than the ones discussed in that Section.

PART III: IMPLEMENTATION ARRANGEMENT

1. PROJECT MANAGEMENT
2. PROJECT AND FINANCIAL RISK MANAGEMENT
3. PROJECT ENVIRONMENTAL AND SOCIAL POLICY
4. MONITORING AND EVALUATION
5. PROJECT RESULTS FRAMEWORK (LOGICAL FRAMEWORK): MILESTONES, TARGETS AND INDICATORS
6. ALIGNMENT WITH ADAPTATION FUND RESULTS FRAMEWORK
7. BUDGET (EXCEL SHEETS, ALSO PROVIDED AS ANNEX II)

   Sheet 1: Summary project budget
   Sheet 2: Breakdown of the project execution costs (CCOP-TS)
   Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
   Sheet 4: Budget disbursement schedule with time-bound milestones.
   Sheet 5: Detailed project budget, Excel format (Annex only)

1. Project Management

Introduction
The arrangements for effective and efficient project implementation and management are introduced. First, project 'ownership' arrangements at overall project level are presented, including coordination arrangements by UNESCO as MIE and CCOP-TS as Executive Entity. Regional and national coordination within countries is also clarified. Actual and prospective partnership arrangements with national institutions are discussed and it is elaborated how national and regional partners as National Implementing Entities (NIE) will play a role in project implementation and management.

On the basis of this application and following project preparatory consultations and arrangements, the following entities will support project implementation and management.

Who is Who: Beneficiaries and stakeholders – NIEs

1. Government of Cambodia, Ministry of Water Resources and Meteorology and Ministry of Mines and Energy deal with groundwater issues in Cambodia.

2. Government of Lao PDR, Ministry of Natural Resources and Environment (MoNRE), and its subsidiary Department for Water Resources (DWR) including the Groundwater Management Division. Furthermore, the Natural Resources and Environment Institute (NREI) has an executive role in groundwater management.

3. Government of Myanmar, Ministry of Agriculture and Irrigation and within the Ministry of Water Resources the Utilization Department (WRUD) has the role of implementing agency.

4. Government of Thailand, Ministry of Natural Resources and Environment; within the Ministry the Department of Groundwater Resources has the responsibilities in planning, assessment, resource conservation, and regulations.

5. Government of Vietnam, MoNRE as the coordinating Ministry for water resources management, is implementing river basin water resources management plans on a national scale that include groundwater. The National Center for Water Resources Planning and Investigation (NAWAPI), has an executive role.

6. Universities, research institutions and local NGOs in the GMS and specifically active in the proposed pilot areas and in a position to contribute to capacity building on groundwater. A specific role is envisaged for the Mekong River Commission and the National Mekong Commissions in the respective riparian countries.

The collaboration will be supported by:

UNESCO: as MIE, it will provide all technical backstopping, facilitation with member States and processes with the Adaptation Fund.

Technical Secretariat of CCOP (CCOP-TS): Coordinating Committee for Geosciences Programmes (in East and Southeast Asia): CCOP-TS, as Executive Entity (EE) will provide technical expertise and coordinate and support implementation along with the national partners.

International Water Management Institute (IWMI): has been at the forefront of research aimed at exploring opportunities for improved groundwater development and management for poverty alleviation and improving groundwater governance across SE Asia. IWMI will be one of the implementing partners.

International Groundwater Resources Assessment Centre (IGRAC): is UNESCO's and WMO's groundwater expertise and resources centre that facilitates and promotes information and knowledge sharing required for sustainable development, management and governance of transboundary groundwater.

Multilateral Implementing Entity (MIE)

As endorsed by the signatories from the five participating countries, UNESCO through its Regional Sciences Bureau for Asia in close coordination with its offices in Bangkok, Hanoi, Phnom Penh and Yangon will serve as MIE for the project. Firstly, a short overview of UNESCO's track record in the subject matter is presented. Secondly, it is elaborated in what way UNESCO, as MIE, will manage the project

UNESCO and water management, including groundwater

UNESCO works to build the scientific knowledge base to help countries manage their water resources in a sustainable way through:

- the activities of its International Hydrological Programme (IHP),
- the Secretariat of the UN-wide World Water Development Programme
- the "UNESCO Water Family", which links over 30 member state-funded and operated centres of expertise in water-related research, education, capacity development and cooperation, as well as a wide network of UNESCO Chairs at at universities and research institutions globally.

The IHP is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance. IHP facilitates an interdisciplinary and integrated approach to watershed and aquifer management, which incorporates the social dimension of water resources, and promotes and develops international research in hydrological and freshwater sciences. IHP is in its eighth phase covering 2014-2021. IHP-VIII brings innovative methods, tools and approaches into play by capitalizing on advances in water sciences, as well as building competences to meet the challenges of today's global water challenges.

Under IHP-VIII, groundwater is one of the main areas where IHP is continuing its pioneering work to learn more about the complexity of aquifer systems, the increasing global risk to groundwater depletion, quality deterioration and pollution, and the resilience of communities and populations dependent on groundwater sources.

Objectives include promoting measures addressing the principles of sustainable management of groundwater, addressing methods for the sound development, exploitation and protection of groundwater resources, developing new groundwater resource maps, and strengthening groundwater governance policy and water user rights in emergency situations. These challenges call for comprehensive research, implementation of new science-based methodologies and the endorsement of principles of integrated management, and environmentally-sound protection of resources.

Focal Areas of IHP-VIII under the theme of "Groundwater in a Changing Environment"

Focal area 2.1 - Enhancing sustainable groundwater resources management
Focal area 2.2 - Addressing strategies for management of aquifers recharge
Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
Focal area 2.4 - Promoting groundwater quality protection
Focal area 2.5 - Promoting management of transboundary aquifers

Key current and recent IHP initiatives include:

GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climate Change) is a UNESCO-IHP project seeking to improve our understanding of how groundwater interacts within the global water cycle, how it supports ecosystems and humankind and, in turn, responds to complex and coupled pressures of human activity and climate change. GRAPHIC was developed to successfully achieve these objectives within a global context and represents a collaborative effort that serves as an umbrella for international research and education.

Through a variety of regional working groups and case studies, GRAPHIC outlines areas of international research, covering major geographical regions, groundwater resource topics, and methods to help advance the knowledge required to address both the scientific and social aspects of this field. Comprehensive information is provided in: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/2015_GRAPHIC_GWandCC.pdf

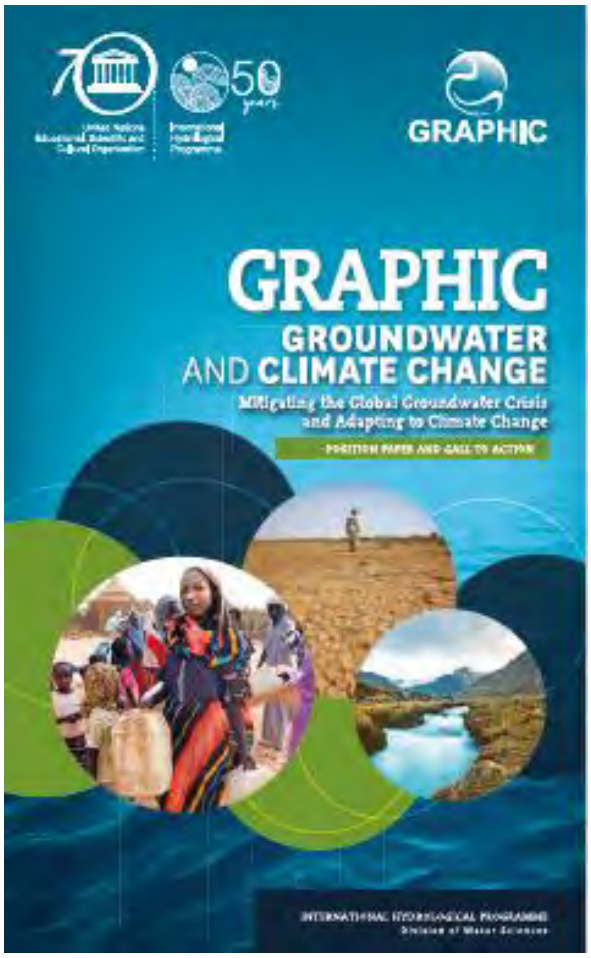


Figure 15: The Graphic Programme of UNESCO-IHP Groundwater and Climate Change (Brochure cover).

The **worldwide ISARM (Internationally Shared Aquifer Resources Management)** Initiative is an UNESCO and International Association of Hydrogeologists (IAH) led multi-agency effort aimed at improving the understanding of scientific, socio-economic, legal, institutional and environmental issues related to the management of transboundary aquifers (http://isarm.org/).

The issue of shared international waters is as old as the national borders that make those waters international. During the last century, significant progress was made in regulation of joint management of surface watercourses; many international river-, lake- or basin commissions have been set up and the legal treaties signed. Although some of these activities address "a groundwater component" as well, major comparable efforts related to the invisible groundwater have started just a few years ago with the ISARM Programme.

Since its start in 2002, ISARM has launched a number of global and regional initiatives. These are designed to delineate and analyse transboundary aquifer systems and to encourage riparian states to work cooperatively toward mutually beneficial and sustainable aquifer development. Comprehensive information is provided in: (http://en.unesco.org/themes/water-security/hydrology/programmes/isarm/general-information).

The World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) was created in 1999 in order to contribute to worldwide efforts towards better managing the Earth's water resources, particularly groundwater. It is a joint programme of UNESCO, the Commission for the Geological Map of the World, the IAH, the International Atomic Energy Agency and BGR. General information is provided at:
http://en.unesco.org/themes/water-security/hydrology/programmes/whymap/resources

'Groundwater for Emergency Situations' (GWES). The aim of the GWES project is to consider natural catastrophic events that could adversely influence human health and life and to identify in advance emergency groundwater resources resistant to natural and man-made disasters that could replace damaged public and domestic drinking water supplies. A very important aspect of the GWES project, in drawing the attention of governments, organizations and individuals to the concept of preparedness for establishing alternative drinking water supplies, is empowerment. Very often a local population is rendered helpless following a disaster, cut off from its traditional water supplies and faced with delays in aid from outside. This may lead to destabilization and demoralization at a time when people need to rebuild their lives (http://unesdoc.unesco.org/images/0019/001921/192182e.pdf).

UNESCO Regional Sciences Bureau for Asia and the Pacific

Located in Jakarta, Indonesia, the UNESCO Regional Sciences Bureau for Asia and the Pacific was established as a field office for South-East Asian Science Cooperation (SEASCO) in 1951. In 1967 it became the Regional Office for Sciences and for South East Asia (ROSTSEA). Since 2001, UNESCO Jakarta has served as the Regional Science Bureau for Asia and the Pacific. Today, the UNESCO Regional Sciences Bureau for Asia and the Pacific also serves as representative office for Brunei Darussalam, Indonesia, Malaysia, the Philippines and Timor-Leste.

As Regional Bureau for Science, UNESCO Jakarta provides strategic expertise, advisory, monitoring and evaluation functions to Member States, other UNESCO Field Offices and United Nations Country Teams in the

area of Science across the entire Asia and the Pacific. In the 48 UNESCO Member States and 2 Associate Members of the Asia-Pacific, UNESCO is present with a network of 13 Field Offices serving at the regional, sub-regional and country levels.

For the implementation of the project, the UNESCO Regional Sciences Bureau for Asia and the Pacific will serve as MIE, in close coordination with the UNESCO Office in Bangkok – as representative office to Lao PDR, Myanmar and Thailand – as well as the UNESCO National Offices in Hanoi and Phnom Penh, and the UNESCO Bangkok Antenna Office in Yangon.

UNESCO Bangkok Asia and Pacific Regional Bureau for Education
Since 1961, UNESCO Bangkok Office has served the UNESCO Bangkok Asia and Pacific Regional Bureau for Education as well as representative office to the five participating countries (joined by Singapore in 2007). The office covers all UNESCO's fields of competence: education, sciences, culture, communication and information. It is responsible for UNESCO activities directly in Thailand, Lao PDR Singapore and Myanmar (through its Antenna Office in Yangon), and indirectly in support of UNESCO Country Offices in Hanoi and Phnom Penh.

Through its network of field offices at the regional, sub-regional and national level, UNESCO has a strong and permanent presence in the region and in the participating countries. In the field of Science, UNESCO's field offices in the participating units collaborate closely and strategically under the overall coordination of the Regional Bureau for Science.

MIE Management tasks
The following implementation support under the MIE modality will be provided by UNESCO for the project:

- Overall coordination and management of UNESCO's MIE functions and responsibilities, and the facilitation of interactions with the Adaptation Fund Board and other relevant parties;
- Oversight of project implementation through close interaction with the project Executive Entity CCOP-TS and with the Project Steering Committee (PSC) and reporting to AF on progress and on budget performance;
- Quality assurance and accountability for outputs and deliverables during project implementation and upon completion;
- Receipt, management and disbursement of AF funds in accordance with the financial standards of the AF;
- Assurance of national government support, continued participation and uptake of results.
- Assurance of continuous compliance with the project's Social and Environmental Management Plan.

UNESCO as MIE and as part of its project management responsibility will appoint through an open competition a **Project Manager** (**PM**) who will oversee the implementation of the project along the tasks outlined above. There will be close cooperation between the PM and the project executive and operational levels (i.e., with Project Director, Coordinating Technical Advisor CTA and CCOP-TS support staff). Through the official network of UNESCO and its field offices in the five participating countries and its Head Office UNESCO as MIE, the PM will be able to actively support project implementation and have regular contact with the Executing Agency (CCOP-TS in Bangkok) over the course of the AF project implementation.

Project Execution
In accordance with its standards and procedures, UNESCO will enter into a contractual agreement with the coordinating executing partner, CCOP-TS, towards the execution of the AF project activities and delivery of the proposed outputs.

The **Project Director (PD)** will be responsible for the overall management of the AF project. The PD (a part-time position taken by CCOP-TS Executive Director will ensure that the project is run transparently and effectively in accordance with AF and UNESCO's guidelines and approved work plans and budgets. The PD will receive project support from the CCOP-TS project finances manager as well as additional staff members within CCOP-TS. The key functions of the PD will be:

- Facilitating the day-to-day functioning of the project support staff;

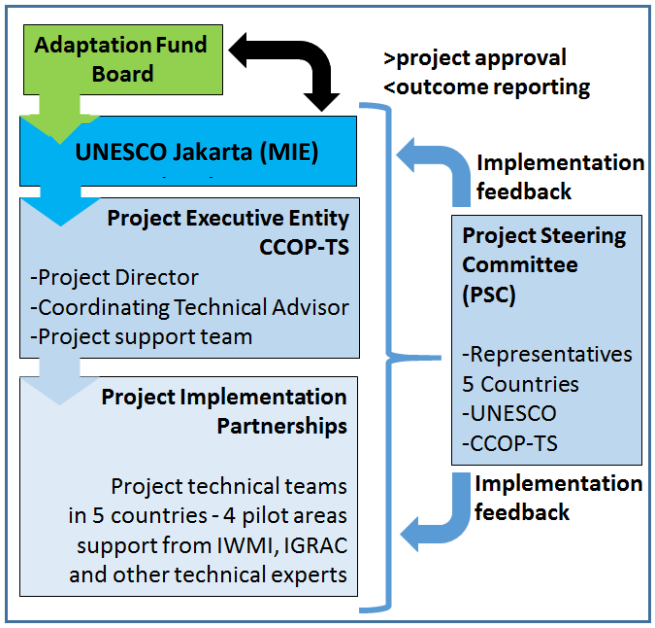
- Managing human and financial resources in consultation with UNESCO and the project CTA to achieve results in line with the outputs and activities outlined in the project document;
- Ensure gender analysis and gender monitoring are undertaken by experts;
- Leading the preparation and implementation of annual results-based work plans and logical frameworks as endorsed by the management of UNESCO;
- Monitoring project activities, including financial matters, and preparing monthly and quarterly progress reports, and organising monthly and quarterly progress reviews;
- Together with UNESCO, organizing PSC meetings;
- Regular reporting and providing feedback on project strategies, activities, progress, and barriers to UNESCO, PSC and project partners; and
- Supporting UNESCO to manage relationships with project stakeholders including donors, NGOs and government agencies

A **Coordinating Technical Advisor (CTA)** will be hired by CCOP-TS to assist the PD and provide technical guidance and support for the implementation of the project. The CTA will:

- Prepare Annual Work plans, TORs for technical consultancies and supervision of consultants' work;
- Assist in monitoring the technical quality of project M&E systems, including annual work plans, indicators and targets;
- provide advice on suitable approaches and methodologies for achieving project targets and objectives;
- provide a technical supervisory function to the work carried out by any other technical consultants hired by the project; and
- assist in knowledge management, communications and awareness raising.

The CTA position will be filled through a transparent and competitive recruitment process that will commence as soon as the Full Project Proposal is approved.

Figure 19: AF project management arrangements.



Step-by-step implementation strategy

- Organise an executive project team consisting of national experts from the five partner countries, and experts from the supporting Technical Assistance partners (CCOP-TS, IWMI, IGRAC). As MIE, UNESCO will convene a PSC.
- Develop a common view and understanding of the role that improved groundwater management shall play in strengthening climate resilience in multiple sectors; identify additional opportunities through transboundary collaboration; sharing information, expertise and collaborative policies for climate resilience.
- Resource assessment: common methodology to be adopted and approach to data collection/sharing; agree on protocols for sharing available data on transboundary aquifers.
- Compile various maps / information services and products available from countries/organisations and further demarcate the recharge and extraction zones and consider transboundary issues.
- Identify data gaps and need for new data; collaborative monitoring approach, initiate base-level monitoring.
- Common approach for groundwater resources management information system, basic functions and operations, training expert users, dissemination to end-users in the five countries.
- Raise stakeholder and public awareness on groundwater vulnerability through development of tailored information for sectoral users and multi-media awareness for urban and rural populations.

- Build capacity of local groundwater management professionals, planners and policy makers in the pertinent national government organisations.
- Consult stakeholders and develop a process of ongoing engagement with the specific actors with interest in groundwater from government, donors, NGO's and the private sector.

These activities collectively serve to create the environment needed to achieve positive change on the ground throughout the GMS by reducing vulnerability and increasing adaptive capacity to the impacts of climate change, including climate variability. Clear indicators to track and demonstrate these outcomes will be developed at an early project stage and monitored by the PSC and activities adjusted as needed.

Terms of Reference for Project Steering Committee (PSC)

The PSC will be formed to keep abreast of the project progress and to facilitate the implementation of the project, while direct implementation of the project and decisions regarding the allocation of resources and assistance under the project will be taken by UNESCO as the MIE and CCOP-TS as EE. The PSC will:

- Facilitate the implementation of the project to achieve progress on time, on scope and on budget
- Review progress reports submitted by the Project Team
- Support the broader dissemination of the project's results, especially towards government entities and policy-makers.

PSC Members: One PSC member from each participating country will be invited through the appropriate governance channels. Hence, the PSC will have five (country) members. Chair will rotate every year. UNESCO as MIE and CCOP-TS will attend, as well as CTA.

PSC Meetings: The PSC will meet quarterly throughout the lifetime of the project and may meet more often as required. A calendar of meetings will be developed at the project inception workshop. Whether virtual meetings can serve after at least two successful in-person meetings have been held will be assessed.

Secretariat function: CCOP-TS as EE will provide secretariat services for the PSC by coordinating meetings, producing documentation and meeting minutes, managing correspondence, information management/ dissemination and related tasks.

Documents will be made available to PSC members at least one month prior to the meetings. Minutes of the meetings will be prepared by UNESCO & CCOP-TS. Members of the PSC will share information with non-member stakeholders.

CCOP-TS for project execution

For this project CCOP-TS is the designated project Executive Entity (EE) . Below, CCOP-TS is briefly introduced and its project management and coordination qualifications highlighted. For a useful introduction and overview, please also consult www.ccop.or.th

CCOP, established in 1966, is one of the oldest intergovernmental organisations in East and Southeast Asia. Its mission is to contribute significantly to the economic development and sustainable management of the environment of the quality of life of its Member countries by the application of Earth sciences knowledge. Its focus is on:

- **Outreach**: to enhance influence with decision-makers, investors and the general public through the provision of relevant earth system science information and to develop appropriate skills to communicate effectively with stakeholders in the CCOP member countries.
- **Cooperation and partnerships**: to enhance the internal and external partnerships to improve the quality, reach, application and impact of earth sciences information and knowledge
- **Knowledge enhancement and sharing**: to manage, promote, share and exploit the region's earth sciences information and skills
- **Data and information:** to advance sharing of data and information and integrate earth sciences data across national boundaries
- CCOP's primary network consists of the 15 member countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste and Vietnam. Additionally, it maintains close ties with a considerable number of Cooperating Countries and Cooperating Organisations. The management and organization structure of

CCOP and CCOP-TS is presented below. At the beginning of 2016 CCOP-TS had 10 permanent staff, including four earth science experts and six support staff.

Technical cooperation and tasks of CCOP-TS

In response to the requests of the member countries CCOP-TS has organized, coordinated and supported a number of capacity building and technical cooperation workshops, training courses and case studies in three technical sectors, geo-resources, geo-environment and geo-information. Most of these activities have multilateral participation and support, and often include attention for transboundary issues (resource management, data and information sharing, harmonization). CCOP-TS also supports specific bilateral technical cooperation. For instance, in 2014 there were 26 training/ workshop activities were carried out that were attended by over 890 participants from all member countries. One of the tasks of CCOP-TS is to ensure workshop results and deliverables are prepared and disseminated (reports, books, database content, website, etc.). CCOP-TS also prepares a regular Newsletter.

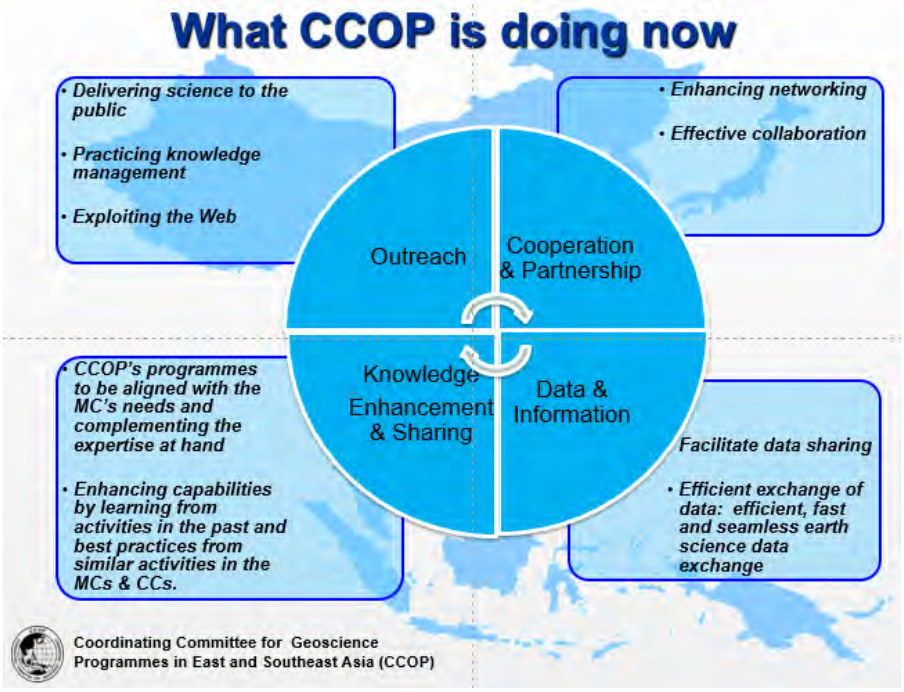


Figure 20: Tasks and coverage of CCOP's activities

CCOP-TS Director and senior experts have the responsibility to continuously liaise with member countries and organisations, ensure donor support and prepare technical meetings. CCOP-TS budget derives mainly from membership fees, income from project execution and support and occasional grants, while its expenditure consists of personnel expenses and operational costs. Its offices are provided by the Royal Thai Government through an arrangement with MoENR and include office workspace and facilities, meeting rooms and services.

CCOP-TS capabilities as a network organization are complemented with thorough and high-level expertise in the subject matter. As part of the 'Geo-Resources' CCOP-TS and its partners have worked on sustainable management of groundwater for a considerable time. There is also relevant expertise in the 'Geo-Information' programme. In all, CCOP-TS is well placed to be tasked with execution of the proposed project.

CCOP-TS Groundwater related project involvement (since 2004)

1. **General Groundwater Resources**
   CCOP-GSJ/AIST Groundwater Project (2004-2015)
   - Phase I: Groundwater Assessment along Great River Basins in East and Southeast Asia (2004-2009)
   - Phase II: Groundwater Assessment and Control in the CCOP Region (2010-2014)
   - Phase III: As a groundwater component of the CCOP-GSJ Project "Development of Geo-Information sharing infrastructure for ASEAN/CCOP countries" (started 2015)
   - Project: "Development of Renewable Energy for Ground-Coupled Heat Pump system in CCOP Regions"
   - Groundwater and Bottled water market

- CCOP-BGR-NAWAPI, Vietnam Workshop, Integrated water resource management in coastal zones with a focus on Groundwater Experiences in East and Southeast Asia Countries, Can Tho, Vietnam, 19-21 January 2016
- CCOP-KIGAM Workshop (Sihanoukville, Cambodia), 1-4 June 2016 Groundwater management and Climate Change Adaptation in the Lower Mekong Basin.

2. Groundwater – Environmental and Geohazard Issues

- CCOP-KIGAM Project "Solutions for Groundwater problems in CCOP region" (2013-2017)
- CCOP-Panya Consultant-DGR Land Subsidence Monitoring System Design Project Workshop/Meeting, 16-22 January 2011, Bangkok, Thailand
- The 6th JPDC-KIGAM-CCOP Jeju Water Forum on 6-9 October 2014 in Jeju, Republic of Korea
- BGR – CCOP Workshop "Integrated water resource management in coastal zones with a focus on groundwater – experiences in East and Southeast Asia countries"

3. Deep Groundwater Programme

- PETRONAS-PETRAD-INSTOCK-CCOP Deepwater Subsea tie-back in Kuching, Malaysia on 24-26 January 2011
- Deep Groundwater Resources (project proposal ready, implementation waiting for external funding)

Figure 21: Scope of activities of CCOP in various relevant fields (Geo-Resources, Geo-Environment and Geo-information). The five lines of work are applied for the Groundwater topic, especially in the less-developed member countries in the network.

Collaboration with groundwater user organizations

In the proposed pilot areas groundwater user organizations (if existing) or other stakeholder groups will be engaged in the project. They may be regarded the primary beneficiaries of the project and will be involved in the development, application, evaluation and wider dissemination of groundwater-based resilience strengthening measures. Groundwater user organizations will be supported (stimulated when they are embryonic or not yet set up), and subsequently will be:

- Actively supporting collection of groundwater data
- Participating in development of groundwater management information products
- Supporting validation of resilience strengthening measures
- Strengthened to be able continue contributing to sustainable groundwater management as part of CCA resilience
- Evaluating and providing feedback on project interventions and impact

For the project management groundwater user organizations are the most important group of project stakeholders that will validate the impact of the project.

NB. groundwater user organizations are not directly involved in Project Management *sensu stricto* (as this comment is raised under the Section related to Project Management.

2. Project and Financial Risk Management

A number of potential project and financial risks have been considered and analysed in the process leading up to this Adaptation Fund proposal. These are summarized in Table 10 below. The risk management strategy of this AF project will be further fine-tuned during the project Inception Phase.

No	Risk	Classification	Impact/ Probability 1: Low 5: High	Mitigation Measure
1	National policy and institutional practices undermine the development of concrete resilience measures in the pilot areas	Institutional	Impact: 4 Probability: 1	The project will work on different intervention levels, from national natural resources management and CCA policy in the five countries (national ministerial level), as well as on regional (responsible agencies and sub-ministerial) level and stakeholder group organisations, to local level through direct interaction with primary stakeholder groups.
2	Data availability and consistency is inadequate to design trusted and acceptable resilience measures.	Environmental	Impact: 3 Probability: 3	The project will follow a step-by-step approach, with simple and low-threshold initiatives first, and then gradually develop more complex and higher impact practices.
3	Resilience measures increase inequity in communities	Environmental and Social	Impact: 3 Probability: 2	Local level implementation through farmer and other groundwater user groups will ensure that resilience measures are demonstrated on the basis of participative processes which are gender-sensitive and enable participation of vulnerable and marginalized groups.
4	Political and safety situation is not supportive of field visits and working with stakeholders in pilot areas	Social, Political	Impact: 4 Probability: 1	Pilot areas have been selected with this in mind. Different pilot areas can be selected, but only if this has to be done early on in the project.
5	Technical support capabilities and budgets from the project are inadequate.	Institutional	Impact: 3 Probability: 2	The project is relying on a participative approach through its engagement with national partners and local stakeholders in the pilot areas. This will stimulate ownership and allow for collaboration with local initiatives and will muster support from national and international partners.

Table 14: Project risks and mitigation measure

3. Project Environmental and Social Policy (ESP)
(Measures for Environmental and Social Risk Management)

Introduction

During the preparation stage of this proposal, UNESCO, as lead applicant and designated IE, in collaboration with partner and representatives from the GMS countries, has conducted a screening and self-assessment in order to determine if the project construct and scope will comply with the ESP principles of the Adaptation Fund. This process and its outcomes are summarized below (Figure 22). In the following section, in short, the measures for environmental and social risk management are described in line with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

The applicant takes note that the Adaptation Fund finances climate adaptation projects and programmes for vulnerable communities in developing countries that are Parties to the Kyoto Protocol. The project acknowledges, and has been designed in accordance with, the Adaptation Fund's Environmental and Social Policy (AF ESP document; March 2016 documentation). Full adherence to the Policy will ensure that the project promotes positive environmental and social benefits, and that a maximum effort is made to mitigate and/or avoids adverse environmental and social risks and impacts.

The project's categorization and compliance with the ESP has been outlined in Part II, Section E. In line with AF guidelines, the project has followed a stepwise approach (depicted in the Figure below) towards setting up and applying an ESMP. The proposed Environmental and Social Management Plan is further introduced below.

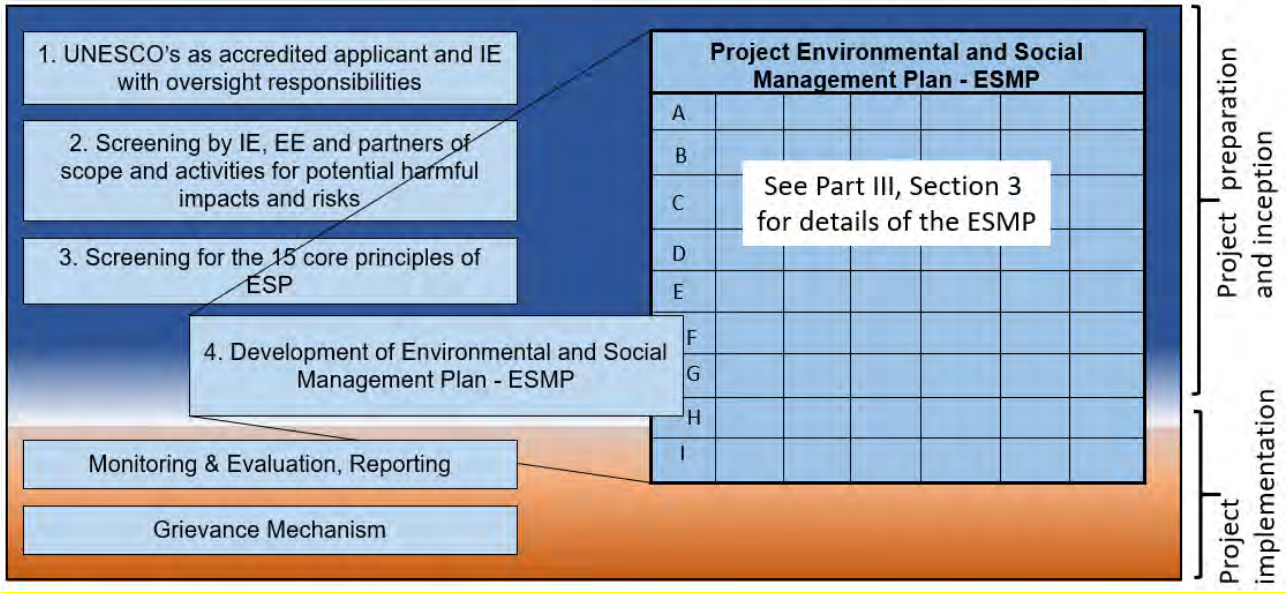


Figure 22: Schematic overview of the project ESP compliance approach. The upper part 1-4 components were developed and applied during project preparation and will be further improved in the project's Inception Phase. The ESMP will be applied during project implementation, as well as monitoring and evaluation, reporting and, when required, activation of the grievance mechanism.

As lead applicant UNESCO strives to apply four key mechanisms to comply with the ESP:

1. Programme-Level Quality Assurance; As elaborated in Part II, Section E. UNESCO's as accredited applicant and IE with oversight responsibilities and core policy to lead in application of environmental, gender and social principles.
2. Project-Level Quality Assurance; As elaborated in Part II, Section E. Screening, by IE, EE and partners in the five countries, of proposed project scope and activities for potential harmful impacts and risks.

3. Project-Level Social and Environmental Screening Procedure; As elaborated in Part II, Section E. Screening of impacts and possible risks of proposed project in relation to the 15 core principles of ESP; Categorization of the project as “B” .
4. Development and application of ESMP; As per guidelines of the Adaptation Fund. The ESMP is further elaborated below.

Finally, in accordance with the project Monitoring and Evaluation approach, progress reporting will pay specific attention to the compliance issues. And following from the project concept and set-up, there is already a high level of stakeholder involvement and this also ensures a low risk of non-compliance for several key principles. Whenever potential non-compliance issues arise, the Grievance mechanism can be activated.

Environmental and Social Management Plan - ESMP

In line with the guidelines of the AF the project applicants have developed an Environmental and Social impacts and risks Management Plan (ESMP). The risks recognized have been assessed for impact and mitigation and proper management measures are identified at project level and at pilot level. The ESMP includes the relevant components, i.e. mitigation plans, institutional arrangements, stakeholder consultation, capacity building, monitoring and evaluation and reporting. The ESMP, tailored for each pilot area will comply with the ESP of the AF and the national technical standards of the relevant country. Once formulated and approved, the status of ESP issues will be reported in the applicable progress and evaluation reports prepared for the AF and national stakeholders.

The proposed ESMP consists of a number of fixed core elements, and is also dynamic, e.g. it can be improved and adapted in the course of the project (especially after the Inception Phase).

Core elements of the Environmental and Social impacts and risks Management Plan (ESMP) are as follows:

	ESMP elements	Who	When
A	Project team awareness and training on compliance with ESP and gender guidelines, monitoring process and related issues.	Core project team and executive partners, pilot coordinators	During project Inception Phase
B	Awareness and training for key project stakeholders, in particular: a) government partners, and b) pilot area teams, with particular reference to vulnerable groups, indigenous peoples.	Core project team and executive partners, pilot coordinators	In the first year of project implementation.
C	Re-assessment of impacts and risks on two levels: 1) integral project and 2) for the four pilots	1) IE and EE 2) Pilot area teams coordinated by EE	Inception Phase
D	Updated reporting on compliance with ESP and gender guidelines and update of monitoring system	Supervision IE and EE	Part of Inception Phase reporting
E	Validation of the monitoring and evaluation approach, and reporting with clear and verifiable indicators and Means of Verification	Supervision IE and EE	Towards the first M & E reporting instant
F	Periodical progress reporting as prescribed in the project management plan	1) IE and EE 2) Pilot area teams coordinated by EE	According to M & E and progress reporting schedule (Section 3, M & E)
G	Gender issues assessment and ensuring positive impacts and compliance	Dedicated gender expert engaged from/through IE	After project Inception, Year 1 and towards completion, Year 4
H	M & E; Systematic progress monitoring, collection of stakeholder feedback and reviews	Supervision IE and EE	At least twice during the project with one survey at the end of the project.
I	Project Steering Committee assessment of compliance	Invited by IE to assess and give feedback	At least twice during the project

J	Awareness and activation of Grievance Mechanism	IE and pilot area coordinator	In the first year of project implementation

Table 15: Core elements of the Environmental and Social impacts and risks Management Plan (ESMP).

Elaboration of ESMP elements

A: UNESCO, as the IE, will provide an introduction and training to the EE and coordinators at the onset of project implementation in order to ensure that all principal project partners have the required knowledge and awareness level regarding their responsibilities with regards to the provisions of the Environmental and Social Policy of the AF as well as the promotion of human rights, including specifically the complaint handling mechanism of the Fund. The ESP of the AF will be used as the main guidance to ensure compliance. The introduction and training on the relevant concept and tools for compliance will be used for the project team, and also for the wider community of participants and key stakeholders.

B: In order to prevent the exacerbation of existing inequities, the project will identify vulnerabilities in pilot areas during the Inception Phase and will monitor the impact during the whole project implementation period. As part of the participative processes, community dialogues, training and close collaboration with national and local authorities will enable participation of vulnerable and marginalized groups and successful signaling, management and mitigation of risks.

C: For each pilot area, the comprehensive risk screening and mitigation plan will be re-visited, following further detailing of the work plans (i.e. project locations, target groups, groundwater management activities and project interventions to be defined in greater detail during the project Inception Phase). Where deemed necessary, project scope and interventions will be adjusted to ensure risks are mitigated and potential negative impacts avoided. As much as possible the risk screening will be done in a participatory manner, with the involved groundwater user and community groups.

D: As part of the compliance approach, ESMP and progress monitoring, the status and issues arisen will be reported at the end of the Inception Phase. The Inception Phase, as a go/no-go moment can be used to improve on any inadequate environmental and social risk monitoring or mitigation.

E: Validation of the monitoring and evaluation set-up, and reporting with clear and verifiable indicators and means of verification. The implementers will build on the proposed M&E approach and, when required, can update the M&E approach in accordance with the latest AF guidelines.

F: Periodical progress reporting as prescribed in the project management plan, and as per AF guidelines. UNESCO and CCOP-TS as IE and EE will prepare the final environmental and social assessment reporting for AF and in a suitable format for people, communities and other stakeholders involved in the project. A special section of the progress reports will be dedicated to stakeholders and vulnerable groups in each pilot area.

G: Gender issues assessment and ensuring positive impacts and compliance. The Terms of Reference for a gender specialist engaged for the project by the IE will be prepared during the IP and the involvement ensured.

H: M&E; Systematic progress monitoring, collection of stakeholder feedback and reviews

I: Project Steering Committee assessment of compliance; following on the partner country consultations on the ESP compliance issues, the project Steering Committee (again composed of representatives from the five countries) will be asked to pay specific attention to this subject.

J: Awareness and activation of Grievance Mechanism (see below).

4. Monitoring and Evaluation, Reporting

As IE, UNESCO will establish a project M&E and reporting mechanism through which to monitor and report, with at least, 1) project progress and results (on the basis of verifiable indicators and MoV's) and 2) impact assessment and compliance with ESP Principles. This will be done throughout implementation of the project. As the project will focus on implementation of activities in four pilot areas, monitoring and reporting processes will place particular emphasis on the (sub)national and regional levels, in the following manner:

For the project as a whole and for each pilot area (4x):

1. Semi-annual workplan preparation and approval assessed by means of checklist on potential negative impact and risks and for each of the fifteen Environmental and Social Core Principles. Activities (Tables 10 & 11); Apply screening measures as introduced in Tables 10 and 11.
2. Upon completion of semi-annual workplans, implementing units will be specifically requested to report any issues pertaining to adverse environmental and social impacts, and/or mitigation actions implemented or considered.
3. An annual summary statement / communique will be prepared on the basis of which further public consultations and associated activities can take place.
4. In each pilot area, a small representative committee of local and national stakeholders will be involved. This committee will approve/endorse:
    a. the overall outcome of the environmental and social impact assessments, and
    b. possible mitigation actions for unforeseen adverse impacts.

    Since the project will focus implementation in the pilot areas, consultation and mobilization of project support and understanding by local stakeholders and their representatives is essential. If necessary, a grievance mechanism can be applied (see below).
5. National partners, in their supporting roles for the implementation of the project, will be involved in and support steps 1-4. This process is overseen by UNESCO as IE and reported on at semi-annual project meetings. The ultimate responsibility for implementation of the M&E mechanism rests with the implementing entity.

UNESCO and the project partners have in the project formulation and initial screening process (Concept Note and Proposal stage) carefully considered any potential direct, indirect, transboundary, and cumulative impacts in the project's area of influence. This assessment is supported and substantiated by considerable earlier and ongoing groundwater work by the project partners in the countries and regions involved.

On this basis, it is concluded that project interventions are unlikely to have any serious adverse environmental or social impacts. Hence the project has been classified in Category B. The monitoring approach outlined in the section above will ensure - in case of doubt or due to unforeseen developments - that any potential risks can be mitigated and any associated negative impacts prevented.

If, against expectations, project implementation generates negative environmental or social impacts, this will be addressed through the M&E mechanism and reflected in the periodical project reporting. The annual project performance report will include a section detailing the status of the ongoing environmental, social impacts and risks, as well as consideration of gender issues. Reports will include, where necessary, a description of any corrective actions taken during the reporting period. The mid-term and terminal evaluation reports will also include a detailed evaluation of the project's performance with respect to gender, and environmental and social risks.

5. Grievance mechanism

All direct beneficiaries of the project and other related stakeholders will be informed about the grievance mechanism and the complaint-handling mechanism of the project. The IE with project partners will produce public information materials (leaflets and brochures) that explain the project, complete with detailed contact information of persons in charge (name, position, address, phone, email), and including access to information regarding the mechanism for handling complaints of the AF (https://www.adaptation-fund.org/page/mechanisms-handling-complaints). These public information materials will be distributed during community consultations and general awareness activities.

As part of the project's ESMP as well as progress and results monitoring, stakeholder feedback and reviews will be collected systematically. Focus will be placed on the results evaluation of tangible measures and activities in the four pilot areas (where the closest connections occur between stakeholder interests and needs and the intended effects and impacts of the project).

As part of the monitoring and evaluation process, a grievances modality will be set up - both for the project as a whole (as part of the project's website and information portal), and as part of the specific evaluation and progress data collection (M&E) in the pilot areas. This approach will allow concerned stakeholders to raise issues (anonymously if they wish), to the project management implementers at all levels of implementation.

Figure 23 depicts the grievance mechanism process to be implemented in the project. The grievance mechanism process will support receiving, evaluating, and addressing project-related grievances from local communities and other stakeholders. It will be possible to express grievances via submission on the website or by phone. Receipt of the grievance will always be acknowledged, recorded and subsequently investigated in a timely manner. Where relevant, resolved grievances will be included among the Frequently Asked Questions on the project website in order to prevent any future misunderstandings.

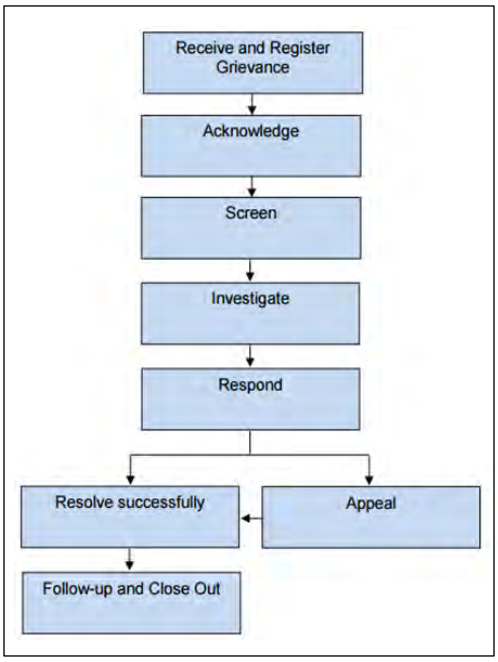


Figure 23: Grievance mechanism activation process.

4. Monitoring and Evaluation

The monitoring and evaluation (M&E) scheme of the project will be applied in accordance with established UNESCO procedures throughout the project lifetime. The M&E plan will be implemented as summarized in Table 16. Integral management and oversight will be provided by the UNESCO project holder and the CCOP-TS project team. The following are a number of essential ingredients for project M&E.

Project Inception: A Project Inception Workshop will be held within the first three months of the project and with participation of all persons and organizations that have been assigned roles and responsibilities in the project organization. Representatives from the national agencies, technical advisors and stakeholders from the region will contribute to the Inception Workshop. The Inception Workshop is crucial to generate momentum for project implementation and to develop the work plan for the first year of the project.

The Inception Workshop will address a number of key issues including:

a. Assist all national partners to fully understand and take ownership of the project;
b. Specify the roles, support services and complementary responsibilities of the project team and the national partners in the five countries;
c. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms;
d. Confirm the procedures and arrangement to engage project staff;
e. Based on the proposed project results framework, review and finalize the first annual work plan;
f. Verify and agree on project indicators, targets and their means of verification, and recheck assumptions and risks;
g. Provide a detailed overview of reporting, as well as M&E requirements. The M&E work plan and budget should be agreed and scheduled;
h. Discuss financial reporting procedures and obligations, and arrangements for audits; (i) Plan and schedule PSC meetings.
i. Roles and responsibilities of all project organization structures will be clarified and meetings planned. The first PSC meeting will be scheduled directly following the Inception Workshop.

Following the Inception Workshop, an Inception Report will be prepared as a key reference document. The Inception Report will serve as an Annex to the signed project document and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly reporting: Quarterly project progress will be monitored by UNESCO on the basis of concise project progress reports.

Comprehensive annual reports: Annual project progress reports are comprehensive key reports which are prepared to monitor progress made since project start and in particular for the previous reporting period. The annual progress reports will include at least the following: (a) Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of- project targets (cumulative); (b) Project outputs delivered per project outcome (annual); (c) Lesson learned/good practice; (d) Annual work plan and other activity and expenditure reports; (e) Risk and adaptive management. UNESCO will assess the quality of annual progress reports for completeness, comprehensiveness, analytical rigor and lessons learned.

Periodic monitoring through site visits: UNESCO and CCOP-TS will participate in project work visit and activities on location (activities as in the agreed schedule in the project's Inception Report and Annual Work Plan) to assess first hand project progress. Members of the PSC and Technical Advisory Group may join these visits incidentally. A Field/Activity Visit Report will be prepared by CCOP-TS for circulation no less than one month after the visit to the project team and PSC members.

Mid-term of project cycle: The project will undergo an independent Mid-Term Evaluation which will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management.

Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for the Mid-term evaluation will be prepared by UNESCO based on guidelines from the AF and in line with UNESCO's evaluation policy as updated in 2016 which calls for a minimum of 3% of project costs to be allocated to the evaluation function.

External final project evaluation: An external final project evaluation will take place during the final three months of the project and prior to the final PSC meeting. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the achieved contributions to capacity development in the country and pilot areas, and the SDG's, as well as the project's relevance, effectiveness and efficiency. The Terms of Reference for this evaluation will be prepared by UNESCO and the project management based on AF programme guidelines and in line with UNESCO's evaluation policy as updated in 2016.

Financial audit: Project audits will follow UNESCO's financial regulations, rules and applicable audit policies. A final certified and audited financial statement will be sent to the AF Board once the project is completed. The external financial audit will be conducted in line with the financial regulations, rules and directives of UNESCO.

Project final reports: During the last three months of the project, CCOP-TS and the implementation team will prepare the Project Final Report. This comprehensive report will summarize the results achieved (Objectives, Outcomes, Outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Description	Responsible party	Budget (tentative) excluding staff time	Time frame
Project Inception Workshop	Project management team	15,000	Project start
Inception Report	Project management team		Two weeks after the Inception workshop
Periodic status/ progress reports	Project management team		Quarterly
Meetings of PSC	Project management team, MIE	40,000	Two times in every year of the project (including virtual/Skype meetings)
Annual Progress Reports	Project management team, MIE		End of each year
Mid-Term Evaluation	External evaluation team	36,700	End of year two
External Audit	External auditor	20,000	At project closing
External Final Evaluation	External evaluation team	110,300	In the final three months of the project
Project final reports	Project management team and MIE		Final concept one month before the end of the project

Table 16: Project reporting and M&E arrangements. The indicative budget reservations are part of the Executive and Implementing Entity reservations. These will be reviewed during the Inception Phase.

5. Project Results Framework (Logical Framework)

Program Strategy	Objectively verifiable indicators				
	Indicator	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
Component 1: Groundwater resource assessment and monitoring: to obtain and use a harmonised regional GW resource inventory supporting a regional GMS approach to address challenges of climate change and resilience, and enable an information-based policy to manage resources and further develop new GW-based resilience strategies and practical interventions.					
Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Extended management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have higher adaptive capacity. At least three services modified per sector (water supply, agriculture, industry).	Regional and local authorities have insufficient knowledge to address challenges of climate change	To increase resilience based on a sound, informed management and harmonised regional policy.	Produced policy documents, agreements made, services modified per sector.	Willingness and commitment of local and national authorities to actively engage in the process. Recognition of importance and necessity of CCA, despite of financial limitation and other obstacles.
	Governments and GW expert community and users refer to this GW inventory and use it.	Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment exists.	A comprehensive overview of regional GW resources (quality, quantity) is included in an easily accessible inventory (GIS, database).	GW resources inventory tool (database and GIS) with content.	National partners are willing to provide data to be included in database.
	GW information (reports, maps, monitoring data) are used in strategies for climate resilience.	There is some GW-related data, but it is hardly used for this purpose.	GW information forms the basis for specific climate resilience measures.	Documentation and evidence for resilience measures application in the pilots.	GW system might not be suitable to support adequate measures (limited quantity, quality issues).

	Monitoring system in place and data being collected in support of operational tool.	GW seen as a static resource (basic inventories) and little or no data on temporal changes exists.	Monitoring system and information is operational and used for periodic updates.	Hard- and software, data files	Expense of periodic data collection might be too high.
	GW resources information supports further climate adaption policy at high policy levels.	Currently, GW information is hardly used.	Clear and consistent reference to GW in support of climate resilience development.	CCA policy documents with reference to GW; GW experts involved in CCA issues.	Project is able to generate tangible results with clear evidence on the ground.
Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.					
Outcome 2: GW users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	In each of the four pilot areas at least two different local GW users' groups (in total 2500 users) are capacitated to use ground-water sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved (AF core indicator 2.1.1)	Farmers and other users deplete GW resources regardless of CCA challenges.	Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.	Attendance of users in resource management meetings/training; guidelines for different water use sectors documented with breakout by sex.	GW users sufficiently aware of CCA challenges.
	GW information is regionally coherent and sufficient to attract interest from users	Information on GW potential is not tangible enough to motivate users to adopt and apply it.	Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.	Information products and guidelines published and circulated.	National partners sufficiently enabled to achieve the objectives and targets for the transboundary aquifer systems.

Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology supports better transboundary GW policies that are more robust and climate change ready.					
Outcome 3: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Low income and vulnerable groups apply GW based resilience measures. Of targeted population groups 70% is aware of predicted adverse impacts of climate change, and of appropriate responses; 30-50 % of targeted population applying appropriate adaptation responses.	Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use or specific measures to support resilience.	Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.	Practices of farmers and other user groups that apply resilience measures	Differences in quality of GW system management may be too large to solve within the timeframe of the project.
	Improved exchange of information on transboundary groundwater management issues.	No transboundary cooperation, incompatible resource inventories, no communication.	Joint and coordinated efforts to use information and tools for monitoring to develop and apply GW management	Database, multi-language information products, shared management tools.	Investments in monitoring equipment may be too costly
	Suite of tools, methods etc. have been prepared		Comprehensive information, tools and methods developed and applied		Underlying data availability may be insufficient to develop useful information products.
Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for climate adaptation through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.					
Outcome 4: A regionally coherent policy for sustainable groundwater management in	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Multi-country or bilateral arrangements to support and	Despite common CCA challenges countries in the region do not	Regionally coordinated GW use contributes to regional, cross-	Multi-country or bilateral consensus documented in	Bilateral relations or specific resource

support of CCA is adopted based on a level playing field of all users in the GMS.	oversee GW management in support of climate resilience objectives.	optimally share practices, knowledge and resources	border climate resilience for food production, rural water supply, etc.	policy documents and similarities in approach.	conflicts may be too serious to overcome.
	Regional coordination recognizes different vulnerabilities and needs of different users. At least three main GW-related policies introduced or adjusted to address climate change risks (one by sector).	Vulnerable groups in the region and suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	Database, multi-language information products, shared management tools. Introduced and/or adjusted policy documents.	Project is able to transfer the results of regional pilots to higher policy levels.
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.					
Outcome 5: GMS stakeholders capably use project tools on GW use for CCA and resilience.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	A CoP on user-oriented groundwater management is active Over 25 partnerships and active collaboration set up to support GW management capabilities that strengthen resilience and reduce detrimental climate change impacts.	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	CoP of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	Proceedings of meetings and collaborative products, joint statements.	Proposed interaction may not evolve to a higher, more effective level.
	Over 120 regional experts support institutional capacity in 5 countries	Although there are regional network meetings there is little coordinated effort to improve	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level.	General academic level within CoP is raised significantly (more PhD's, more MSc's). Proceedings of meetings and	There is sufficient support and funding within the region to sustain the envisaged

	(male/female = 60/40%).	overall impact level.		collaborative products, joint statements.	regional collaboration.
	GW CoP is actively engaged with different stakeholder groups and provides tailored information. Over 750 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	As above	GW CoP is regionally active and able to contribute effectively to different GW system, sustainability or CCA challenges.	CoP is visible with contributions and input in the regional CCA debate and multilateral coordination processes. Proceedings of meetings and collaborative products, joint statements.	Risk: The regional CCA debate may be dominated by other groups.

Table 17: Project Logical Framework

6. Alignment with Adaptation Fund Result Framework

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the greater Mekong Subregion through improved groundwater management and transboundary cooperation

Alignment of Project Objectives/Outcomes with AF Results Framework

Project Objective(s)[25]	Project Objective Indicator(s)	AF Fund Outcome	AF Fund Outcome Indicator	Grant Amount (USD-indicative)
Groundwater resources management is improved, thus increasing the CCA and resilience of GMS countries to protect people, livelihoods and ecosystems.	Over 25 partnerships and active collaboration set up to support groundwater management capabilities that strengthen resilience and reduce detrimental climate change impacts. Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	2,500,000
Groundwater users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.	In four pilot areas at least two different local groundwater users' groups are capacitated to use groundwater sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved.	**Outcome 3:** Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level.	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses. 3.2. Percentage of targeted population applying appropriate adaptation responses.	2,400,000

[25] The AF uses OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (US $ indicative)
A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	Greater groundwater management services made more responsive through improved resource assessments, management capability and information tools and human resources capacity in the sector. Greater water and specifically groundwater management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have been improved towards higher adaptive capacity.	**Outcome 4:** Increased adaptive capacity within relevant development sector services and infrastructure assets.	4.1. Responsiveness of development sector services to evolving needs from changing and variable climate. 4.1.1. Number and type of development sector services modified to respond to new conditions resulting from climate variability and change (by sector and scale).	1,000,000
Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Vulnerable people in four pilot areas and five countries will be able to rely on improved water management in support of livelihoods and other water needs.	**Outcome 6:** Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	6.1 Percentage of households and communities having more secure access to livelihood assets. 6.2. Percentage of targeted population with sustained climate-resilient alternative livelihoods.	1,000,000 800,000
A regionally coherent policy for sustainable groundwater management in support of CCA is adopted based on a level playing field of all users in the GMS.	Local interventions and guidelines (at least 3 in each pilot area) support resilience measures that are upscaled to national policies and guidelines. Regional (5 countries) and transboundary cooperation in pilots will generate at least 15 risk policies/guidelines.	**Outcome 7:** Improved policies and regulations that promote and enforce resilience measures.	7.1. Number of policies introduced or adjusted to address climate change risks (by sector).	500,000

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (USD-indicative)
GMS stakeholders and communities capably use project tools on groundwater use for CCA and resilience.	Number of partnerships and active collaboration set up to support groundwater management capabilities that strengthen resilience and reduce detrimental climate change impacts.	**Outcome 1:** Reduced exposure to climate-related hazards and threats.	1.1 Number of projects/ programmes that conduct and update risk and vulnerability assessments by sector and scale.	800,000
	Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	

Table 18: Alignment of Project Objectives/Outcomes with AF Results Framework

The result framework has been complemented with an overview of core impact indicators (SMART), using the core indicators tables prescribed by AF.

ADAPTATION FUND CORE IMPACT INDICATOR 1: NUMBER OF BENEFICIARIES

Date of Report							
Project Title			Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience				
Country			Cambodia, Lao PDR, Myanmar, Thailand, Vietnam				
Implementing Agency			UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations				
Project Duration			4 years; 2020-2023				
AF Core Impact Indicator 1: "Number of Beneficiaries"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4*				*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
			1	*2*	*3*	*4*	
1. Direct beneficiaries supported by the project	0	2200	500	800	400	500	i.e. people trained or directly involved
1a. GW user groups		115	20	50	20	25	Average size of GW user group is 20 people
1b. GW management provincial – regional level	0	405	50	150	125	80	Participants from selected provinces/districts
1c. GW management & policy national level		230	30	100	60	40	Participants from national and subnational level
Clarification; 500 = No. of people participating in training and/or other awareness raising activities or otherwise directly involved in project activities. It is also reflecting the larger populations in for instance the upper Mekong Delta pilot areas. This is a very conservative estimate; the numbers will be adjusted on the basis of data collected during project Inception and more specific workplans.							
Female direct beneficiaries	0	880	200	320	160	200	Set at 40 % for the GW / water/ natural resources management sector
Youth direct beneficiaries (aged 15-24)	0	220	50	80	40	50	Set at 10 %, for instance through doing a school-oriented awareness/training programme
2. Indirect beneficiaries supported by the project (*in thousands*)	0	1981	175	878	396	532	The communities of the above group (i.e. 5 trainees from 1 village or district of 5000 people, so here the No. of indirect beneficiaries is 5000. Estimated as a reasonable % of the total population in the pilot area = 8-10 %. **The total is about two million.**
Female indirect beneficiaries	0	792	70	351	158	213	Set at 40 % of the total
Youth indirect beneficiaries (aged 15-24)	0	396	35	176	79	106	Set at 20 %, for instance through doing a school-oriented awareness/training programme. At 20 % this means 1/100 = 1% of the total population

AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"

Date of Report							
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations						
Project Duration	4 years; 2020-2023						
AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4*				*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
			1	*2*	*3*	*4*	
Sector: Cross-sectoral: Water Management, Food Security, Rural Development, Agriculture, Health			Water supply based on GW resources touches upon all these sectors and it is the explicit aim to develop and apply GW-based resilience measures for different sectoral stakeholders.				
Targeted Services / Assets 1) Development Services (developed/improved)	0	8	8	8	8	8	**Development services;** support for technical and managerial skills and regulatory framework for GW management, improved capacity of regional and local monitoring and oversight, increased capacity of GW use-related extension services.
2) Physical assets/infrastructure *(produced/improved/strengthened)* - *Well systems* - *GW recharge systems* - *Monitoring systems*	0 0 0 0	5 2250 90 18	5 150 10 2	5 1200 30 6	5 400 30 6	5 500 20 4	**Physical assets/infrastructure:** Physical infrastructure to increase resilience and adapt to climate change including: GW exploitation and recharge systems, resource use monitoring networks and necessary data management and processing systems, water harvesting and conservation systems. The number of individual (small) wells could be significantly higher.
Changes in asset status - Development Services; (*Qualit.)* - Training, information and awareness services (Quant.)	0 0	3-5 24	3-5 3	3-5 8	3-5 8	3-5 5	Services and Assets change of status 5: Fully improved, 4: Mostly Improved or 3: Moderately improved

AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"

Date of Report							
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations						
Project Duration	4 years; 2020-2023						
AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4* *1*	*2*	*3*	*4*	*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
Natural Asset or Ecosystem - Improved water retention areas - Aquifer recharge areas	0 0	-	-	-	-	-	The number of designated water retention and aquifer recharge areas is indicated below; size in ha cannot yet be specified, the given number is indicative
Change in state *Effectiveness of protection/ rehabilitation - Scale (1-5*	0	3-5	3-5	3-5	3-5	3-5	5: Fully improved, 4: Mostly Improved or 3: Moderately improved
Total number of natural assets or ecosystems protected/ rehabilitated	0 0	18 21	3 4	4 6	8 8	3 3	Natural areas and ecosystems elements designated as recharge areas

TABLE 19: ADAPTATION FUND CORE IMPACT INDICATORS

7. Project budget

This technical project proposal is accompanied by a comprehensive budget proposal, following Adaptation Fund guidelines. The budget is available in **Annex II** (Excel format). Soft copies can be provided on request.

Project budgets (Excel sheets annexed)
Sheet 1: Summary project budget
Sheet 2: Breakdown of the project execution costs (CCOP-TS)
Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
Sheet 4: Budget disbursement schedule with time-bound milestones.
Sheet 5: Detailed project budget, Excel format (Annex II)

In this main document we present summaries of the different budget sheets

Sheet 1: Summary project budget

No.	Description	Budget (US $)
1.	Programmatic costs, Component 1 - 5	4,200,000
2.	Execution Costs (CCOP-TS) @ 8.5 %	357,000
3.	Subtotal	4,557,000
4.	Management fee MIE @ 7.5 % of Subtotal	341,775
5.	**Total Project budget**	**4,898,775**

Sheet 2: Breakdown of the Project Execution Costs (CCOP-TS)

No.	Description	Budget (US $)
1.	Project Coordinating Technical Advisor	180,000
2.	CCOP-TS Support staff	90,000
3.	Operational costs	40,000
4.	Project related regional travel	26,000
5.	External services (website, accountant)	21,000
	Total	**357,000**

Sheet 3: Budget for the Implementing Entity (MIE, UNESCO) management fee.

No.	Description	Budget (US $)
1.	General programme implementation support	173,000
2.	Finance, budget and treasury support	46,000
3.	Reporting to Adaptation Fund, M&E	49,000
4.	Project related regional travel	25,687
5.	Operational costs, publications costs	26,866
6.	External services (procurement, accountant)	21,222
	Total	**341,775**

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	Upon Agreement signature		Year 1		Year 2		Year 3		Year 4		Total %	Total Amount
											(US $)	
Scheduled Date	12/01/2020		12/01/2021		03/01/2022		03/01/2023		03/01/2024			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$ 549,845.39**		**$ 1,470,565.60**		**$ 1,490,627.25**		**$ 852,736.76**		**$ 4,898,775.00**

[a/]Use projected start date to approximate first year disbursement
[b/]Subsequent dates will follow the year anniversary of project start
[c/]Add columns for years as needed

PART IV: ENDORSEMENT LETTER BY NATIONAL GOVERNMENTS, ACCREDITED SIGNATORIES CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government:

Cambodia: Mr. Tin Ponlok, Secretary-General, National Council for Sustainable Development (NCSD) / Ministry of Environment	Endorsement letter is attached
Lao PDR: Mr. Syamphone Sengchandala, Deputy Director-General, Department of Climate Change (DCC), Ministry of Natural Resources and Environment	Endorsement letter is attached
Myanmar: Mr. U Ohn Winn, Union Minister, Ministry of Natural Resources and Environmental Conservation	Endorsement letter is attached
Thailand: Dr. Wijarn Simachaya, Permanent Secretary, Ministry of Natural Resources and Environment	Endorsement letter is attached
Viet Nam: Dr. Tran Hong Ha, Minister, Ministry of Natural Resources and Environment	Endorsement letter is attached

B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (Lao PDR and Vietnam) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

Name and Signature
Implementing Entity Coordinator: **SHAHBAZ KHAN** DIRECTOR UNESCO JAKARTA

Date: 5.8.2019	Tel and email: +6221 7399 818 ext 801 s.khan@unesco.org
Project Contact Person: **Hans Dencker Thulstrup (Jakarta), Benno Boer (Bangkok)**	
Tel. and Email: +62 21 739 9818 x810; h.thulstrup@unesco.org 66-2-3910577 X 343 ; b.benno@unesco.org	

Annexes

Annex I: Comprehensive characterization of the proposed four pilot areas

Annex II: Detailed budget and budget Excel sheets

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation

Annex I: Comprehensive characterization of the proposed four pilot areas

Pilot area 1: Mekong River riparian and transboundary aquifers-Vientiane Plains, Lao PDR - Thailand

Proposed pilot area location
Vientiane Plain (VP), 4,500 km^2 area extending across all or parts of Vientiane Capital, Vientiane and Bolikhamxay provinces, population around 0.8 million people. The area directly borders the Mekong River. There is potential connectivity with adjacent Nong Khai province in Thailand.

Site characteristics
Vientiane Plain is underlain by alluvial infill overlying sandstone/siltstone with outcropping or buried rocksalt (part of the Khorat Plateau system in adjacent Thailand with very similar aquifers). GW serves domestic purposes (most villages and some urban residential), agriculture (small scale irrigation and livestock), industry (packaged water drinking suppliers, and limited harvesting of rocksalt from saline reserves). Transboundary implications of deep GW systems are poorly understood, and not considered for management. The same may be said of interaction of GW systems with Mekong River surface water.

Rationale for selection
This is one of the largest and perhaps most economically important lowland plains in Lao PDR, and the most intensively studied GW resource in the country. A rudimentary monitoring network has been set up and running since 2014; the area is easily accessible from Vientiane Capital.

GW activities carried out in the Vientiane Plan to date
GW resources have been studied by various means: regional drilling investigations, resistivity surveys, recharge and discharge estimation studies, water quality assessments, GW use perception study, participatory management study, community GW irrigation scheme set up and evaluated, GW model constructed, GW management for upper Vientiane Plain was initiated.

Proposed measures for vulnerability reduction and/or GW supply improvement
Increase resilience of local communities through improved conjunctive use of water, creating conditions for more extensive, sustainable GW developments in the region. These developments will offer more water for possible crop and livestock diversification and intensification, industry and domestic supply as well. Local scale GW resource assessment will be implemented, including socio-economic and environmental aspect of developments. Suggested developments will be accompanied with a monitoring network design and piloting and institutional capacity enhancement to ensure sustainable use (i.e. prevent aquifer drawdown and pollution, transboundary effects) and further development of GW resources (in particular where those are connected to and recharge from Mekong or major tributaries). All suggested activities, including awareness raising will be executed by local/national partners, assisted by international specialists.

Proposed partnerships and roles
Natural Resources and Environment Institute (NREI) – GW model development, scenario testing
Department of Water Resources, GW Management Divisions (DWR-GMD) – management plan formulation including stakeholder engagement.
National University of Laos, Faculty of Water Resources (NUOL-FWR) – local scale resource assessments and modelling.
National University of Laos, Faculties of Sciences, Engineering and of Environmental Sciences with graduate student projects on GW related topics.

Linkages to current Capacity building efforts
1) New PhD project on recharge estimation for lower Nam Ngum sub-basin started in 2017
2) MSc study at Hiroshima University by Lao PDR, MONRE, Department of Water Resources Management staff on village level GW quality.
3) Australia's AVID support to further develop curriculum in IWRM and GW at National University of Laos, Faculty of Water Resources

Publications and other resources
1. http://gw-laos.iwmi.org/
2. Suhardiman, D., Pavelic, P., Giordano, M. and Keovilignavong, O. (forthcoming) Agricultural groundwater use in

the Vientiane Plains: Farmers' perceptions of opportunities and constraints. Human Ecology J.

3. Clément, C., Vinckevleugel, J., Naolee, K., Sotoukee, T. and Pavelic, P. (forthcoming) Community-managed groundwater irrigation on the Vientiane Plain of Lao PDR: Trial implementation and results from the first season of operation. IWMI Working Paper.

Proposed Activities

In addition to the proposed and described project activities several focused activities will be carried out by the proposed project consortium, in collaboration with local partners.

No.	Topic	Partners
1	GW management planning (GW use inventory, stakeholder consultations, tailoring GW regulations, decision support tool development, awareness raising).	DWR supported by IWMI & NREI
2	GW planning tool refinement and scenario testing	NREI supported by IWMI or Khon Kaen University
3	Participatory GW management in alluvial areas	IWMI supported by DWR

Overview of the Vientiane Plain (Lao PDR) pilot area (next page)

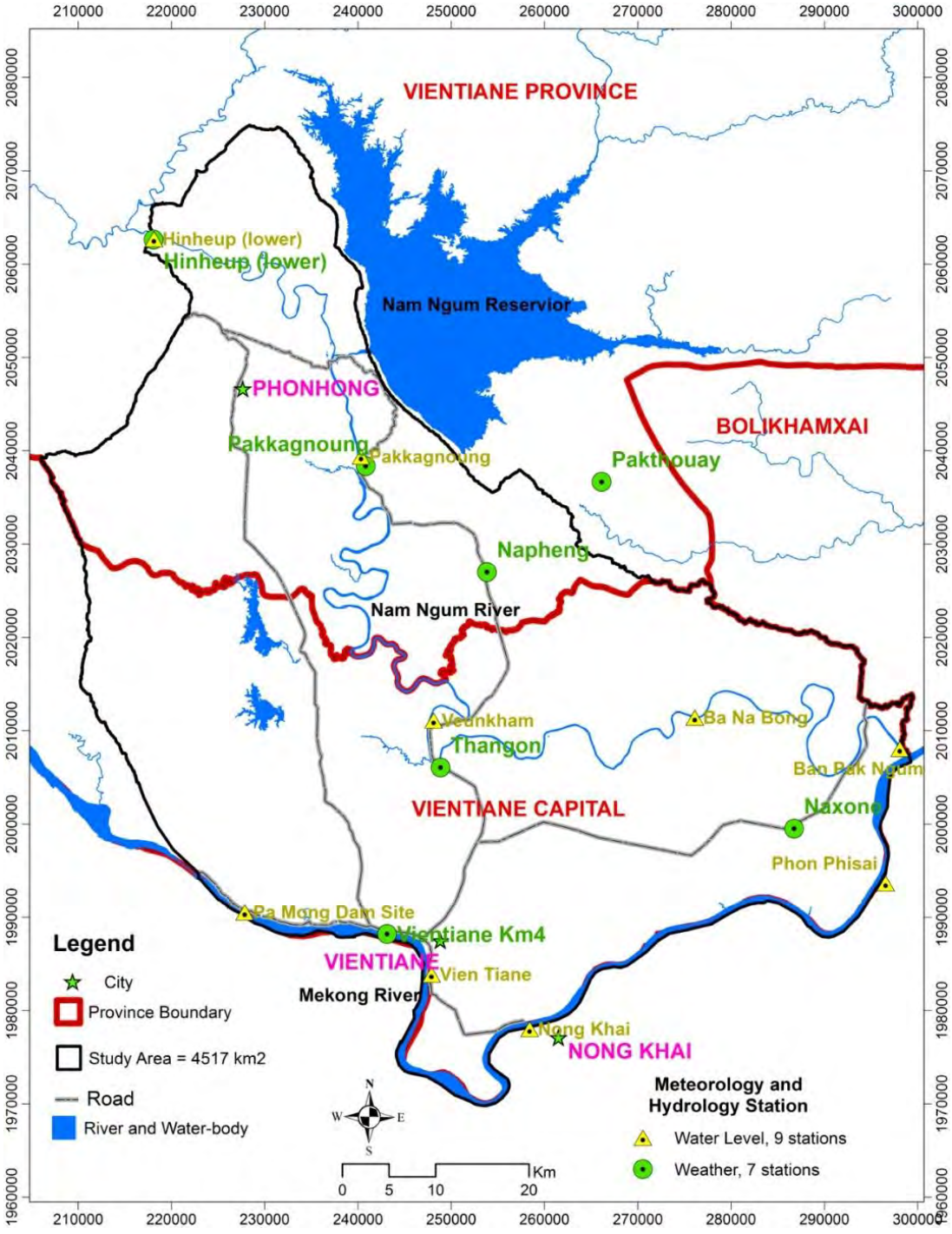


Figure 1: Overview of the Vientiane Plain (Lao PDR) pilot area

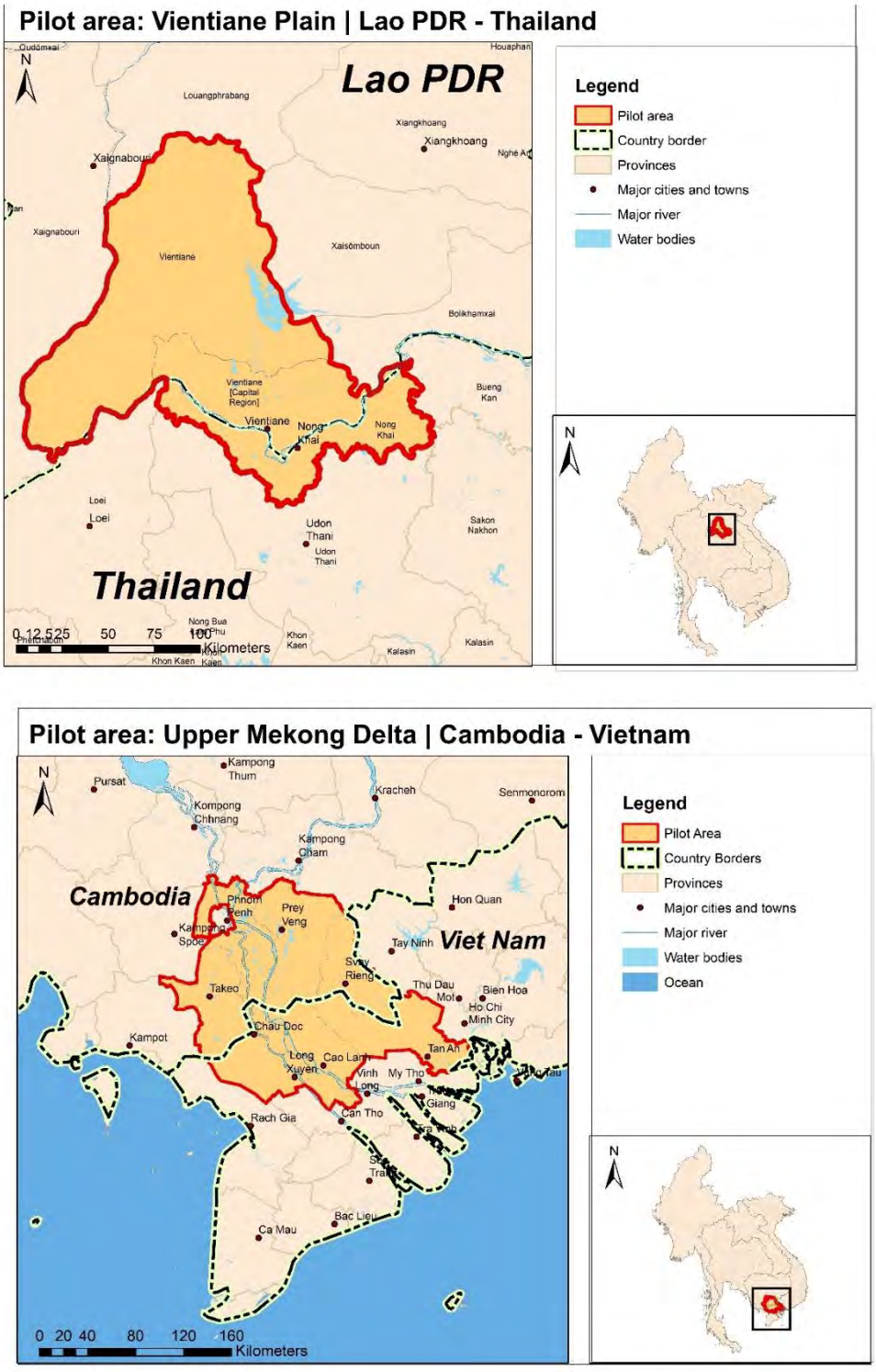


Figure 2; Regional overview of Pilot areas 1 and 2

Pilot area 2: Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia)

Proposed pilot area location
Upper Mekong Delta region in Vietnam and adjacent lowlands adjacent to Mekong River in Cambodia, 12,000 km^2 area with a population of an estimated 4 million people. The area is part of major aquifers fed by the Mekong River system. It comprises the provinces Takeo, Kandal and Prey Veng in Cambodia, and the provinces of An Gian, Dong Thap and Long An in Vietnam.

Site characteristics
Subtropical lowland river plain with main channels of Bassac and Mekong Rivers, intensively used for paddy rice and food crop cultivation. Mekong and Bassac River waters intensively used for irrigation and water supply, but in the dry season increasing use of shallow and deep GW from dug wells, shallow and intermediate boreholes. Seasonal floods play a crucial role in natural replenishment of Cambodia and Vietnam Mekong Delta aquifers, but the flooding patterns are strongly affected by changing climate and upstream river developments. At the same time, dependency on reliable and good water supply for food production and domestic use is increasing.

Transboundary implications of deep GW systems are poorly understood, and not considered for management (unlikely for phreatic aquifer). The same may be said of interaction of GW systems with Mekong River surface water.

Rationale for selection
This is one of the largest and perhaps most economically important transboundary aquifer systems in the Lower Mekong Sub-region. The importance of long-term supply of GW (quantity and quality) for food production, both in Cambodia and in southern Vietnam, cannot be overemphasized. The dynamics of the system are explicitly transboundary, while also the effects of regional developments (viz. dam construction, flood control and diversion of Mekong River waters, development of the Tonle Sap basin) are complex and most likely considerable.

GW activities carried out in the upper Mekong Delta to date
GW resources are being exploited and studied quite intensively by provincial government organisations on both sides of the border. In Vietnam this is partly executed and supported by DWRPIS. In Cambodia government policy on GW is not very well developed and there is very limited capacity to engage in active and focused interventions.

Proposed measures for vulnerability reduction and/or GW supply improvement
Increased demand and change in recharge pattern and quantity require additional attention to transboundary aquifers. In this project, transboundary cooperation will be supported by technical and non-technical measures and scaled up. Internationally developed and world-wide used methodology and information systems will be implemented to strengthen information exchange and further build up confidence between the aquifer / riparian parties. The baseline for these activities will be the present GW management practice and the lesson learned. Therefore, a systematic sharing of experience, in particular from Vietnamese Mekong Delta to neighbouring Cambodian Mekong Delta, will be very instrumental for sustainable use of GW resources, anticipating over-exploitation and mitigating risk of transboundary conflict over GW. Methods to increase aquifer recharge, control/regulate abstraction and decrease demand will be assessed for local conditions, prioritised and piloted/tested where feasible. Specifics of transboundary GW governance and options to adjust/change user needs to avoid and/or mitigate current or future constraints will be shared and discussed with wide circle of stakeholders in the region, embedding their active participation in the governance process.

Proposed partnerships and roles
Vietnam's NAWAPI (MONRE) institute and its southern branch, the Division for Water Resources Planning and Investigation in the South of Vietnam (DWRPIS). In view of the underdeveloped situation in Cambodia, the execution of the activities in this pilot area will need substantial support from international experts.

Linkages to current capacity building efforts
There is a unique opportunity to apply and learn from the well-developed GW system knowledge and data management in the Vietnamese provinces for the rather poorly monitored and studied Cambodian aquifers. The Vietnamese experience includes the ongoing efforts to develop IWRM-based approaches to address climate change threats and long-term water supply strategies. The project is the first to address GW-oriented resource management issues in the transboundary area

with inclusion of knowledge transfer, capacity building and regional cooperation.

Publications and other resources

Various DWRPIS reports and publications by DWRPIS

1. Erban, L. S.M. Gorelick & H.A. Zebker, 2014; Groundwater extraction, land subsidence and sea-level rise in Mekong Delta, Environ. Res. Lett. 9.
2. The Mekong Delta System: Interdisciplinary Analysis of a River Delta, F.G. Renaud and Claudia Kuenzer (eds.), Springer 2012, pp. 463; incl.: Frank Wagner, Vuong Bui Tran and F.G. Renaud; Groundwater Resources in the Mekong Delta: Availability, Utilization and Risks, pp. 201-220.
3. Climate Change Adaptation Planning for Urban Water Supply in Soc Trang Province, Dierks, R, 2016, Conference paper

Proposed Activities within the overall project approach

In addition to the proposed and described project activities, several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	Setting up a system of joint GW monitoring; supporting the GW monitoring capabilities in Cambodia	Project, with support of DWRPIS, Vietnam, Cambodia partners
2	Inventory and quantification of GW abstractions and use by different sectors; starting dialogue with main stakeholders	Project, with support of DWRPIS, Vietnam, Cambodia partners
3	Preliminary orientation on resilience enhancing measures in the framework of integrated surface-GW management	Project, with support of DWRPIS, Vietnam, Cambodia partners

Next page: Detailed map of Mekong delta transboundary area

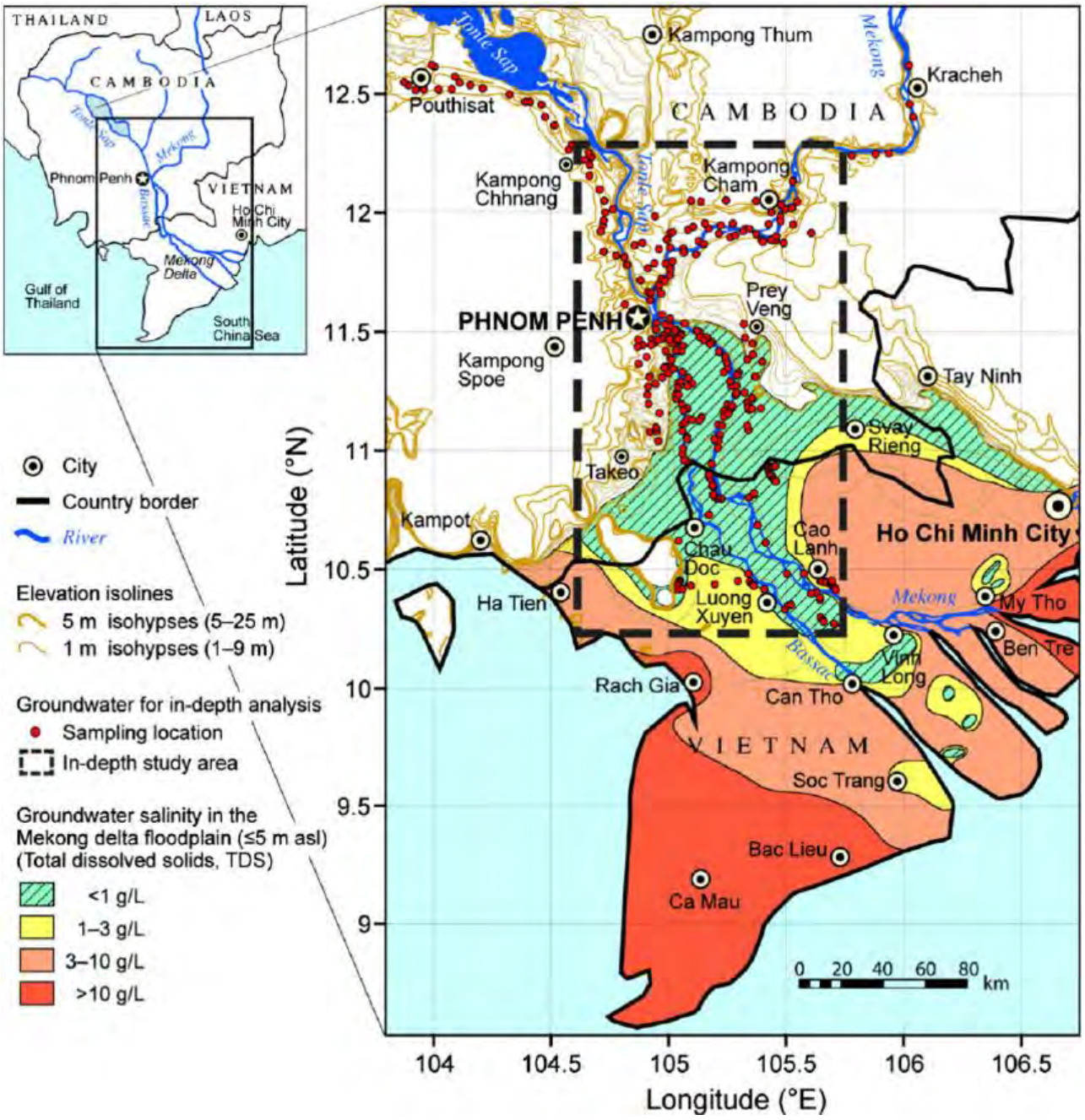


Figure 3: Overview of the Mekong Delta transboundary area

Map of the Mekong Delta depicting GW salinity in the Holocene aquifers. Sampling locations for in-depth GW analysis (n = 352) are indicated by red dots. The contour plot shows the salinity distribution. The salinity data was obtained from the DGMV (Ho Chi Minh City, Vietnam). The flat topography is indicated by elevation lines calculated with ArcGIS from the digital elevation model Gtopo30. Source: Contamination of drinking water resources in the Mekong delta floodplains: Arsenic and other trace metals pose serious health risks to population, Buschmann et al., 2008, Environment International.

The focus of the pilot will be on the transboundary aquifers southeast of Phnom Penh (see regional map in Figure 2).

Pilot area 3: NW Cambodia – Eastern Thailand border area

Proposed pilot area location
Northwest Cambodia – Eastern Thailand border area (Cambodia Banteay Meanchey, Oddar Meanchey, Siem Reap Provinces; adjacent Thailand provinces of Changwat Sa Kaeo, Buriram, and Srin).

Site characteristics
The area is characterized by modest rainfall and a distinct dry season. Increasingly, due to climate change effects, monsoonal rains are late and come in the form of intensive cloudbursts, leading to flooding. GW system are poorly studied, but it is well known that GW use for domestic and agriculture irrigation purposes is widespread. There is a significant water deficiency in the second half of the dry season, viz. March-May, increasing pressures on GW use. Measures for recharge and storage are considered.

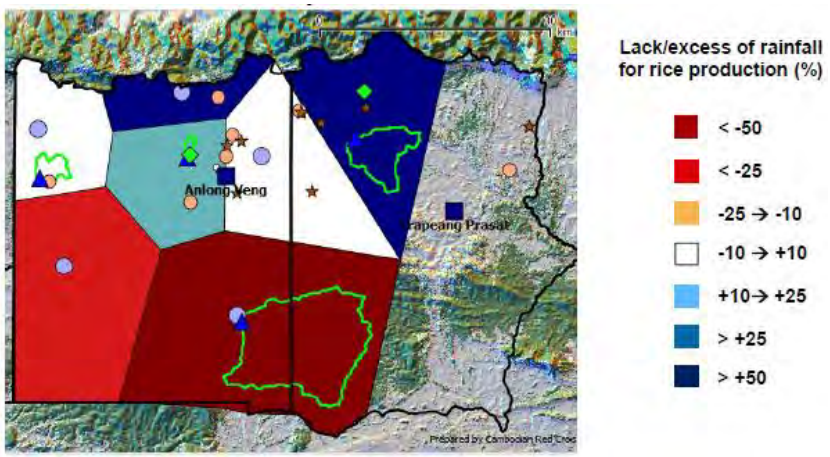


Figure 4: Water needs in north-western part of Cambodia. Regional water deficiencies occur in parts of northwest Cambodia (May 2013 situation). At the same time there is a water surplus in upstream catchments. Integrated surface-GW management and GW recharge can significantly contribute to climate resilient rural land use.

Rationale for selection
Vulnerability of rural population; potential to increase sustainable GW use in support of rural livelihoods, food production and rural (domestic) water supply; significant potential to increase climate change resilience on the basis of improved and more sustainable GW management. The Angkor World Heritage site is on the Heritage in Danger list due to subsidence from excessive GW extraction. The Tonle Sap Lake Biosphere Reserve is also is very much dependent on GW to retain its rich wetland biodiversity.

GW activities carried out in the area to date
Experts of Khon Kaen Groundwater Research Centre (Thailand**)** compiled the hydrogeologic units of Changwat province and Sakaeo province that forms a part of the Siem Reap hydrologic basin (see overview map). Inventories were also made of drill well locations in the border area, on the basis of several databases from the Thai Government offices. For the Thailand side, there is rather comprehensive information regarding surface- and GW resources and wells as shown in the map as well as other relevant data, e.g. land use, soils, communities, etc. The largely rural population in the border area and the rural districts down to Tonle Sap Lake rely on GW resources (with several water wells in every village). The aquifer is meta-sedimentary aquifer, but with a rather variable GW potential across the region. It is assumed that similar aquifer systems extend across the border area in both Thailand and Cambodia and transboundary relationships occur.

Proposed measures for vulnerability reduction and/or GW supply improvement
Intensified development of GW resources is recommended here to increase availability and ensure sustainable use of GW, particularly in dry periods. A joint assessment is required, including the suitability of water recharge/storage methods. GW monitoring network design and piloting is envisaged as well. A customized information system to support assessment and monitoring will be introduced. The system will also serve as an enabling environment for transfer, storage, processing and dissemination of data and information relevant to the specific conditions and aquifers in the Siem Reap basin. This will allow Cambodian water agencies and stakeholders to consolidate knowledge on GW resources and plan informed management measures. A standardised information system will facilitate exchange of information among GW experts from Thailand and

Cambodia, providing the common baseline and platform for common actions at the regional level, including raising awareness about GW resources and climate in the changing world.

Proposed partnerships and roles
The activities in this pilot are will emphasize transboundary (Thai-Cambodia) cooperation and learning, focusing on improved assessment and monitoring of potential GW resources, determining user needs and resilience potential of regional agricultural land use systems on the basis of enhanced GW use. The envisaged partnership will preferably be at user and local level (districts, provinces) emphasizing building up capacity where it is needed and can be used. These activities will be supported by the international and regional expert teams under the project.

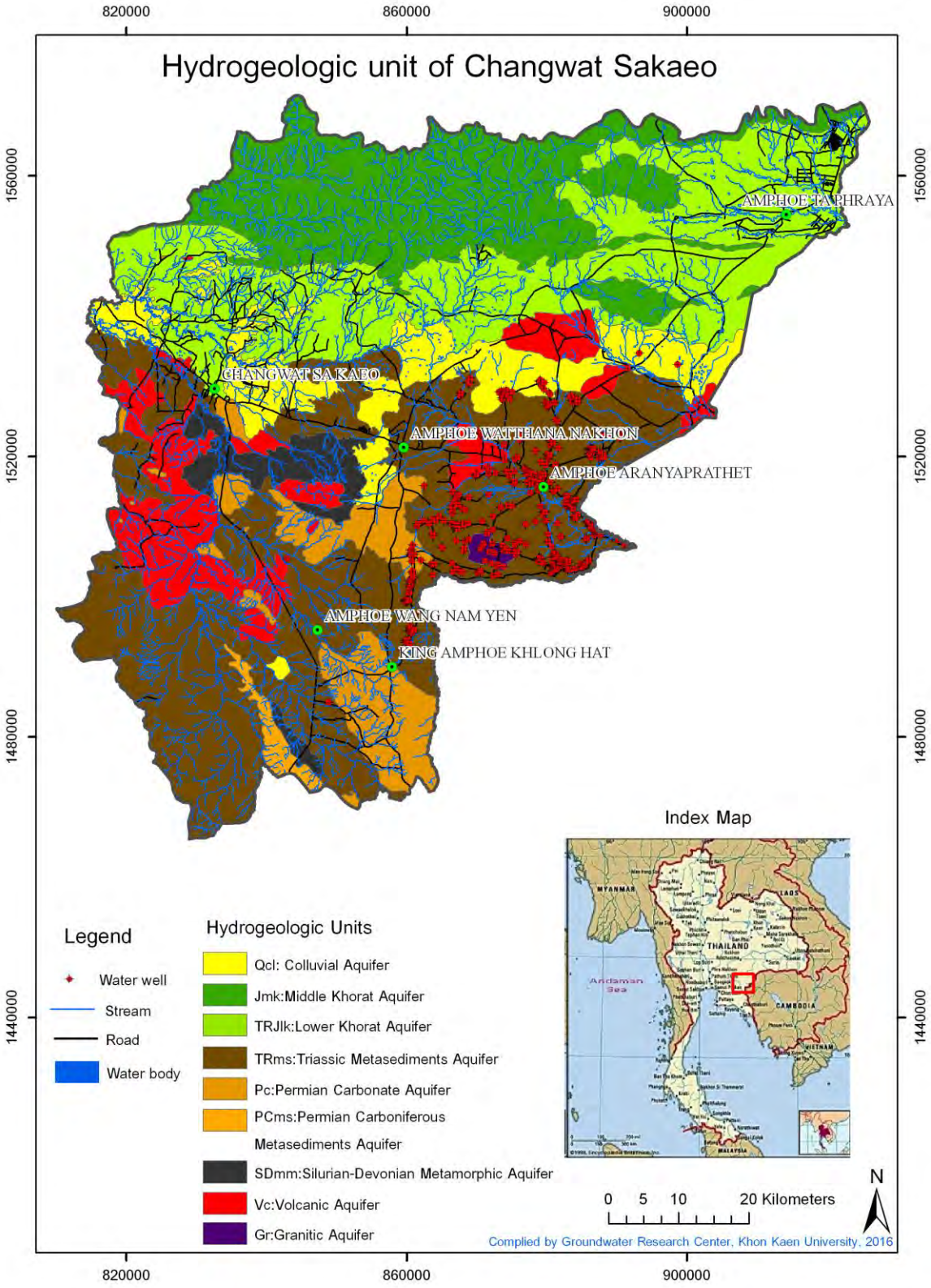
Linkages to current capacity building efforts
The project will use results from earlier GW studies in Cambodia, but in the designated region very little has been done.

Proposed Activities within the overall project approach
In addition to the proposed and described project activities, several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	Conducting a joint GW resource assessment, installing basic monitoring system; supporting the GW management capabilities in Cambodia	Project, with support of Thailand DGR, Cambodia partners
2	Dialogue with main stakeholders, potential to increase GW use in support of food production and rural water supply	Project, with support of Thailand DGR, Cambodia partners
3	Setting up joint task force to develop resilience enhancing measures in the framework of integrated surface-GW management	Project, with support of Thailand DGR, Cambodia partners

Pages below

Figure 5: Overview map of the hydrogeologic units of Changwat province and Sakaeo province, southeast Thailand that form part of the transboundary Thai – Cambodia Siem Reap hydrologic basin. Although highly variable in nature, the aquifer systems locally offer significant potential for sustainable GW use in support of more climate resilient agriculture. There is little confirmed information on the Cambodia side of the border.


Hydrogeologic unit of Changwat Sakaeo
820000
860000
900000
1560000
1520000
1480000
1440000
AMPHOE TAPHRAYA
CHANGWAT SA KAEO
AMPHOE WATTHANA NAKHON
AMPHOE ARANYAPRATHET
AMPHOE WANG NAM YEN
KING AMPHOE KHLONG HAT
Index Map
MYANMAR
LAOS
THAILAND
Andaman Sea
CAMBODIA
VIETNAM
MALAYSIA
Legend
Water well
Stream
Road
Water body
Hydrogeologic Units
Qcl: Colluvial Aquifer
Jmk:Middle Khorat Aquifer
TRJlk:Lower Khorat Aquifer
TRms:Triassic Metasediments Aquifer
Pc:Permian Carbonate Aquifer
PCms:Permian Carboniferous Metasediments Aquifer
SDmm:Silurian-Devonian Metamorphic Aquifer
Vc:Volcanic Aquifer
Gr:Granitic Aquifer
0 5 10 20 Kilometers
N
Complied by Groundwater Research Center, Khon Kaen University, 2016

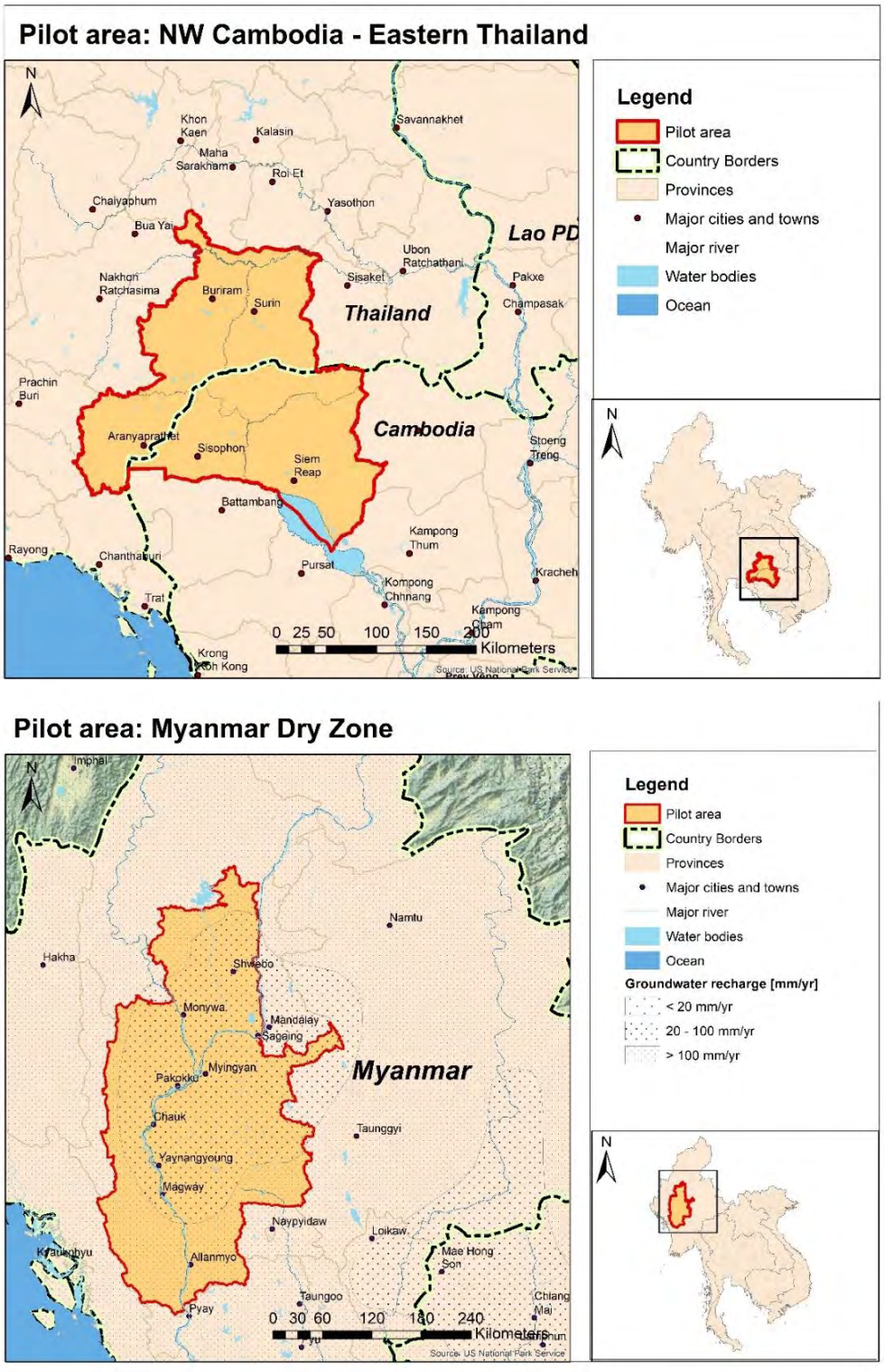


Figure 6: Maps of proposed pilot areas in Cambodia – Thailand and in Myanmar.

Pilot area 4: Myanmar Dry Zone, Yin Mar Bin – 99 Ponds irrigation scheme pilot area

Proposed pilot area location
The 99 Ponds GW irrigation scheme area is located in Central Myanmar at Yin Mar Bin Township, Sagaing Region (900 km^2 area in Myanmar's Dry Zone). The total population of the township is around 137,000 people.

Site characteristics
The area is underlain by alluvial, Irrawaddy and Pegu aquifers, which provide flow at varying depths and flow rates and are used for both domestic purposes and irrigation. Shallower Kokkogon Alluvial aquifer is used mainly for domestic supply. The deeper, semi-confined, high yielding Ywatha Aungban aquifer was developed in 1994-5, with drilling of 417 artesian tube wells supplying water to 99 ponds, to irrigate 8,181 acres. The scheme was extended with a further 32 wells and 8 ponds in 2000. A total of more than 1,980 tube wells (government and private) have been developed in the area. Poor construction and lack of operational flow regulation valves mean that many artesian wells are allowed to flow uncontrolled. Both yield and artesian water levels have declined significantly from pre-development conditions (artesian flow levels have dropped from 439 to 408 feet above mean sea level); and water levels fluctuate seasonally and depending on discharge from other wells. There is increasing concern amongst farmers and water managers about availability of water and wastage from the system; but some well owners are unwilling to cap wells for fear of losing flow.

Rationale for selection
Ministry officials have highlighted the urgency of a) regulating free-flowing wells and b) monitoring of levels to understand the recharge dynamics of the system, in order to prevent wastage and long-term depletion of the aquifers. Both technical and social inputs are required to help communities understand the dynamics of the system and allay fears about capped wells losing water.

GW activities carried out in the 99 Ponds area to date
Some monitoring of GW levels has been conducted by WRUD since 1994 (Tin Win, 2016). Recharge evaluation study of similar aquifers in neighbouring Monywa region has been done (Than Zaw, 2016).

Proposed measures for vulnerability reduction and/or GW supply improvement
Capping of wells and a regular monitoring of GW head are the urgent measures required to preserve GW resources at current level and ensure their informed management. If wells are allowed to continue flowing freely, levels will inevitably decline over time, leaving the communities vulnerable to water shortages. A focussed GW assessment will provide the necessary information on aquifer dynamics, including the recharge and discharge through artesian wells. The outcomes will be translated in layman terms and used in an awareness campaign, specifically developed for the local population, well owners and users. Informed management plans will be developed on use of GW resources, including systematic processing of monitoring data and regulatory measures. Options to adjust/change user needs to avoid and/or mitigate current or future constraints will be considered as well and shared/discussed with stakeholders. Lessons learned will be transferred to other regions (in Myanmar and elsewhere) facing similar issues.

Proposed partnerships and roles
- Department of Irrigation and Water Utilisation (DIWU) – GW monitoring, inputs to resource assessment and recharge studies; management plan formulation.
- Yangon Technical University / Mandalay Technical University – local scale resource assessments and modelling.
- Local NGO, in collaboration with WHH (the German NGO Welthungerhilfe) or Mercy Corps; stakeholder engagement, community consultation and training.

Publications and other resources
-Tin Win (2016) – Fluctuation of water level changes in Yinmarbin Artesian Zone.
-Than Zaw (2016) - Hydrogeological Framework and Spatially Distributed Groundwater Recharge Patterns, A Study around Ayardaw Township (Myanmar) Using Geospatial Approach.
- Presentations at Workshop on reviewing the water well drilling experiences and hydrogeological status in Myanmar. Naypyitaw, March 2016.

Proposed Activities

In addition to the proposed and described project activities several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	GW resource assessment and study of recharge dynamics	Project, IWMI, DIWU, YTU
2	GW management planning (Inventory of GW use, stakeholder consultations, GW regulations)	Project, IWMI, DIWU, NGO
3	Participatory planning and implementation of well capping and monitoring program in artesian areas	Project, NGO's and DIWU

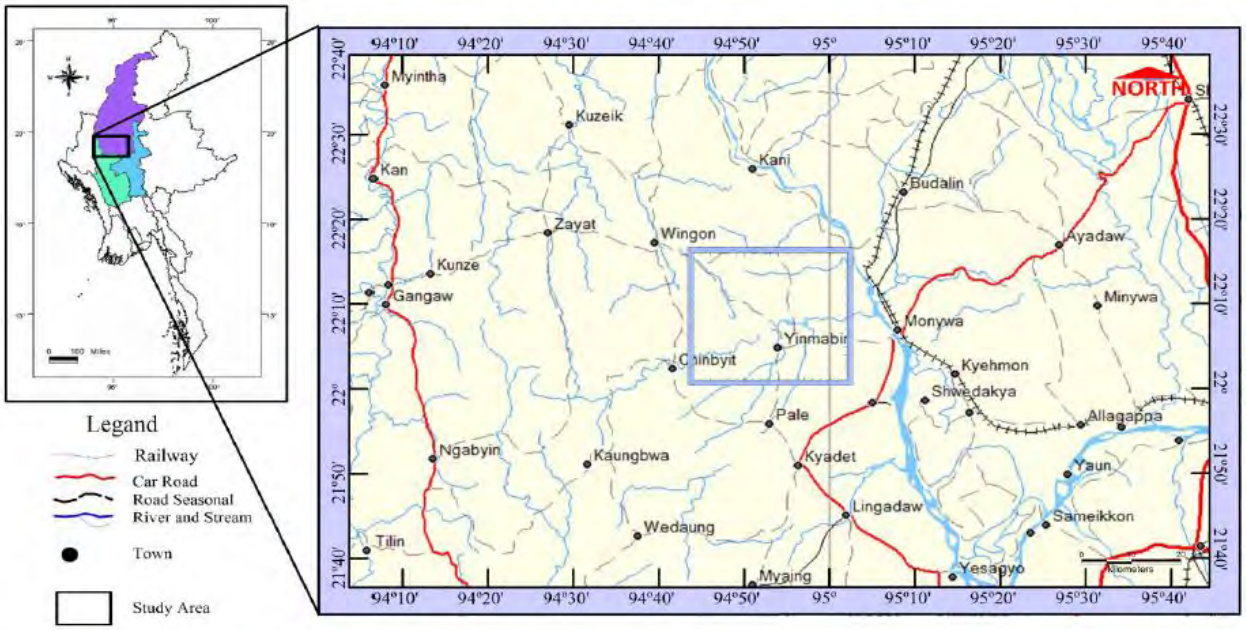


Figure 7: Location of the proposed pilot area in Myanmar, Central Dry Zone

---------- End of additional document----------

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation

Annex II: Detailed budget and budget Excel sheets

Budget (Excel sheets, Annex IV)

Sheet 1: Summary project budget
Sheet 2: Breakdown of the project execution costs (CCOP-TS)
Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
Sheet 4: Budget disbursement schedule with time-bound milestones.
Sheet 5: Detailed project budget, Excel format (Annex)

Sheet 1: Summary project budget

Project Component		2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $
ANNUAL TOTALS PER COMPONENT							
Component 1		510,500	324,200	119,200	246,100		1,200,000
Component 2		101,000	208,500	174,500	16,000		500,000
Component 3		130,900	315,100	413,500	140,500		1,000,000
Component 4		66,000	98,500	175,500	160,000		500,000
Component 5		121,700	314,500	395,300	168,500		1,000,000
	Subtotals	**930,100**	**1,260,800**	**1,278,000**	**731,100**		**4,200,000**
Project Execution Costs 8.5 %		79,059	107,168	108,630	62,144		357,000
	Subtotals	1,009,159	1,367,968	1,386,630	793,244		4,557,000
Management Fee 7.5 %		75,687	102,598	103,997	59,493		341,775
	Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**		**4,898,775**

Sheet 2: Explanation and breakdown of the project Execution costs

			2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $	
	Project/Programme Execution cost 8.5 %								
Exec.-1	Project Coordinating Technical Advisor		40,000	55,000	60,000	25,000		180,000	
Exec.-2	CCOP-TS Support staff		20,809	23,691	23,000	22,500		90,000	
Exec.-3	Operational costs		8,000	17,000	12,000	3,000		40,000	
Exec.-4	Project related regional travel & stay		5,000	6,227	8,380	6,394		26,000	
Exec.-5	External services (website, accountant)		5,250	5,250	5,250	5,250		21,000	
		Subtotal	**79,059**	**107,168**	**108,630**	**62,144**		**357,000**	

CTA Position under CCOP-TS, covered partly by CCOP-TS Execution cost budget	yr 1	yr 2	yr 3	yr 4	
Annual expenses remuneration	75000	75000	75000	75000	$300,000
Housing Allowance	15000	15000	15000	15000	$60,000
					$360,000
Out of CCOP-TS budget					$100,000
					$260,000

Sheet 3: Explanation and breakdown of the MIE Management fee 7,5 %

			2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $	
	Project Management Fee charged by the Implementing Entity 7.5 %								
Mngmt-1	General programme implementation support		41,000	46,000	53,000	33,000		173,000	
Mngmt-2	Finance, budget and treasury support		11,250	12,500	15,250	7,000		46,000	
Mngmt-3	Reporting to Adaptation Fund, M & E		12,250	15,500	14,250	7,000		49,000	
Mngmt-4	Project related regional travel		6,187	7,507	6,500	5,493		25,687	
Mngmt-5	Operational costs, publications costs		0	14,366	9,000	3,500		26,866	
Mngmt-6	External services (procurement, accountant)		5,000	6,725	5,997	3,500		21,222	
		Subtotal	**75,687**	**102,598**	**103,997**	**59,493**		**341,775**	

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	Upon Agreement signature		Year 1		Year 2		Year 3		Year 4		Total %	Total Amount
											(US $)	
Scheduled Date	12/01/2020		12/01/2021		03/01/2022		03/01/2023		03/01/2024			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$ 549,845.39**		**$ 1,470,565.60**		**$ 1,490,627.25**		**$ 852,736.76**		**$ 4,898,775.00**

Sheet 5: Detailed project Activity budget

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	UNESCO	CCOP-TS	CTA	IGRAC	IWMI	REMAINDER
	Component 1: Groundwater Resource assessment and monitoring	Harmonised regional GW resource inventory supporting regional GMS approach to address challenges of climate change and resilience; information-based policy to manage resources and further develop new GW based resilience strategies and practical interventions.												
Incept-1	Component work package Inception & preparation		National expert time, TA tima	15,000				15,000						
Incept-2	Inception visits 5 countries and data collection		National expert time, TA time, travel & stay, data costs	90,000				90,000						
Incept-3	Inception report contributions		National expert time, TA time	9,600				9,600						
Activ. 1.1	Component techncial coordination and support		national expert time, TA time	7,000	9,600	9,600	7,000	33,200						
Activ. 1.2	Database and GIS systems set-up and management, 4 pilot areas: groundwater related data inputs and costs		GIS expert time, data files	50,000	25,000	25,000	15,000	115,000						
Activ. 1.3	5 Country Workshops on project scope and setting up project network (CoP)		Workshop costs, TA time, travel & stay, consumables	125,000				125,000						
Activ. 1.4	Groundwater resources & aquifer status reports, 4 pilot areas		TA time, national expert time		50,000			50,000						
Activ. 1.5	Development of basic groundwater monitoring system in 4 pilot areas, installation of equipment		National expert time, TA time,	19,200				19,200						
Activ. 1.6	Equipment costs (4 pilot areas)		Equipment costs	120,000	35,000	20,000		175,000						
Activ. 1.7	Pilot area localised data collection approach and practicalities, with paticipation of stakeholders and groundwater users		National expert time, travel & stay, consumables	16,000				16,000						
Activ. 1.8	Pilot areas resilience potential characterization; 1 central workshop for four pilot areas		National expert time, TA, workshop costs, travel & stay		55,000			55,000						
Activ. 1.9	Mid-term evaluation of groundwater resources status of pilot areas, 4 dedicated workshops, at the end of year 2		Workshop costs, TA time, national experts time, travel & stay, consumables		68,000			68,000						
Activ. 1.10	Regional project Conference (Siem Reap, Cambodia) and field visit; participants from 5 countries, national expert teams, TA support team, invited speakers, and supporting resource persons		Workshop costs, TA time, national experts time, travel & stay, consumables				155,000	155,000						
Activ. 1.11	Support Mid-term review and Project Steering Committee meetings		TA time, national expert time		7,000	9,000		16,000						
Activ. 1.12	National technical expert inputs for Project Steering Committee meetings (8 times)		National expert time, TA time	9,200	9,100	9,100	9,100	36,500						
Activ. 1.13	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	10,000	20,000	10,000	20,000	60,000	$60,000					
Activ. 1.14	General consumables and logistics		Consumables	2,000	2,000	2,000	2,000	8,000						
Activ. 1.15	National pool of experts time (5 countries, multiple institutions)		National expert time	27,500	28,500	22,500	26,000	104,500						
Activ. 1.16	International TA support, pool of experts		TA expert time, travel & stay	10,000	15,000	12,000	12,000	49,000						
			Subtotal	510,500	324,200	119,200	246,100	**1,200,000**			$72,000	$120,000	$120,000	$828,000

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number					
	Component 2: Priority use and stakeholders	Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.												
Incept-4	Component work package Inception & preparation		national expert time, TA time	6,000				6,000						
Incept-5	4 pilot areas; visits to communities and local government, NGO's		national expert time, travel &	32,000				32,000						
Incept-6	Inception report contributions		national expert time, TA time	3,500				3,500						
Activ. 2.1	Resilience strengthening pilots		national expert time, TA expert time, operational costs, travel & stay		45,000	35,000	15,000	95,000						
Activ. 2.2	Materials & equipment, installation costs in 4 pilots		materials & equipment		40,000	3,000		43,000						
Activ. 2.3	Pilot areas socio-economic and water users characterization		national expert time, external consultant services	28,000	28,000			56,000						
Activ. 2.4	Gender balance programme set-up and implementation		national expert time, TA expert time, operational costs, travel & stay	3,000	11,000	11,000		25,000						
Activ. 2.5	Information products on vulnerability issues for each of the four pilot areas, for different groundwater user groups		national expert time, TA expert time, travel & stay		24,000	36,000		60,000						
Activ. 2.6	Dialogue meetings with national policymakers and experts on strategic importance of groundwater resources in the overall climate change adaptation discussion		national expert time, TA expert time, operational costs, travel & stay		27,000			27,000						
Activ. 2.7	Pilot for regional water-supply companies that use groundwater information on groundwater management tools		time, operational costs, travel & stay			34,000		34,000						
Activ. 2.8	Resilience Agenda, Atlas, interAction in pilot area meetings (product preparation, local workshops)		national expert time, TA expert time, operational costs, travel & stay		14,000	37,000		51,000						
Activ. 2.9	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000		25,000	$25,000					
Activ. 2.10	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000		25,000						
Activ. 2.11	International TA support, pool of experts		TA expert time, travel & stay	10,000				10,000						
Activ. 2.12	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500						
			Subtotal	101,000	208,500	174,500	16,000	**500,000**		30000	50000	50000	$345,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 3: Resource management, information tools and equipment	Greater resilience and sustainable GW resource use, with protection of low income and vulnerable user groups. Transboundary groundwater policies more robust and climate change ready.													
Incept-7	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-8	Expert meeting on resource management information concepts and tools; option and start up development		TA expert time, national expert time, travel & stay	32,000				32,000							
Incept-9	Inception report contributions		national expert time, travel &	3,500				3,500							
Activ. 3.1	Application of database and GIS tools; specialised information products that can be derived from it What do the results tell us (statistics in the database, geographical info: .		TA expert time, national expert time, travel & stay	52,000	32,000	32,000		116,000							
Activ. 3.2	Tailored database and GIS tools development and demonstrations, data hosting and provision services		External services; supporting TA expert time, national expert time, travel & stay;		45,000	45,000	25,000	115,000							
Activ. 3.3	Revisit resilience potential: what can user do with it; how to exploit this ? Prepare Resilience potential asssessment		Supporting TA expert time, national expert time		56,000	42,000		98,000							
Activ. 3.4	Pilots supported with groundwater monitoring and management information and applicatin to develop resilience options		Supporting TA expert time, national expert time, travel &		36,000	56,000	31,000	123,000							
Activ. 3.5	Technical meetings: Co management of Surface and Groundwater, with national expert and MRC, supporting organisations		External services; supporting TA expert time, national expert time, travel & stay;			38,000	22,000	60,000							
Activ. 3.6	Actual Management interventions like MAR or other		Regional TA expert time		42,000	28,000	12,000	82,000							
Activ. 3.7	Supporting reslience measures in 4 pilot areas, including installations and equipment		Material costs; supporting TA expert time, national expert time,		60,000	98,000		158,000							
Activ. 3.8	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000	25,000	50,000	$50,000						
Activ. 3.9	National pool of experts time (5 countries, multiple institutions)		National expert time	15,000	23,000	33,000	11,500	82,500							
Activ. 3.10	International TA support, pool of experts		TA expert time, travel & stay	13,000	3,600	24,000	8,000	48,600							
Activ. 3.11	General consumables and support services		Consumables	1,400	7,500	7,500	6,000	22,400							
			Subtotal	**130,900**	**315,100**	**413,500**	**140,500**	**1,000,000**			60000	100000	100000	$690,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 4: Regional cooperation, coordination and information exchange.	A regionally coherent policy for climate adaptation through sustainable GW resource management; level playing field for all sectoral users in the region, efficiency gains in common approach and support tools.													
Incept-10	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-11	Research and documentation of policy context and practical cases; documentaiton packages for 5 countries		TA expert time, national expert time, travel & stay	24,000				24,000							
Incept-12	Inception report contributions		national expert time, travel & stay, TA expert time	3,500				3,500							
Activ. 4.1	Documentation on transboundary aquifer systems; resource status, transboundary implications and policy reccommendations		National expert time, TA expert time,		16,000	16,000		32,000							
Activ. 4.2	Pilot areas workshops (4x) on transboundary climate policy		Workshop expenses			45,000	40,000	85,000							
Activ. 4.3	Application of TBA Assessment Methodology on the four pilot areas		National expert time, TA expert time, Travel & stay, consumables			27,000	26,000	53,000							
Activ. 4.4	Working group on sharing & co-development of tools		National expert time, TA expert		24,000	24,000	24,000	72,000							
Activ. 4.5	Working group on national policy and strategy		time, Travel & stay, consumables		24,000	19,000	24,000	67,000							
Activ. 4.6	Regional policy coordination; preparation of White paper for ASEAN forum, emphasizing climate adaptation in transboundary regions		National expert time; support services, TA xpert time		12,000	10,000	12,000	34,000							
Activ. 4.7	Documentation materials for pilot regions		National expert time			8,000	8,000	16,000							
Activ. 4.8	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		5,000	10,000	10,000	25,000	$25,000						
Activ. 4.9	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000	7,000	32,000							
Activ. 4.10	International TA support, pool of experts		TA expert time, travel & stay	16,000	8,000	8,000	8,000	40,000							
Activ. 4.11	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500							
			Subtotal	**66,000**	**98,500**	**175,500**	**160,000**	**500,000**			30000	50000	50000	$345,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number					
	Component 5: Capacity building and training	Internal capacity in the GMS region to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups.												
Incept-13	Component work package Inception & preparation		national expert time, TA time	9,000				9,000						
Incept-14			TA expert time, national expert time, travel & stay					0						
Incept-15	Inception report contributions		national expert time, travel & stay	3,500				3,500						
Activ. 5.1	Training programme in MAR, ASR and other storage and GW potential strengthening techniques, connected to pilots (2x)		Training workshops		37,500	37,500		75,000						
Activ. 5.2	Higher eduction scholarships (10 MSc positions) for promising young BSc graduates		Scholarships for training in the region	50,000	50,000	20,000		120,000						
Activ. 5.3	Transboundary aquifer management; training programme (IGRAC)		Training workshops		42,500	37,500		80,000						
Activ. 5.4	GGMN – the next level training for the Lower Mekong SubRegion; training and learning-by-doing (IGRAC)		Training workshops	42,500		42,500		85,000						
Activ. 5.5	Co-management of surface and groundwater; training workshop with MRC experts		Training workshops		42,500		42,500	85,000						
Activ. 5.6	Information and resources sharing & cooperation on formal training programmes in institutes, recognition of each other certificates, etc.		Training workshops		42,500	40,000	25,000	107,500						
Activ. 5.7	**Learning and knowledge management** subcomponent; Information repository and sharepoint		Web services, resource materials, national expert time,		40,000	40,000	20,000	100,000						
Activ. 5.8	Pilot area (4x) on site training stakeholders and groundwater users; development of training materials for end-users		national experts time, TA time, materials			32,000	18,000	50,000						
Activ. 5.9	Support to professional and higher education formal training programmes in the region		TA expert time, national expert time, travel & stay		20,000	40,000	20,000	80,000						
Activ. 5.10	Regional Conference on Capacity building, Knowledge management, Studies; Groundwater management and Climate Change Adaptation		Conference costs, national expert time, TA expert time			75,000		75,000						
Activ. 5.11	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		15,000	10,000	25,000	50,000	$50,000					
Activ. 5.12	National pool of experts time (5 countries, multiple institutions)		National expert time	8,000	12,000	6,000	6,000	32,000						
Activ. 5.13	International TA support, pool of experts		TA expert time, travel & stay	7,200	8,000	8,000	8,000	31,200						
Activ. 5.14	General consumables and support services		Consumables	1,500	4,500	6,800	4,000	16,800						
			Subtotal	**121,700**	**314,500**	**395,300**	**168,500**	**1,000,000**			65000	100000	100000	$685,000

				2020	2021	2022	2023	4 year							
	Project Component			Year 1	Year 2	Year 3	Year 4	Total US $							
	ANNUAL TOTALS PER COMPONENT														
	Component 1			510,500	324,200	119,200	246,100	**1,200,000**							
	Component 2			101,000	208,500	174,500	16,000	**500,000**							
	Component 3			130,900	315,100	413,500	140,500	**1,000,000**							
	Component 4			66,000	98,500	175,500	160,000	**500,000**							
	Component 5			121,700	314,500	395,300	168,500	**1,000,000**							
			Subtotals	930,100	1,260,800	1,278,000	731,100	**4,200,000**							
	Project Execution Costs 8.5 %			79,059	107,168	108,630	62,144	**357,000**		357,000					
			Subtotals	1,009,159	1,367,968	1,386,630	793,244	**4,557,000**							
	Management Fee 7.5 %			75,687	102,598	103,997	59,493	**341,775**	$341,775						
			Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**	**4,898,775**	**$551,775**	**$357,000**	**$257,000**	**$420,000**	**$420,000**	**$2,893,000**	
									UNESCO	**CCOP-TS**	**CTA**	**IGRAC**	**IWMI**		
												Total of these 5:	**$2,005,775**		
													INDICATIVE ONLY		
				2020	2021	2022	2023	4 year					CHECK	$4,898,775	
Activity	**Project Component**	**Outcome(s)**	**Cost items**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total US $**				3			
	Project/Programme Execution cost 8.5 %														
Exec.-1	Project Coordinating Technical Advisor			40,000	55,000	60,000	25,000	180,000							
Exec.-2	CCOP-TS Support staff			20,809	23,691	23,000	22,500	90,000							
Exec.-3	Operational costs			8,000	17,000	12,000	3,000	40,000							
Exec.-4	Project related regional travel & stay			5,000	6,227	8,380	6,394	26,000							
Exec.-5	External services (website, accountant)			5,250	5,250	5,250	5,250	21,000							
			Subtotal	**79,059**	**107,168**	**108,630**	**62,144**	**357,000**							
	Project Management Fee charged by the Implementing Entity 7.5 %														
Mngmt-1	General programme implementation support			41,000	46,000	53,000	33,000	173,000							
Mngmt-2	Finance, budget and treasury support			11,250	12,500	15,250	7,000	46,000							
Mngmt-3	Reporting to Adaptation Fund, M & E			12,250	15,500	14,250	7,000	49,000							
Mngmt-4	Project related regional travel			6,187	7,507	6,500	5,493	25,687							
Mngmt-5	Operational costs, publications costs			0	14,366	9,000	3,500	26,866							
Mngmt-6	External services (procurement, accountant)			5,000	6,725	5,997	3,500	21,222							
			Subtotal	**75,687**	**102,598**	**103,997**	**59,493**	**341,775**							

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of the Kingdom of Cambodia, Lao People's Democratic Republic, the Republic of the Union of Myanmar, the Kingdom of Thailand and the Socialist Republic of Vietnam to increase climate change resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation.

Endorsement letters from the AF Designated Authorities in each of the five participating countries

KINGDOM OF CAMBODIA
Nation Religion King

National Council for Sustainable Development
General Secretariat
No: 231 GSSD

Phnom Penh.... 23rd .....May 2019

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience

In my capacity as designated authority for the Adaptation Fund in Cambodia, I confirm that the above regional project/programme proposal is in accordance with the Royal Government of Cambodia national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Cambodia.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by UNESCO and executed by Department of Green Economy of the General Secretariat of National Council for Sustainable Development in collaboration with the Ministry of Water Resources and Meteorology and the Ministry of Mines and Energy with technical support and coordination from Coordinating Committee for Geosciences Programme (in East and Southeast Asia)-CCOP, International Water Management Institute (IWMI), and International Groundwater Resources Assessment Centre (IGRAC).

Yours Sincerely,

Tin Ponlok
Secretary-General

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment
Department of Climate Change

Vientiane Capital, dated: 18 July 2019

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase climate change resilience.

Dear Sir or Madam,

In my capacity as designated authority for the Adaptation Fund in Lao PDR, I confirm that the above regional project/programme proposal is in accordance with Lao PDR national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Lao PDR.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by UNESCO and executed by relevant country agencies, namely the Ministry of Natural Resources and Environment (MoNRE) through the Natural Resources and Environment Institute (NREI), with technical support and coordination from Coordinating Committee for Geosciences Programme (in East and Southeast Asia) - CCOP, International Water Management Institute (IWMI), and International Groundwater Resources Assessment Centre (IGRAC).

Sincerely,

Syamphone SENGCHANDALA
Deputy Director-General,
Department of Climate Change, MOMRE
Designated Authority for the Adaptation Fund of Lao PDR

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL CONSERVATION

Ref No (F)6(1)/01(I)/(2569 / 2019)
Date 31st July, 2019

To

The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: **Endorsement for Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience**

In my capacity as designated authority for the Adaptation Fund in Myanmar, I confirm that the above regional project/programme proposal is in accordance with government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Myanmar.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by UNESCO and executed by the Irrigation and Water Utilization Management Department of the Ministry of Agriculture, Livestock and Irrigation with the technical support and coordination from Coordinating Committee for Geosciences Programme (in East and Southeast Asia)-CCOP, International Water Management Institute (IWMI), and International Groundwater Resources Assessment Centre (IGRAC).

Sincerely,

Ohn Winn
Union Minister
Ministry of Natural Resources and Environmental Conservation
Chairman of the National Environmental Conservation and Climate Change Central Committee
Building No. 28
Nay Pyi Taw, Myanmar

The Republic of the Union of Myanmar

Ministry of Agriculture, Livestock and Irrigation

Irrigation and Water Utilization Management Department

Ref No; MaAhYa/6-588(543 /2019)

Date ; 30 May 2019

Shahbaz Khan

Director and Representative

Subject : Endorsement for Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience

Dear Sir,

I confirm that the above regional project/ programme proposal with support from the Adaptation Fund. If approved, the project/ programme will be implemented by UNESCO and executed by the IWUMD of the Ministry of Agriculture, Livestock and Irrigation with technical support and coordination from coordinating committee for Geosciences Programme (in East and Southeast Asia)- CCOP, International Water Management Institute (IWMI).

(Tin Maung Aye Htoo)

Deputy Director General

Irrigation and Water Utilization Management Department

Ministry of Agriculture , Livestock and Irrigation

Office No.50, Nay Pyi Taw

CC - Office copy

- **Float**

No. 1007.4/ 1542

Ministry of Natural Resources and Environment
92 Soi Phahol Yothin 7, Phahol Yothin Road
Phayathai, Bangkok 10400 Thailand
Tel./Fax. +66 2265 6692

24 June B.E. 2562 (2019)

To: Adaptation Fund Board Secretariat
c/o Global Environment Facility
1818 H Street NW, Washington DC 20433, USA

Subject: Endorsement for Groundwater Resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience

In my capacity, as Designated Authority for the Adaptation Fund in Thailand, I confirm that the above regional project proposal is in accordance with the government's national and sub-regional priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the Mekong Region.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by United Nations Educational, Scientific and Cultural Organization (UNESCO) and executed by the Department of Groundwater Resources (DGR) of Thailand with technical support and coordination from Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP), International Water Management Institute (IWMI), and International Groundwater Resources Assessment Centre (IGRAC).

Yours sincerely,

W. Simachaya

(Mr. Wijarn Simachaya)
Permanent Secretary
Ministry of Natural Resources and Environment

SOCIALIST REPUBLIC OF VIET NAM

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

Ha Noi, 31May 2019

The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for the Project Proposal on "Groundwater resources in the Greater Mekong Sub-region: collaborative management to increase climate change resilience"

In my capacity as Designated Authority for the Adaptation Fund in the Socialist Republic of Viet Nam, I confirm that the above regional project/programme proposal is in accordance with government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the Socialist Republic of Viet Nam, which is part of the Greater Mekong Sub-region.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. If approved, the project will be implemented by UNESCO and executed by the National Centre for Water Resources Planning and Investigation - Ministry of Natural Resources and Environment of Vietnam, with technical support and coordination from Coordinating Committee for Geosciences Programme (in East and Southeast Asia) – CCOP, International Water Management Institute (IWMI), and International Groundwater Resources Assessment Centre (IGRAC).

Yours sincerely,

Dr. Tran Hong Ha
Minister of Natural Resources and Environment
Designated Authority for the Adaptation Fund
Socialist Republic of Viet Nam

Address: 10 Ton That Thuyet street, South Tu Liem district, Ha Noi, Viet Nam
Tel: +84 24 37956868, Fax: +84 24 38359221, Email: icd-monre@monre.gov.vn, Website: http://www.monre.gov.vn

Budget (Excel sheets, Annex IV)

Sheet 1: Summary project budget

Sheet 2: Breakdown of the project execution costs (CCOP-TS)

Sheet 3: Implementing Entity (MIE) management fee (UNESCO)

Sheet 4: Budget disbursement schedule with time-bound milestones.

Sheet 5: Detailed project budget, Excel format (Annex)

Sheet 1: Summary project budget

Project Component		2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $
ANNUAL TOTALS PER COMPONENT							
Component 1		510,500	324,200	119,200	246,100		1,200,000
Component 2		101,000	208,500	174,500	16,000		500,000
Component 3		130,900	315,100	413,500	140,500		1,000,000
Component 4		66,000	98,500	175,500	160,000		500,000
Component 5		121,700	314,500	395,300	168,500		1,000,000
	Subtotals	**930,100**	**1,260,800**	**1,278,000**	**731,100**		**4,200,000**
Project Execution Costs 8.5 %		79,059	107,168	108,630	62,144		357,000
	Subtotals	1,009,159	1,367,968	1,386,630	793,244		4,557,000
Management Fee 7.5 %		75,687	102,598	103,997	59,493		341,775
	Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**		**4,898,775**

Sheet 2: Explanation and breakdown of the project Execution costs

			2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $	
	Project/Programme Execution cost 8.5 %								
Exec.-1	Project Coordinating Technical Advisor		40,000	55,000	60,000	25,000		180,000	
Exec.-2	CCOP-TS Support staff		20,809	23,691	23,000	22,500		90,000	
Exec.-3	Operational costs		8,000	17,000	12,000	3,000		40,000	
Exec.-4	Project related regional travel & stay		5,000	6,227	8,380	6,394		26,000	
Exec.-5	External services (website, accountant)		5,250	5,250	5,250	5,250		21,000	
		Subtotal	**79,059**	**107,168**	**108,630**	**62,144**		**357,000**	

CTA Position under CCOP-TS, covered partly by CCOP-TS Execution cost budget	yr 1	yr 2	yr 3	yr 4	
Annual expenses remuneration	75000	75000	75000	75000	$300,000
Housing Allowance	15000	15000	15000	15000	$60,000
					$360,000
Out of CCOP-TS budget					$100,000
					$260,000

Sheet 3: Explanation and breakdown of the MIE Management fee 7,5 %

		2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $
	Project Management Fee charged by the Implementing Entity 7.5 %					
Mngmt-1	General programme implementation support	41,000	46,000	53,000	33,000	173,000
Mngmt-2	Finance, budget and treasury support	11,250	12,500	15,250	7,000	46,000
Mngmt-3	Reporting to Adaptation Fund, M & E	12,250	15,500	14,250	7,000	49,000
Mngmt-4	Project related regional travel	6,187	7,507	6,500	5,493	25,687
Mngmt-5	Operational costs, publications costs	0	14,366	9,000	3,500	26,866
Mngmt-6	External services (procurement, accountant)	5,000	6,725	5,997	3,500	21,222
	Subtotal	**75,687**	**102,598**	**103,997**	**59,493**	**341,775**

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	Upon Agreement signature		Year 1		Year 2		Year 3		Year 4		Total %	Total Amount
											(US $)	
Scheduled Date	12/01/2020		12/01/2021		03/01/2022		03/01/2023		03/01/2024			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$ 549,845.39**		**$ 1,470,565.60**		**$ 1,490,627.25**		**$ 852,736.76**		**$ 4,898,775.00**

Sheet 5: Detailed project Activity budget

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	UNESCO	CCOP-TS	CTA	IGRAC	IWMI	REMAINDER
	Component 1: Groundwater Resource assessment and monitoring	Harmonised regional GW resource inventory supporting regional GMS approach to address challenges of climate change and resilience; information-based policy to manage resources and further develop new GW based resilience strategies and practical interventions.												
Incept-1	Component work package Inception & preparation		National expert time, TA tima	15,000				15,000						
Incept-2	Inception visits 5 countries and data collection		National expert time, TA time, travel & stay, data costs	90,000				90,000						
Incept-3	Inception report contributions		National expert time, TA time	9,600				9,600						
Activ. 1.1	Component techncial coordination and support		national expert time, TA time	7,000	9,600	9,600	7,000	33,200						
Activ. 1.2	Database and GIS systems set-up and management, 4 pilot areas: groundwater related data inputs and costs		GIS expert time, data files	50,000	25,000	25,000	15,000	115,000						
Activ. 1.3	5 Country Workshops on project scope and setting up project network (CoP)		Workshop costs, TA time, travel & stay, consumables	125,000				125,000						
Activ. 1.4	Groundwater resources & aquifer status reports, 4 pilot areas		TA time, national expert time		50,000			50,000						
Activ. 1.5	Development of basic groundwater monitoring system in 4 pilot areas, installation of equipment		National expert time, TA time,	19,200				19,200						
Activ. 1.6	Equipment costs (4 pilot areas)		Equipment costs	120,000	35,000	20,000		175,000						
Activ. 1.7	Pilot area localised data collection approach and practicalities, with paticipation of stakeholders and groundwater users		National expert time, travel & stay, consumables	16,000				16,000						
Activ. 1.8	Pilot areas resilience potential characterization; 1 central workshop for four pilot areas		National expert time, TA, workshop costs, travel & stay		55,000			55,000						
Activ. 1.9	Mid-term evaluation of groundwater resources status of pilot areas, 4 dedicated workshops, at the end of year 2		Workshop costs, TA time, national experts time, travel & stay, consumables		68,000			68,000						
Activ. 1.10	Regional project Conference (Siem Reap, Cambodia) and field visit; participants from 5 countries, national expert teams, TA support team, invited speakers, and supporting resource persons		Workshop costs, TA time, national experts time, travel & stay, consumables				155,000	155,000						
Activ. 1.11	Support Mid-term review and Project Steering Committee meetings		TA time, national expert time		7,000	9,000		16,000						
Activ. 1.12	National technical expert inputs for Project Steering Committee meetings (8 times)		National expert time, TA time	9,200	9,100	9,100	9,100	36,500						
Activ. 1.13	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	10,000	20,000	10,000	20,000	60,000	$60,000					
Activ. 1.14	General consumables and logistics		Consumables	2,000	2,000	2,000	2,000	8,000						
Activ. 1.15	National pool of experts time (5 countries, multiple institutions)		National expert time	27,500	28,500	22,500	26,000	104,500						
Activ. 1.16	International TA support, pool of experts		TA expert time, travel & stay	10,000	15,000	12,000	12,000	49,000						
			Subtotal	510,500	324,200	119,200	246,100	**1,200,000**			$72,000	$120,000	$120,000	$828,000

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 2: Priority use and stakeholders	Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.													
Incept-4	Component work package Inception & preparation		national expert time, TA time	6,000				6,000							
Incept-5	4 pilot areas; visits to communities and local government, NGO's		national expert time, travel & stay	32,000				32,000							
Incept-6	Inception report contributions		national expert time, TA time	3,500				3,500							
Activ. 2.1	Resilience strengthening pilots		national expert time, TA expert time, operational costs, travel & stay		45,000	35,000	15,000	95,000							
Activ. 2.2	Materials & equipment, installation costs in 4 pilots		materials & equipment		40,000	3,000		43,000							
Activ. 2.3	Pilot areas socio-economic and water users characterization		national expert time, external consultant services	28,000	28,000			56,000							
Activ. 2.4	Gender balance programme set-up and implementation		national expert time, TA expert time, operational costs, travel & stay	3,000	11,000	11,000		25,000							
Activ. 2.5	Information products on vulnerability issues for each of the four pilot areas, for different groundwater user groups		national expert time, TA expert time, travel & stay		24,000	36,000		60,000							
Activ. 2.6	Dialogue meetings with national policymakers and experts on strategic importance of groundwater resources in the overall climate change adaptation discussion		national expert time, TA expert time, operational costs, travel & stay		27,000			27,000							
Activ. 2.7	Pilot for regional water-supply companies that use groundwater information on groundwater management tools		time, operational costs, travel & stay			34,000		34,000							
Activ. 2.8	Resilience Agenda, Atlas, interAction in pilot area meetings (product preparation, local workshops)		national expert time, TA expert time, operational costs, travel & stay		14,000	37,000		51,000							
Activ. 2.9	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000		25,000	$25,000						
Activ. 2.10	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000		25,000							
Activ. 2.11	International TA support, pool of experts		TA expert time, travel & stay	10,000				10,000							
Activ. 2.12	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500							
			Subtotal	101,000	208,500	174,500	16,000	**500,000**		30000	50000	50000	$345,000		

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 3: Resource management, information tools and equipment	Greater resilience and sustainable GW resource use, with protection of low income and vulnerable user groups. Transboundary groundwater policies more robust and climate change ready.													
Incept-7	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-8	Expert meeting on resource management information concepts and tools; option and start up development		TA expert time, national expert time, travel & stay	32,000				32,000							
Incept-9	Inception report contributions		national expert time, travel & stay	3,500				3,500							
Activ. 3.1	Application of database and GIS tools; specialised information products that can be derived from it What do the results tell us (statistics in the database, geographical info: .		TA expert time, national expert time, travel & stay	52,000	32,000	32,000		116,000							
Activ. 3.2	Tailored database and GIS tools development and demonstrations, data hosting and provision services		External services; supporting TA expert time, national expert time, travel & stay;		45,000	45,000	25,000	115,000							
Activ. 3.3	Revisit resilience potential: what can user do with it; how to exploit this ? Prepare Resilience potential asssessment		Supporting TA expert time, national expert time		56,000	42,000		98,000							
Activ. 3.4	Pilots supported with groundwater monitoring and management information and applicatin to develop resilience options		Supporting TA expert time, national expert time. travel &		36,000	56,000	31,000	123,000							
Activ. 3.5	Technical meetings: Co management of Surface and Groundwater, with national expert and MRC, supporting organisations		External services; supporting TA expert time, national expert time, travel & stay;			38,000	22,000	60,000							
Activ. 3.6	Actual Management interventions like MAR or other		Regional TA expert time		42,000	28,000	12,000	82,000							
Activ. 3.7	Supporting reslience measures in 4 pilot areas, including installations and equipment		Material costs; supporting TA expert time, national expert time,		60,000	98,000		158,000							
Activ. 3.8	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000	25,000	50,000	$50,000						
Activ. 3.9	National pool of experts time (5 countries, multiple institutions)		National expert time	15,000	23,000	33,000	11,500	82,500							
Activ. 3.10	International TA support, pool of experts		TA expert time, travel & stay	13,000	3,600	24,000	8,000	48,600							
Activ. 3.11	General consumables and support services		Consumables	1,400	7,500	7,500	6,000	22,400							
			Subtotal	**130,900**	**315,100**	**413,500**	**140,500**	**1,000,000**			60000	100000	100000	$690,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 4: Regional cooperation, coordination and information exchange.	A regionally coherent policy for climate adaptation through sustainable GW resource management; level playing field for all sectoral users in the region, efficiency gains in common approach and support tools.													
Incept-10	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-11	Research and documentation of policy context and practical cases; documentaiton packages for 5 countries		TA expert time, national expert time, travel & stay	24,000				24,000							
Incept-12	Inception report contributions		national expert time, travel & stay, TA expert time	3,500				3,500							
Activ. 4.1	Documentation on transboundary aquifer systems; resource status, transboundary implications and policy reccommendations		National expert time, TA expert time,		16,000	16,000		32,000							
Activ. 4.2	Pilot areas workshops (4x) on transboundary climate policy		Workshop expenses			45,000	40,000	85,000							
Activ. 4.3	Application of TBA Assessment Methodology on the four pilot areas		National expert time, TA expert time, Travel & stay, consumables			27,000	26,000	53,000							
Activ. 4.4	Working group on sharing & co-development of tools		National expert time, TA expert		24,000	24,000	24,000	72,000							
Activ. 4.5	Working group on national policy and strategy		time, Travel & stay, consumables		24,000	19,000	24,000	67,000							
Activ. 4.6	Regional policy coordination; preparation of White paper for ASEAN forum, emphasizing climate adaptation in transboundary regions		National expert time; support services, TA xpert time		12,000	10,000	12,000	34,000							
Activ. 4.7	Documentation materials for pilot regions		National expert time			8,000	8,000	16,000							
Activ. 4.8	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		5,000	10,000	10,000	25,000	$25,000						
Activ. 4.9	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000	7,000	32,000							
Activ. 4.10	International TA support, pool of experts		TA expert time, travel & stay	16,000	8,000	8,000	8,000	40,000							
Activ. 4.11	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500							
			Subtotal	**66,000**	**98,500**	**175,500**	**160,000**	**500,000**			30000	50000	50000	$345,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 5: Capacity building and training	Internal capacity in the GMS region to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups.													
Incept-13	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-14			TA expert time, national expert time, travel & stay					0							
Incept-15	Inception report contributions		national expert time, travel & stay	3,500				3,500							
Activ. 5.1	Training programme in MAR, ASR and other storage and GW potential strengthening techniques, connected to pilots (2x)		Training workshops		37,500	37,500		75,000							
Activ. 5.2	Higher eduction scholarships (10 MSc positions) for promising young BSc graduates		Scholarships for training in the region	50,000	50,000	20,000		120,000							
Activ. 5.3	Transboundary aquifer management; training programme (IGRAC)		Training workshops		42,500	37,500		80,000							
Activ. 5.4	GGMN – the next level training for the Lower Mekong SubRegion; training and learning-by-doing (IGRAC)		Training workshops	42,500		42,500		85,000							
Activ. 5.5	Co-management of surface and groundwater; training workshop with MRC experts		Training workshops		42,500		42,500	85,000							
Activ. 5.6	Information and resources sharing & cooperation on formal training programmes in institutes, recognition of each other certificates, etc.		Training workshops		42,500	40,000	25,000	107,500							
Activ. 5.7	**Learning and knowledge management** subcomponent; Information repository and sharepoint		Web services, resource materials, national expert time,		40,000	40,000	20,000	100,000							
Activ. 5.8	Pilot area (4x) on site training stakeholders and groundwater users; development of training materials for end-users		national experts time, TA time, materials			32,000	18,000	50,000							
Activ. 5.9	Support to professional and higher education formal training programmes in the region		TA expert time, national expert time, travel & stay		20,000	40,000	20,000	80,000							
Activ. 5.10	Regional Conference on Capacity building, Knowledge management, Studies; Groundwater management and Climate Change Adaptation		Conference costs, national expert time, TA expert time			75,000		75,000							
Activ. 5.11	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		15,000	10,000	25,000	50,000	$50,000						
Activ. 5.12	National pool of experts time (5 countries, multiple institutions)		National expert time	8,000	12,000	6,000	6,000	32,000							
Activ. 5.13	International TA support, pool of experts		TA expert time, travel & stay	7,200	8,000	8,000	8,000	31,200							
Activ. 5.14	General consumables and support services		Consumables	1,500	4,500	6,800	4,000	16,800							
			Subtotal	**121,700**	**314,500**	**395,300**	**168,500**	**1,000,000**			65000	100000	100000	$685,000	

				2020	2021	2022	2023	4 year							
	Project Component			Year 1	Year 2	Year 3	Year 4	Total US $							
	ANNUAL TOTALS PER COMPONENT														
	Component 1			510,500	324,200	119,200	246,100	**1,200,000**							
	Component 2			101,000	208,500	174,500	16,000	**500,000**							
	Component 3			130,900	315,100	413,500	140,500	**1,000,000**							
	Component 4			66,000	98,500	175,500	160,000	**500,000**							
	Component 5			121,700	314,500	395,300	168,500	**1,000,000**							
			Subtotals	930,100	1,260,800	1,278,000	731,100	**4,200,000**							
	Project Execution Costs 8.5 %			79,059	107,168	108,630	62,144	**357,000**		357,000					
			Subtotals	1,009,159	1,367,968	1,386,630	793,244	**4,557,000**							
	Management Fee 7.5 %			75,687	102,598	103,997	59,493	**341,775**	$341,775						
			Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**	**4,898,775**	**$551,775**	**$357,000**	**$257,000**	**$420,000**	**$420,000**	**$2,893,000**	
									UNESCO	CCOP-TS	CTA	IGRAC	IWMI		
												Total of these 5:	$2,005,775		
									INDICATIVE ONLY						
				2020	2021	2022	2023	4 year					CHECK	$4,898,775	
Activity	Project Component	Outcome(s)	Cost items	Year 1	Year 2	Year 3	Year 4	Total US $							
	Project/Programme Execution cost 8.5 %											3			
Exec.-1	Project Coordinating Technical Advisor			40,000	55,000	60,000	25,000	180,000							
Exec.-2	CCOP-TS Support staff			20,809	23,691	23,000	22,500	90,000							
Exec.-3	Operational costs			8,000	17,000	12,000	3,000	40,000							
Exec.-4	Project related regional travel & stay			5,000	6,227	8,380	6,394	26,000							
Exec.-5	External services (website, accountant)			5,250	5,250	5,250	5,250	21,000							
			Subtotal	**79,059**	**107,168**	**108,630**	**62,144**	**357,000**							
	Project Management Fee charged by the Implementing Entity 7.5 %														
Mngmt-1	General programme implementation support			41,000	46,000	53,000	33,000	173,000							
Mngmt-2	Finance, budget and treasury support			11,250	12,500	15,250	7,000	46,000							
Mngmt-3	Reporting to Adaptation Fund, M & E			12,250	15,500	14,250	7,000	49,000							
Mngmt-4	Project related regional travel			6,187	7,507	6,500	5,493	25,687							
Mngmt-5	Operational costs, publications costs			0	14,366	9,000	3,500	26,866							
Mngmt-6	External services (procurement, accountant)			5,000	6,725	5,997	3,500	21,222							
			Subtotal	**75,687**	**102,598**	**103,997**	**59,493**	**341,775**							

ADAPTATION FUND

REGIONAL PROJECT/PROGRAMME PROPOSAL

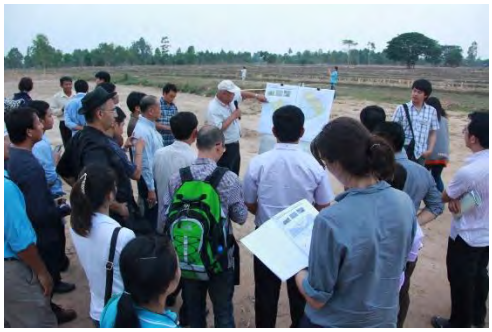
PROJECT/PROGRAMME INFORMATION (Summary)

Title of Project/Programme:	***Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience***.
Countries:	Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Vietnam
Thematic Focal Area:	Transboundary water management
Type of Implementing Entity:	MIE
Implementing Entity:	UNESCO
Executing Entities:	National Agencies, CCOP-TS, IWMI, IGRAC
Amount of Financing Requested:	**US $ 4,898,775**

Groundwater resources in the Greater Mekong Subregion

Collaborative management to increase climate change resilience.

A collaboration of the Kingdom of Cambodia, Lao People's Democratic Republic, the Republic of the Union of Myanmar, the Kingdom of Thailand and the Socialist Republic of Vietnam to increase climate change resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation.

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

IWMI International Water Management Institute

IWMI is a member of the CGIAR Consortium and leads the:

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

COORDINATING COMMITTEE FOR GEOSCIENCE PROGRAMMES IN EAST AND SOUTHEAST ASIA (CCOP)

igrac International Groundwater Resources Assessment Centre

Bangkok, July 2016; 1st revised version Jun 2017; 2nd revised version June 2018; 3rd revised version, April 2019; © UNESCO

Contents

Abbreviations

ADB	Asian Development Bank
AF	Adaptation Fund
ASEAN	Association of Southeast Asian Nations
AVID	Australian Volunteers for International Development
AWP	Annual Work Plan
CCA	Climate Change Adaptation
CBDRM	Community-based Disaster Risk Management
CBNRM	Community-based Natural Resource Management
CBOs	Community Based Organizations
CCOP-TS	Coordinating Committee for Geoscience Programmes in East and Southeast Asia – Technical Secretariat
CoP	Community of Practice
DIWU	Department of Irrigation and Water Utilization (Myanmar)
DMH	Department of Meteorology and Hydrology
DRR	Disaster Risk Reduction
DWRPIS	Division for Water Resources Planning and Investigation in the South of Vietnam
GEF	Global Environment Facility
GGMN	Global Groundwater Monitoring Network
GGIS	Global Groundwater Information System
GMS	Greater Mekong Subregion
GW	Groundwater
GWES	Groundwater for Emergency Situations
IHP	International Hydrological Programme
IMS	Information Management System
INGO	International Non-governmental Organization
IGRAC	International Groundwater Resources Assessment Centre
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MAR	Managed Aquifer Recharge
M&E	Monitoring and Evaluation
MIE	Multilateral Implementing Entity
MONRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
MSL	Mean Sea Level
NAWAPI	National Center for Water Resources Planning and Investigation (Vietnam)
QGIS	Quantum GIS – Geographic Information System
SDGs	Sustainable Development Goals
TBA	Transboundary Aquifer
TWAP	Transboundary Water Assessment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WASH	Water, Sanitation and Hygiene
WRUD	Water Resources Utilization Department (Myanmar)

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Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience

PART I: PROJECT INFORMATION

1. Project Background and Context

1.1 Resource status: Groundwater in the Greater Mekong Subregion

The Greater Mekong Subregion (GMS) comprises the sovereign nations of Cambodia, Lao People's Democratic Republic (Lao PDR), Thailand, Myanmar and Vietnam. With a rapidly increasing population in the range of 250 million people, the region is experiencing more variable surface water flows, a prolonged dry season and intensifying droughts and a growing demand for water resources including groundwater. Despite relatively abundant surface water resources, a considerable number of low-income groups and urban/rural communities rely on low-cost groundwater for their domestic, agrarian and industrial use. Several groundwater reserves are transboundary and it is recognised that there is limited capacity to manage these shared resources and limited knowledge about the sustainable yields of these transboundary aquifers. This proposal seeks to address this institutional and governance challenge through implementing a transboundary groundwater collaboration. Recent and predicted population dynamics will put more pressure on limited water resources, accelerated by consumption and behavioural patterns, unless serious awareness, education, and science-based information flow will balance this trend. According to UN DESA[1], the population of the five member states has exceeded to >233 million in 2018, versus 62 million in 1950, and it will reach a total of >372 million people by 2050 and beyond, with only Thailand reaching population stability very soon. This means the total population increase is 600 % in only 100 years, and still increasing.

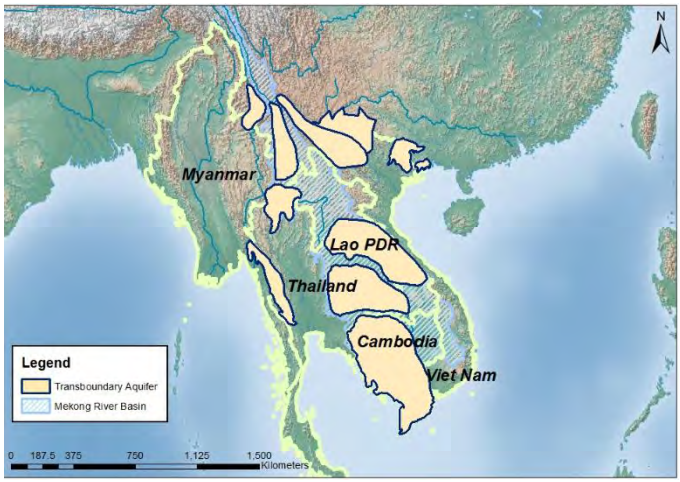


Figure 1: Overview of the main transboundary groundwater aquifers in the Greater Mekong Subregion; source IGRAC.

Throughout the GMS, complex relationships occur between upstream recharge areas and downstream aquifers. The total potential capacity of groundwater resources is estimated to be about 60 million m³/day. Important transboundary aquifers straddle the border areas and highlight the need for multilateral cooperation for effective management of shared resources (Landon, 2011[2]). Recent studies (i.e. Erban, 2014[3]; Wagner *et al.,* 2012[4]) illustrate the intensive use and economic significance of groundwater for both the Vietnamese and Cambodian part of the Mekong Delta. This also applies for the drought sensitive northeast of Thailand (the Isan region), adjacent parts of Lao PDR (Pavelic *et al*., 2014 [5] ; Vote *et al.,* 2015 [6]) and Myanmar's central plain (McCartney *et al*. 2013[7]).

[1] https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/
[2] Landon. M., 2011; Preliminary compilation and review of current information on groundwater monitoring and resources in the Lower Mekong River Basin. USGS report to Mekong River Commission.
[3] Erban,L. S.M.Gorelick & H.A.Zebker, 2014;Groundwater extraction, land subsidence and sea-level rise in Mekong Delta, Environ.Res.Lett. 9.
[4] Frank Wagner, Vuong Bui Tran and Fabrice G. Renaud; Groundwater in the Mekong Delta: Availability, Utilization and Risks, in The Mekong Delta System, Interdisciplinary Analyses of a River Delta, Renaud and Kuenzer (eds.), Springer, 2012)
[5] Pavelic. P., O. Xayviliya and O. Ongkeo., 2014; Pathways for effective groundwater governance in the least-developed-country context of Lao
[6] Vote, C.,, J Newby, K Phouyyavong, T Inthavong and Eberbach, P. 2015; Trends and perceptions of rural household GW use and the implications for smallholder agriculture in rain-fed Southern Laos. International Journal of Water Resources Development, 02/2015; DOI:10.1080/07900627.2015.1015071
[7] McCartney, M.; Pavelic, P.; Lacombe, G.; Latt, K.; Zan, A.K.; Thein, K.; Douangsavanh, S.; Balasubramanya, S.; Rajah, A.; Myint, A.; Cho, C.; Johnston, R.; Sotoukee, T. 2013. Water resources assessment of the dry zone of Myanmar. [Project report of the Livelihoods and Food Security Trust Fund (LIFT) Dry Zone Program]. Vientiane, Laos: International Water Management Institute (IWMI); Yangon, Myanmar: National Engineering and Planning Services (NEPS). 52p

Groundwater is also an extremely important resource for crop irrigation, food production (notably in Myanmar, Thailand and Vietnam), industry (e.g. food processing, mining) and domestic supply for urban and rural communities. Due to rapid economic and population growth, pressures on groundwater in the region are increasing fast. Climate variability creates a more uncertain dimension of stress, with, for example, the recent El Niño related drought in Thailand leading to emergency measures involving the drilling of 900 wells for irrigating parched rice fields with unknown longer-term consequences (Bangkok Post, 23 June 2015).

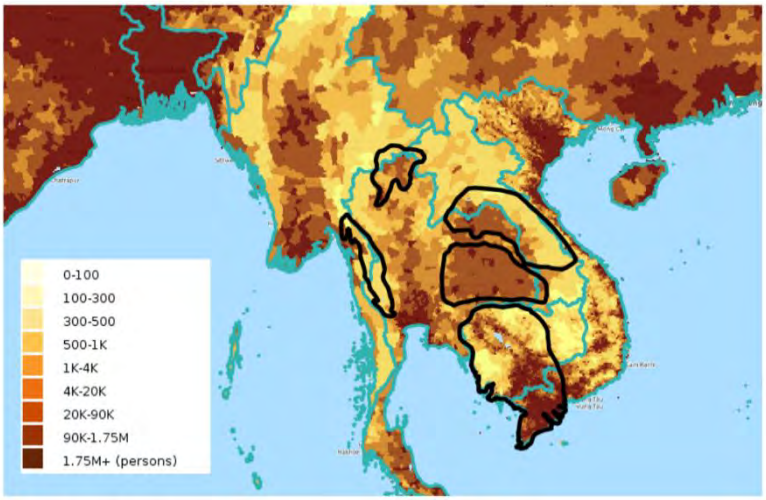


Figure 2. Main Transboundary aquifer (TBA) systems in the region and the population density in 2015 in the region (data: SEDAC: Socio-economic Data and Applications Center).

Population densities (persons/sq. km) vary quite significantly throughout the region but it can be said that in more densely populated areas there is a significant dependency on groundwater for agricultural (irrigation) water needs, rural and urban water supply for domestic needs, especially in more frequent and prolonged droughts.

1.2 Groundwater resources users and increased vulnerabilities

In the recent past over-extraction of groundwater for production of high-value crops, such as coffee, has caused a severe drop in groundwater levels in parts of the Vietnamese highlands. The same is happening in the upstream part of the Mekong Delta (Cambodia) were rice production for export causes unsustainable use of groundwater[8]. Intensification of irrigation to meet the food demand of growing populations rapidly increases use of groundwater in all countries in the region. In some areas such as southern Cambodia, parts of Lao PDR and the Mekong and Ayeyarwady Deltas, naturally occurring arsenic contamination is already exacerbated by increased groundwater use and higher pumping rates. Climate change adds additional factors of groundwater recharge limitations. Groundwater supports valuable ecosystem services by feeding wetland ecosystems, valuable habitats of fish and aquatic plants contributing to food-security.

Intrinsic linkages between surface water and groundwater exist, but are not always clear. Incidentally, the system connectivity between surface water ecosystems (rivers and wetlands), larger watersheds, land use practices and groundwater is being recognized. In this context, it is critical that climate patterns and climate change realities are considered. These must be studied and the results taken into account in water allocation planning. Further expansion of irrigation, land use changes (deforestation) in the highland areas, increase of domestic and industrial use in expanding cities (capital and in the provinces) of the GMS may result in significant depletion of groundwater resources in the future, leading to reduced water availability, higher pumping costs, saltwater intrusion in coastal areas, and loss of ecosystem services. These effects will be exacerbated by the impacts of climate change (increasing demand, potentially reducing recharge) throughout the GMS. The full impacts of climate change on groundwater availability are likely to be complex and require further investigation.

[8] Erban, L.E., S.M. Gorelick, 2016; Closing the irrigation deficit in Cambodia: Implications for transboundary impacts on groundwater and Mekong River flow. http://dx.doi.org/10.1016/j.jhydrol.2016.01.072

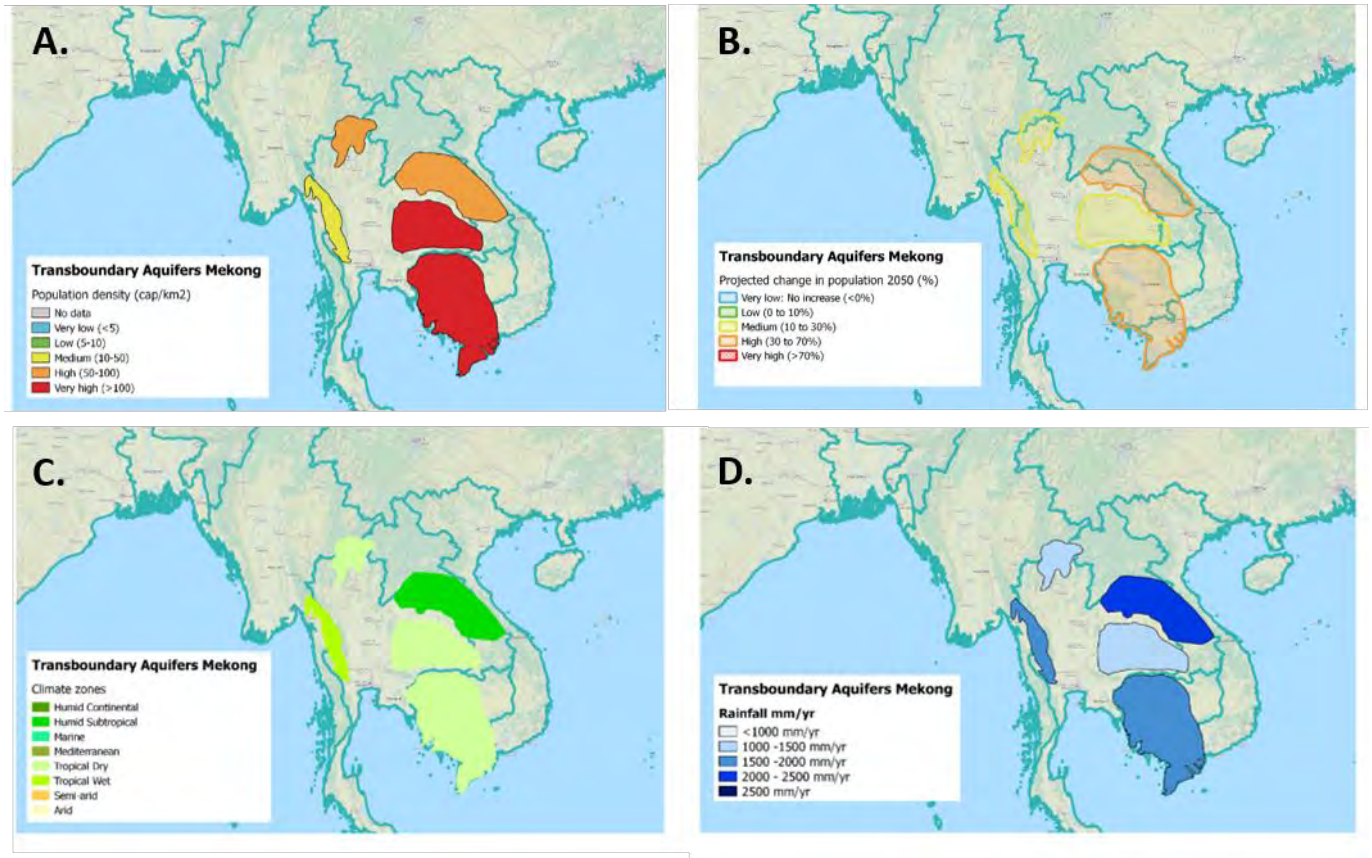


Figure 3: Overview of characteristics of the main Transboundary Aquifers located in the GMS and shared by Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. A. Population density; B. Projected change in population; C. Climate zones and D. Average annual precipitation. Data derived from the Transboundary Water Assessment Programme (TWAP), http://twapviewer.un-igrac.org).

Comprehensive groundwater management and specialized studies (dedicated monitoring, resource assessments) are a relatively new and underdeveloped domain, pertinently so in Lao PDR, Cambodia and Myanmar. In Thailand the Department of Mineral Resources-Division for Groundwater Management has, over the last decades, made substantial efforts to map groundwater resources (1:250.000 series hydrogeological maps / groundwater maps) throughout the country and conducted various regional and specialized studies. Besides major studies in the Bangkok metropolitan region and important work also was done in the drier northeast of the country (Isan region) where agriculture relies heavily on groundwater. In a similar mode, systematic groundwater mapping and studies in Vietnam have progressed since early investigations in Red and Mekong River deltas and development of expertise and capacity in central government agencies under the Ministry of Natural Resources and Environment (MONRE). Groundwater is now a recognized component in studies for provincial and municipal water supply and there is growing awareness on long-term supply and water quality issues (arsenic, salinity intrusion, pollution in urban areas). Unfortunately, the situation is very different in Lao PDR and Cambodia where groundwater is a rather neglected resource. Only gradually it is considered in national water, environmental and natural resources management policies and slowly some capacity is being developed.

Monitoring

The status of groundwater resources needs to be monitored regularly to provide a basis for their assessment and to estimate quantities and quality. Without appropriate data collection and assessment, there can be no effective groundwater management. Groundwater is monitored in many parts of the world by measuring its levels, abstraction rates, spring discharge and quality. Groundwater level point measurements are often interpolated and combined with other data (e.g. remote sensing and modelling) to assess the state of groundwater resources over a larger area. Increasingly, there is active involvement in groundwater monitoring by stakeholders and users (see for instance Akvo Flow; http://akvo.org/products/akvoflow/ for crowdsourcing approaches to data collection); this is of particular interest for this project. There is however, a lack of pertinent groundwater information at the regional and local scales, which hampers assessment and informed water management in general and the use and allocation of limited resources for specific purposes as intended in this project. Worldwide, organisations have taken up the challenge of setting up and supporting systematic collection of data and development of monitoring networks. One of these is the **Global Groundwater Monitoring Network** (GGMN) established and supported by IGRAC (www.un-igrac.org/ggmn).

The GGMN is an easy to use and versatile tool that provides access to and analytical capabilities for groundwater monitoring data. Groundwater data and changes occurring in groundwater levels (resource status) can be displayed on a regional scale. Additional data layers and information are available to understand the monitoring data in a broader water-related context. The web-based software application assists in the spatial and temporal analysis of monitoring data. The system is integrated with QGIS to process data offline. QGIS is an open source Geographic Information System that contains a variety of functionalities to analyse the data and create spatially interpolated GW level maps (see for instance: www.un-igrac.org/ggis). The tool can be used and filled with data for any specific area, and data analysis, output, maps and charts can be derived in accordance with user needs.

Ongoing groundwater and hydrogeological studies in the five countries by themselves are not sufficient to address water scarcity and food production vulnerabilities; a paradigm shift in groundwater management is required to come to a concerted effort to develop resilience based on comprehensively supporting supply-demand issues, both from resources (Supply perspective), as well as from water user and stakeholder perspective (Demand). Much more than in the past, groundwater experts need to be aware of user needs, and possibilities and constraints to sustainably use. At the same time, farmers, water supply managers, industrial plant managers and other users have to be informed and enabled about the (im)possibilities of groundwater use, surface- and groundwater co-management practices and other measures to support development of more resilient irrigation, food production and water supply systems. This paradigm shift can be illustrated on different levels, from very basic to strategic policy-making levels, by the use of more appropriate information products. Traditionally, hydrogeological or groundwater potential maps do not provide very clear or pertinent information to water users in different sectors (agriculture, industry, domestic water supply) who develop and manage water supply. In order to use the resource more efficiently, in view of increasing demand and scarcity, this can be improved. On a higher level, groundwater resources are now more commonly seen as an intrinsic part of the water system and correctly so; groundwater resources are of strategic importance for national agriculture and food systems, energy systems, ecosystem services, rural and urban water supply and obviously, evolving climate change adaptation (CCA) strategies. Hence, appropriate groundwater information is of strategic importance on a (supra)national level and particularly also for transboundary water issues (as in the GMS). In this project, focus will be on addressing water user needs in various sectors and jointly developing resilience measures, and on strengthening strategic groundwater management and transboundary cooperation.

Groundwater use

Across the GMS GW plays a major role to supply water for domestic, agricultural and industrial use, with a major share going to irrigation in rural areas and to industrial-domestic water supply in urban areas. Agricultural users commonly use surface water from streams and ponds as well as GW from shallow tube wells. GW is easily exploited by individual farmers due to general availability, quality and relative low development costs. Pavelic et al. (2015) describe different typologies of agricultural GW use in Myanmar Dry Zone; these are representative for the wider region.

- Deeper tube wells (larger farmers)
- Shallow tube wells and permanent (deeper) dug wells
- Seasonal dug wells in riverbeds
- Shallow dug wells and ponds for small extractions

Increasingly, GW is exploited, via deeper tube wells, in government-supported domestic water supply programmes for villages and smaller towns. These schemes are often hampered by poor management. Large scale irrigation schemes using GW have been developed with international technical assistance. Whereas normally large industrial water users would use surface water (sugar mills, cement factories), increasingly there are shifts to reliable, good quality GW.

1.3 Climate change scenarios and climate change impacts in the region

All GMS countries are vulnerable to the adverse effects of the existing climate and weather patterns; flooding and heavy monsoon rains are common but the region can also experience prolonged dry season droughts with pronounced and common water scarcity, with major impacts on the regional and national food security. The monsoon occurs from May to October, with heavy rains, high humidity and strong winds. From November to April is the dry season, with little rain, low humidity and not much wind. Total rainfall across the region varies from extremely high (up to 5000 mm annually) to a mere 700 mm per year in the central Dry Zone of Myanmar; with patchy evapotranspiration rates. These recurrent dry spells (in conjunction with population dynamics that happened already), constitute a constant threat to the livelihoods of the rural poor. The climate is influenced by the El Niño Southern Oscillation, which causes inter-annual variations, bringing warmer, drier winters in El Niño years and cooler than average summers in La Niña years. Temperature records show an increase in mean annual temperatures and the number of dry, hot days annually. Future projections suggest that these trends will continue, with the average annual temperature rising by 0.7-2.7°C by the 2060's and 1.4-4.3°C by the 2090's throughout the year (depending on the greenhouse gas emission scenario and the climate model used).

Climate models predict a minor increase in annual rainfall in the coming decades but with notable regional and seasonal differentiations. Generally speaking, it is expected that shorter and wetter rainy seasons will occur, with longer and drier dry seasons, and more anomalous seasonal events, such as the occurrence of short droughts during the rainy seasons. Together, these impacts mean increased uncertainty in the availability of water for domestic and agricultural users. Given that the climate will be increasingly variable, with more pronounced extremes, the impacts of climate change will be evident primarily through extremes in the water system, which have significant implications for different sectors and water users. (Johnston *et al*., 2010[9]).

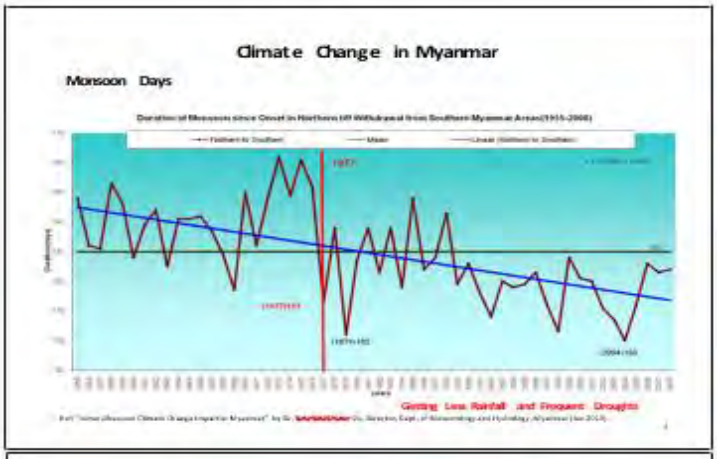


Figure 4: Climate change trends in Myanmar's Dry Zone: Rising dry season temperatures and shorter rainfall periods.

[9] Johnston, R., Lacombe, G., Hoanh, C.T., Noble, A., Smakhtin, V., Suhardiman, D., Kam, S.P. and Choo, P.S., 2010; Climate Change, Water and Agriculture in the Greater Mekong Sub-Region. International Water Management Institute Research Report 136

1.4 Transboundary resource management and regional cooperation

Climate change vulnerabilities are not bounded by national borders. Likewise, groundwater resources are crossing state borders, including in the GMS. Accordingly, both climate change related vulnerabilities and resilience measures involving groundwater resources have to be assessed and managed at the regional and aquifer-wide scale. Besides assessment of groundwater resources, the overall survey includes environmental, socio-economic and policy / institutional aspects. The proposed project, for shared aquifers, will foster information management, and international relationships, by initiating to set up an international cooperation mechanism.

Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, classifications, languages and/or technologies. Harmonized data and information should preferably be stored in an on-line Information Management System (IMS) along with outcomes of assessment and possible management scenarios. As such, it is a valuable tool in the joint, and science-based management of internationally shared aquifers. Moreover, contemporary IMS can easily store and combine info from various web-based sources, allowing analysis of GW resilience in a broader context of climate change (i.e. including surface water, land use, demographic predictions, etc.).

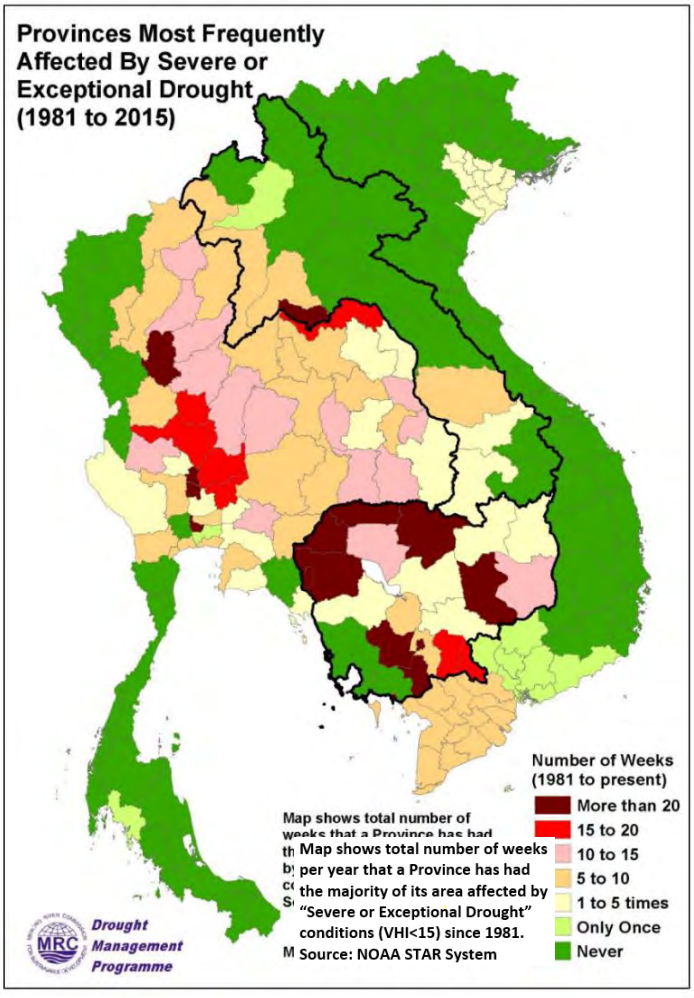


Figure 5: Regional impact of droughts (Source: MRC.org). With changing climate, the frequency of exceptional drought tends to increase (e.g. Vietnam's 2016 drought was recorded the worst drought in almost 100 years; (UNICEF, 2016[10])).

The project proposes to work in four pilot sites, including in the most vulnerable regions, such as the Vientiane Plains (Lao-PDR-Thailand, bordering Mekong River), the border area between northwest Cambodia and Thailand, the upper Mekong Delta region shared by Cambodia and Vietnam, and the Central Myanmar Dry Zone.

Role of Mekong River Commission

The Mekong River Commission (MRC) has built up a long track record in contributing to regional water resources management in support of broader socio-economic development and sustainable management of natural resources. The most recent MRC Basin Development Plans [11] provide a comprehensive, integrated water resources management-based framework. Unfortunately, with respect to groundwater issues the role and mandate of the MRC is less well documented.

[10] UNICEF, 2016. Vietnam, Humanitarian Situation Report #2, https://www.unicef.org/appeals/files/UNICEF_Vietnam_Humanitarian_SitRep_3_June_2016.pdf

[11] Integrated Water Resources Management-based Basin Development Strategy 2016-2020 For the Lower Mekong Basin, MRC.; http://www.mrcmekong.org/assets/Publications/strategies-workprog/MRC-BDP-strategy-complete-final-02.16.pdf

Logically, it could provide an initial platform for regional transboundary groundwater cooperation, for instance focusing on a number of priority issues, such as:

- Monitoring and data sharing
- Information sharing and a joint approach to deal with high arsenic and chemical element concentrations
- Inclusion of groundwater resource assessments and data monitoring in future Basin Development Plans
- Other associated and emerging challenges (groundwater, basin, eco-hydrology, resource management, population, SDGs etc.)

This project will develop the functionality and *modus operandi* that could, potentially, be transferred to MRC as a more permanent entity with a regional water resources advisory mandate in the GMS.

Integrated Water Resources Management-based Basin Development Strategy *(BDS)* 2016-2020 For the Lower Mekong Basin

Today, the LMB is home for 65 million people, 80% of whom live in rural areas dependent on agricultural livelihoods. Many are still poor, however, all countries are expected to have reached middle-income status by 2030. The Mekong contributes significantly to this growth through the opportunities it provides, including water and waste-water services, energy, agriculture, fisheries, transport and trade, and ecosystems services. However, without coordinated development and effective management, the Mekong can also threaten continued growth through the risks that it brings, including the risks of floods and droughts, the deterioration of water quality, the reduction of sediment loads, and the overall deterioration of ecosystem services and biodiversity. The BDS 2016-2020 recognizes these trends, takes a long-term outlook, and examines longer term water resources development needs. It is assessed that the current national water resources development plans are sub-optimal from a basin-wide perspective. These plans fall short in protecting key environmental assets and protecting millions of increasingly affluent people against major floods (and droughts and other climate change parameters). Finally, the distribution of the benefits, impacts and risks from planned basin development are not equitably distributed.

Figure 6: The recently published Basin Development Strategy (MRC, 2016) focuses on the Mekong River basin surface water resources, while there is increasing awareness that a significant share of water needs for irrigation agriculture, domestic and industrial water supply are met by supplies from groundwater sources. Obviously, surface and groundwater systems are intricately linked, in particular when it comes to addressing the impacts of climate change. This project aims to develop explicit resilience potential on the basis of improved groundwater management, in conjunction with the regional development ambition.

Even though the transboundary cooperation in surface water management has progressed, there is no common approach, recognition and cooperation for groundwater resources. The challenges in river management (resource sharing, impacts of river management and hydropower development, climate change, etc.) are equally valid for groundwater resources and their diverse users. The absence of a sizeable community and cooperative network of groundwater experts in the GMS severely hampers addressing these issues, in particular in Myanmar, Lao PDR and in Cambodia, where local capacity in hydrogeology is very limited. Regional cooperation in the ASEAN Economic Community offers an opportunity to tackle these challenges.

Information Management Systems for Transboundary Groundwater

The Global Groundwater Information System (GGIS) is an interactive, web-based portal to groundwater-related information and knowledge. The main purpose of the system is to assist in collection and analysis of information on groundwater resources and the sharing of this information among water experts, decision makers and the public.

IGRAC has provided Information Management Systems (IMS) to a variety of groundwater projects. Those IMS are designed to store interpreted and processed data from the assessment of the groundwater resources in order to be used as a tool to support decision makers and to create transparency between the (international) stakeholders. The project IMS can and will be set up in such a way that they facilitate sharing of data between project partners only, and/or with the general public.

A new IMS will be developed, and, pending on the outcome of member State discussion during a project validation workshop, as a stand-alone application or, if preferred, further integrated with existing modules available in the GGIS. This will allow for shared information systems among the participating countries (and observers). This, in turn, will facilitate joint management and better groundwater governance focused on coordination, scientific knowledge, social redress and environmental sustainability.

GGIS Portal capabilities:

1. Store variables, thematic maps and documents.
2. Visualize geospatial data and information in a map viewer.
3. Share and analyse results in a protected environment before making it publicly available.
4. Add map layers from external sources via web map services (WMS).
5. Generate new pieces of information by creating overlays of thematic maps.

Meta Information Module
Maps are an excellent tool to communicate spatial data and information, and metadata related to the map layers is of equal importance. Therefore, the GGIS also contains a meta-information module which allows uploading, storing and searching of additional information linked to the data presented in the system, like documents or references.

1.5 Knowledge and information gaps

There is limited and regionally incoherent information on groundwater resources of the GMS, in particular the kind of insight required to deal with pressing issues, such as:

- Extent and/or characteristics of superficial and confined aquifer systems, including useable resource volumes in aquifers systems in the GMS, existing and/or potential water quality threats.
- Current groundwater volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply.
- Relationships between recharge in highland (upstream) areas and resource potential in lowland (downstream) areas. This includes the groundwater dynamics of several important transboundary systems. Climate change, land use changes, watershed eco-system changes, demand changes, socio-economic changes including, and major interventions in the river systems (dam and reservoir construction, upstream water diversion and flow regulation) will affect these delicate balances in supply and demand. The relationships are not known.
- Sustainability (in view of increasing abstraction) of groundwater resources due to climate change and change factors (natural or anthropogenic).

To understand better the resource and resilience potentials and vulnerabilities of GW systems of the GMS, detailed hydrogeological investigations are required. Crucial groundwater monitoring data are needed to keep track of resource status and detect possible critical depletion, for developing and using regional groundwater information systems and for understanding transboundary groundwater flows. These regional (transboundary) models and information tools will help manage and conserve resources. It is therefore also necessary to:

- Visualize (in maps) regional and transboundary GW (recharge and extraction) systems and enable assessment of GW recharge rates from flooding and rainfall under the current and future climate conditions.
- Determine GW resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience.

1.6 Capacity building

The regional landscape of GW management capability and expertise is rather diverse. Especially in Lao PDR, Cambodia and Myanmar integrated and comprehensive GW management and specialized studies are rare, mainly due to a lack of well-trained and experienced experts. At the same time, the recognition of GW as a key natural resource is beginning to reach higher policy levels in government. Fortunately, the situation has been very different in Thailand and Vietnam where GW work took off decades ago and became part of natural resources and water agencies' mandates. Subsequently, also professional training and research activities took place. In Thailand, there is a fairly good understanding of the most important national GW resource systems, viz. those underlying the central-north Chao Praya plain and metropolitan Bangkok, and more diverse and problematic aquifer systems in the northeastern Isan region. In this region, irrigated agriculture relies significantly on GW and now there is a considerable number of well-trained hydrogeologists and irrigation experts that know how to deal with GW. In Vietnam, agricultural development work in Red and Mekong River deltas has resulted in a fair degree of capability in central government agencies in the north and south of the country. In a growing community of experts, there is increasing awareness on the need to develop expertise on a number of challenging issues, like long-term urban water supply and water quality issues (arsenic, salinity intrusion) and, more recently, integrated water resources management (IWRM) to ensure the sustainability of the highly productive agricultural systems in both the Red river and Mekong River delta. Both from government and academe in Vietnam there is ongoing and high-level awareness to further develop human resources capacity through higher education and participation in national and international research. There is also a willingness to engage and collaborate with neighboring countries.

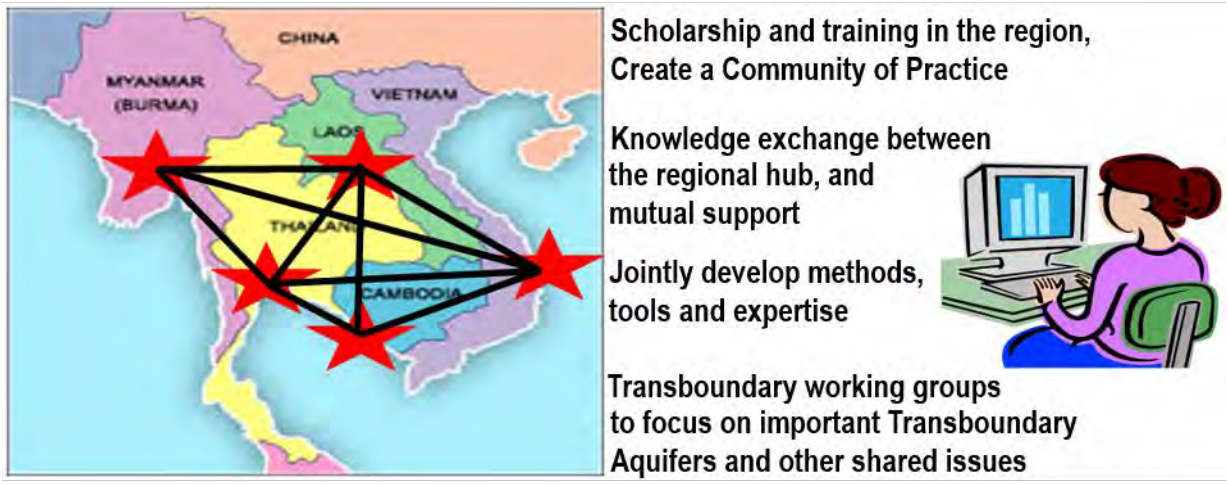


Figure 7: Regional cooperation will improve coherence, sustainability and embedding of project outcomes. It will also be the foundation for capacity building and knowledge transfer in the project.

This project will make use of the professional and political momentum (the processes that are part of the drive for ASEAN economic integration and cooperation) to build a GMS community of cooperation for capacity development in GW management. Strengthening of capabilities can take place throughout the region, but will be most explicit in the three countries most in need, i.e. Lao PDR, Cambodia and Myanmar. It will start with a verification and inventory of basic GW relevant skills and practical knowledge and general information on the size and qualifications of the practitioners, and their institutional context. Subsequently, capacity building efforts will be directed towards at least three generic issues:

1) Supporting capacity development of groundwater professionals towards better understanding and apprehension of new technologies that need to be engaged to ensure groundwater-based solutions and support for climate resilience. Examples are understanding and application of IWRM principles, (ground)water governance, groundwater monitoring and information systems, issues of transboundary groundwater management, new concepts and technologies like managed aquifer recharge (MAR), co-management of surface and GW, stakeholder involvement for data collection.
2) Enhancing the skills and understanding of GW stakeholders. GW professionals should practice and be aware

of the fact that the resource with many stakeholders; farmers need irrigation water, rural communities and towns need water supply for domestic use, industries and mining operations need process good quality water, and GW is intricately linked with other valuable ecosystem services. Comprehensive and good GW studies and management should cater to all these interests and wide diversity of stakeholders. All these stakeholder groups can also develop climate resilience measures through responsible and forward-looking GW use. This will be explicitly addressed in Components 2 and 5 of the project.

3) In order for this approach to be successful, it is also necessary to have better awareness and understanding at higher policy levels. First, an assessment will be undertaken of the basic responsibilities and tasks for GW management as an important resource are in place on national government level. Second, policy development and linkage to other sectoral policies can be supported and broadened to explicitly include issues of climate resilience, sustainability and vulnerability reduction through more active GW management. Political awareness will be built up.

The project will follow a regional approach so that countries with a relatively advanced position (viz. Thailand, Vietnam) can take a leading role, share experience and lessons-learned. Additional international expert support will be provided. The project will organize and conduct a number of training workshops, with regional participation (Component 5: Training Activities: see Part II, Section A, Component 5). The degree in which national and/or regional specialized training is available will be assessed and collaboration opportunities set up. Where useful training courses are offered, project participants will be selected and invited to enroll.

The project will generate important data, information, knowledge and linkages. It is intended to facilitate these functional linkages by means of an on-line knowledge management and information repository. First, the functionality will be built-in in the project website, but gradually expanded to become a dedicated information and resources sharing tool.

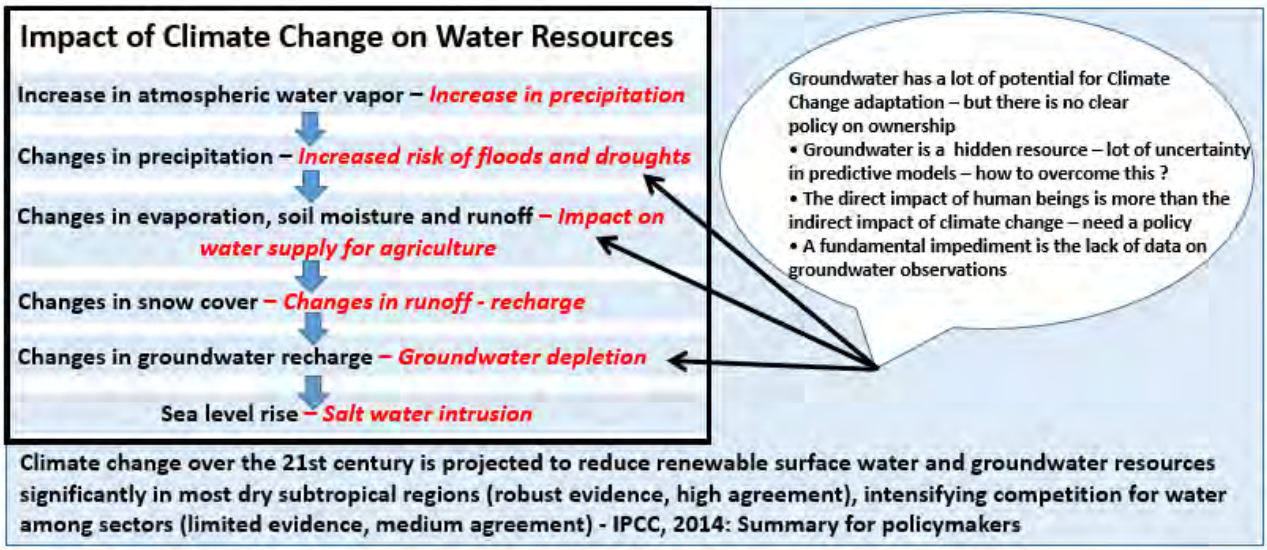


Figure 8: Earth and water resources systems are affected by the impacts of climate change. By virtue of its intrinsic properties the GW system has considerable resilience that can be developed and used to benefit water users and other stakeholders. This needs to be done with the utmost care, resource depletion following unsustainable use and mismanagement (because of a lack of guiding / monitoring data) are serious impediments.

1.7 Promoting gender equality

The project takes a pro-active approach to gender issues. This approach is reflected in the project design through the inclusion of activities that emphasize community engagement and participation, as well as knowledge sharing and exchange with communities and women's groups. Activities will be tailored to the specific context and needs in each of the pilot areas (pilot area-specific interventions). The project will maintain an active focus on SDG 5 (Gender Equality) targets, and will monitor progress as part of its Environmental and Social Management Plan (see Part III, Section 3).

Sustainable Development Goal 5: Achieve gender equality and empower all women and girls

The project makes a focused contribution to SDG5, in particular towards the following targets:

Target 5.4: aims to recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.

Target 5.5: aims to ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.

Target 5.7: aims to undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws.

Target 5.8: aims to enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

Ensuring access to clean and safe water from groundwater sources for women and girls will significantly contribute to achieving the above goals and targets, especially in the participating Least Developed Countries (LDC) Cambodia, Lao PDR and Myanmar, where more than 25% of their population have limited access to basic drinking water and sanitation services; this percentage is higher in the selected pilot areas.

This proposal explicitly emphasizes the participation and accrued benefits of women and girls via active, engaged and balanced participation of women in all interventions suggested in this proposal, such as:

- Balanced participation of women during initial project workshops, and collecting input from women experts during the project inception phase.
- Pro-actively encouraging participating governments and national partners to include women in their project teams and in the communities of practice, both locally as well as nationally .
- Balanced women participation in project activities, such as setting up and managing the Information Management System IMS (IT capabilities), designing and carrying out groundwater and other field surveys/assessments (field work).
- Ensure participation of female experts in the project ICT and data components (user interfaces of IT systems, websites, data collection questionnaires, etc.).
- Ensure gender-balanced participation in expert meetings, advanced and community-based training sessions.
- Promote the recognition of (ground)water related work and services performed by women as an essential element of climate resilient water supply and use systems.
- Ensure gender-balanced representation in the project's Steering Committee

1.8 Outlook

Overall, the project aims to enhance the resilience potential of improved and regionally coordinated groundwater management and demonstrate that it can provide effective tools and capacities to reduce vulnerability. To enhance adaptive capacity and reduce climate change vulnerability for specific target groups, the project will focus on implementing the following activities:

- Use the upgraded collective expertise and awareness of the groundwater community regarding CCA and resilience strategies to ensure that further work in the groundwater sector better supports the needs of vulnerable user groups.
- Demonstrate, further develop and ensure that information is available on the 'resilience potential' of improved groundwater management and use (i.e. through collaborative transboundary aquifer management)
- Identify additional new vulnerability reduction options, develop these and share practices with relevant vulnerable groups (i.e. enhanced aquifer recharge practices that use wet season water surplus to create dry season reserves. These will be set up in cooperation with local stakeholder groups and under intraregional CCA initiatives).
- Ensure that new and innovative groundwater management information products specifically cater to the needs of the identified and targeted vulnerable groups (for instance using smart phone networks to distribute and collect information).
- Train a new generation of GW experts to think beyond the technical challenges of the physical GW system and ensure that they recognize and can respond to the multi-disciplinary and multi-sectoral nature of GW management, and are therefore able to engage with a wider range of stakeholder groups to resolve vulnerability issues and increase sustainable water use.

The project aims to enhance climate change resilience via better groundwater management, capacity, and sub-regional cooperation. This requires a range of mutually supporting interventions and activities at different levels. These include:

- Organize a regional project validation workshop and annual interim workshops to provide guidance for implementation and ensure effective feedback mechanisms;
- Set up groundwater monitoring systems in the four pilot areas;
- Develop a common approach to - and setting up - a Groundwater Information Management System (IMS)
- Implement surveys/assessments to collect data on groundwater and related topics;
- Establish education and information centers in each pilot area through which to provide expert training, and community group awareness activities; and
- Provide training on groundwater and nature-based solutions, including train-the-trainer, train-the-teacher, and community-based training in collaboration with relevant governmental bodies, local authorities and stakeholder groups;
- Carry out groundwater skills, knowledge and capacity inventories;
- Ensure sustainability of project results and deliverables by cultivating ownership and capabilities among local and national partners.

2. Project Objectives and Outcomes

2.1 Project objectives

The main project objective is derived from a sequence of relatively simple and straightforward concepts. In reverse hierarchy, these are:

- There are excellent opportunities for regional cooperation and coordination to address climate resilience and mitigate threats from droughts and water shortages for food security and rural/urban livelihoods
- Groundwater (a "hidden resource") as an important component and integral part of the water system but is insufficiently considered in general IWRM policies and national CCA strategies
- National groundwater management expertise (from capable to very weak) needs to be developed further. National expert groups in some countries are not yet specifically oriented towards the potential of groundwater to contribute to climate resilience and vulnerability reduction.
- There is a fundamental need to develop closer relationships between groundwater user groups and their urgent water needs for food production (irrigated agriculture), for sustaining rural water supply and other water demands, and the groundwater expert community in order to improve groundwater management and long-term sustainability and address priority needs from different end-user groups.

Bringing these considerations together, the following major objective is obtained:

Establish effective regional capacities, partnerships and network in the Greater Mekong Subregion (Vietnam, Lao PDR, Cambodia, Thailand, Myanmar) for the sustainable management and utilization of groundwater resources as an adaptation response to protect people, livelihoods and ecosystems from climate change impacts.

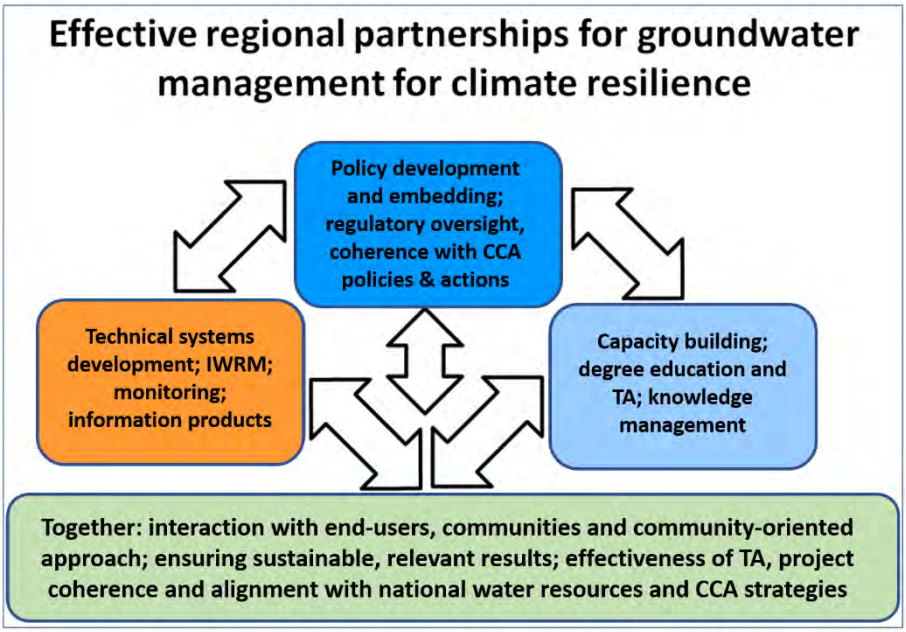


Figure 9: Departing from traditionally rather technical studies of the GW physical system (red box), with little awareness of the "demand" side (i.e. GW users), the project aims to connect GW professionals in the five countries with the current policy context of IWRM, integrated resource management, and resource use (blue box) to address sustainability issues and CCA – vulnerability reduction. In the GMS, there are excellent opportunities for collaborative capacity building and knowledge management (green-blue box to the right). The foundation for successful intervention and technical assistance (TA) lies in engagement with the GW end-users (bottom green box). Together with the different user groups (different users – different needs) CCA and resilience measures will be developed on the ground, and with recommendations for general guidelines and policy. Regional cooperation will also enable addressing transboundary issues.

Specific objectives are:

- Prepare an updated groundwater shared aquifer inventory for the GMS countries, develop resource management concepts and tools and a monitoring network for GW systems;
- Understand GW recharge processes and formulate recommendations for protection and long-term sustainable management;
- Address issues of transboundary groundwater management also as an incentive to develop collaborative solutions and;
- Increase participation of stakeholders by implementing principles of groundwater governance through 1) dialogues with users to assess groundwater use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, population);
- Develop and implement targeted groundwater vulnerability reduction measures, groundwater quality improvement, identification and protection of strategic groundwater reserves;
- Build capacity and raise standards for groundwater practitioners across the GMS countries and initiating regional water cooperation (diplomacy).
- Obtain high-level agreement on climate resilience through strategic planning for groundwater resources.

2.2 Project outcomes

The main project outcomes are defined in conjunction with the five main components:

Outcome 1: Groundwater resource assessment and monitoring: A regional GMS approach to address challenges of climate change and resilience is developed and operationalized, based on an information-based policy.

Outcome 2: Priority use and stakeholders: Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.

Outcome 3: Resource management, information tools and equipment: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized in a gender-balanced approach.

Outcome 4: Regional cooperation, coordination and information exchange: A regionally coherent policy for sustainable groundwater management in support of CCA is adopted, based on a level playing field among all users in the GMS.

Outcome 5: Capacity building and training: GMS stakeholders capably use project tools towards groundwater use for CCA and resilience.

These five outcomes will be achieved in the four pilot areas as a cross-cutting, transboundary result that will **significantly strengthen the local capacity of primary stakeholders to address climate resilience issues across the region**. Implementation of project activities in the four pilot areas will be guided by the project's cross-cutting objectives and will enable the joint generation of resilience deliverables on the ground.

2.3 Contribution towards the SDGs

The project makes a distinct and measurable contribution towards the 2030 Agenda and the Sustainable Development Goals. A particular contribution is made towards SDG13 on Climate, SDG6 on Water and Sanitation for all, as well as SDG5 (Gender Equality), SDG11 (Sustainable Communities) and SDG17 (Partnerships and collaboration). However, through the project's contribution towards improved management, data collection, capacity development, knowledge dissemination and community participation related to groundwater issues, climate change and ecosystem management, contributions are made across a broad spectrum of the Goals, as summarized below.

SDG 1 No poverty
The project contributes to reducing the number of people living in poverty, by enhancing clean water availability and food security, and providing water resources for economic purposes / livelihoods. The project contributes significantly to enhance resilience of communities in poverty to climate change-associated environmental shocks and disasters.

SDG 2 No Hunger
The project contributes to achieving food security by ensuring sustainable supply of groundwater for food production, domestic needs and livelihoods.

SDG 3 Good health and well-being
The project ensures improved standards for groundwater quality including monitoring on arsenic and other pollutants and by ensuring groundwater availability for domestic use to contribute to reducing threats of water-borne health risks.

SDG 4 Education
The project targets and supports community groups (women, men and young adults) to develop basic skills and awareness about groundwater/water use related topics. In the four pilot areas, a community-of-practice will develop and disseminate knowledge and guidelines for improved groundwater management.

SDG 5 Gender
The project fosters gender-inclusion and the empowerment of women and girls, as detailed under 'Promoting Gender Equality' (see section 1.7 above).

SDG 6 Water
The project contributes significantly to SDG 6 targets by enhancing the knowledge, skills and overall capacities (including resource assessment, policy development, training and demonstration) to manage groundwater and conserve resources for priority use, to reduce water wastage, stimulate water conservation and re-use, improve water use efficiency, reduce water scarcity and improve understanding of (ground)water-ecosystems linkages.

SDG 11 Sustainable Communities
The project contributes to more sustainable communities through awareness and involvement (participatory planning & management) in resource management and use.

SDG 12 Sustainable Production and Consumption
Project interventions contribute to ensuring that people in the pilot areas have access to relevant information and enhanced awareness for sustainable development and lifestyles in harmony with nature, including the management of groundwater resources.

SDG 13 Climate
The project significantly enhances resilience and adaptive capacity against climate change impacts at all levels through the full suite of project activities including training, knowledge availability and application of best practices, fostering the human capacity for climate-change-impact-reduction. Implementation of the project will not generate any negative climate impacts.

SDG 15 Life on land
The project contributes to improved understanding of fresh (ground)water-ecosystem linkages, engages in water-ecology assessments, wetland utilization (as protected recharge areas), develops and engages in conservation supporting measurers, and supports the application of nature-based solutions.

SDG 17 Partnerships for the Goals
The project contributes to the mobilization of financial resources and local partner commitment to regional cooperation to further the SDGs; it enhances south-south cooperation between five participating countries on

natural resources management and knowledge sharing; and promotes the transfer of environmentally sound technologies to low-income countries while focusing on vulnerable groups.

3. Project Components and Activities

3.1 Overview

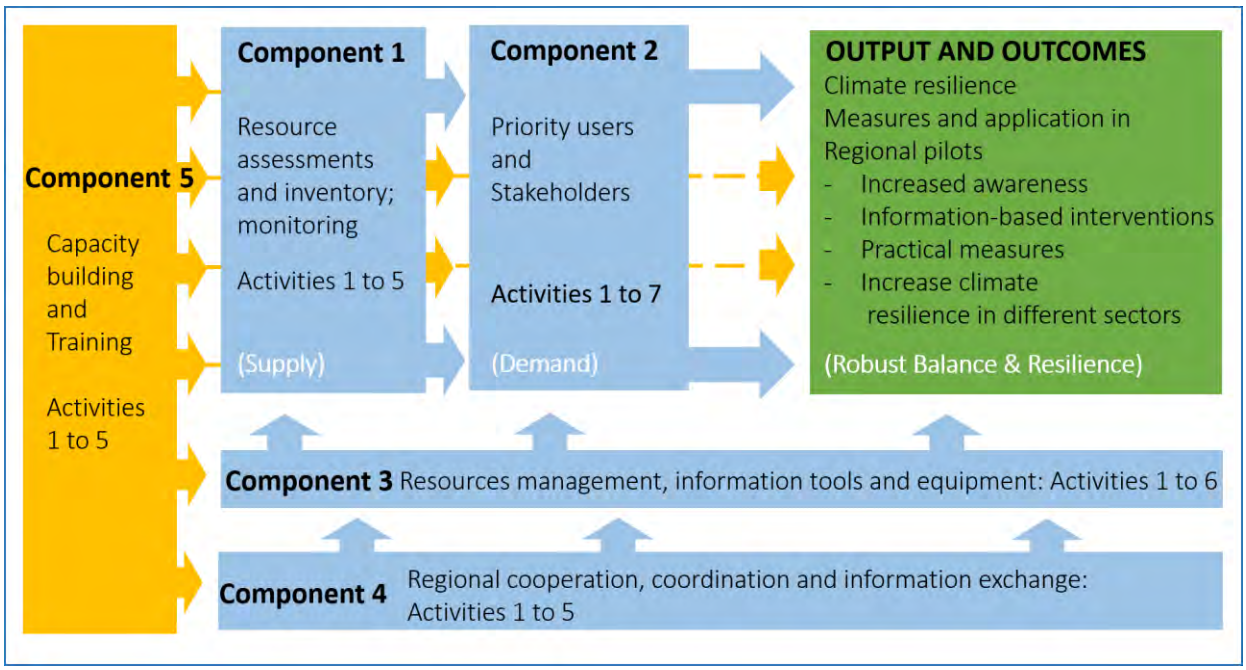


Figure 10: Schematic presentation of the project structure (four main "technical" components and one cross-cutting component for capacity building) and intervention strategy that will result in climate resilience in four regional pilots on the basis of a robust balance between groundwater supply and demand.

3.2 Regional pilots

The project activities as elaborated in the next sections will be implemented in four regional pilots. In each pilot, the same activity format will be applied, considering local circumstances. The aim of the project is to enhance climate resilience in all pilot areas. The results can be multiplied across the region and used as case studies, by the national Governments and/or the MRC. This is expected to generate a multiplier effect and long-term multilateral cooperation. The proposed pilot areas are:

1. Lao PDR – Thailand (Mekong river riparian aquifer systems (Lao PDR, Thailand, and possibly Cambodia); The Vientiane Plains, Lao PDR and adjacent aquifers in Thailand will be the priority area. Other areas like the Southern Lao PDR Pakse region (Lao PDR – Thailand – Cambodia TBA) can also be included.

2. Vietnam – Cambodia (Upper Mekong Delta Transboundary Aquifers. Mekong Delta aquifers in Vietnam are intensively used and contribute to the high productivity agri- and aquaculture systems in the entire Delta. It is assumed that major recharge takes place in the upper delta region in Cambodia, but this TBA system is poorly understood and there is little qualitative data.

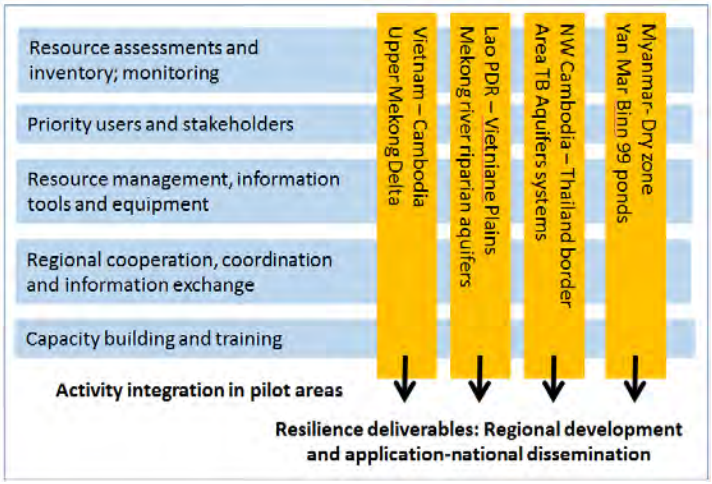


Figure 11: Project structure and activity integration in the proposed pilot areas.

3. Cambodia – Thailand (North-West Cambodia – Eastern Thailand border area)**.** Transboundary aquifers in drought prone area with vulnerable rural population. Groundwater potential is essential to support food security / rural water supply and demand from tourism sector.

4. Myanmar Dry Zone (Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area). The Dry Zone is one of Myanmar's most vulnerable areas to climate change. The selected area is characterized by intensive groundwater use, for both domestic and agricultural irrigation. There is increasing concern amongst farmers and water managers about availability of water, among others because of poor management.

Scope of Activities in the Pilot Areas

The activities proposed in the pilot areas are intended to deal with priority climate resilience issues in each area, and have a high degree of relevance to other areas with comparable physical and socio-economic characteristics in the region. Collectively, the interventions in the four pilot areas have been designed and will be further detailed to contribute to the five main outcomes of the project (1. resource assessments and information survey; 2. engagement with groundwater users, 3. IMS, inventories and tools; 4. regional cooperation, and 5. training & capacity building).

Pilot area 1 focuses on the Mekong River riparian and transboundary aquifers-Vientiane Plains, Lao PDR. In the first activity, a groundwater management plan would be elaborated. This would be the first for Lao PDR, capitalizing on the increasing interest in GW resources in the country. It will be one of the major tools to support planning and decision making for the pilot area and serve as a model for other parts of Lao PDR and possibly also adjacent parts of transboundary aquifers in Thailand. This activity is divided into various tasks: (i) carrying out an inventory of the existing wells and GW use across the various districts of the Plains; (ii) consultations with a broad range of stakeholders including government officials across relevant sectors, the private sector, NGOs, and the community; (iii) tailoring regulations in consultation with local authorities and other stakeholders and (iv) awareness raising through dissemination of project findings through communication material tailored to specific stakeholders. To better serve the planning, a numerical GW flow model would also be developed and validated with field measurements and used for scenario analysis. The model would explore a range of possible development scenarios including those identified by stakeholder consultations to ensure sustainable GW management can be achieved. The opportunities for so-called bottom-up approaches to GW management processes would be explored by assessing community perceptions and interest in participatory GW management and identifying relevant entry points to compliment traditional top-down approaches.

Pilot area 2 focuses on the Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia). The first activity would involve setting up a joint GW monitoring system between Vietnam and Cambodia. Through this collaborative exercise, the GW monitoring capabilities of the Cambodian counterparts in particular would be improved. An inventory of GW infrastructure would be prepared and GW use estimated for the various aquifer units and sectorial uses. The undertaking of these activities will form the basis for dialogue and awareness raising amongst the main stakeholders on key issues related to transboundary aquifer management and interactions between the surface water and GW systems. The information and discussion generated also serve to identify potential resilience enhancing measures in the context of transboundary integrated surface-GW management. For instance, 1) Who are the most important stakeholder groups that stand to benefit, in terms of climate resilience, from improved and more active GW management; 2) To what extent is serious GW depletion occurring and can this be reversed; 3) Would any GW vulnerability reduction measures (such as Managed Aquifer Recharge (MAR)) contribute to increase GW resilience effectively?

Pilot area 3 focuses on the Northwest Cambodia – Eastern Thailand border area. The first activity to be carried out would be a joint GW resource assessment, recognizing that greater efforts are needed on the Cambodian side where very little is currently known. From the Thailand side of the border, useful lessons-learned and existent GW management practices can be adopted. A basic monitoring system would be established and necessary training to relevant agencies provided to support improved GW management capabilities in Cambodia. Through dialogue with the main stakeholders, the potential to increase GW use in support of food production and rural water supply would be explored and the best possible evidence-based case for sustainable development determined. A joint

task force would be setup to develop resilience enhancing measures in the framework of integrated surface-GW management.

Pilot area 4 focuses on Myanmar: Central Myanmar Dry Zone, Yin Mar Bin – 99 Ponds area where a GW resource assessment and study of the recharge dynamics would be the first activity leading to GW management planning (inventory of GW infrastructure and use, stakeholder consultations, GW regulations). These would dovetail into participatory-based planning and implementation of well capping and monitoring program in artesian areas to ensure the sustainability of supplies. When these initial stages have been completed, more advanced management practices will be introduced, very much like in the Lao PDR-Thailand pilot (see above).

Project activities will be implemented in each of the four regional pilots, applying the same activity format, adjusted to suit local circumstances.

Joint activities covering all pilot areas:

- Organize a sub-regional project validation workshop and annual interim workshops (for example within the Tonle Sap UNESCO Biosphere Reserve or other suitable locations in one of the pilot areas);
- Organize a sub-regional policy development meeting with five participating countries and possible participation by stakeholders as observers;
- Establish an Information Management System (IMS) for groundwater resources and groundwater use;
- Carry out data collection, analysis, reporting and entry into the IMS, ensure there is a plan to sustain its use after the project;
- Carry out groundwater skills and knowledge capacity inventories, needs assessment, and training;
- Hand-over the project from UNESCO to the national partners and possibly MRC after project completion.

Activities to take place in each of the pilot areas:

- Carry out groundwater surveys/assessments (and produce associated reports and maps);
- Carry out information surveys on (ground)water demand and use in different sectors (agriculture, domestic, urban, industry), and produce reports and maps;
- Provide training on groundwater monitoring, management and sustainable use, also covering concepts of recharge (MAR) and including train-the-trainer, dissemination to communities (all in close collaboration with relevant governmental agencies, local authorities and groups';
- Establish a simple groundwater monitoring system, in each of the four pilot areas, following a participatory approach and ownership by users.

Integration of all project activities in each pilot area will stimulate a balanced and output oriented way of working, without undue focus on specific studies or research. In each of the pilot areas the project will generate specific and stakeholder-oriented, practical climate resilience measures, such as increased public awareness, information on groundwater resource potential, and groundwater system data and monitoring information results, in order to propose tailored and information-based interventions (See also Annex 1, where the resilience measures are further specified). Three of the four areas will include working in challenging transboundary aquifer systems and developing bilateral or multilateral cooperation. The available information from the different regions indicates the anticipated climate resilience measures can be targeted to different sectors. In all pilot regions, stakeholders include a significant number of high-vulnerability groups.

3.3 Pilot areas description

The following section provides a general overview of the characteristics and salient properties of the proposed pilot areas. The project will focus on the stakeholder groups in these areas; farmers, groundwater users in villages and small towns, small industries or other activities that rely on groundwater. General information is provided in Table 2 and Annex 1. Project activities will be designed in such a way that vulnerabilities will be addressed and climate resilience strengthened in each pilot area and for specific stakeholder groups, as follows:.

- Local[12] authorities (village, municipal, district and provincial level)
- Local, regional and national groundwater specialists and professionals in government agencies and academia;
- Local, regional and national groundwater specialists and professionals in the private sector and agriculture
- Farmer's groups;
- Representatives from small or larger industries that operate in the area;
- Community groups, with representatives of ethnic minorities (if any), women and youth.

A more comprehensive elaboration of the problem analysis and intervention logic for each of the four pilot regions is provided in **Annex I.**

[12] "Local" refer to people from within the pilot area; regional: from within the pilot area and relevant adjacent locations

Table 1: Overview of pilot area characterization (see also Annex I).

	PILOT AREA 1 Lao PDR-Thailand	PILOT AREA 2 Vietnam-Cambodia	PILOT AREA 3 Cambodia-Thailand	PILOT AREA 4 Myanmar Dry Zone
Location	**Vientiane Plains** with the Mekong River riparian aquifer systems, including Lao PDR, Thailand, and Cambodia	**Upper Mekong Delta** transboundary aquifers in Vietnam and Cambodia	**North-West Cambodia – Eastern Thailand** border area	**Central Myanmar Dry Zone**
Precipitation /Climate zone	2,000 mm/yr Tropical Dry	1,700 mm/yr Humid Subtropical	1,400-2,000 mm/yr Tropical Dry	800-1,100 mm/yr Tropical Dry
Population density and projected growth	Average to high	Very high	Average	Average
Major land use	Paddy, vegetable crops, forest, urban	Paddy, vegetable crops, cities and villages	Paddy, vegetable crops, forest,	Paddy, vegetable crops (smallholders)
Aquifer type	Alluvium bounded by sandstone on margins and at depth	Alluvium, at depth older, semi-consolidated river deposits (sand and clay)	Thin alluvium, sandstones	Artesian system. Cemented sand and gravel overlain by sand to clay alluvium
Recharge rates	200-400 mm/yr (approx.)	Vietnam: 300 mm/yr Cambodia: not known	Thailand: 200 mm/yr Cambodia: not known	Not known
Interactions with surface water	Groundwater drains to rivers which are affected by hydropower schemes; infiltration from small reservoirs and ponds	Groundwater recharge from river channels with high/low seasonal flow; infiltration from small reservoirs and ponds	Recharge from small rivers, ponds, small reservoirs; Groundwater drains to rivers and Tonle Sap lake (UNESCO Biosphere Reserve)	Groundwater recharged from rainfall in ranges to west, and possibly seepage from Yama dam
Current abstraction	Relatively low (based on the available data)	High to extremely high, deep tube wells and shallow wells	Low (Cambodia) and modest to high in Thailand	High – >1,400 tube wells
Major purposes for abstraction	Domestic, emerging agriculture, small industry (packaged water, salt production)	Irrigation, village supply, city water supply, minor industry	Small scale irrigation, village supply	Irrigation, village supply
Water quality	Good; salinity (natural), some organic contamination	Good, some concern about arsenic levels, pesticide etc. pollution from surface water	Good, some concern about arsenic levels, microbial pollution at groundwater points	Generally good (possibly some problems with salinity in the upper aquifer)
Transboundary issues	Recharge from Mekong River and connectivity with adjacent Thai aquifers	Integrated resource management by Cambodia – Vietnam authorities; recharge from Mekong River (floods); pollution threats	Contrast between Thailand and Cambodia regions in utilization of resource; very limited management in Cambodia	There have been no dedicated studies for TBA assessment.
Major issues/threats groundwater for climate resilience	Expansion of groundwater use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifer	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.

Each of the four pilot areas is located in a transboundary and/or important groundwater region (Myanmar). Relevant statistics of these areas are provided in the table below. Based on these data, project beneficiaries number a minimum of 5 % and maximum of 10 % of the total population, adding up to a total of around 2 million people. This number of direct beneficiaries may vary across the regions. Clarification of column headers is provided on the next page, below Table 2.

Table 2: Relevant statistics for the pilot areas.

1. Pilot area	2. Provinces-districts	3. Population	4. No. of project beneficiaries	5. Vulnerable groups	6. Issues and threats	7. Economic benefits	8. Additional comments
1. Lao PDR - Thailand			Around 8-10 % 175,000	Mixed peri-urban and rural population; low & middle income households, farmers	Expansion of groundwater use, for irrigation and domestic use, rapid urbanization, poor oversight of (possibly) large extractions	Improved access to water for domestic use→ lower cost of living; increased irrigated agriculture; → food supply ensured → higher incomes	Social benefits include reduced time spent by women & children in collecting water; environmental benefits for streams and wetlands supporting habitat and livelihoods
Lao PDR	Vientiane province	419,000					
	Vientiane Cap. Region	821,000					
Thailand	Nhong Khai	517,000					
2. Cambodia - Vietnam			Up to 10 %, mostly rural 878,000	Predominantly rural population; low & middle income households, farmers; water users in provincial towns	Overall volume of extractions, decreasing recharge; implications of extraction and lesser recharge for shallow domestic wells and downstream replenishment of aquifers	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	In Cambodia % of villages with access to water through tube/pipe water wells is 80 %; % of villages exposed to drought and/or food shortage in the five years prior to census was 38 %.
Cambodia	Takeo	845,000					
	Kandal	1,265,000					
	Prey Veng	947,000					
	Svay Rieng	483,000					
Vietnam	An Giang	2,143,000					
	Dong Thap	1,667,000					
	Long An	1,436,000					
3. Cambodia - Thailand			Up to 8 %, mostly rural 396,000	Predominantly rural population; low & middle income households, farmers	Non-sustainable use in Thailand; undervalued resource in Cambodia; management capabilities and better alignment with user needs.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured. Long-term resilience	The area is prone to severe and prolonged drought and has relatively little surface water resources. Increasing groundwater demand for tourism in vulnerable areas.
Cambodia	Banteay Meanchey	678,000					
	Oddar Meanchey	186,000					
	Siem Reap	896,000					
Thailand	Sakeo	552,000					
	Buriram	1,579,000					
	Surin	1,392,000					
4. Myanmar Dry Zone			Up to 10 %, mostly rural 532,000	Predominantly rural population; low & middle income households, farmers	Drawdown and fluctuation of artesian water levels. Concern about wastage from free-flowing boreholes. Unregulated expansion of private wells.	More resilient water supply for agriculture: → higher incomes; resilient water supply for domestic use: → lower costs; preparedness for prolonged drought:→ food supply ensured	Rapidly changing socio-economic context leading to higher demand; poor groundwater governance framework and little experience with local resource management
Myanmar	Southern part of Sagaing region	(5,325,000)					
	Other part of Dry Zone						
Totals			1,981,000				

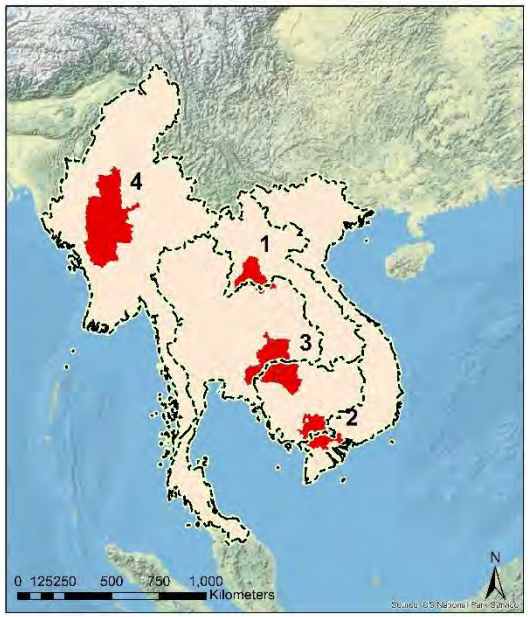
Clarification of column headers

1. No clarification needed.
2. No clarification needed.
3. **Population numbers**: Approximate total population numbers are given based on various documents and internet sources;
   Lao PDR: https://en.wikipedia.org/wiki/Provinces_of_Laos (2015 Census);
   Cambodia; Census of Agriculture report, 2015;
   Thailand: https://en.wikipedia.org/wiki/Provinces_of_Thailand & Thailand Human Development Report, UNDP (2014)
   Vietnam: https://en.wikipedia.org/wiki/Provinces_of_Vietnam; General Statics Office of Vietnam
   Myanmar https://en.wikipedia.org/wiki/Districts_of_Myanmar; Population and Housing Census of Myanmar, 2014, Summary of the Provisional Results, Ministry of Immigration and Population, Myanmar.
4. **No. of project beneficiaries;** between 5 and 10 % of the total population.
5. **Vulnerable groups;** where possible, listing of specific vulnerable groups is provided (as determined by the socio-economic and physical characteristics of the area); the project will always focus on the women, children and young adults segment of the general population (over 60 %). The proposed Cambodia provinces are among the poorest and most densely populated in the country (2015 Census).
6. **Issues and threats:** as summarized in the profiles of the pilot areas (Annex 1)
7. **Economic benefits;** not very different across the pilot areas, but since a majority of the population is rural, improved groundwater management will contribute to lower cost for domestic water, improved access to water for irrigated agriculture and hence higher incomes, improved capacity to absorb shocks in water supply in times of prolonged drought. For non-agricultural, (urban) stakeholders the project contributes to lower cost for water supply and savings for water purchase.
8. **Remarks**

In addition to the characterization of the proposed pilot areas in Annex 1, an overview of the selected provinces and districts, with population density information is provided on the following pages.

Figure 12: This and next page: Proposed pilot areas for the AF project “Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase climate change resilience”, a collaboration of Cambodia, Lao PDR, Myanmar Thailand and Vietnam to increase climate resilience in the Greater Mekong Sub-region through improved groundwater management and transboundary cooperation.

Pilot areas - Groundwater resources in the Greater Mekong Subregion



Legend

- 1. Vientiane Plain
- 2. Upper Mekong Delta Cambodia-Vietnam
- 3. NW Cambodia-Thailand
- 4. Myanmar Dry Zone
- Country Borders

Location of the proposed four pilot areas. The involved provinces

1.Vientiane Plain | Lao PDR - Thailand

Vientiane Cap. Region	(Lao PDR)
Vientiane province	(Lao PDR)
Nhong Khai	(Thailand)

2. Upper Mekong Delta | Cambodia - Vietnam

Takeo	(Cambodia)
Kandal	(Cambodia)
Prey Veng	(Cambodia)
Svay Rieng	(Cambodia)
An Giang	(Vietnam)
Dong Thap	(Vietnam)
Long An	(Vietnam)

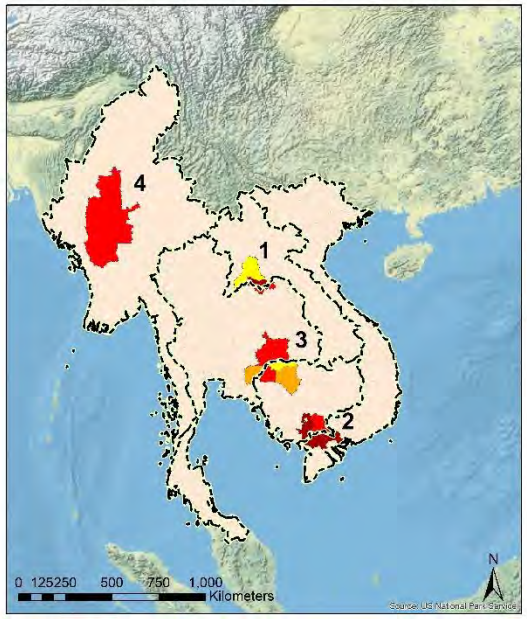
3.NW Cambodia - Eastern Thailand

Banteay Meanchey	(Cambodia)
Oddar Meanchey	(Cambodia)
Siem Reap	(Cambodia)
Sakeo	(Thailand)
Buriram	(Thailand)
Surin	(Thailand)

4. Myanmar Dry Zone

Sagaing region	(Myanmar)
Magway	(Myanmar)
Mandalay	(Myanmar)

Groundwater vulnerability: Population density in pilot areas

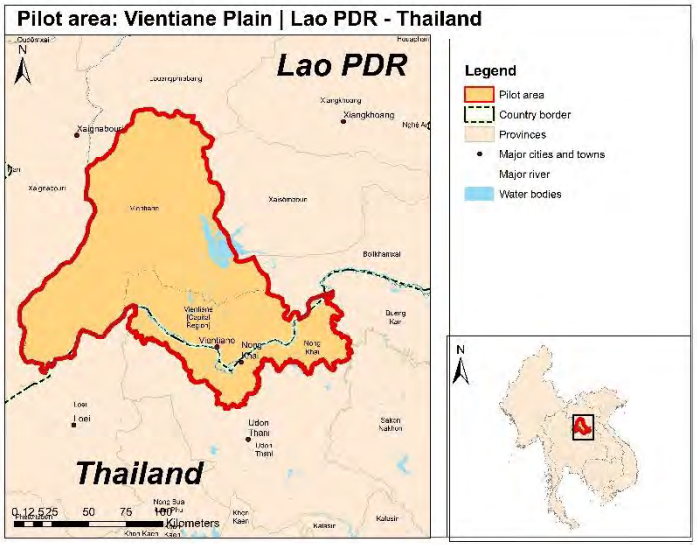


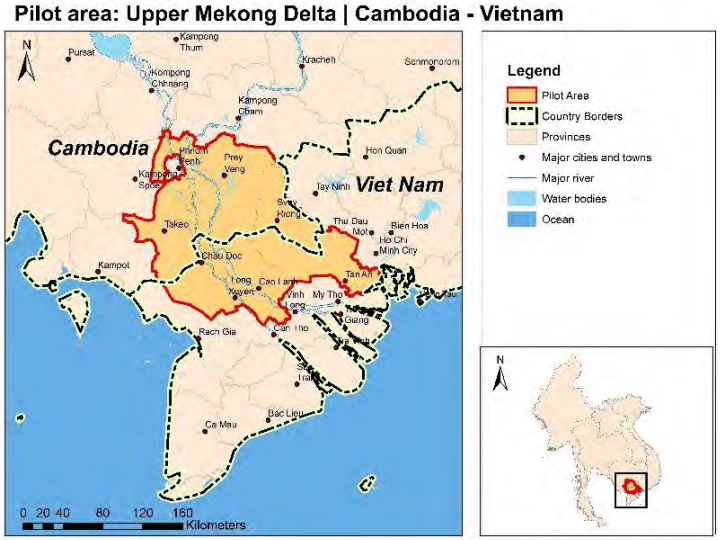
Legend

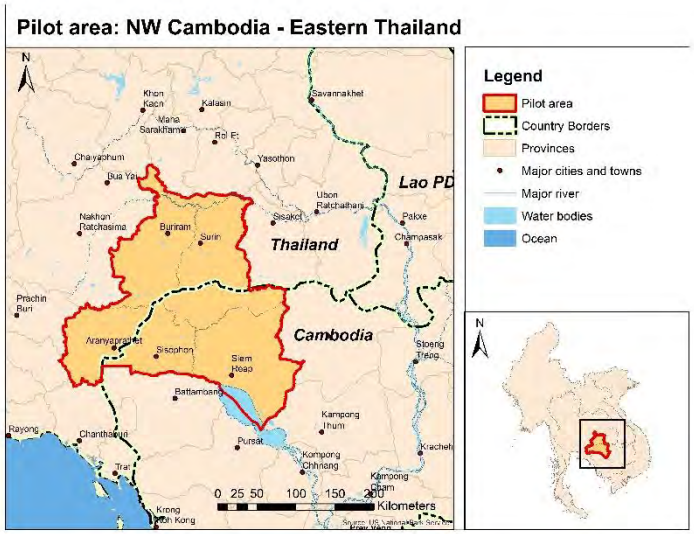
- 1. Vientiane Plain
- 2. Upper Mekong Delta Cambodia-Vietnam
- 3. NW Cambodia-Thailand
- 4. Myanmar Dry Zone
- Greater Mekong region
- Provinces

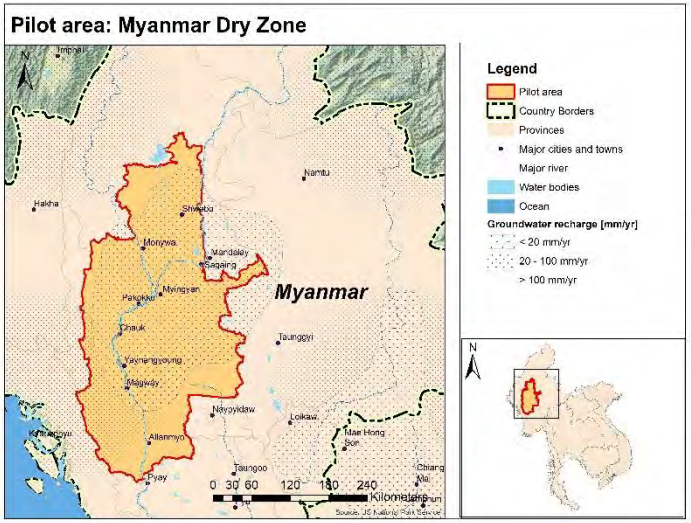
Population density (capita/km2)

- 25 - 50 (medium)
- 50 - 100 (high)
- 100 - 200 (very high)
- > 200 (very high)


Pilot area: Vientiane Plain | Lao PDR - Thailand
Lao PDR
Thailand
Legend
Pilot area
Country border
Provinces
Major cities and towns
Major river
Water bodies
Kilometers


Pilot area: Upper Mekong Delta | Cambodia - Vietnam
Cambodia
Viet Nam
Legend
Pilot Area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Kilometers


Pilot area: NW Cambodia - Eastern Thailand
Thailand
Cambodia
Lao PD
Legend
Pilot area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Kilometers


Pilot area: Myanmar Dry Zone
Myanmar
Legend
Pilot area
Country Borders
Provinces
Major cities and towns
Major river
Water bodies
Ocean
Groundwater recharge [mm/yr]
< 20 mm/yr
20 - 100 mm/yr
> 100 mm/yr
Kilometers

4. Resource Allocation and Project Finances

4.1 Resource allocation

Table 3: Principle overview of the project with resource allocation, activities and outputs - outcomes

Project Components	Activities	Expected Outputs	Expected Outcomes	Country
1. Groundwater resource assessment and monitoring (US $ 1,200,000)	Updated and harmonised regional groundwater resources and shared aquifer inventory; Groundwater vulnerability and resilience potential assessment; common groundwater systems monitoring network, with community of experts and on- line information systems are created.	Harmonised regional groundwater resource inventories are utilized to support regional GMS approach to address challenges of climate change and resilience; Information-based policies are enabled to manage resources and further develop new groundwater-based resilience strategies and practical interventions.	A regional GMS approach to address challenges of climate change and resilience is created, based on an information-based groundwater policy.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
2. Priority use and stakeholders (US $ 500,000)	Dialogues with groundwater users including women and vulnerable groups to assess groundwater use scenarios for different sectors; develop and provide custom-made practical guidelines, training to attain sustainable use.	Increased participation by groundwater users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.	Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and are able to participate in groundwater management.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
3. Resource management, information tools and equipment (US $ 1,000,000)	Compile and integrate all collected data into the online information portal; develop and implement best GW management equipment and measures to each pilot area for vulnerability reduction and/or GW supply improvement.	Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS region. Information-based measures to align GW management with broader climate change resilience measures and surface water management.	Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
4. Regional cooperation, coordination and information exchange. (US $ 500,000)	Review the groundwater policies and activities of the GMS countries; Organize regional workshop with GMS countries for TBA management; Develop and initiate institutional set-up and appropriate legal framework for TBA management in GMS.	A regional cooperative network is established for sustainable GW management in support of CCA, establish an information exchange mechanism and collaboration to address further challenges to go from data to information to policy to practice.	A regionally coherent policy for sustainable groundwater management in support of CCA is adopted based on a level playing field of all users in the GMS.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam

5. Capacity building and training (US $ 1,000,000)	Training workshops targeting to different groundwater users, communities and stakeholders are organized for technical and institutional supports; International conference and workshops are organized.	A groundwater community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.	GMS stakeholders capably use project tools on groundwater use and management for CCA and resilience.	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam
6. Project/Programme Execution cost, 8.5 % (CCOP-TS)				357,000
7. Total Project/Programme Cost				4,557,000
8. Project Management Fee 7.5 % charged by the Implementing Entity (MIE, UNESCO)				341,775
Amount of Financing Requested				**4,898,775**

Resource Allocation: although there will be a limited number of generic project activities the majority of the inputs will be dedicated to implement the project components in each of the four regional pilots.

A breakdown of cost items for activities versus project outcomes is presented in the detailed budget, **Annex II**.

4.2 Project Calendar

Table 4: The dates of important milestones for the proposed project are indicated.

Milestones	Expected Dates
Start of Project/Programme Implementation	January 2020
Inception Phase	January - May 2020
Start-up of four regional pilot programmes	June-September 2020
Mid-term progress workshops of regional pilots	December 2021
Mid-term Review (with Steering Committee)	Jan-March 2022
Regional project Conference and field visits	September 2022
Project/Programme Closing	December 2023
Terminal Evaluation	January - March 2024

PART II: PROJECT JUSTIFICATION

Introduction

This section of the proposal covers all items **A to L of the Adaptation Fund proposal format** checklist. If necessary detailed info will be provided in Annexes. Unnecessary overlap with previous sections is avoided.

A. Overview of project components

The project will consist of five interlinked components. For each component, we will define a limited number of specific activities with Results or Outputs. Outcomes (higher level results and/or impacts) as introduced in the previous section are defined at the component level. Under the five project components, each activity has a separate budget line and has inputs that include a number of cost items. Activities will be implemented at project level (generic, or GMS focus) or relate to project implementation in one or more of the four pilots in transboundary areas. The project is a collaborative effort of national groundwater agencies (and other contributing national parties) from the five participating countries with support from independent regional and international groundwater and climate change experts including IWMI and IGRAC.

Overall project implementation will be supported by CCOP-TS (project executive support), while project management, finance and administration are carried out by the UNESCO Regional Bureau for Natural Sciences in Jakarta, in close support and cooperation from UNESCO Office Bangkok, and further supported by UNESCO Headquarters Science Sector in Paris. Further details of project management are provided in Part III of this document.

The following is a summary introduction of the five main project components, with a first elaboration of the concrete activities. This project framework will form the basis for detailed work plans that will be developed at subregion level for each of the four pilots, during the Inception Phase of the project. This will be done in close collaboration with the national partners in each of the five countries.

Component 1: Groundwater resource assessment and monitoring

Outcome: A regional GMS approach to address challenges of climate change, sustainable water use and resilience is created for evidence based decision making and management.

Outputs: Harmonised regional groundwater resource inventories are utilized to support regional GMS approach to address challenges of climate change, sustainable water use and resilience; evidence-based policies are developed to enable and support management of integrated water resources and further contribute to development of new groundwater-based climate resilience strategies and practical interventions.

Major Activities

1. Updated and harmonised regional groundwater resources and shared aquifer inventory is created.
2. Groundwater vulnerability and resilience potential assessment is carried out.
3. Common groundwater systems monitoring network, with community of experts and on-line information systems designed and implemented.

Activity details for groundwater resource assessment and monitoring

1. **Groundwater resources inventory** on basis of published data and maps, set up database and GIS tool modelled after IGRAC's tools or using CCOP GIS tool; not necessary all data in it, but especially common approach and methodology; start with countries with a lot of data (possibly existing tools, Cambodia and Lao PDR may not have well developed data inventories.
2. **Monitoring resource status** (no data means no information and it is not possible to develop rational interventions); setting up minimum monitoring of selected aquifers (high potential, transboundary, vulnerable ones); Develop and agree on protocol to share monitoring data, select number of aquifer for active monitoring (should be active in year two to see trends year 2-3-4)).
3. **Aquifer status and vulnerability assessment;** exploitation history and trends, depletion indicators; document different examples from different countries, as examples.
4. **Resilience potential:** develop assessment framework, tentative resource classification in terms of resilience potential initially on basis of groundwater system properties. So where Activity 1-3 are fairly common groundwater resource studies, in Activity 4 we make the step towards climate resilience concepts and tools. Results will show either resilience potential (use groundwater to help farmers and other users to build resilience) or vulnerability or negative resilience potential, i.e., the resource status is such that it does not offer much to strengthen resilience, on the contrary, existing groundwater use, supporting some form of resilience, could be threatened because of depletion, pollution or other factors. When developing resilience potential always remember, (positive) resource value is different for every user group, depending on their capability or need. What is positive resilience potential for large industrial users could be negative or neutral for small farmers.
5. **Geographical coverage:** Indicated Pilot areas; selected, preferably transboundary areas with very pertinent, practical and end-user-oriented approach. These areas will also feature in the other components. On the basis of results from Component 2 (Priority use and stakeholders) define tailored information products, training and awareness activities, coaching and guidance (to farmers, vulnerable groups or intermediaries). Ultimately generate improved resilience for these areas and their inhabitants, whilst working with stakeholders who may take the findings and enable scaling up in other areas.

Groundwater resources inventory, organizing data collection, harmonization

Besides hydrogeological characterizations, groundwater assessment includes environmental, socio-economic and policy/institutional aspects. In the case of the internationally shared groundwater resources in the proposed pilot areas, information management and collaborative international work are two very important aspects to be taken up. Common monitoring and assessment usually face the challenge of data harmonization, including reference systems, formats, definitions, classifications, languages and/or use of different technologies. Therefore, one of the issues to enable collaborative management is to harmonize the hydrogeological information in the selected pilot areas. This will support a common regional view of the groundwater resources in the Mekong, providing a basis for collaborative actions, such as monitoring, pollution prevention and balanced use.

Aquifer status and vulnerability assessment

The transboundary aquifer assessment guidelines developed by IGRAC and UNESCO-IHP can be used for the groundwater inventory and aquifer vulnerability assessment process. The methodology covers hydrological, hydrogeological, socio-economic, environmental, legal and institutional aspects of the groundwater systems and transforms those into resource status and/or resilience indicators. These indicators can be used to facilitate communication between parties with very diverse levels of knowledge and professional backgrounds, one of the components towards collaborative management. The methodology also deals with challenges such as general lack of data, inaccessibility of groundwater information and harmonisation of data across borders. The assessment will provide the scientific and technical basis for actions and agreements, including to development of a specific action plan for the region. The methodology is based on a participatory approach to increase recognition, shared responsibility and transparency of the assessment processes. The collection, harmonization and analysis of the data on the transboundary aquifers should be carried out by a joint team of national experts from the involved countries. The joint assessment and fact-finding of the selected transboundary aquifers lay the first foundation for informed joint management.

Component 2: Priority use and stakeholders

Outcome: Groundwater users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.

Outputs: Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.

Major Activities

1. Dialogues with GW users to assess GW use scenarios for different sectors
2. Develop and provide custom-made practical guidelines to attain sustainable use of groundwater

Activity details at the regional level (in the proposed four pilot areas)

1. Overview of most important GW user groups (user typologies); understanding user perspectives; defining further work packages to think about targeting different users in different ways.
2. Information dissemination on vulnerability issues; challenges for users, most vulnerable groups
3. What GW experts can do to support users; here the results of Component 1 come in: resilience potential. How is it appreciated by different users?
4. **Resilience strengthening pilots** for different users in different locations, resilience development and demonstration. The following options will be considered:
   a. Pilot for agriculture/farmers, using small-scale MAR (Managed Aquifer Recharge)
   b. Pilot for regional water-supply companies that use specific information in GW management tools, making use of tools to manage resources and understand vulnerabilities and information-based resilience options; further develop resilience options
   c. Dialogues with national policymakers and experts on strategic importance of GW resources in the overall CCA discussion
      - Improve general understanding of the transboundary system
      - Clarify roles and responsibilities of local institutions
      - Information, participation and dialogue between stakeholders on both sides of the border
      - Involve local and regional authorities
5. **Geographic coverage:** Work package to distinguish different users, at different GW management levels in small pilots, but also national strategic level, focus on pertinent, practical and end-user oriented outputs (information products, training and awareness activities, coaching and guidance (to farmers, or intermediaries).
6. Give examples in workshop with different sectors, i.e. examples of water supply companies on long-term strategy in Mekong Delta, i.e. how to ensure water supply in view of multiple threats, recharge depletion, salinity intrusion, pollution, etc.
7. **Resilience Agenda** for coming years; what do users need to do and consider (**Triple A** approach: **Agenda:** what are the issues, what has priority, when do we need to act: **Atlas/database**: where are our resources,

location issues, protection, overlapping claims): **interAction** Who is going to do what, how do we interact - rules of the game, who will decide? who will pay?

Active interventions

In order to have a tangible impact on the ground, the project's activity plans for the four pilot regions will focus on co-development with GW users of suitable interventions in support of sustainable use and vulnerability reduction. Foremost among these is using the wet season rainfall surpluses to resupply GW buffers to overcome dry season droughts, in other words – enhancing GW recharge. A range of technical options are available for stimulating GW recharge. Direct surface methods are among the most widely used and simplest. Depending on local conditions, water is simply spread over fields to percolate into shallow aquifers. Other methods include digging flooding pits or shafts; or 'injecting' water into aquifers through deep boreholes or tube wells from surface water bodies. GW recharge is often best accomplished as a by-product of integrated or 'conjunctive' management of reservoir and canal seepage, injection and infiltration of return flow from irrigation, enhanced infiltration of rainfall, or the simple levelling of fields or construction of small check dams. Technology aside, a managed recharge strategy strongly implies a shift to co-management of surface water and GW. These interactions are well understood in the scientific domain, but remain almost entirely separate domains in the day-to-day worlds of policy and water management authorities.

Groundwater storage and replenishment (through MAR) offers a number of unique benefits, including potentially wider, more equitable access. GW (as long as there is a source of it) is accessible to anyone with the means to dig/ drill a well; an attractive option where surface water management is often highly politicized. As a CCA measure, aquifers respond to droughts and climate fluctuations much more slowly than surface storage structures, and are more resilient buffers during dry spells. The approach borrows from extensive and successful experiences elsewhere, among others in India (Table below; Source: Shah, 2009).

Table 1: Climate change and water storage alternatives.

	Small surface storage	Large surface reservoirs	Aquifer storage (BAU)	Managed aquifer storage
1. Make water available where needed (space utility)	↑↑↑	↑↑	↑↑↑↑	↑↑↑↑↑
2. Make water available when needed (time utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
3. Level of water control offered (from utility)	↑	↑↑	↑↑↑↑	↑↑↑↑↑
4. Non-beneficial evaporation from storage	↓↓↓↓	↓↓	↓	↓
5. Non-beneficial evaporation from transport	↓↓	↓↓↓	↓	↓
6. Protection against mid-monsoon dry spell (2-8 weeks)	↑↑	↑↑↑	↑↑↑↑↑	↑↑↑↑↑
7. Protection against a single annual drought	↑	↑	↑↑↑	↑↑↑↑↑
8. Protection against two successive annual drought	↑	↑	↑↑	↑↑↑↑
9. Ease of storage recovery during a good monsoon	↑↑↑↑↑	↑↑↑↑	↑↑	↑↑↑
10. Social capital cost of water storage and transport and retrieval structure	↓↓	↓↓↓↓↓	↓↓	↓↓↓
11. Operation and maintenance social costs of storage, transport and retrieval structures	↓	↓↓	↓↓↓↓↓	↓↓↓
12. Carbon footprint of agricultural water use	↓	↓↓	↓↓↓↓↓	↓↓↓

Table 5: The overview shows four possible storage and improved ground-water management alternatives.

The analysis assigns up to five benefits or five disbenefits to each of 12 resilience considerations. The first two options, small surface water storage facilities and large surface water reservoirs are quite well known, but provide little or negative resilience enhancement. The third option, aquifer storage, represents traditional GW use (Business as Usual – BAU), with mostly intensive exploitation (and depletion) of shallow aquifer storage, without any demand-side management or systematic strategy of enhancing aquifer recharge. The fourth option, managed aquifer storage, is not widely applied yet, and will require a radical shift in thinking. It recognizes that GW demand will and can increase, but, depending on a region's hydrology, aquifer storage can sustain this increase with proactive demand side management and a region-wide program of managed aquifer recharge.

Component 3: Resource management, information tools and equipment

Outcome: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.

Outputs: Adequate collaborative resource management methods and tools made available, enabling information sharing, cooperation and mutual support across the GMS. Information-based measures to align groundwater management with broader climate change resilience measures and surface water management.

Major Activities:

1. Compile and integrate all collected data into the online information portal for best information sharing and analysis
2. Develop and implement best groundwater management equipment and measures for each pilot area for vulnerability reduction and/or groundwater supply improvement.

Activity details:

1. Using the database and GIS tool; develop a number of specialised information products that can be derived from it.
2. Revisit resilience potential: what can user do with it; how to exploit this?
3. Pilots to confirm proper groundwater use is a resilience strengthening option
4. Identification of best practices of conjunctive management of surface and groundwater based on environmental and socioeconomic aspect of each pilot area
5. Resilience strengthening pilots for different users in different locations, resilience development and demonstration. The following options will be considered:
    - Pilot for agriculture/farmers, using small-scale MAR
    - Pilot for regional water-supply companies that use specific information in groundwater management tools, making use of tools to manage resources and understand vulnerabilities and information-based resilience options; further develop resilience options
    - Dialogues with national policymakers and experts on strategic importance of groundwater resources in the overall CCA discussion
    - Improve general understanding of the transboundary system
    - Clarify roles and responsibilities of local institutions
    - Information, participation and dialogue between stakeholders on both sides of the border
    - Involve local and regional authorities
6. Groundwater monitoring schemes; minimum requirements prescribed for general monitoring; for selected aquifer locations defining and agreement on monitoring set up; installation and using the first results

The collected and harmonized data and information for the GMS in general and for the four pilot areas will be stored in an online Information Management System (IMS) along with outcomes of assessment and possible management scenarios. IGRAC can provide the IMS that can operate as a data and information sharing platform between the countries and the various water sector and climate resilience actors and stakeholders, covering issues like groundwater resource availability, monitoring of changes and more (pro)active management supporting climate resilience. A dedicated IMS will be set up for each pilot study, and later these will be integrated into one 'Groundwater resources in GMS Portal'. Final output will be one information portal with an overview of the outcomes of the project and database on groundwater monitoring observations and other tailor-made tools.

In order to ensure tangible impact on the ground, the project's activity plans for the four pilot regions focuses on co-development with groundwater users of suitable interventions in support of sustainable use and vulnerability reduction. Resource conservation as well as supply augmentation will both be considered and evaluated on their merits. Pilot trials of demand management that can be built upon have started in pilot area 1. Opportunities to use wet season rainfall surpluses to resupply groundwater buffers to overcome dry season droughts will be identified - in other words, enhancing groundwater recharge through Managed Aquifer Recharge (MAR). A range of technical and social options are available for stimulating groundwater recharge. A staged, risk-based approach will be followed. Project team members have extensive experience in MAR in the region and globally. IWMI, working with national and international partners, have commenced a farmer-driven MAR pilot trial in the Central Highlands of Vietnam. This could potentially be linked to the pilot areas. A managed recharge strategy strongly implies a shift to

co-management of surface water and groundwater. These interactions are well understood in the scientific domain, but remain almost entirely separate domains in the day-to-day worlds of policy and water management authorities in the countries concerned.

The intervention above will be piloted in the target sites, with the objective of ensuring sustainable groundwater use and vulnerability reduction. Different measures for groundwater vulnerability reduction and water supply improvement will be implemented depending on the environmental and socioeconomic conditions of each pilot area. In the upper Mekong Delta, for instance, the different levels of understanding of the aquifer system between Cambodia and Vietnam have restricted strategic planning of groundwater resource management, thus extra attention will be paid to a systematic sharing of experience, in particular from Vietnamese Mekong Delta to neighbouring Cambodian Mekong Delta. Overexploitation of groundwater in the Vietnamese part of the Mekong Delta has caused several issues such as seawater intrusion and land subsidence, thus instrumental measures will be suggested and feasibility of the state-of-art technology. For example, MAR will be tested to increase aquifer resilience. For the Cambodia-Thailand TBAs, intensified development of groundwater resources is recommended to increase availability and ensure its sustainable use, particularly in dry periods. Thus, a joint assessment will be carried out, including the suitability of water recharge/storage methods. Groundwater monitoring network design and piloting is envisaged as well. (For more details, see **Annex I**).

The project's pilot areas are located in transboundary regions, areas where groundwater users are at risk from unsustainable groundwater supply caused by competitive groundwater use between neighbouring countries. Growing demands on water use and disagreements between neighbouring nations over resource state and development could exacerbate the potential threat of water conflicts, making groundwater users in these areas particularly vulnerable to groundwater shortages. The identification of project beneficiaries - groundwater users of four pilot areas with a special attention paid to marginalized/vulnerable groups, low-income rural communities and women – has been made in response hereto.

Component 4: Regional cooperation, coordination and information exchange

Outcomes: A regionally consistent policy and management of groundwater resources in support of CCA is adopted through effective stakeholder engagement in the GMS.

Outputs: A regional cooperative network is established to exchange information and collaborate on addressing climate change challenges from information-based policy making to collaborative management.

Major Activities:

1. Review and analyse current groundwater policies and activities of the GMS countries.
2. Establish and operationalise regional groundwater officials' group between GMS countries for implementing international consensus and guidelines concerning transboundary groundwater management.
3. Develop suitable institutional setup and appropriate legal framework for TBA management in GMS

Activity details for coordinating regional cooperation network

1. Document for all five countries the groundwater policies and groundwater management activities; what is there to learn from each other, why is it done the way it is done?
2. Focus on issue of transboundary aquifers: where, what? Are there common interests. Set up a task force to bring transboundary aquifer (water resources) management to a higher level?
3. At least two follow up workshops by making use of the results produced in the other project components (database, joint monitoring, etc.).
4. Elaborate transboundary regional cooperation for the four selected transboundary groundwater systems as case studies (1. Vietnam-Cambodia: upper Mekong Delta aquifer system; 2. Lao PDR-Thailand: riparian Mekong aquifers (Vientiane plains); 3; Eastern Thailand – NW Cambodia border region aquifers, 4. Myanmar Dry Zone aquifers).
5. Establish two working groups on sharing and co-development of tools and on national/regional policy and strategy.

These activities will be facilitated through a high-level joint assessment mechanism coordinated by UNESCO through its Regional Sciences Bureau for Asia and the Pacific as MIE.

Harness multilevel stakeholder engagement for the transboundary aquifers

Depending on the outcomes of the groundwater inventory, appropriate institutional setups and/or appropriate legal frameworks for their joint and sustainable management need to be developed. Once the interdependence of these countries has been recognized and accepted, the next step consists in establishing contact between them, both technical-regional as well as strategic-national-regional (diplomatic) level. This step allows the exchange of viewpoints, the development of confidence and solidarity measures, the sharing of information, and the coherent, pragmatic and progressive implementation of the various operational tools. The experience of UNESCO especially through established workshop mechanisms such as the Potential Conflict to Cooperative Potential (PCCP), *Groundwater for decision-makers* training materials will be helpful for assisting in harnessing regional cooperation, by providing their specific advice and assistance, and by encouraging the development and implementation of international consensus building and guidelines concerning transboundary groundwater management.

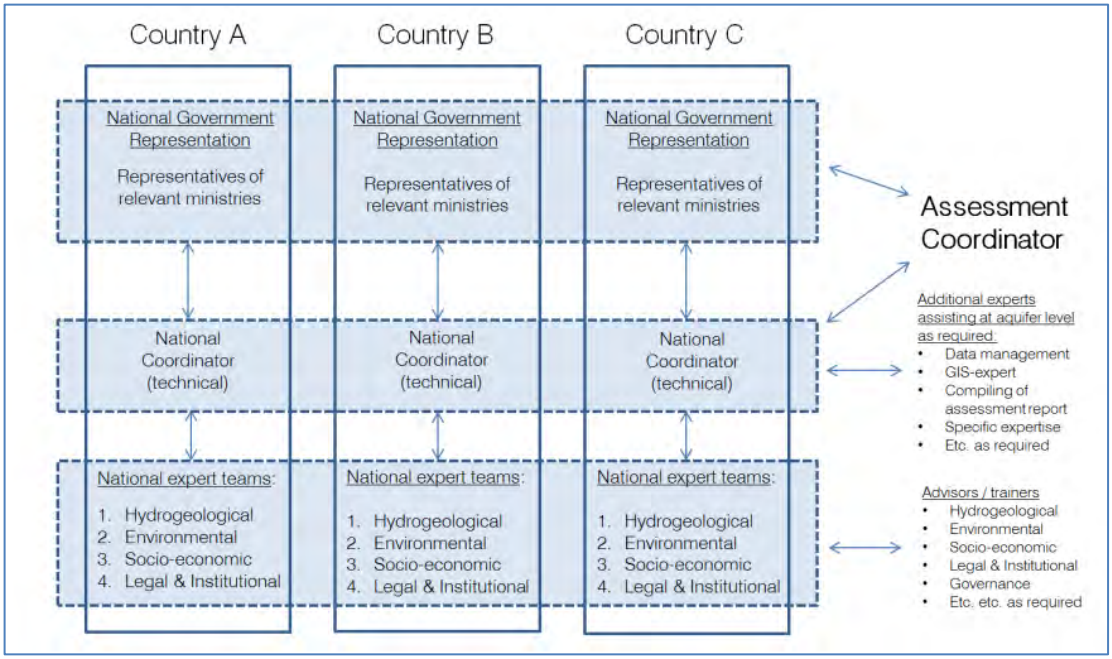


Figure 13: Example from the TBA Collaborative Assessment Methodology. Executing a joint assessment will bring together experts and government officials from pilot regions as well as national levels to help build consensus mechanisms for standardisation leading to climate change resilience. In this project, in order to improve the understanding of the shared aquifer systems as well as the collaborative management, the involved countries should progressively develop groundwater management network. Technical experts and stakeholders network will be established by bringing national as well as local officials together in regional workshops, focusing on the four pilot regions. Official meetings serve to create dialogues between the ministries from various countries to share knowledge, agree on common objectives, discuss stakes and (economic) benefits, ideas on collaborative actions and mechanisms and possibly financing issues. Source for graphic: IGRAC & UNESCO-IHP (2015).

Component 5: Capacity building and training

Outcomes: GMS stakeholders capably use project tools on groundwater use for CCA and resilience.
Outputs: A groundwater community-of-practice created and equipped with the knowledge and skills to ensure technical and policy capabilities. Expert groups can tackle acute problems, GMS cooperation.

Major Activities:
1. A number of training workshops targeting to different GW users, communities and stakeholders are organized to provide different technical and institutional supports.
2. International conference and workshops are organized to disseminate the results of the project

Programme details for capacity building and training:

Training programmes Subcomponent

1. Training workshops (Information on the tentative scope of the training courses provided in textbox below)
   a. MAR, ASR and other storage and groundwater potential strengthening techniques, connected to pilots
   b. Training workshops on transboundary aquifer management; training programme (IGRAC)
   c. GGMN – the next level for the GMS; training and learning-by-doing (IGRAC)
   d. Conjunctive-management of surface water and groundwater; training workshop with MRC experts
   e. Community Dialogue (CD) training/workshops on participatory groundwater monitoring, developing monitoring with support of user groups and to increase groundwater user engagement in management of resources.
2. **Support formal training programmes**: Support to existing and/or new formal training programmes at institutes in the region covering aspects of groundwater management for resilience
3. Information and resources sharing and cooperation on formal training programmes in institutes, recognition of each other certificates, etc.

Learning and knowledge management Subcomponent

4. **Information repository and Sharepoint.** The Sharepoint facility will be a publicly accessible database (Data repository) where all available data and information is stored and can be accessed. It will support taking stock of the current levels of understanding, research focus and management of groundwater, to assess the status of groundwater policies with respect to the existing and further developing knowledge base (see for instance: www.kindraproject.eu)
5. **International Conference** to disseminate the results of the project.

Figure 14: Myanmar: Discussion with farmers on the use of tube wells for irrigation water supply. The project will be working with GW experts at various levels, but will also focus on direct interaction with stakeholder groups to extend GW use practices for climate resilience.

a. Training/workshops on transboundary aquifer management
The workshop on transboundary aquifer assessment and management will provide national experts with guidance and tools to execute the assessment in a systematic way. The workshop follows a participative approach in which the regional experts will start the joint–fact finding. Joint-fact finding assists in opening discussion, increased knowledge-sharing, and overall transparency of the assessment processes. These components are all important to reach a common understanding and to enable collaborative management. The training programme will specifically deal with and will be tailored to the selected transboundary aquifer system (one of the three pilot areas).

Content of the training

- Transboundary aquifers and their management
- Guidance for data collection and harmonization
- How to go from data to knowledge?
- Training to work with the Information Management System
- Transboundary Dialogue on GW issues and Joint Cooperation mechanisms

b. Training/workshops on advanced groundwater monitoring and analysis
The purpose of the training course is to train a group of GW professionals on GW monitoring networks, setting up monitoring network, and basic information on processing of the information. The second part of the training would provide the local technical consultants/researchers with modern technical skills in the use of Global Groundwater Monitoring Network (GGMN) and GW modelling tools. The GGMN provides an interactive portal for storage, processing and dissemination of GW data. The training participants will have the opportunity to acquire an active role in the GGMN Network and to continue to use the GGMN interactive portal.

Content of the training

- Groundwater monitoring objectives and monitoring network types
- Procedures and methods of setting-up a groundwater monitoring network
- Groundwater monitoring equipment
- Open source and freely available groundwater software tools
- GGMN Portal (Database and information management)
- Time series analysis
- Spatial interpolation in QGIS
- FREEWAT software (open source GW modelling tool in QGIS)

c. Training/workshops on conjunctive management of surface and groundwater; training workshop with MRC / National Mekong Commission experts
IGRAC will provide content for this training targeted to staff from the Mekong River Commission and National Mekong Commission members with a focus on 'Integration of Groundwater Management into Transboundary Basin Organizations'. The training course will be tailored for the GMS, and partly based on the manual on 'Integration of Groundwater Management into Transboundary Basin Organizations', developed in corporation with IGRAC, Cap-Net, Germany's Bundesanstalt for Geowissenschaften und Rohstoffe (BGR), IWMI, AGW-Net/UNDP and the former GW-MATE team of the World Bank. The manual is designed to help develop capacity within the river basin organizations to include and manage (transboundary) GW issues. A community of experts affiliated with the Mekong River Commission and National Commissions in the region provides an initial platform for transboundary GW cooperation.

Furthermore, the project will engage in ***Community Dialogue (CD) meetings***

The Community Dialogue meetings will serve to increase awareness and capacity for groundwater management at community level are key to achieve long-term sustainability of groundwater use under changing climate in the GMS. In order to promote capacity building of local people in response to groundwater related issues, this project will implement a community level learning programme and awareness raising meeting, particularly focusing on ensuring human rights to clean water access, livelihood improvement potential of new development, responsible groundwater management and gender equality. For the most effective delivery of the project's outputs and

outcomes to local communities, this project will consider a variety of communication/learning channels, reflecting socio-economic and indigenous contexts of the region.

UNESCO, as a specialized agency of the UN with a mandate in education, natural and social sciences, culture and communication, will apply an intersectoral and integrated strategy that encompasses both natural and social and human sciences components, by emphasizing the linkage between evidence-based groundwater solutions and its realization at community level. UNESCO adopts a human rights based approach as a normative principle, through which protection of human rights for the vulnerable groups in GMS will be further promoted. A close partnership with CCOP, IWMI, IGRAC, national agencies and local authorities will facilitate effective and efficient implementation of the strategy.

Content of the workshops/meetings would likely include:

- Community dialogue meeting to gain insights into local problems and priorities and to raise awareness on sustainable groundwater use and protection
- Community dialogue meeting on building resilience tools on climate change water-related disasters (drought) based on groundwater resource availability and socio-economic status of local communities
- Community learning to promote clean water/sanitation access for women and girls in unsafe environments

These events will be undertaken with the participation of key stakeholders from the water, agriculture, energy, health, environment sectors at the local level to build integrated capacity and ensure effective linkages are made with existing policies and plans.

B. Innovative solutions to climate adaptation

The project includes new and innovative solutions to climate change adaptation, in particular the following:

1. **Climate resilience and added value of regional approach, Greater Mekong Subregion transboundary collaboration**

By introducing and stimulating robust methods for resource assessment and collaborative principles for sustainable groundwater use, valuable water resources can be more effectively allocated for strategic and emergency purposes, thereby enhancing resilience in water supply and food production. Climate resilience is based on a broader suite of options, including limited surface water and groundwater, and overall use efficiency is stimulated.The regional approach creates significant efficiency gains in development of resource management concepts, tools and supporting systems and in developing the required regional human resources capacity. By developing regional regulatory guidelines for appropriate groundwater use, unsustainable practices are prevented equally across the region (also creating a level playing field), instead of pushing communities to compete with each other.

2. **Sustainability assessment of limited and valuable groundwater resources**

To increase resilience and reduce vulnerability it is essential to assess sustainable groundwater extraction rates under various current and future land use conditions, develop with users “low vulnerability” land use and identify solutions to overcome high vulnerability cases, assess impacts of the current and likely future climate change conditions on the groundwater resources; create awareness on the potential depletion of limited groundwater resources; and develop fall-back options and water use efficiency measures that have a direct impact on the ground.

3. **Innovative solutions to climate change adaptation; a regional approach and cost-effectiveness**

The development of groundwater MIS for the region will provide ample opportunities to introduce innovative ICT supported data collection, information sharing and training. Direly needed groundwater resources monitoring in collaboration with well owners and water users provides excellent opportunities for data collection through crowdsourcing, which also strengthens stakeholder involvement.

The programme connects to national priorities for CCA, i.e. groundwater conservation and sustainable use, as included in respective national CCA policy documents. The programme partners are already working on related studies in the region; this earlier and ongoing work will pave the way for this new and challenging regional project.

4. **An IWRM approach including groundwater and focused on farmers perspectives and needs.**

Unlike many other studies and projects dealing with water resources management this intervention will apply IWRM from a groundwater system perspective, based on the fact that farmers and other water users almost always use (complementary) groundwater to cover seasonal water needs. This applies to farmers producing food and market crops, but more strongly to a large number of rural water users for domestic purposes. Groundwater is nearly always a reliable source for low-cost and relatively good quality water. In applying IWRM principles specific attention will be paid to user perspectives, matching needs from different user groups and developing insight in what ways groundwater can contribute to increased resilience. This is not only different as compared to integrated (surface) water studies, but also requires a bottom-up (from the users’ side) perspective on groundwater resources, versus a more traditional top down (from the resource assessment side) perspective.

It is believed that especially this innovative approach will generate significant, tangible and acceptable climate resilience support to primary stakeholders in the countryside and rural towns.

C. Project economic, social and environmental benefits

Positive environmental and social impacts, a balanced intervention with sustainable results

The project will mitigate climate change impacts on food production and water supply, based on the better use of empirical data, for the groundwater system and environmental parameters, the socio-economic system (groundwater users) and the governance context. Actual and potential future socio-economic risks for rural communities caused by the impacts of climate change will be reduced via better access to irrigation water for food production and for domestic use (WASH). The funding requested is allocated to carry out data analysis (existing data and collecting new data on climate, watershed system, ecohydrology, ground-water availability in space and time, and the monitoring of groundwater quality related parameters (multi-element analysis, arsenic content, water-flow-rates and water-consumption carrying capacities). The project is unique in the sense that it will set up these activities with a groundwater-user based perspective, and in a participatory manner, involving local communities and primary stakeholders. The activities in the pilot areas will deepen the knowledge base on the groundwater system and vulnerabilities. Increased knowledge and related information will be shared with stakeholders - men and women - and a network of a sub-regional community of experts will be established to advise the end-users on best practices.

Positive social impacts:

- To stimulate sustainable use of groundwater resources, select the best crops for irrigation, and avoid over-utilization, depletion and salinization of aquifers.
- To stimulate nature-based solutions, and the recycling and utilization of waste-water in order to reduce the pressure on ground-water, for specific domestic purposes, such as washing, flushing, irrigation.
- To support approaches to ensure equitable access to water for food production and domestic use. It will enable conservation of scarce water resources for low-income groups.
- Enabling regional discussion on shared groundwater resources, climate, eco-hydrology, and responsible consumption and production in support of the targets of several SDGs.

Positive environmental impacts:

- Avoid depletion of aquifers and allow for continuous water-consumption based on aquifer carrying capacity
- Avoid salinization and increase of chemical particles (cadmium, arsenic, manganese; multi-element analysis and monitoring) via monitoring and respecting carrying capacities.
- Enhance nature-based solutions, which in turn, have a positive impact on biodiversity conservation.
- Enrich the selection and variety of food crops following best practices in time and space.
- Enhance wind-breaks, hedges and rows of trees towards agro-forestry and enriched cultural landscapes, generating better long-term man-made ecosystem functioning when compared with mono-specific agricultural schemes.
- Enhanced environmental awareness and community knowledge on eco-system functioning, ground-water recharge capacity, climate patterns and its relation to ground-water flow, nature-based solutions, and waste-water recycling.

Beneficiaries of the project

Indirectly, the project benefits the lives and livelihoods of around 300 million people that reside in the GMS, by enhancing their water-security, food-security, and food-commodity-production capacities in consideration of climate change factors.

It also benefits indirectly people purchasing agricultural crops that are being produced in the GMS, via generating a more sustainable crop-production capacity in times of increased climate issues.

The project directly benefits all people living in the four pilot sites, via enhanced climate resilience skills related to water availability, water management, agricultural practices, nature-based solutions, and more responsible consumption and production.

Principally, the proposed interventions support the people living in the pilot areas by contributing to achieve the listed SDGs and their specific targets via scientific research, knowledge enhancement, knowledge sharing, cross-border resource management, demonstration and training.

The communities in the pilot areas where the project will take place will benefit from better information and understanding about the importance of groundwater, eco-hydrology, climate issues, and the SDGs and how it affects their livelihoods, via specific training, based on scientific research, monitoring, and best practices, including in schools. The information generated from the project, communicated via train-the-trainer, train-the –teacher, and community outreach programs, will directly help local farmers, water resource managers, agricultural extension staff, water user organizations, well drillers and potable water suppliers including men and women from vulnerable groups, communities and schools including teachers and young people, to better understand water as a crucial resource and its importance for sustainable human living, and it is connected to climate-surface eco-hydrology, water-shed systems, and human dynamics and interventions.

Another important group of beneficiaries from the project will be project partners from the five countries and the stakeholder groups at national, provincial, district and local levels tasked with managing the groundwater. We aim to build capacity for central (national) level managers through to field-level technicians from government agencies in relevant sectors along with staff/students from universities that are engaged in this project.

Vulnerable groups
In the pilot areas are certain groups of people that are specifically vulnerable to climate change issues. The groups include resident ethnic minority goups as well as those resettled from mountainous areas voluntarily or as a result of government policy. Rural women and children incur much of the burden of fetching domestic water from groundwater wells in villages situated remote from clean and reliable surface waters, particularly in the more remote inland areas. Many of these communities still lack clean and reliable supplies and adequate sanitation. Using gender analysis and vulnerable group experts as well as local authorities, the socio-economic background and status of marginalized/vulnerable groups in the region will be identified in detail during the Inception Phase and will be monitored through the project implementation period. These groups will receive special attention with a focus on training and interventions that will reduce their burden, for example through and training and application of Green Academy aspects (rain-water; grey-water, black-water management; clean energy; youth groups engagement). By identifying women, young people and ethnic minorities as some of the key users and local champions for groundwater, the project will give particular emphasis to ensuring ongoing and improved rights to access groundwater. Consultations and training will involve women, young people, and marginalized communities engaged in or aspiring to make use of groundwater for domestic supplies and crop or livestock production.

Low income rural population:
Traditionally, groundwater is already an important source for water supply for agricultural and domestic purposes for low-income rural population, not connected to piped water systems or irrigation schemes. This project will improve the knowledge for long-term availability, carrying capacity, and sustainability of groundwater supplies to strengthen the better management and avoid over-utilization of groundwater wells.

Gender and youth considerations: From rural population groups, female and youth stakeholders will be specifically targeted in accordance with their traditional roles in food production for households and domestic water. Within the project a gender platform will be established with predominantly female members who will actively engage on enhancing women's and young people's skills on groundwater issues, and related factors, including climate change, ground-water management, eco-hydrology, and rural and domestic water consumption related aspects. Best practices from previous initiatives in the region and beyond will be reviewed and adopted where applicable[13].

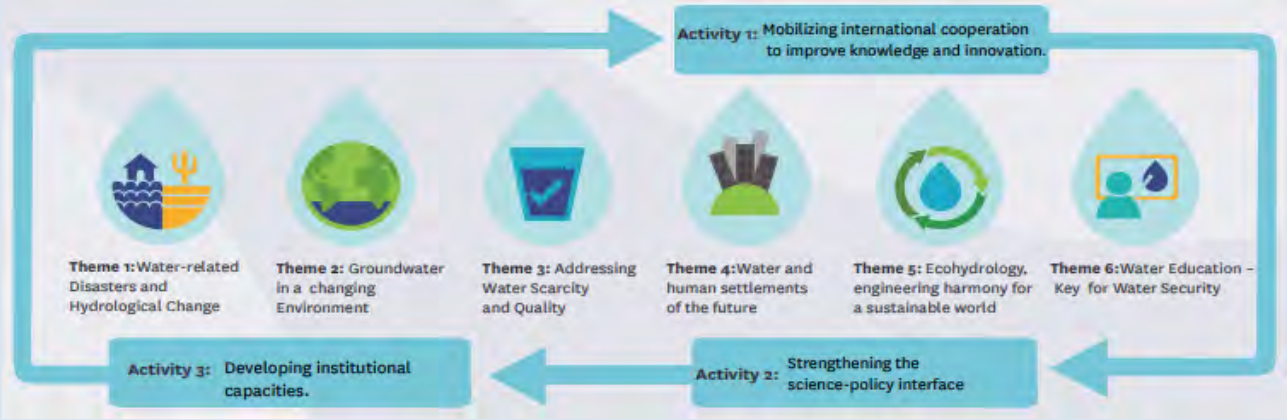
[13] *See for example (Calisesi, F., B. Böer & E. Kumfa 2016: Guidelines for UNESCO Green Academies in Africa – globally applicable. Internal and external guidelines for an innovative UNESCO Pan-African initiative. UNESCO Addis Ababa Liaison Office with the African Union Commission and UNECA. 91 p.).*

Among others, IWMI experts have shown that gender-sensitive approaches to groundwater development and management[14] help secure and protect access and use for women and the rural poor. Gendered water rights determine access and control over groundwater resources. Men and women differ in their needs and technological preferences for groundwater extraction and are affected differently when groundwater development interventions are introduced.

Reference is also made to UNESCO's (including IGRAC) support for gender equality in relation to groundwater management and use. See: http://GWportal.org/focal-area/gender .

In the project, a proactive gender approach will be undertaken (see also Part I, Section 2) throughout the project implementation in the four pilot areas along the lines of these best practices via training, application and demonstration. The workforce of this project will be comprised considering the gender balance and youth involvement via schools and community outreach.

UNESCO-IHP (International Hydrological Programme) advocates for more equitable water resources management and human development opportunities for both women and men (see for instance: https://unesdoc.unesco.org/ark:/48223/pf0000233579 or https://en.unesco.org/genderequality).



Gender equality is one of UNESCO's global priorities, with a commitment to promote equality between women and men across the Organization's mandate. Gender equality is not only a fundamental human right, but a necessary foundation for the creation of sustainable and peaceful societies.

Women represent at least half of the workforce in agriculture and food production, and often bear the daily burden of carrying water to their families. This issue has been reduced in the past few decades, but it is still an issue and needs investigation. Although women play such a pivotal role in water resource management, sanitation and hygiene (especially in rural areas), gendered water data are among the least available of national level indicators, and 45% of countries do not produce any gender statistics related to water. Climate change, inadequate access to water, and poor water quality negatively affect women's and girls' health, education, employment, income, and empowerment in ways that are distinct from their male counterparts There are corresponding risks to both local and global food production and the care of livestock. Additionally, in academia, women are under-represented in hydrogeology studies mainly because of the structure of academia and historically low numbers of women entering the field.

International Hydrological Programme

[14] *IWMI training programme: Gender and Institutional Approaches to Groundwater Development Management, MODULE 6: GENDER MAINSTREAMING IN AGRICULTURAL WATER MANAGEMENT;* http://publications.iwmi.org/pdf/H042180.pdf , and http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/Module6.pdf

D. Cost effectiveness

Cost effectiveness through national agency and stakeholder contributions
The project will be implemented in close partnership with national agencies mandated with groundwater management and involved in supportive groundwater studies. Through these, there will be substantial in-kind contributions and spin-off of regional collaboration (better exchange of information, sharing of experience, joint studies, etc.). The resilience pilots will be multiplied and extended across the national territories of the five countries. Furthermore, for various proposed pilots and implementation activities there will be contributions from stakeholders, communities and local government. Although this kind of operation is organisationally complex there will be significant cost reductions and, importantly, increased ownership and awareness. For example, stakeholders and groundwater users will be invited to propose case studies and practical cases in which climate resilience measures will be applied and tested-demonstrated.

Cost effectiveness of technical assistance and leverage
The executive model set up for the project emphasizes regional (from the five participating countries) sourcing of many inputs for activities, and regional coordination and support from CCOP-TS. CCOP-TS has been able to organize and implement regional collaboration projects that have shown high cost-effectiveness by making use of technical support and contributions from national government agencies. Additionally, the use of peer-support and local experts from the different expert communities is foreseen.

It is anticipated that the project and its executive proponents CCOP-TS, IWMI and IGRAC will be able to leverage additional support from partners that are active in the region and the subject matter. For instance, there is current support from Australia's DFAT (Department of Foreign Affairs and Trade) for IWMI's groundwater work in Lao PDR, and for climate adaptation and resilience in the Mekong Delta.

1. CCOP-TS has longstanding and active cooperation with BGR. There are currently activities in Vietnam, Lao PDR and Myanmar.
2. CCOP-TS has a long standing and active cooperation with JICA of Japan. Further cooperation in this project is envisaged.
3. There is active cooperation on groundwater management and CCA with KIGAM, Republic of Korea (Korea Institute of Geoscience and Mineral Resources). Recently, and in preparation of this proposal, a workshop was convened with representatives of all partners from the region (*CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and Groundwater Resources in the Mekong River Basin", Sihanoukville, Cambodia, 1-4 June 2016).* An earlier workshop also served in preparation and inspiration for this proposal *(CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.* Further support from KIGAM and Korea International Cooperation Agency (KOICA) is envisaged.

The component for hardware and equipment is relatively small, and the items purchased will be for long-term use; upon completion of the project ownership of equipment will be transferred to the national agencies.

Cost effectiveness in project operations
The project *modus operandi* will be 'implementation by the stakeholders, for the stakeholders'. This means limited technical assistance support will be mobilized to develop, organize and implement activities (especially in the pilot areas) with and for the primary stakeholder, the actual and potential users. This will be a cost effective approach, as only overhead costs and limited time inputs will be incurred.

A similar principle will be adopted for activities on higher policy and institutional levels as it is believed that the main objectives of the project will feed directly into the main policy and operational tasks of the involved national partner agencies. It is expected that the strategic support the project can offer will leverage internal resources and create a win-win situation for the project and the national contributors.

Alternatives to the proposed solutions
The following three features are considered key to the cost effectiveness of the proposed approach and envisaged solutions. It is argued that possible alternatives, as suggested below are less cost effective.

1. A regional approach and transboundary cooperation: Alternative: a specific country focus, or specific, and different interventions in different countries.

2. Accent on bottom-up, in pilot areas, with local stakeholders and national agencies, setting up of activities and generating results and impact followed by extrapolation to policy level and possibly national application: Alternative: a top-down approach, starting with policy issues at a multilateral level.
3. Strong role of national cooperating partners and modest support of international technical assistance: Alternative: explicit external and international technical assistance support.

Ad 1. We believe the regional approach generates considerable multiplier effects and synergies. It comes at an appropriate time and connects both to the underlying theme of transboundary groundwater management, as well as to the active CCOP-TS and UNESCO network of groundwater professionals in the region. In the incipient ASEAN Economic Community, despite some traditional controversies and disputes, the region is coming together more and more. Expected efficiency gains are:

- Sharing of information, dissemination of best-practices and project results across five countries
- Identification and elaboration of comparable groundwater management challenges, use of similar tools and application of comparable solutions
- Closer cooperation in capacity development and formal training across the five countries, whereas otherwise it would be done in five relatively small groundwater Communities of Practice (CoP)
- Region-wide distribution and multiplication of integral project results, if relevant translated into national languages. Alternative, country-focused approaches would be far less ambitious and would have a relatively low impact (larger cost/impact ratio).

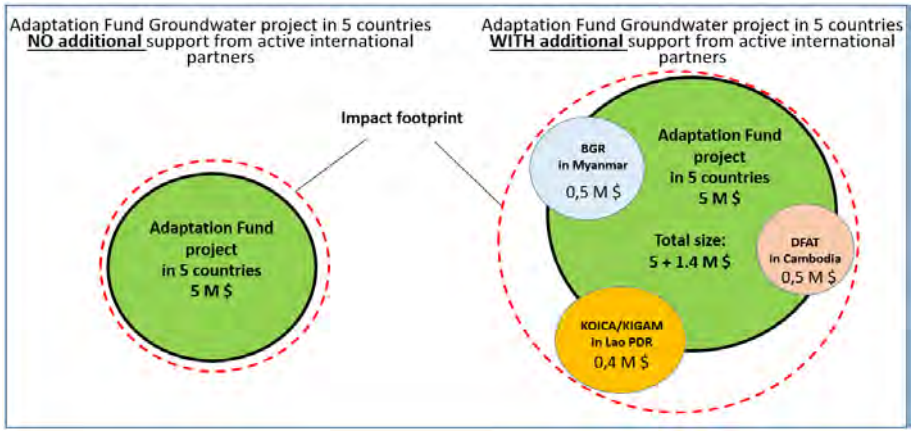


Figure 15: Leverage from AF funds to stimulate further regional and collaborative groundwater *management for strengthening climate resilience. The project could form the core of an even larger GMS programme, with a concerted effort significantly enlarging impact (NB; figures indicated in the right part of the figure are hypothetical. Real spending by these organisations during the last 5 years has probably been higher.*

Ad 2. We believe an alternative top-down approach would certainly contribute to improved groundwater management at national levels, meeting new and more appropriate natural resources management targets (in a context of CCA). But there would be a strong risk of not achieving substantial climate resilience impacts for the primary stakeholders. Our regional experience also confirms the higher effectiveness of local farmer, and/or other actors-based interventions and innovations versus government-introduced measures (top-down). By following the bottom-up approach we also aim to steer the national partners towards generating impact on the ground, in provinces, and not instead to sticking to traditional but often ineffective work processes aimed at meeting national statistical targets.

Ad 3. With increasing costs of international technical assistance both CCOP-TS and UNESCO are increasingly aware that significant cost savings can be achieved by working with national advisors and experts from within the region. This is challenging and requires strong coordination and some guidance, but can still generate impressive impacts. Furthermore, this *modus-operandi* is nowadays far more appreciated in ASEAN. We see that other projects easily involve two to three long-term international experts where this project proposes one Coordinating Technical Advisor. By more substantially involving national partners (five countries) we achieve significant cost savings while aiming for high impacts.

We are working on developing further collaboration with other potential donors (introduced above), where the rationale is that this project can act as a core project, with affiliated supporting initiatives. If this leverage is successful, the effectiveness of the allocated Adaptation Fund support would be substantially enlarged.

E. Consistency with national or sub-national sustainable development strategies

Economic growth and food security have been important objectives of the governments of Vietnam, Lao PDR, Cambodia, Thailand and Myanmar. Over the last decade water resources management policies also have evolved in the countries towards more integrated management and in awareness of making use of finite resources in support of achieving the MDGs, and more recently the SDGs. In Vietnam, for instance, this has resulted in the adoption of a new Law on Water Resources (2009), recognition of IWRM principles and the setting up of River Basin Management approaches for the integrated management of surface and groundwater resources.

In Lao PDR donor support (ADB, DFAT/AusAid) and international cooperation (GIZ, IWMI) have supported development of IWRM based policies and capacity at policy and operational level (National IWRM Support Programme, ADB, DFAT/AusAid and associated programmes). Although these policies and operational practices are far from mature, there is growing awareness, understanding and political ambition to strengthen natural resources management including groundwater in support of societal needs and in recognition of vulnerabilities of low income groups like small farmers. There is also a firm understanding that the impacts of climate change are not to be underestimated. In the Lao PDR the **National Adaptation Programme of Action to Climate Change (2009)** includes two main action points on groundwater. These are well aligned with this proposal.

For **Thailand**, the project will closely align its initiatives with the Ministry of Natural Resources and Environment and the Office of Climate Change Coordination, Office of National Resources and Environmental Policy and Planning (ONEP) as the focal point for the **Thailand Strategic Plan on Climate Change**. For the specific interventions it will coordinate with the sectoral agencies mandated to address CCA. The AF project is anticipated to contribute to the strategic objectives shown in Table 6.

Table 6: Thailand's Strategic Plan on Climate Change main strategies and anticipated AF project impact.

	Plan Strategy	**This AF project's impact**
1	Build capacity to adapt and reduce vulnerabilities to climate change impacts	Focus on pilot areas to build capacity for stakeholders and institutional partners
2	Promote greenhouse gas mitigation activities based on sustainable development	Developing sustainable use of natural resources
3	Support research and development to better understand climate change, its impacts and adaptation and mitigation options	Resource assessments, study and inventories of transboundary groundwater systems, assessing potential for resilience measures
4	Raise awareness and promote public participation	Focus on pilot areas and preparation of targeted information products
5	Build capacity of relevant personnel and institutions and establish a framework of coordination and integration	Build capacity for institutional partners, stimulate intra-institutional cooperation (interaction MONRE – Agriculture)
6	Support international cooperation to achieve the common goal of climate change mitigation and sustainable development	Regional cooperation, information sharing, intra-regional capacity building

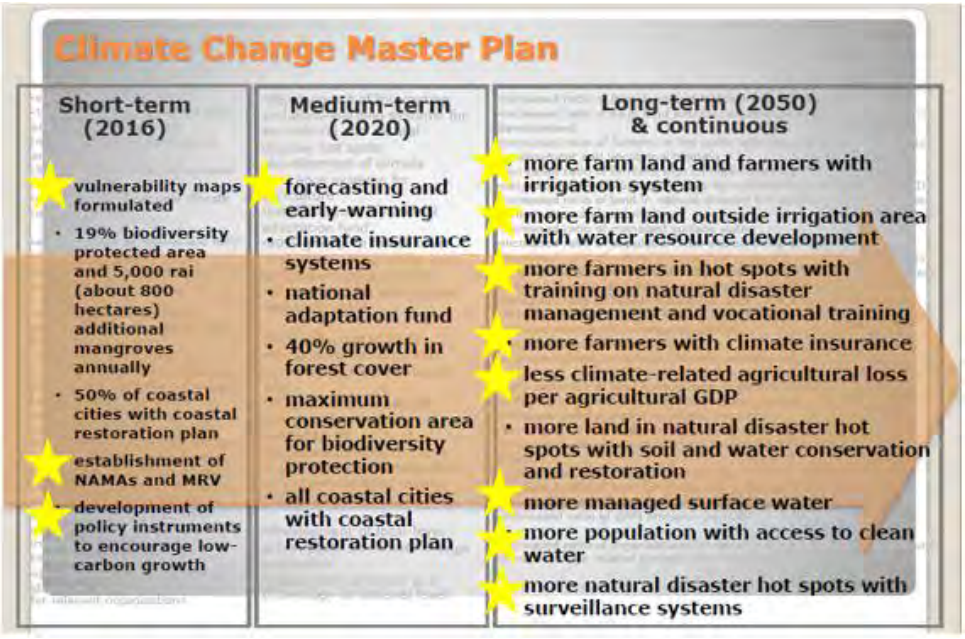


*Figure 16: Alignment of the AF project to **Thailand's Short. Medium and Long-term objectives of the Climate Change Master Plan**. The yellow stars mark the partial objectives on which the AF project will have an impact.*

For Vietnam we also refer to the national CCA agenda under its main proponent, MONRE, viz. **National Strategy on Climate Change**, period 2011-2020, (issued by Prime Minister Nguyen Tan Dung, 139/QĐ-TTg, December, 2011), http://www.chinhphu.vn/portal/page/portal/English/strategies/strategiesdetails?categoryId=30&articleId=10051283

Its main policy objectives include prioritization of integrated water resources management to meet water needs on river basin level. Furthermore, the project closely aligns with strategic national development objectives as also supported by Vietnam's international development partners like ADB and the World Bank and for instance documented in ADB's **Environment and Climate Change Assessment for Vietnam (2013)** http://www.adb.org/sites/default/files/institutional-document/33916/files/viet-nam-environment-climate-change.pdf

Further alignment with Vietnam's national policies and sectoral needs is documented in recent documentation on ADB's work in Vietnam.


PROJECT RESULT / CASE STUDY

July 2016

Project Strengthening Water Management and Irrigation Systems Rehabilitation Project

In Viet Nam, Some Farmers are No Longer at the Mercy of the Monsoons

New laws, policies, training centers—and plenty of infrastructure upgrades like water pumps and irrigations systems—are helping Vietnamese farmers deal with the challenges of weather, geography, and climate change.

Viet Nam is helping farmers respond to climate change to protect their harvests and their livelihoods.

Figure 17; In Vietnam, ADB support work by water resources management experts (central government, local agencies) to work with farmers in the country-side to address water management issues and apply IWRM principles to respond to the effects of climate change and develop measures to sustain farmers' livelihoods.

In Cambodia the Cambodia Climate Change Strategic Plan (CCCSP)[15], 2014-2023 (2013) has laid the foundation for integration of climate change and climate resilience issues into national and sub-national level planning. The development of climate change strategies, action plans and financing frameworks are among the priority actions undertaken as defined in the National Strategic Development Plan Update (NSDP) 2009 – 2013. The development of the CCCSP was a significant step towards embedding climate change in the NSDP 2014 – 2018 and in sector development plans of all relevant ministries. The CCCSP will guide national entities and assist non-governmental organizations and development partners in developing concrete and appropriate measures and actions related to adaptation and greenhouse gas mitigation, which were the supportive pillars for the achievement of the Rectangular Strategy and Cambodia Millennium Development Goals.

This project, within its modest operational domain covering availability of water resources and sustainable use of strategic groundwater potential, will support these initiatives. Furthermore, it will connect directly to most of the eight strategic objectives of the CCCSP, as summarized in Table 7. The implementation schedule of this project will generate results that will directly feed into the medium-term implementation of the CCCSP, and further support its long-term (2021-2050) ambitions, in particular contributing to the following stated response measures:

- Poverty alleviation; as more than 80% of the population depends largely on subsistence agriculture, floods and droughts could push large numbers of people below the poverty line;
- Management of water and fisheries is the lifeline of the Cambodian people. Changes in hydrology as a result of climate change may have adverse effects on water resources and fisheries;
- Expansion of capacity for provision of water and sanitation, particularly to rural areas.

*Table 7: Eight strategic objectives of **Cambodia Climate Change Strategic Plan**, 2014 – 2023 and alignment with this proposal.*

Eight strategic objectives of Cambodia Climate Change Strategic Plan, 2014 – 2023		**Connection with this AF proposal (+ = weak, +++ = strong**	**Potential Impact of this proposal to the strategic objective**
1	Promote climate resilience through improving food, water and energy security;	++	+++ : food, water security
2	Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts	+	+ : working with low-income groups, water supply for domestic use
3	Ensure climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites;	++	++: sustainable management of groundwater in the pilot areas
4	Promote low-carbon planning and technologies to support sustainable development;	-	-
5	Improve capacities, knowledge and awareness for climate change responses;	++	+++: strong knowledge and capacity building impact, awareness and climate resilience measures
6	Promote adaptive social protection and participatory approaches in reducing loss and damage due to climate change;	+++	+++: working in 2 pilot areas, participatory approaches and climate resilience measures
7	Strengthen institutions and coordination frameworks for national climate change responses; and	+++	+++: Transfer of pilot area and regional experiences to institutions and coordinated efforts
8	Strengthen collaboration and active participation in regional and global climate change processes.	+++	+++: transboundary collaboration and dissemination of results, international TA support.

For Myanmar, the project connects to the five thematic areas from the **National Adaptation Programme of Action (NAPA;** https://unfccc.int/resource/docs/napa/mmr01.pdf **),** namely (1) agriculture and forestry, (2) biodiversity, (3) water resources, (4) energy, transport and industry and (5) public health. Specifically, our project will support the

[15] http://www.cambodiaip.gov.kh/DocResources/ab9455cf-9eea-4adc-ae93-95d149c6d78c_007729c5-60a9-47f0-83ac-7f70420b9a34-en.pdf

stated need to *"climate-proof rural water management, safeguard agricultural output from flooding and drought, combat erosion, and rehabilitate degraded lands".*

In addition, the project is aligned with the National Sustainable Development Strategy (NSDS) (NCEA, 2009) which aims to achieve sustainable management of natural resources, integrated economic development, and sustainable social development. The NSDS proposes a number of actions that would improve the resilience of people vulnerable to climate change including increasing water availability by harnessing seasonal water flows and improving storage capacity and improved water application techniques at the farm level. In our project we will specifically develop the potential to use groundwater and develop underground storage to provide for dry season water needs. Our approach to develop a more water-user oriented groundwater management practice is also in line with Myanmar's National Action Plan (NAP) under the UN Convention to Combat Desertification (UNCCD) that states the ambitions to develop more sustainable environmental management "with full participation of the local people in order to achieve indirect benefit for their present and future generations", "increase seasonal income" and "transfer the technologies to the farmers". Specifically, it will help Myanmar to:

- Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;
- Reduce the proportion of the population without sustainable access to safe drinking water and basic sanitation.

Institutionalization

Our strategy focuses on strengthening the capabilities and potential within the extended groundwater community to support CCA. The focus of the initiative will be on the national agencies and their networks (associated government entities and other ministries, the national policy level), and towards local managers and groundwater users in different sectors (local to provincial; farmers and industry, water users). We aim for important institutionalization gains at 1) the higher policy levels ("Improved groundwater management is an important climate resilience tool)" and 2) at grassroots, end-user level, capabilities are embedded to use groundwater as a resilience enhancing strategy.

F. Compliance with relevant standards and with ESP of Adaptation Fund

In this first part of this section, relevant national standards are discussed and it is explained how the project will meet and abide by these standards and regulations. The second part explains how the proposed project will comply with environmental and social principles as provided in the AF Environmental and Social Policy. Screening of the project and proposed interventions leads to a categorization of the project as "B"; It is discussed how this categorization is reached. Further elaboration on project impact and risk management (as part of the ESMP) is provided in Part III, Sections 2 and 3.

F-1. Compliance with technical standards at country and regional level

The implementation of the project at country and regional level relies on approval from and falls under the responsibility of the respective line ministries (and, where relevant, international agreements) related to climate change adaptation, natural resources management (including groundwater) and rural development. Project activities have been assessed by the national partners to ensure compliance with the relevant sectoral policies and national technical standards; this is further elaborated below. The remainder of this subsection (F-1) details the national technical standards in each of the five GMS countries. The compliance assessment presented here is based on a extensive consultations with experts, stakeholders and relevant government officials from the region, in combination with the expert judgement of the IE, EE and technical partners (see section I for further details).

Sectoral (water, groundwater) policies and technical standards

The project deals with natural resources management policy issues specifically relating to groundwater and will comply with all relevant groundwater management guidelines and technical standards established by and applicable in the participating countries. Within each country, the relevant ministries will rely on their line- and technical agencies. The institutional and regulatory frameworks in the five participating countries are quite heterogeneous, representing a broad range in terms of regulatory development, complexity and degree of enforcement. In Thailand and Vietnam, groundwater policy and management regulations are quite well developed. In Lao PDR, Cambodia and Myanmar a detailed regulatory framework for groundwater is virtually absent. The project makes a contribution towards the further development and improvement of these regulations while at the same time aims to ensure that the associated climate change adaptation regulatory context and resilience development is strengthened. Preparing for this project, the following has been focused on and considered:

- General ownership laws on water and underground resources (where groundwater is sometimes classified as a "mineral resource")
- Restrictions on groundwater extraction and depletion (such as for construction of drilled wells).
- Guidelines and/or restrictions on groundwater recharge (relating to quality and pollution controls).
- Regulations concerning water quality protection and pollution control (such as the application of pesticides and fertilizers that may pose a serious threat to groundwater quality).
- IWRM guidelines applied in river basins, as well as guidelines concerning the relationship between surface- and groundwater (relating to issues such as natural recharge, base flow, springs, etc.).

For the five countries, the following policy, legal and regulatory documents are of particular relevance to the project [16] (See Table 8 for further detail):

- **Thailand:** IWRM Policy and Plan [17], 9th National (Water) Plan; Groundwater Act (1977) [18] and amendments, Groundwater Fund; Institutional Adjustments
- **Vietnam:** General Law on Water Resources (2012, Order No. 17/2012/QH13, additional regulations like Decree No. 179/1999/ND-CP (1999) and several supporting decrees and regulations. A more comprehensive overview of relevant legal and regulatory issues is provided in Nguyen (2012)[19].The

[16] This is not intended as a comprehensive overview, only the most relevant laws/regulations are mentioned here.

[17] Thailand Environment Monitor, Integrated Water Resources Management : A Way Forward (June 2011) http://documents.worldbank.org/curated/en/367151468303847751/pdf/633680ESW0P1080RM00June020110Final0.pdf

[18] Thailand Groundwater Act (1977): http://www.krisdika.go.th/wps/wcm/connect/93a892004e2b8774998bfb798fdc4669/Groundwater+Act%2C+B.E.2520+%281977%29.pdf?MOD=AJPERES&CACHEID=93a892004e2b8774998bfb798fdc4669

[19] Nguyen, T. (2012). Legal framework of the water sector in Vietnam: achievements and challenges. *Journal Of Vietnamese Environment*, *2*(1), pp. 27-44. http://dx.doi.org/10.13141/jve.vol2.no1.pp 27-44

water regulatory framework in Vietnam is quite extensive, including for groundwater. However, the degree of enforcement is variable.

- **Cambodia:** Law on Water Resources Management, 2007; Law on Environmental protection and Natural Resources Management (1996); Sub-decree #27 on water Pollution Control (1999); Overall and in practice, there are only few regulations concerning groundwater use and management.
- **Myanmar:** Laws and regulations related to the development, management and use of groundwater resources, in particular:
  - The 'Conservation of Water Resources and River Law, (2006)
  - Environmental Conservation Law (2012), pertaining to water quality standards
  - Environmental Impacts Assessment (EIA) Procedure (2015)

  Responsibility for groundwater in Myanmar straddles two government ministries. For day-to-day operational guidelines the Ministry of Agriculture addresses groundwater-related issues (in particular the use of groundwater for irrigation); while general regulatory issues for groundwater fall under the Ministry of Natural Resources and Environment, as do issues relating to climate change adaptation. Additional, more contemporary legislation is being developed, as discussed in an April 2018 news article on the preparations of laws concerning groundwater management[20].
- **Lao PDR:** Water and Water Resources Law (1996, 2017) and Environmental Protection Laws (1999, 2015); these recently adopted documents contain only limited references to groundwater (protection). More recently, a National Water Resources Strategy and Action Plan (2015) and a National Groundwater Action Plan have been formulated. Both regulations remain under development and are pending approval; In terms of active application and enforcement of relevant regulations for groundwater, progress in Lao PDR has been limited to date.

Taking note of the particular context in each country, the project aims to further strengthen the practical implementation of groundwater-related regulatory and governance legislation and guidelines by offering training and building capacity among key line ministry officials and staff of agencies.

During project implementation, compliance with existing and relevant guidelines and standards will be ensured through the full engagement of national partner agencies. To ensure there will be no conflicts of interest, a verification and review of the compliance assessment will be conducted by the technical implementing partners (IWMI and IGRAC, as well as key international agencies such as MRC). The project will in this way ensure that national partner agency compliance is verified, reviewed and assured through the expertise contributed by the partnering technical institutions. Furthermore, where clear local/national regulations and standards are missing, the project will support their introduction and application. It must be stressed however, that the application of the label "technical standards" for many of the existing regulations and guidelines is not entirely accurate. Technical guidelines exist in all five participating countries, but these are fairly general in nature, often not quantitatively defined, and their implementation in some cases weak or non-existent. The project will make a targeted contribution towards addressing this gap.

By virtue of 1) its regional approach, and 2) its focus on sustainable and responsible groundwater management, this project will strengthen and widen the availability, awareness and application of such technical standards and guidelines. Based on the initial assessment of the regional institutional context and consultations with the relevant actors and stakeholders (see the overview provided in Section II. H), no compliance issues with currently active laws, standards and regulations issues are anticipated.

Table 8 below gives an overview of the relevant country ministries and technical agencies and departments from which relevant standards and guidelines apply to the project. For groundwater-related capacity building and training, the project will work with the regional hubs for education and training i.e. the leading national institutions as summarized below. The project's capacity building, training and knowledge transfer activities will be reviewed and endorsed by these institutions.

[20] https://www.mmtimes.com/news/law-drafted-save-underground-water.html

	Countries: Ministries (Policy level)	Country Agencies / Departments (Technical)	Educational / Capacity building
	Cambodia Water Resources and Meteorology; Environment; Mines and Energy; Agriculture, Forestry and Fisheries; Rural Development	**Cambodia** Department of Geology; Climate Change Department; Department of Environmental Impact Assessment	**Cambodia** Royal University of Phnom Penh; Institute of Technology of Cambodia
	Lao PDR Natural Resources and Environment; Energy and Mines	**Lao PDR** Division for groundwater Management (DGM); Natural Resources and Environment Institute (NREI)	**Lao PDR** National University of Laos, Faculty of Water Resources
	Myanmar Agriculture and Irrigation Water Resources; Public Works; Natural Resources Environmental Conservation	**Myanmar** Water Resources Utilization Department	**Myanmar** Yangon Technical University
	Thailand Natural Resources and Environment	**Thailand** Department of groundwater Resources (DGR); Groundwater Research Centre	**Thailand** Groundwater Research Centre, Khon Kaen University
	Vietnam Natural Resources and Environment; Agriculture and Rural Development	**Vietnam** National Center for Water Resources Planning and Investigation (NAWAPI), DWRPIS (Ho Chi Minh City)	**Vietnam** Hanoi University Water Resources; Vietnam National University - HCMC

Table 8: Overview of the participating country ministries and technical agencies and departments from which relevant standards and guidelines will be used, and with which cooperation will ensure compliance with the relevant laws and regulations.

Environment Impact Assessment (EIA) Standards: The five participating countries have established EIA practices and apply national EIA standards (Table 9). The EIA frameworks adopted by the participating countries employ a similar assessment approach involving screening, scoping, impact assessment, approval and post-decision implementation. Implementation of EIAs in the GMS countries is mandated under the relevant ministry (e.g. Ministry of Environment in Cambodia) in coordination with other relevant ministries (e.g. agriculture, natural resources, health, etc.).

The proposed project will be implemented in close partnership with relevant national authorities; accordingly, vulnerability reduction measures in the proposed project will be designed to be consistent with national EIA standards (principles of precaution and prevention, public participation in preparation and monitoring stages, conservation of biodiversity, effective compliance, etc.). Beyond the EIA, the proposed project will also give strong emphasis to potential social issues such as gender and equality. This will ensure that social and environmental safeguards are fully in place. If - despite this approach - issues arise, measures from the ESMP can be applied, and a grievance mechanism can be activated (see proposal Part III, Section 3).

Countries	Environmental legislation & EIA guidelines
Cambodia	Law on Environmental Protection and Natural Resources (1996); Sub-decree on EIA Process (1999); Prokas on EIA General Guideline (2009)
Lao PDR	Environmental Protection Law (No. 29/NA 2012); Environmental Impact Assessment Guidelines (2012, MONRE)
Myanmar	Environmental conservation Law (No. 50, 2014); Environmental Impact Assessment Procedure (No. 616, 2015)
Thailand	Enhancement and Conservation of National Environmental and Quality Act (1992); Environmental Impact Assessment in Thailand (2013)
Vietnam	Law on Environmental Protection (No 55/QH13, 2014);

Table 9: EIA laws and guidelines in the GMS countries.

Climate Change Adaptation: The main goals of the proposed project (increasing resilience of communities to climate change via capacity-building, improved management and groundwater vulnerability reduction measures) are in line with climate change policies and the national climate change adaptation strategies in each country, as follows:

- *Cambodia Climate Change Strategic Plan* 2014-2023:
- *Promote climate resilience through water security*; National Adaptation Programme of Action of Lao PDR: *Strengthening human resources capacity related to water resources management*;
- Myanmar's National Adaptation Programme of Action: *Reduce climate change vulnerability in rural area*
- Thailand Climate Change Master Plan: *Water, flood and drought management*;
- Vietnam National Climate Change Strategy 2011-2020: *Water resource security*.

Furthermore, the principal activities of the proposed project (such as improved TBA inventory and formulation of sub-regional/international networks) are also strongly aligned with the national development strategies in the GMS. Several aspects hereof are included in the Strategy on Water Resources 2025 in Lao PDR (2015), Myanmar Water Resources Policy (2014), Master Plan for Groundwater Management in Thailand (2011).

Under these conditions, all project activities and outputs will fully comply with the prevailing policy, laws and technical standards at the country level, in terms of policy, legal and technical frameworks. The project will establish close partnerships with the relevant institutions within these frameworks and optimize national ownership of project implementation, outcomes and results. The project has been designed to ensure that ownership rests firmly within the five participating countries, while at the same time supporting and actively seeking validation against relevant regulations and standards. This may also imply the provision of assistance towards preparing and introducing - in an advisory capacity - new guidelines or technical standards, in countries or for specific technical subjects where these are not available.

It is important to note that strengthening compliance, support and general and specific interventions as outlined in this proposal towards enhanced groundwater resilience remain the overall aim of the project; the preparation and introduction of detailed and technically specified groundwater management regulations is not. However, contributions towards the elaboration of such guidelines will be undertaken where sustainable and comprehensive groundwater management has proven its worth as a climate resilience strengthening option. Hence, emphasis is placed on collaborating with national partner agencies, transferring expertise and strengthening capacity, including the development of relevant and applicable technical standards. The project will in particular facilitate the sharing and dissemination of successful examples among the participating countries, organizations and communities.

At the technical level, project activities and outputs will as a minimum meet the technical standards prevailing in water and natural resources management in the participating countries. This is achieved by ensuring that the design, implementation and monitoring of project activities involves technical groundwater agencies from the five participating countries and/or their local/provincial representatives in the four proposed pilot areas. The project will also make full use of guidelines and other documents produced by partners and projects working in the participating countries. For example, UN-Habitat has developed a Manual on Drought Prevention in Myanmar[21] in consultation with experts from government ministries, UN agencies, INGOs and NGOs. This Manual - which has particular relevance for the Myanmar Dry Zone pilot - will be consulted as relevant in the other pilot areas as well.

In terms of the project's engagement with legislative frameworks in the participating countries, meeting the prevailing groundwater and natural resources management standards and regulations is not expected to represent a highly significant challenge. As discussed above, in Lao PDR, Myanmar and Cambodia these regulations are fairly general and in some respects poorly or not at all defined. Rather, the greater challenge will be to develop new and innovative practices and interventions that - once proven useful - may be the subject of new or revised and improved regulatory guidelines and standards (that also meet and include climate change adaptation concepts) formulated and adopted by higher policy levels. This will be done in close collaboration with the project's stakeholders and national participating agencies (Table 9).

Also in this regard, the regional cooperation aspect of the project will serve as a source of guidance. In Thailand and Vietnam, regulations are more developed and application has penetrated further. Hence, the project's regional

[21] See: http://www.fukuoka.unhabitat.org/programmes/ccci/pdf/ASSESSING_CLIMATE_RISK_IN_MYANMAR_Summary.pdf

scope adds value by mobilizing and making use of expertise from the more advanced groundwater management and extension centres in the region to ensure that relevant standards and guidelines are shared and applied in a similar way across the region. Both UNESCO and CCOP-TS can make us of a rich and diversified experience in other countries from which best-practices and relevant track record can be obtained.

Summary of March 2019 survey and workshop feedback
Assessment of and compliance with national standards, guidelines and ESP Principles

In March 2019, representatives of the Adaptation Fund Designated Authority in each participating country took part in a consultative workshop to review and respond to the comments made as a result of the Adaptation Fund review of the proposal document. In addition to the workshop itself, representatives of the five countries were requested to provide feedback through a questionnaire circulated in advance. The questionnaire introduced and requested input relating to the following issues:

1. A further assessment on the risk of causing detrimental effects, for instance in relation to any of the 15 environmental and social principles.
2. How to ensure a gender balanced or gender positive approach and outcomes; possible additional measures.
3. Will proposed activities in the indicated pilot area require an Environmental Impact Assessment (according to government's regulations)?
4. Consultations with stakeholders in the pilot regions, additional stakeholder groups (e.g. farmer groups, local water managers) that should be consulted?
5. The most urgent adaptation challenges and vulnerabilities
6. Project management and implementation set-up and capabilities; (is it adequate to monitor for, identify and mitigate possible negative effects of this project)?

Below, a concise summary of the questionnaire responses is presented, with particular emphasis on new and complementary information.

Questionnaire responses (a selection)

1. **Myanmar:** our assessment is that this project will not cause detrimental effects
   Cambodia: The proposed activities do not cause detrimental effects to any of the Adaptation Fund environmental and social principles.
   Vietnam: The proposal does not violate any of the proposed principles, but mainly brings practical benefits to participating countries. The first is for the lives of people living and directly affected around the Mekong River basin. Then, it is necessary for the countries to participate in improving the capacity of managing groundwater issues, ensuring the security of groundwater sources which are increasingly polluted and exhausted.

2. **Myanmar:** Institutional strengthening on the issue of gender balance
   Cambodia: we suggest mainstreaming the importance of groundwater resources and its conservation and protection in women and community educational programmes.
   Vietnam: The proposal addresses the enhancement of interactions and allows women to benefit from the proposal that is entirely consistent with the social policies in Vietnam on gender equality.

3. **Cambodia:** for this project's activities no EIA is required in Cambodia.
   Myanmar: In Myanmar, groundwater laws and regulations are not designated yet, but project activities will require an environmental impact assessment in accordance with government's regulations.
   Vietnam: In the indicated pilot area of the project Environmental Impact Assessment is required in accordance with our government's regulations base on Law on Environmental Protection (No 55/QH13, 2014).

4. **Cambodia:** Consultation may be conducted with the line ministries related to the consumption and protection and conservation of water resources that include the Ministry of Environment, Ministry of Water Resources and Meteorology, Ministry of Agriculture, Forestry and Fisheries, Ministry of Rural Development, Ministry of Mines and Energy, and the Ministry of industry and Handicrafts. Consultation can also involved the local authorities such as provincial departments and communities in the pilot areas in each province.
   Myanmar: stakeholder groups have little knowledge of groundwater management, while they see it is a valuable resource; hold meetings with villagers and water user groups sharing awareness of groundwater in the pilot regions.
   Vietnam: several methods are proposed for stakeholder consultation: 1. Question - Answer; 2. Obtain consultations through the internet (website - consult; Social media, 3. By documents and official letters are sent to grassroots levels for consultation.

5. **Vietnam:** The most urgent challenges and vulnerabilities in our country's pilot area are: 1. Uneven population distribution, low awareness of water resources protection, indiscriminate exploitation of underground water. mainly

depends on demand, not interested in potential; 2. The network of water resources monitoring and supervision is not fully synchronized to fully assess the quality and quantity; The current situation of exploitation and use is still inadequate.
Cambodia: A regular monitoring program should be established and groundwater information should be available to local groups; Important issues are: Access to and uncontrolled use of groundwater and tube well installation, over-pumping; resources assessment: Quantity and quality of groundwater: How much groundwater is available?; location of suitable recharge zones, protection and conservation of recharge zones.
Myanmar: Groundwater laws and regulations; in Myanmar groundwater laws and regulations are not designated yet; need a strong groundwater data exchange programme among institutions.

6. **Vietnam:** The project management and implementation set-up can deliver the expertise and capability to monitor for, identify and mitigate possible negative effects of this project.
Cambodia: The management and implementation setup is very appropriate for this project; All expertise and capability are included.
Myanmar: There is no missing expertise

Consultation workshop on the AF reviewer's comments and improvements to the project scope, risk assessment and environmental and social compliance issues. Hanoi, March 20-21-22, 2019, Vietnam; With representatives of Myanmar, Thailand, Lao PDR, Cambodia and Vietnam (from the groundwater and climate change adaptation sector), technical partners and external experts.

F-2. Compliance with the ESP of the Adaptation Fund

1. Accreditation

As accredited organization with the Adaptation Fund, UNESCO has undergone the required assessments to make sure that sound standards are adhered to and that effective social and environmental safeguards are applied to identify any project risks in advance, prevent any harm and improve the effectiveness and sustainability of results. Towards this commitment, UNESCO will, as IE for the project, rely on its environmental, social, ethical and gender principles, standards and policies – principles that are essential not only for the present project, but for UNESCO's entire body of work.

In line with its Constitution, UNESCO works with its member states and civil society to strengthen the foundations for lasting peace, the eradication of poverty, sustainable development and intercultural dialogue. The ESP of UNESCO (see: https://unesdoc.unesco.org/ark:/48223/pf0000260723) states that UNESCO is committed "to further universal respect for justice, for the rule of law and for the human rights and fundamental freedoms, which are affirmed for the peoples of the world, without distinction of race, sex, culture, language, religion or sexual orientation." The projects/programmes implemented by UNESCO shall be designed to meet the environmental and social principles, including *Compliance with the Law, Marginalized and Vulnerable Groups, Human Rights, Gender Equality an Women's Empowerment, Core Labour Right and Working Condition, Indigenous People, Protection of Natural Habitats, Conservation of Biological Diversity and Sustainable Management of Living, Natural Resources, Land and Soil Conservation, Land Acquisition and Involuntary Resettlement, Climate Change, Pollution Prevention and Resource Efficiency, Public Health, Safety and Security, Pest Management and Physical and Cultural Heritage*[22].

Consequently, UNESCO is firmly committed to abide by the internationally set environmental and social policies and standards of the AF, ensuring that - in furthering the Fund's mission of addressing the adverse impacts of climate change - projects and programmes supported by the Fund do not result in unnecessary environmental and social harms.

2. Screening for potential negative Impacts and Risks

For the proposed project, UNESCO as IE and CCOP-TS as Executive Entity have carefully considered all ESP compliance issues. In collaboration with country partners, the initial project scope and technical activities have been screened for unwanted environmental and social effects. The initial preparatory screening analysis of the proposed project has been carried out through a) workshop consultations with regional experts, sectoral officials from the five countries and stakeholders, b) communication with officials and experts on groundwater management, c) gender

[22] Statement on UNESCO's Environmental and Social Policies (2016), http://en.unesco.org/sites/default/files/statement_on_unesco.pdf.

and water governance experts. Summarized below in Tables 10-11 are the results of the initial screening analysis, including an indication of where action will be taken and where further assessment is needed. Further details are also available in the summary of March 2019 survey and workshop feedback (p. 57).

Table 10 provides an overview of major potential risks, screening procedures and mitigation measures for project implementation in the four pilot areas. During the Inception Phase of the project, when more detailed workplans are developed and activities defined (i.e. exact locations, target groups, types of groundwater use), additional risk screening and (when required) mitigation measures, can be applied as part of the ESMP (see Part III, Section 3).

Potential Risk	Screening/ Monitoring	Mitigation/ruling out
Proposed groundwater resilience measures and approach is not recognized as a useful Climate Change Adaptation measure	Dialogues and communication from primary stakeholders to higher governance levels to signal issues.	When CCA interventions prove effective in the pilot areas, efforts will be made to ensure these are recognized and approved as formal guidelines. Good practices will be documented extensively and can be formalized as 'standards' or guidelines and form the basis for changes in regulatory framework. Worldwide, there are now many groundwater-based adaptation measures that have proven effectiveness and that can be introduced.
Project and anticipated overall improvement of groundwater management can lead to significant increase in extraction.	The course of the project can be adjusted when intermediate results point towards this risk (ESMP element progress evaluation and interactions with Steering Committee)	This is a genuine risk, but also the core ambition of the project. Possibly, GW extraction can increase, but with the additional water resources forming a buffer to mitigate effects of climate change (drought). Key is not to exceed the limits of sustainable use and to disseminate understanding that also groundwater is a limited resource.
Project introduces untested practices with detrimental effects	Careful screening of activities in Inception Phase and early phase of the implementation.	The project's international and regional expert pool has considerable experience in the region, and sustainable groundwater management is advanced in Thailand and Vietnam. In the project ESMP there are several safeguards to mitigate these potential effects
Resilience measures increase inequity in communities	Screening trough liaison with local farmers', women's and other community-based groundwater user groups	Local level implementation through farmer and other groundwater user groups will ensure that resilience measures are demonstrated on the basis of participative processes that are gender-sensitive and enable participation of vulnerable and marginalized groups.
Endangering of natural habitats	Screening of pilot areas for critical national habitats	Activities will not take place in critical national habitats.
Insufficient trust among aquifer sharing countries in pilot area	Screening/monitoring and trust-building via participatory activities of riparian/aquifer sharing countries	The project will follow a step-by-step approach, with trust-building and joint fact finding to gradually develop more complex and higher impact (positive) practices.
Bilateral stress and lack of consensus	Monitoring of feedback from stakeholders and partners in bilateral working groups, periodical project result evaluation	The project specifically aims to deliver positive transboundary impacts. Introduction of trust-building measures and demonstration of positive effects of interventions and project impacts. Partner organization IGRAC has accumulated significant international experience in transboundary issues.
Resilience measures increase gender inequity in communities	Screening trough liaison with local farmers', women's and other community-based groundwater user groups	By identifying women who are key users and beneficiaries of groundwater, the project prioritizes understanding of their access to, use and management of groundwater. Women and vulnerable groups will be identified in the inception phase and the gender component will be monitored throughout the project implementation phase.

		The training will also include a component on awareness raising among local stakeholders, with emphasis on women and marginalized communities engaged in or aspiring to be engaged in groundwater use for domestic supplies, crop production, issues related to groundwater use and protection, and means to access necessary technology, markets, and community-based monitoring and management.
Resilience measures affect water quality and energy efficiency	Implementation of applicable standards of energy efficiency use	The pilot projects will be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use and the production of waste, and the release of pollutants (not expected).
Loss of ecosystem services and biodiversity	Monitoring ecosystem services (supporting, regulation, provisional and cultural)	Relevant authorities at national and site level, supplemented by Environmental NGOs with a local presence will assess any significant potential changes to ecosystem services and biodiversity, and provide guidance on project design to ensure that these are effectively mitigated.
Focus on groundwater versus more integrated approach; too narrow ?	Project progress monitoring and evaluation with technical partners and regional Steering Committee; contact with MRC and independent external evaluators..	As argued in the introduction part of this proposal this approach is necessary to ensure groundwater is taken into account sufficiently and adequately, as part of an IWRM approach. In may countries this is not the case – groundwater issues are not considered for the bigger water picture.

Table 10: Overview of major potential risks, screening procedures and mitigation measures for the four pilot areas.

3. Screening of 15 Environmental and Social Principles

Development and dissemination of climate and groundwater information, sharing of knowledge and capacity building activities that are the core of the project will be carried out in a manner that respects the principles of compliance with the law, human rights[23] and gender equity, access and equality. The approach and activities will be sensitive to the needs of marginalized and vulnerable groups, and will be implemented according to the applicable risk mitigation measures in the pilot areas (see Table 10 above).

For example, by identifying women who are key users and beneficiaries of groundwater, the project prioritizes understanding of their access to, use and management of groundwater. The design of training activities will include awareness raising among local stakeholders with emphasis on women and marginalized communities engaged in or aspiring to be engaged in groundwater use for domestic supplies, crop production, issues related to groundwater use and protection, and means to access necessary technology, markets, and community-based monitoring and management.

The checklist provided in the Adaptation Fund guidelines for Environmental and Social Policies has been reviewed in detail with responses provided below.

[23] UNESCO's procedure for dealing with alleged violations of human rights (2016), UNESCO, Available at http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ERI/pdf/BrochureProcedure104_2016EN.pdf

	Checklist of environmental and social principles	Potential impacts and risks	Further assessment procedure and possible preventive and measures
1	Compliance with the Law; Projects/programmes supported by the Fund shall be in compliance with all applicable domestic and international law.	The project's intervention and impact addresses this principle. Compliance issues depend on the applied groundwater vulnerability reduction measures. Accordingly, an EIA at each pilot area will be carried out as a principal activity of the project, in compliance with national environmental laws.	Relevant national authorities were consulted during the proposal development process to ensure compliance with all relevant laws. Pre-project assessments indicate the proposed interventions meet EIA regulations and do not generate negative impacts. TBA management will operate within prevailing laws and regulations in the participating countries as well as any applicable international laws. In case of potential conflicts or unclear laws and regulations, the project will recommend clarifications and consensus seeking measures. Training on applicable laws and regulations will be provided to project partners in the participating countries to facilitate and ensure compliance.
2	Access and Equity; Projects/programmes supported by the Fund shall provide fair and equitable access to benefits in a manner that is inclusive and does not impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights. Projects/ programmes should not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups.	The project's intervention and impact directly addresses this principle in a positive sense.	Access to low-cost and stable water supply for primary livelihood and WASH purposes will be supported for all with priority given to vulnerable and low-income groups. Planned activities will be scrutinized in semi-annual workplans and closely monitored. In order to prevent exacerbation of existing inequalities, the project will analyse existing inequalities and identify vulnerabilities and potential risks during the Inception Phase. During implementation, project impact on vulnerable and marginalized groups will be closely monitored and reported.
3	Marginalized and Vulnerable Groups: Projects/programmes supported by the Fund shall avoid imposing any disproportionate adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, tribal groups, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS. In screening any proposed project/ programme, the implementing entities shall assess and consider particular impacts on marginalized and vulnerable groups.	The project's intervention and impact indirectly addresses this principle.	A needs assessment will be carried out to identify the most vulnerable communities within the pilot areas. Vulnerable groups will be supported in their access to low-cost and stable water supply. Project documentation will be provided and community awareness meetings will be held to ensure consultation and compliance. For social risk assessment for vulnerable groups, see the additional comment under 2: Access and Equity Principle.

4	Human Rights: Projects/programmes supported by the Fund shall respect and where applicable promote international human rights.	The project's intervention and impact addresses this principle.	The fundamental human right to water as a source for basic livelihood will be strengthened. Although adverse impacts are not expected, this aspect will be closely monitored to ensure that a human rights-based approach is followed throughout project implementation.
5	Gender Equity and Women's Empowerment: Projects/programmes supported by the Fund shall be designed and implemented in such a way that both women and men (a) have equal opportunities to participate as per the Fund gender policy; (b) receive comparable social and economic benefits; (c) receive comparable social and economic benefits; and (b) do not suffer disproportionate adverse effects during the development process.	The project's intervention and impact addresses this principle.	During the project design phase, workshop discussions (see Section F-1 above) focused on gender and the role of women in relation to the possible project interventions. The project will pursue and support gender equity and women's involvement in all activities through its core approach to direct stakeholder involvement in resource management. This aspect will be closely monitored for positive impacts and will be considered and comprehensively reported as one of the outcomes of the project. In order to prevent possible exacerbation of existing gender inequalities, the project will further assess potentially critical gender-related issues during the Inception Phase and will monitor these closely during project implementation.
6	Core Labour Rights; Projects/programmes supported by the Fund shall meet the core labour standards as identified by the International Labour Organization.	The project's intervention and impact indirectly addresses this principle.	Project implementation will to some extent rely on collaboration with local staff and workers. ILO labour standards will be respected, and adherence to prevailing national labour rules and standards.
7	Indigenous Peoples: The Fund shall not support projects/programmes that are inconsistent with the rights and responsibilities set forth in the UN Declaration on the Rights of Indigenous Peoples and other applicable international instruments relating to indigenous people.	The project's intervention and impact indirectly addresses this principle.	The GMS region is home to a number of indigenous peoples. During the consultation workshops, it was confirmed that project intervention measures have been designed so as to guard against any effect on rights, property, and settlement, natural and cultural heritages of indigenous peoples. UNESCO's policy on engaging with indigenous people [24] will be consulted and applied in all relevant contexts. The project will in addition build awareness on indigenous peoples' rights as applicable to this initiative, and document mutually accepted outcomes.

[24] UNESCO policy on engaging with indigenous people (2017), UNESCO, Available at http://unesdoc.unesco.org/images/0024/002477/247738e.pdf or https://en.unesco.org/indigenous-peoples/policy

8	Involuntary Resettlement; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids or minimizes the need for involuntary resettlement. When limited involuntary resettlement is unavoidable, due process should be observed so that displaced persons shall be informed of their rights, consulted on their options, and offered technically, economically, and socially feasible resettlement	The project's intervention and impact does not address this principle.	The project neither requires, necessitates or encourages resettlement of any community or population. The project will ensure that any groundwater use and conservation related activities will not require, recommend or necessitate resettlement measures.
9	Protection of Natural Habitats: The Fund shall not support projects/programmes that would involve unjustified conversion or degradation of critical natural habitats, including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognized as protected by traditional or indigenous local communities.	The project's intervention and impact indirectly addresses this principle through the identification and enhanced protection of natural habitat areas with the potential to serve as locations for groundwater storage and recharge. Conversion or degradation of natural habitats for commercial and/or agricultural purposes to non-sustainable crops will neither occur or be promoted or encouraged in the context of this project.	The project will prioritize conservation of natural habitats when these contribute to groundwater recharge processes and storage (ecosystem services). The project will encourage and promote the reinforcement of natural habitat safeguarding through the development of stronger linkages between natural habitats, water conservation, sustainable use and groundwater recharge. These aspects will be closely monitored during the project implementation.
10	Conservation of Biological Diversity: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species.	The project's intervention and impact indirectly addresses this principle in a similar way as Principle No. 9.	In accordance with the project's objectives, a contribution will be made towards the conservation of biodiversity (viz. by enhancing the protection of wetlands, forested recharge areas, land use planning supporting recharge, etc.). Interventions and proposals for future action developed in the context of project implementation will be examined for any possible adverse effects on biological diversity in the GMS region, and shall be designed to avoid any such detrimental effects. Where relevant, the project will engage UNESCO-designated sites within the pilot areas (notably the Tonle Sap Biosphere Reserve and Angkor World Heritage Area in Cambodia).
11	Climate Change: Projects/programmes supported by the Fund shall not result in any significant or unjustified increase in greenhouse gas emissions or other drivers of climate change.	The project's intervention and impact indirectly addresses this principle.	Project implementation will not result in any increase in greenhouse gas emissions or other drivers of climate change. Interventions and proposals for future action developed in the context of project implementation will be examined for any possible contributions towards climate change drivers, and shall be designed to avoid any such contributions. This aspect will be closely monitored, in compliance with national environmental laws (EIA) and national climate change strategies.

12	Pollution Prevention and Resource Efficiency; Projects/programmes supported by the Fund shall be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.	The project's intervention and impact indirectly addresses this principle.	Resource use and aquifer recharge measures will be developed in an energy-efficient manner and by taking utmost care for protecting existing resources from pollution. Interventions and proposals for future action developed in the context of project implementation will be reviewed and designed to ensure maximal energy efficiency, minimal resource use and waste/pollution release. This aspect will be closely monitored for compliance with national environmental laws (EIA).
13	Public Health: Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids potentially significant negative impacts on public health.	The project's intervention and impact indirectly addresses this principle.	Although adverse impacts are highly unlikely and not expected, this aspect will be monitored during project implementation in compliance with national environmental laws (EIA) and other relevant guidelines (e.g. drinking water standards, groundwater quality). UNESCO policy prescribes that projects do not use or promote use of any substances listed under the Stockholm Convention on Persistent Organic Pollutants, or any other substances known to pose a risk to the health of people, biodiversity or the environment. This principle will be strictly adhered to.
14	Physical and Cultural Heritage; Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids the alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Projects/ programmes should also not permanently interfere with existing access and use of such physical and cultural resources.	The project's intervention and impact addresses this principle, in particular in the context of the Angkor World Heritage site in Cambodia and associated cultural heritage sites in the area.	Groundwater management at the Angkor World Heritage site is extremely important in view of the high demand (tourism) and the detrimental effects of large extractions on the site (notably land subsidence/settlement issues), which have been linked to structural damage at the property. The project will dedicate specific attention to support the mitigation of these risks throughout consultation with governmental bodies and other relevant stakeholders. UNESCO, as the only UN agency with a mandate in the field of culture and with a long-term on-site field presence at the Angkor World Heritage site, will engage in inter-sectoral and multi-stakeholder collaboration to ensure prevention of damage to cultural heritage sites and the maximization of project benefits towards the sustainable management of cultural heritage in all participating countries. The project will in this context draw from UNESCO's unique expertise in managing disaster risk at cultural heritage sites.

15	Lands and Soil Conservation; Projects/programmes supported by the Fund shall be designed and implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services.	The project's intervention and impact directly addresses this principle.	The overall aim of the project is to support the conservation of soil and lands that provide valuable ecosystem services, such as groundwater recharge. Project implementation is not expected to have adverse impacts on the conservation of lands and soil. Interventions and proposals for future action developed in the context of project implementation will be reviewed and designed to ensure that soil and land degradation is avoided. Although adverse impacts are highly unlikely and not expected, this aspect will be monitored during project implementation in compliance with national environmental laws and other relevant guidelines.

Table 11: Checklist of project's potential impacts conform guidance document for Implementing Entities on compliance with the Adaptation Fund Environmental and Social Policy.

Based on a comprehensive screening, none of the proposed activities in the pilot areas will generate negative impacts or pose risks in Category A of the Adaptation Fund's impact classification. Project activities with potential (limited) adverse impact are small scale, mostly community-based and very localized. They will be co-managed by local communities where possible. Communities will have a stake in avoiding negative environmental and social impacts, which will contribute towards ensuring that the risk of any unintended negative impact is small and localized and can be rapidly mitigated in the context of project implementation. Given this, cascading or cumulative negative impacts are highly unlikely. Proposed activities requiring additional environmental or social screening represent a minor part of the project. Where and when applicable or needed, mitigation measures will be integrated into the project implementation stage, as part of the ESMP and progress monitoring process, as further detailed in Part III, Section 3.

Based on our assessment of the impact of and risks associated with the proposed interventions as outlined above, the project is classified as "B" in accordance with the Adaptation Funds impact classification.

G. Duplication of other initiatives or ongoing projects

The project is the result of an intensive regional consultation process, described under Section J (below) with participation of representatives from the five countries and international experts active in the region. The groundwater community is not too large, but the network includes experts with different affiliations (government organisations (different ministries, such as natural resources, agriculture, water, environment and climate change policy), R&D institutions, universities, etc.). In this setting there is a good oversight of comparable or related initiatives. There are national or more localized projects, targeting small and specific stakeholder groups, but to our knowledge there is no existing or planned regional and multifaceted programmes as described in this proposal and thus currently no potentially overlapping initiatives.

Earlier initiatives with a somewhat comparable focus included a launch workshop in 2011 by the Asia Pacific Water Forum (APWF) for a regional knowledge hub for groundwater management, with support of the Institute for Global Environmental Strategies (IGES, Japan), ADB, Department of Groundwater Resources (DGR), Thailand Asian Institute of Technology (AIT), and other knowledge hub partners (see: https://www.iges.or.jp/en/natural-resource/groundwater/index.html . The meeting had three main objectives:

- Discuss and explore ways to highlight and prioritize groundwater issues on main water agenda and identify feasible actions for sustainable development of resources;
- Clarify importance of groundwater in the time of global change to address food and water security and suggest ways to safeguard its strategic resource value from emerging challenges;
- Facilitate partnership with clients, partners and relevant organisation working in the field of groundwater and dig into opportunities to synergize efforts being taken in different corners of the region.

But this project lacked concrete interventions on the ground due to poor financial support and after the launch workshop there was no further follow-up.

A more successful example of a past initiative is TWAP https://apps.geodan.nl/igrac/ggis-viewer/viewer/twap/public/default . This is now being set up as an independent project and is financially supported, but has no explicit Mekong Region focus.

About TWAP

Recognizing the value of transboundary water systems and the fact that many of them continue to be degraded and managed in fragmented ways, the Global Environment Facility Transboundary Water Assessment Programme (GEF TWAP) was developed. The Programme aims to provide a baseline assessment that identifies and evaluates changes in these water systems caused by human activities and natural processes, and the consequences such have on dependent human populations. The project is the first truly global comparative assessment for transboundary aquifers, lakes, rivers and large marine ecosystems, as well as a thematic evaluation of the open ocean, through institutional partnerships that hope to seed future global assessments. The project results are envisioned to assist the GEF and other international organizations in setting priorities for supporting the conservation of transboundary water systems. More information on TWAP including final reports can be found on www.geftwap.org

The portal gives access to the map based results from the groundwater component of the Transboundary Waters Assessment Programme. The data shown in this portal have been made available by national experts from countries involved in the TWAP groundwater project. It also includes the results from scenario analyses using the global WaterGAP model (University of Frankfurt, Germany) and a study on groundwater systems of small island developing states, also called SIDS (Simon Frasier University, Canada). More information on TWAP groundwater, including reports on methodology and outcomes, can be found on https://isarm.org/twap/twap-groundwater

H. Learning and Knowledge Management

Learning and knowledge management is one of the key components of the project (under Component 5); capacity building, training and knowledge dissemination are firstly directed at the CoP of groundwater workers, who need to be better equipped with proper management tools and supported with relevant expertise, and secondly, at groundwater end-users and stakeholders who need to be more aware and supported with technologies and information to use groundwater to increase resilience. Hence, the learning and knowledge development and management outcomes for the project have been defined as:

"Internal capacity in the GMS to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups "

The proposed regional approach will ensure involvement and results for five countries and operational and resource efficiency. Activities to capture and disseminate lessons learned include:

- A series of training workshops with participants from the groundwater CoP from the five countries
- Dissemination of relevant expertise and skills to end-users in resilience pilots. In these practical, hands-on demonstrations we will exploit various learning tools, such as: news items in local media, public and school presentations, water management briefings with local community groups, awareness actions for private sector, short training workshops and courses on climate change. Information and supporting guidelines will be consolidated in policy briefs for national decision makers, best practice guidance materials and tools.
- Collaboration with the training institutes in the countries to adapt and improve formal training programmes and promote increased participation by women in the sector.
- International conference

A more detailed work plan for the proposed activities will be developed during the Inception Phase of the project.

The first challenge of the learning and knowledge management component of the project is to address a number of knowledge and information gaps; it is of critical importance that knowledge and learning development starts from the correct foundations and proper understanding. The following are important and basic resource management concepts that need to be addressed: (between brackets the project component/activity in which the issue will be addressed):

- Extent and/or characteristics of superficial and confined aquifer systems, including resource volumes in aquifers systems in the selected pilot areas, existing and/or potential water quality threats (Component 1).
- Current groundwater volumes being abstracted for various uses; future demand scenarios for irrigation, urban and rural water supply (Component 2)
- Relationships between recharge in highland areas and resource potential in lowland areas. This includes several important transboundary systems. Climate change and land use changes will affect these delicate balances in supply and demand (Component 1).
- Sustainability (in view of increasing abstraction) and vulnerability of riparian groundwater resources to climate change induced changes in precipitation and changes in river flow regimes, be they natural or anthropogenic (Component 1).
- To understand better the resource and resilience potentials and vulnerabilities of groundwater systems of the region, detailed hydrogeological and geophysical investigations are required. A crucial monitoring network is needed to monitor resource status and critical depletion, and for developing and using regional groundwater information systems and groundwater flow models. These regional (transboundary) groundwater models and information tools will help manage resources. It is therefore also needed to visualize (in maps) regional and transboundary groundwater (recharge and extraction) systems and enable assessment of groundwater recharge rates from flooding and rainfall under the current and future climate conditions. (Component 3).
- Determine groundwater resource potential in shallow and deep aquifer systems (for different users) and demonstrate how this potential can be developed to increase resilience. (Components 1, 2 and 3).

Learning, knowledge development and sharing of expertise are key elements of the program; the more advanced groups (Thailand, Vietnam) will contribute to this process by helping their less advanced colleagues in Lao PDR, Myanmar and Cambodia. In comparison with isolated single-country interventions this is much more cost effective. The bulk of the technical support work can be done by regional experts.

Capacity building to form a regional community of experts and address societal needs: Sustainability aspects are highly dependent on the human resources capacity dimensions. With a strong focus on human resources development a new generation of better skilled and equipped groundwater experts will engage with pertinent challenges of the coming decades. They can do this better in a concerted manner, with common tools and data. Sustainability is also enhanced by closely linking groundwater resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional CoP will be fostered, building upon efforts previously undertaken by the project partners. This CoP will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies. The opportunities for regional cooperation are being greatly strengthened in readiness for the establishment of the ASEAN Economic Community later this year.

Finally, the project will benefit for proposed project partners' (IWMI and IGRAC) dedication to knowledge development and sharing, such as IWMI's global GRIPP initiative. GRIPP would provide a useful vehicle for knowledge sharing at the regional and global levels.

GRIPP: Groundwater Solutions for Policy and Practice
GRIPP is a global level, multi-partner initiative of the IWMI working closely with IGRAC and a host of other partners. Its aims are to '*secure Groundwater resources for livelihoods, food security, climate resilience and economic growth while sustaining the resource for future generations*' by:

a) creating long-term partnerships
b) sharing lessons
c) scaling-up successes
d) filling knowledge gaps

Thus GRIPP brings in tested success stories, new technology, and innovative policy and institutional approaches for groundwater management in order to achieve the SDGs related to climate resilience, food security, and sustainable water management. As this global mandate conform closely with those of this regional project, it is anticipated that the inception phase of this project will enable close interactions and linkages to be developed to enable two-way feedback and learnings to better address these contemporary groundwater management challenges. For further information visit: http://gripp.iwmi.org/

I. Project consultation process

The consultation process for the preparation of the AF project proposal has been guided by UNESCO and CCOP-TS with external support of IWMI and IGRAC, in close contact with national partners in the five countries. Crucial element in this process has been the possibility to obtain first-hand information, experience and input from local stakeholders through earlier and ongoing work in the five countries. This proposal is largely the result of this ongoing presence in the region and the approach underwrites the long-term engagement with the subject and, increasingly, also the awareness on significant vulnerabilities. Although the engagement of CCOP-TS and UNESCO with the groundwater CoP has been successful in its own right, the need was felt to raise the stakes and bring the challenge of CCA and supporting resilience to the forefront. Hence, this is one of the objectives of this AF project. In these project preparation workshops (listed below) also discussions were dedicated to the challenge of how to interact with stakeholders in such a way that vulnerable groups and women are prioritised. Consensus was made by all participants that girls and women in unsafe/polluted environment of GMS suffer from lack of fresh water access, sanitation problems and increasing vulnerability to water-related disasters. Special emphasis should be placed on sustainable groundwater supply to the rural poor, women in the vulnerable working environment and girls in unsafe conditions through continuous consultation and close collaboration with local community/NGOs/governmental bodies. In the characterization of the four proposed pilot areas (Annexed) further supporting information is provided as to the role of potential beneficiaries, vulnerable groups and groundwater users.

A summary of relevant activities of the international consultation process is provided in the table below:

Consultation	Date/Place	Participants	Objective
Vietnam, Mekong Delta Participation in research workshop of Rise & Fall research on groundwater and land subsidence in Mekong Delta (https://www.uu.nl/en/futuredeltas/project-rise-and-fall	March 2015, Can Tho, Vietnam	National and regional experts, international researchers, representatives from regional government agencies Mekong Delta	Dissemination of approach for and results of groundwater studies and climate adaptation approach, data collection, discussion on groundwater management in the delta provinces.
Consultations with village authority and households on community managed water supply for domestic use and agriculture.	April-September 2015; Ekxang village, Phonhong District, Lao PDR	Households comprised of ethnic minority groups, household heads, village authorities	Discussions to establish how communities self-manage groundwater supplies to reduce vulnerability to extreme seasonal water scarcity.
CCOP-KIGAM-UNESCO-DGR workshop on Sustainable groundwater Management in Mekong River Basin	May 2015, Bangkok, Thailand.	KIGAM, CCOP-TS, DGR (Groundwater Agency) staff, international and national experts, representatives of regional stakeholder groups	Discussions on regional cooperation for groundwater management, effects of climate change; Status reports on groundwater management practices in the countries; Discussions on the project concept.
Multiple meetings and workshops on development of Lao PDR groundwater policy, management and capacity development	April-September 2015, Vientiane, Lao PDR	MONRE officials Lao PDR, national groundwater experts, provincial officials and community representatives	Discussions on development of Lao PDR National groundwater Action Plan, Climate Adaptation & resilience measures; Discussions on the project concept.
Meetings on regional cooperation groundwater management	September 2015, Bangkok and Khon Kaen, Thailand	CCOP-TS, DGR (groundwater Agency) staff, experts of AIT, Chulalongkorn University, groundwater Research Centre Khon Kaen University	Discussion on technical issues (groundwater monitoring, data collection capacity development and regional cooperation).
Village consultations under Myanmar Healthy Rivers Initiative (IWMI)	November 2015 – ongoing; Six villages in Myanmar	Villagers (farmers and fishermen) and community representatives (including women's groups), local government officials	Ongoing project on water use and access in rural villages, and community priorities and concerns (with specific consideration of issues of women and the poor); includes consideration of use of surface vs groundwater resources.
Regional workshop on groundwater management BGR-NAWAPI	January 2016, Can Tho, Mekong Delta, Vietnam	National groundwater experts, provincial officials and community representatives; farmers groups and village people	Sharing experiences and practices on groundwater management, climate adaptation and resilience, discussions on the project concept
UNESCO-IGRAC workshop groundwater Monitoring Workshop for South-East Asia;	March 2016, Bangkok Thailand.	National groundwater and hydro met experts, provincial officials and community representatives;	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation
CCOP-KIGAM training workshop on sustainable groundwater resource management with partner agencies from the Mekong region.	May 2016, Daejeon, Korea	National groundwater experts from Mekong region countries, provincial officials and national groundwater researchers in Mekong region	Discussions on groundwater status in each country and training on prediction and management of groundwater security.
CCOP-KIGAM-UNESCO-MME Workshop on "Climate Change and groundwater Resources in the Mekong River Basin".	June 2016, Sihanoukville, Cambodia	National groundwater experts, provincial officials and community representatives; community representatives	Proposal preparation of this proposal, with representatives of all partners from the region
Farmer Consultation on Community scale groundwater irrigation	August 2016 Phousan village, Phonhong District, Lao PDR	Women and men farmers, agricultural extension officers, district officials	Consultation with farmers and other stakeholder on the viability of community scale groundwater irrigation based in initial results of a pilot trial
ACIAR-MAF Policy Dialogue	October 2016 Vientiane, Lao PDR	Vice Minister, Department Heads, government officials, researchers	Policy-science discussions on the potential role of groundwater-for-irrigation for small for agriculture in Lao PDR
UNESCO-IGRAC workshop on Monitoring for Regional and Transboundary groundwater Management for Vietnam	October 2016 Hanoi, Vietnam	National groundwater experts, provincial officials and international groundwater specialists	Discussion on the technical project activities (monitoring, data collection and management), Capacity development and regional cooperation
IWMI – MOALI workshop on groundwater in Myanmar Dry Zone	November 2016, Napyitaw, Myanmar	National groundwater experts, Ministry officials, international groundwaterspecialists	Discussion on availability and access to hydrogeological data in Myanmar, and Ministry priorities for groundwater resource assessments.
Participation in workshop of SALINPROVE project on Mitigating groundwater SALINity impacts for	28 November – 2 December, 2016 Tra Vinh , Viet Nam	National and regional experts, international researchers representatives from provincial	Discuss the overall outcomes of the project, the activities and work plan for 2016/2017, the involvement of the

imPROVEd water and food security in coastal areas under socio-economic and climate change		government agencies Tra Vinh, Mekong Delta, Vietnam.	stakeholders, and the data requirements and acquisition strategy.
Participation in workshop of Project on Adaptation to groundwater vulnerability of Asian cities to climate change: developing capacity to bridge the science and policy interface.	Asian Institute of Technology (AIT), Thailand 13-14 December, 2016	National experts from Thailand, Vietnam, Pakistan, and Indonesia; international researchers from Asian Institute of Technology (AIT), Institute for Global Environmental Strategies (IGES)	Shared a draft of methodology of groundwater vulnerability assessment and adaptation options and its application; Presented the overall status of groundwater resources in their respective cities and then prioritize major issues; Prioritized the groundwater vulnerability issues and indicators using multi-criteria decision-making and identify suitable set of indicators for vulnerability assessment, and finally prioritized potential adaptation measures.
Consultations and meetings on the use of groundwater for water supply in Lao provinces	Late 2016 and ongoing, Lao PDR	ADB, Lao PDR national groundwater experts, officials Ministry Public Works, Dept. Water Supply, provincial officials and community representatives (water supply sector);	Sustainable and responsible use of groundwater, resilience measures, capacity development, monitoring and data collection
Consultations on the AF reviewer's comments and improvements to the project scope, risk assessment and environmental and social compliance issues.	Hanoi, March 20-21-22, 2019, Vietnam	Representatives of Myanmar, Thailand, Lao PDR, Cambodia and Vietnam (from the groundwater and climate change adaptation sector), technical partners and external experts	Collect information on the issues and discuss ESMP and other measures to ensure compliance with the Principles; review the general scope of the project and its activities and assess it meets national standards and objectives.

Table 12: Overview of consultations and technical workshops with stakeholders groups, groundwater community experts and government agencies on issues relevant for the scope of the project, regional embedding and alignment. Directly and indirectly, the results of these consultations have fed into this proposal.

UNESCO coordination and consensus building role builds on established experience in diverse programmes on environment and natural resources management, both in and beyond the region. UNESCO, through its diplomatic and official network, has access to, and is able to mobilise high-level political and institutional offices and support in the region. In this way, UNESCO was able to muster support for this proposal and this will be the way UNESCO will support during implementation. On the one hand disseminating information on the project status, objectives and progress, and on the other hand seeking for confirmed political support, assistance (if needed) and promoting acceptance and embedding of verified project results.

CCOP-TS executive support: The CCOP-TS approach is such that progressively regional collaboration takes place without much external technical assistance; CCOP-TS has nearly 60 years of experience with keeping regional cooperative networks alive in this way.

In preparation of the proposal, important support was also gathered in the following consultative meetings:

1. CCOP-KIGAM-UNESCO-DGR Workshop on Sustainable Groundwater Management in Mekong River Basin 19-20 May 2015, Bangkok, Thailand.

CCOP Technical Secretariat, in collaboration with the Korea Institute of Geoscience and Mineral Resources (KIGAM), the UNESCO Bangkok Office and the Department of Groundwater Resources (DGR) of Thailand, co-organized this workshop on 19-20 May 2015 in Bangkok, Thailand. This meeting is within the framework of the five-year CCOP-KIGAM Project "Solutions for Groundwater problems in the CCOP region" funded by KIGAM since 2013.

The meeting was attended by 26 participants (45 % female) from CCOP Member Countries, Cambodia, Republic of Korea, Lao PDR, Myanmar, Thailand, Vietnam, international resource persons and CCOP-TS staff.

It was recognized from the presentation of country reports that Cambodia, Lao PDR and Myanmar have limited information available on groundwater resources and lack any mechanisms to regularly monitor groundwater for

quality or quantity. On the other hand, Thailand and Viet Nam have adequate monitoring data at the national level. To address this dearth of information on groundwater and encourage collaboration in its management, a proposal was made during the workshop for the creation of a groundwater monitoring network and to provide technical support to countries in need of developing sustainable management plans for this resource.

Figure 18: Participants of the May 2015 workshop (not all shown in the picture)

2. UNESCO-IGRAC workshop, Bangkok, March 2016

UNESCO-IGRAC workshop Groundwater Monitoring Workshop for South-East Asia; On 15-16 March 2016, the workshop was held in Bangkok Thailand. The workshop was organised by UNESCO Bangkok Office, DGR and the IGRAC under the framework of the Global Groundwater Monitoring Network (GGMN) programme. In total 45 groundwater specialists from six countries (Cambodia, Iran, Malaysia, Myanmar, Thailand and Vietnam) attended the workshop.

Workshop objectives
The purpose of the workshop was to bring together national and international groundwater experts to review the state of groundwater monitoring in the region, to introduce the GGMN programme and its possible role in Southeast Asia. The workshop was also intended to build synergies and strengthen international water cooperation.

Results and Contributions
Presentations were given by country representatives to share experiences on the current state of groundwater monitoring, information management and future challenges. The GGMN was introduced followed by a live demonstration of the GGMN Portal. Participants explored the functionalities of the GGMN Portal to become familiar with the GGMN Programme and the GGMN Portal functionalities. There was an interactive session to identify the bottlenecks for proper groundwater monitoring and translate some of those into additional developments for the GGMN Programme.

Professor Yangxiao Zhou (IHE Delft Institute for Water Education) provided a presentation on groundwater monitoring in the Netherlands and the use and application of time series analysis for groundwater monitoring data. Afterwards, participants learned how to work with the time series analysis tool available in the GGMN Portal and how to create spatially interpolated groundwater maps using the GGMN Portal. Sangam Shrestha (Asian Institute of Technology) presented the recently published book: 'Groundwater Environment in Asian Cities: Concepts, Methods and Case Studies'. Dutch experts affiliated with IGRAC introduced the use of remotely sensed data for monitoring and the role of information technology and big data in groundwater research and management.

3. CCOP-KIGAM-UNESCO workshop Sihanoukville, Cambodia, June 2016

A workshop on *"Climate Change and Groundwater Resources in the Mekong River Basin"* was convened in preparation of this proposal, with representatives of all partners from the region (Sihanoukville, Cambodia, 1-4 June 2016.

CCOP-KIGAM-UNESCO-MME Workshop
"Climate Change and Groundwater Resources in the Mekong River Basin"

Date: 1-4 June 2016
Venue: Sihanoukville, Cambodia
Host: CCOP, KIGAM, UNESCO, and MME
Participants: Vietnam, Lao PDR, Cambodia, Thailand, Myanmar, China, Republic of Korea and international experts

Background
Groundwater is a valuable natural resource and one of the primary sources of water in Mekong River countries. Global climate change is expected to affect availability and sustainability of groundwater resources by altering hydrological cycles and groundwater recharge in the face of human activities (higher demand). Despite its importance, the impact of climate change on groundwater resources has received inadequate attention in Mekong River countries. The communication and collaboration between countries are required (1) to more urgently assess climate change effects on groundwater, and (2) to mitigate the impact of climate changes to the water resource supply in the Mekong River Basin.

Aims of the workshop
The objectives of this workshop were to promote sharing information and best practices among Mekong countries for assessing availability of groundwater resources under climate change and to support member countries to prepare for sustainable groundwater management. The key players of each country in the Mekong River Basin addressed major issues and status of groundwater management with changing environment. Strategies to enhance collaboration between neighbouring countries and to adapt to future climate change were discussed. The workshop provided opportunities to further understand the dynamic relationships between climate change and groundwater and to provide strategies for sustainable groundwater resource management in the lower Mekong River Basin.

In all, the sequence of regional meetings and workshops laid the foundation for the project concept and consensus on priorities and opportunities. The meetings were well attended by a regionally representative assemblage of groundwater experts, policy-makers and government officials responsible for natural resources management and CCA policies. The network has multiple important functions:

1. Share ideas and information on the status of groundwater resources management and alignment with national and regional government policies
2. Provide an opportunity to assess the status of national capabilities and mandates
3. Support regional cooperation, capacity building and knowledge exchange. The regional network is complemented and supported by international experts.
4. Identify opportunities and priorities for regional cooperation and increasing the impact of the sector.

It is believed that the series of workshop and bilateral meetings has resulted in a shared vision and ambition to use groundwater expertise and potential not just as an additional natural resource, but as a strategic asset, that, when used sustainably and responsibly, can make a significant contribution to climate resilience and livelihood improvement.

Until this stage, vulnerable groups and groundwater users in the five countries and proposed pilot areas have been involved indirectly in the proposal consultation process. The process of consultation will continue during the Inception of the project, and during project implementation, with direct consultations between the project team and national implementers and stakeholders in the pilot areas.

Because of the open and participatory nature of the mentioned consultation workshops (and characteristic for the approach of CCOP-TS and UNESCO in their programmes) the consultation and technical discussions are fruitful in bringing to the fore specific and/or new concerns from country representatives. As a result, this proposal incorporates and prioritizes some of those concerns, in particular **the engagement of groundwater experts and the groundwater CoP directly with stakeholders and groundwater users**. This approach is now much more at

the core of the project. (Traditionally and very often discussions in groundwater expert group workshops, conferences, etc. deal with very specific technical and details and the workings of the physical groundwater system, and not so much with the interests of vulnerable groups). Primarily, in the consultation process, participants from the region, with firm connections to the "local" issues and groundwater users in the provinces, were able to specifically present their views and experiences. So, with participating international experts who work in the region, and groundwater workers from the five countries attending there was a strong link from groundwater users and vulnerable groups and their concerns to project conceptualization.

- (Inter)national experts and groundwater workers from the region involved in proposal preparation are actively working on the ground and have a strong link with groundwater users and stakeholder groups in the countries and in the proposed pilot areas
- Issues discussed and inserted into the project concept primarily reflect concerns of user groups and stakeholders, although these groups and their interests will be more specifically framed during project implementation, when we will bring on board experts in gender analysis and on regional indigenous communities

J. Justification of funding

The project focuses on building climate resilience on the basis of "hidden" and poorly managed groundwater resources in particular for vulnerable rural communities, and other low-income users in cross-border regions of Lao PDR, Cambodia, Thailand, Myanmar and Vietnam.
The overall justification of the project lies in the potential to use groundwater, always a reliable and "safe" resource for low-income groups to provide water for food production, domestic use and production processes. This potential remains undeveloped in large parts of the GMS for a number of reasons. The project will address the following:

- Poor information on and confirmation of resource potential: The project will prepare an updated groundwater inventory of shared aquifers in border regions (four pilot areas), develop resource management concepts and tools, and set up a much needed monitoring network for groundwater systems.
- Regional collaboration will enhance understanding of groundwater recharge processes and formulate recommendations for protection and long-term sustainable management.
- In the general approach and in the pilot areas issues of transboundary groundwater management will be addressed. Taking up transboundary challenges will also form an incentive to develop collaborative solutions.
- In addition to making use of the available national capacities, the project will aim for intensive participation of local stakeholders by implementing principles of groundwater governance through 1) dialogues with users to assess groundwater use scenarios for different sectors (agriculture, industry, rural and urban domestic water supply) and 2) develop and provide appropriate information to ensure sustainable use by different user groups (agriculture, industry, domestic water supply).
- On the basis of improved information (supply/demand assessments, climate vulnerability profiles) the project will develop and implement targeted vulnerability reduction measures, groundwater supply quality improvement measures, and identification and protection of strategic groundwater reserves. Implementation of different project activities will be integrated in the four pilot areas and will generate resilience deliverables on the ground.
- On the medium and longer-term the investments in training, capacity building and raising standards for the groundwater CoP across the GMS and initiating regional water cooperation (diplomacy) will generate long-term benefits.
- Strategic planning for groundwater resources will support high level policy consensus and regional cooperation and make significant contributions to climate resilience of low income and rural population.

In the following summary, for each main project component a justification of the funding is given, followed by a concise reflection on Adaptation alternatives. (Table on the following pages)

<table>
<tr><td colspan="4">Component 1: Groundwater resource assessment and monitoring: to obtain and use a harmonised regional groundwater resource inventory supporting regional GMS approach to address challenges of climate change and resilience, and enables an information-based policy to manage resources and further develop new groundwater-based resilience strategies and practical interventions.</td></tr>
<tr><td rowspan="4">Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.</td><td>Baseline (without AF project)</td><td>Additional (with AF project)</td><td>Justification</td></tr>
<tr><td>Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment.</td><td>A comprehensive overview of regional GW resources (quality, quantity) is included in a easily accessible inventory (GIS, database).</td><td rowspan="4">It is essential to prepare a thorough inventory of available GW resources. But this should not be an academic or stand-alone investment. The resource potential should be made in close connection with a comprehensive assessment of water user needs (for different sectors: rural food production/agriculture, domestic water needs and small town water supply). Without proper understanding of the resource availability GW can still be used as a resilience (as is done in many places), but issues of sustainability and depletion of scarce resources will crop up.

By combining expertise from within the region with modest Technical Assistance support in a focused and coordinated intervention valuable and relevant resource availability information will be prepared and made available in formats that improve use by stakeholders and users. It will be possible to level regional differences

Adaptation Alternative? Information on GW resources is available especially in Thailand and Vietnam, but much less so in Myanmar, Lao PDR and Cambodia. This unbalanced information base is not supportive to sustainable resource use and developing fair and equitable resilience measures, forms a challenge especially for proper management of transboundary aquifer systems. Existing GW information lacks detail and quality due to a low level or absence of monitoring, especially so with respect to GW management in border regions. So it would be difficult to work on the basis of existing information and not possible to achieve the set objectives.</td></tr>
<tr><td>There is some GW-related info, but hardly used for this purpose.</td><td>GW information forms the basis for specific climate resilience measures.</td></tr>
<tr><td>Groundwater is seen as a static resource (basic inventories) and no to little data on temporal changes (or depletion)</td><td>Monitoring system and information operational and used for periodic updates.</td></tr>
<tr><td>Currently, GW information is hardly used.</td><td>Clear and consistent reference to GW in support of climate resilience development.</td></tr>
</table>

Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.			
Outcome 2: GW users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Farmers and other users deplete GW resources regardless of CCA challenges.	Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.	Due to the scientific and academic character of GW studies, also a somewhat neglected chapter not really part of water resources management and neither at the core of natural resources management, the results of GW studies were always a bit out of reach for many GW user groups. By addressing this, the project will deliver tangible results to different water users so that a) climate change resilience is strengthened, and b) limited but critical GW resources are not depleted. This will be done in close consultation with the stakeholders, in all parts of the proposed pilot areas. From the local pilots, the project will reach for higher institutional and policy levels, to ensure recognition of GW as a resource that can contribute to regional resilience. **Adaptation Alternative?** Working in the traditional manner will bring the risk of not reaching the target groups, or maintaining the mismatch and poor coordination between the GW CoP and the user sectors. The project workplan allows for flexibility and adaptation (to be used during the Inception Phase) to specific require-ments to generate results in the pilot areas.
	Information on GW potential is not tangible enough to motivate users to adopt and apply.	Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.	
Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology support better transboundary GW policies that are more robust and climate change ready.			
Outcome 3: Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use of specific measures to support resilience.	Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.	On the basis of improved information (supply/ demand assessments, climate vulnerability profiles) the project will develop and implement 1) targeted vulnerability reduction measures, if necessary aimed at meeting the needs of specific or vulnerable groups, 2) GW supply quality improvement measures,m 3) identification and protection of strategic GW reserves. Ad 1-2: For each of the pilot areas a critical analysis will be prepared of vulnerabilities for agricultural production, domestic (rural) water supply and possibly other major water users (industry like food processing). Other sectors/stakeholders are not excluded. This will clarify the main climate change related vulnerabilities and stakeholder groups. We will focus on vulnerabilities that have potential to be mitigated on the basis of improved and responsible GW management. Such practices could include: seasonal withdrawals for specific purposes,
	No transboundary cooperation, incompatible resource inventories, no communication.	Joint and coordinated efforts to use information and tools (monitoring) to develop and apply GW management	
	Only very basic, general information is available	Comprehensive information, tools and methods	

		developed and applied; resilience measures developed and applied (related to the physical GW system, governance of water resources or adaptation of user needs).	in combination with recharge measures, adaptation of user needs (different crops or income generating activities), governance and administrative arrangements (allocate limited shallow GW for low-income users), diversification of GW based water supply (deeper aquifers, new well fields), quality treatment of surface- or GW to make it suitable for specific user needs; technical improvements of extraction wells. Increases in extraction should be accompanied by resource conservation (elsewhere) or increase in recharge. Ad 3: Vulnerability mitigation should be accompanied with a careful assessment of water needs versus water sourcing options (surface water or GW). Improved understanding of the GW system (Component 1) supports a better assessment and quantification of the available resources and possibly specific constraints in further use. Vulnerable high quality resources (i.e. for drinking water supply) may need to be protected. GW use options could be adapted (i.e. strategically located deep GW extraction cold replace vulnerable shallow extraction). Basic monitoring of GW dynamics is needed to be able to match regional extraction volumes/rates to regional recharge rates. All measures rely on support from and awareness in stakeholder/user groups, which is in itself already a vulnerability reduction result. Implementation of different project activities will be integrated in the four pilot areas and this will generate resilience deliverables on the ground. The project will provide farmers and rural communities and village water user groups in the pilot areas with awareness, understanding and skills to manage limited GW resources to overcome climate-change induced perennial droughts and water shortages. **Adaptation Alternative?** One of the fundamental questions is the use of surface vs. GW. In principle, similar resilience levels could be reached with the use of surface water, commonly available in the proposed pilot areas (but not in drought periods). However, the investments needed to ensure availability of surface water and the complexities involved in management give low-income user and rural communities poor leverage and little influence. Surface water, originating outside the area, and destined for other users downstream, is not really an alternative for the “hidden” resource underground. Our approach complements other interventions that deal with surface water management.

Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for CCA through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.			
Outcome 4: A regionally coherent policy for sustainable GW management in support of CCA is adopted based on a level playing field of all users in the GMS.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Despite common CCA challenges countries in the region do not optimally share practices, knowledge and resources.	Regionally coordinated GW use contributes to regional, cross-border climate resilience for food production, rural water supply, etc.	In the provinces, when discussing GW resources for use in agriculture or for domestic purposes, few people realize the resource is not simply available from an underground (limitless) source, but forms part of a complex system with recharge areas, GW flow in complex aquifer systems, interaction with surface water and sometimes is affected by large scale spatial and long-term temporal dynamics. A similar misunderstanding is encountered among higher policy levels. Our approach for regional and transboundary, joint development is aimed at overcoming these misunderstandings. This justifies a fair amount of bilateral and five-country meetings and workshops, to create a joint understanding, both on advanced technical levels, as well as on policy coordination and complex cross-border cooperation. **Adaptation Alternative?** From a GW management perspective, there is no real alternative; if there is no real cross-border coordination resource depletion will take place in the medium- to long-term, and communities on both sides of the border will suffer.
	Vulnerable groups in the region and cross-border suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.			
Outcome 5: GMS stakeholders capably use project tools on GW use for CCA and resilience.	**Baseline (without AF project)**	**Additional (with AF project)**	**Justification**
	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	Community of Practice of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	The project investments in training, capacity building and raising standards for GW CoP will use within-the-region training. There is a high (double) return on investment as both the participants as well as the host institutions will benefit. The programme will offer fertile training grounds for a new generation of experts, in a learning-by-doing approach that will cover practical, on-the-ground issues in the pilot areas, but also higher policy levels. New and innovative subject matter and policy context will be injected to give more relevance to the sector. The project will be implemented with limited international TA and build on existing networks. **Adaptation Alternative?** The direction of development is really set for further ASEAN
	Although there are regional network meetings there is little coordinated effort to improve overall impact level.	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level	
		Groundwater CoP is regionally active	

		and able to contribute effectively to different GW system, sustainability or CCA challenges.	cooperation for and coordination of important policies in the region. It is an option to implement the project with experts from advanced countries in the GMS region (Thailand, Vietnam). But this will lead to unsustainable results in the priority areas and for priority low income groups in Myanmar, Lao PDR and Cambodia. The underdeveloped GW management capacity in these countries is a challenge and an opportunity to develop greater climate resilience. Bringing in more international TA will substantially raise the interventions costs, as would training in leading institutions outside the region.

Table 13: Summary overview justification of funding and adaptation alternatives, with for each main project component a justification of the funding, followed by a concise reflection on Adaptation alternatives

K. Sustainability of outcomes

Project sustainability is highly dependent on human resources capacity dimensions. With a strong focus on human resources development, a new generation of better skilled and equipped female and male groundwater experts will be supported to engage with pertinent challenges of the coming decades. Project outcomes will allow for this process of capacity development to proceed in a concerted manner, with common tools and data. Sustainability of outcomes will also be enhanced by closely linking groundwater resource studies to societal needs (in various sectors like food production, domestic water supply, industry, ecology/environment). A regional community of practice will be fostered, building upon efforts previously undertaken by the project partners. Working in a more concerted manner, this groundwater community of practice will meet and share issues annually. The project will also provide an enabling environment and give support to postgraduate studies; this will generate long-term benefits to the sector and enhance sustainability. Finally, the project's engagement with community-level organizations in the pilot sites will strengthen the position of communities as resource owners and custodians.

The proposed implementation partnership, with UNESCO, CCOP-TS as executive partner and technical support from IWMI and IGRAC forms a solid foundation for outcome sustainability. All partners have a long time presence in the region and are dedicated to continue their activities, in close cooperation with the national partners. The envisaged project cooperation will simulate stronger and more effective intraregional cooperation in the future, and provides a collaboration model that makes more effective use of support from partners outside the region (like JICA, AusAid, KOICA, BGR, global funds and other development initiatives).

Project outcomes will be shared and made available for uptake by relevant regional organisations such as MRC and Climate Change coordination focal points under ASEAN. On the national level, national Mekong River Commissions will be engaged.

L. Environmental and social impacts and risks

As further elaborated in Part III, project management, Section 2 and Section 3, the proposed project seeks to fully align with the Adaptation Fund's Environmental and Social Policy (ESP). Table 10 (in Section III.3 below) summarizes the initial analysis that has been carried out to evaluate environmental and social impacts of the project versus the AF policy. Also, it indicates where steps will be taken and where further assessment is needed (in those domains were positive impacts are anticipated). This will be done as part of the project monitoring and evaluation effort.

Activities under Component 1 to 5 are all 'knowledge' activities that are community focused, and nearly all with explicit stakeholder participation, they are also limited in spatial scale and impact (no or very limited physical construction or disturbance), and can easily be adapted, changed or reversed. According to the Adaptation Fund's Environmental and Social Policy, "Projects/programmes with potential adverse impacts that are fewer in number, smaller in scale, less widespread, reversible or easily mitigated should be categorized as Category B." (Source: Adaptation Fund Environmental and Social Policy document.). Therefore, no serious environmental and social risks, whether direct, indirect or cumulative are envisaged to arrive as a result of any of the proposed activities under Components 1 to 5. In a proactive manner, the project Environmental and Social Management Plan will be applied. (see Part III, Section 3).

As elaborated throughout the proposal the project specifically aims to deliver positive transboundary impacts.

The miscellaneous field activities that will be formulated in detail for the implementation of the designated pilot areas need to be scrutinized more closely. Some of these may be considered 'hard' activities, and as such have the potential, without environmental and social safeguarding and mitigation measures, to have minor negative environmental and social impacts. However, in our assessment, none of the proposed activities is expected to be in Category A of the Adaptation Fund's impact classification. This is because this project proposes potentially 'hard' activities that are small scale and very localized, and co-managed by local communities where possible, who have a stake in avoiding negative environmental and social impacts. This means that the potential for direct impacts is small and localized, that there can be few indirect impacts. Given this, cascading or cumulative negative impacts are also unlikely.

Sections 2 and 3 of the Management Part III below deals with potential financial risks and environmental and social impacts. The project did not, at this stage, identify explicit or implicit environmental and/or social risks other than the ones discussed in that Section.

PART III: IMPLEMENTATION ARRANGEMENT

1. PROJECT MANAGEMENT
2. PROJECT AND FINANCIAL RISK MANAGEMENT
3. PROJECT ENVIRONMENTAL AND SOCIAL POLICY
4. MONITORING AND EVALUATION
5. PROJECT RESULTS FRAMEWORK (LOGICAL FRAMEWORK): MILESTONES, TARGETS AND INDICATORS
6. ALIGNMENT WITH ADAPTATION FUND RESULTS FRAMEWORK
7. BUDGET (EXCEL SHEETS, ALSO PROVIDED AS ANNEX II)

   Sheet 1: Summary project budget
   Sheet 2: Breakdown of the project execution costs (CCOP-TS)
   Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
   Sheet 4: Budget disbursement schedule with time-bound milestones.
   Sheet 5: Detailed project budget, Excel format (Annex only)

1. Project Management

Introduction
The arrangements for effective and efficient project implementation and management are introduced. First, project 'ownership' arrangements at overall project level are presented, including coordination arrangements by UNESCO as MIE and CCOP-TS as Executive Entity. Regional and national coordination within countries is also clarified. Actual and prospective partnership arrangements with national institutions are discussed and it is elaborated how national and regional partners as National Implementing Entities (NIE) will play a role in project implementation and management.

On the basis of this application and following project preparatory consultations and arrangements, the following entities will support project implementation and management.

Who is Who: Beneficiaries and stakeholders – NIEs

1. Government of Cambodia, Ministry of Water Resources and Meteorology and Ministry of Mines and Energy deal with groundwater issues in Cambodia.

2. Government of Lao PDR, Ministry of Natural Resources and Environment (MoNRE), and its subsidiary Department for Water Resources (DWR) including the Groundwater Management Division. Furthermore, the Natural Resources and Environment Institute (NREI) has an executive role in groundwater management.

3. Government of Myanmar, Ministry of Agriculture and Irrigation and within the Ministry of Water Resources the Utilization Department (WRUD) has the role of implementing agency.

4. Government of Thailand, Ministry of Natural Resources and Environment; within the Ministry the Department of Groundwater Resources has the responsibilities in planning, assessment, resource conservation, and regulations.

5. Government of Vietnam, MoNRE as the coordinating Ministry for water resources management, is implementing river basin water resources management plans on a national scale that include groundwater. The National Center for Water Resources Planning and Investigation (NAWAPI), has an executive role.

6. Universities, research institutions and local NGOs in the GMS and specifically active in the proposed pilot areas and in a position to contribute to capacity building on groundwater. A specific role is envisaged for the Mekong River Commission and the National Mekong Commissions in the respective riparian countries.

The collaboration will be supported by:

UNESCO: as MIE, it will provide all technical backstopping, facilitation with member States and processes with the Adaptation Fund.

Technical Secretariat of CCOP (CCOP-TS): Coordinating Committee for Geosciences Programmes (in East and Southeast Asia): CCOP-TS, as Executive Entity (EE) will provide technical expertise and coordinate and support implementation along with the national partners.

International Water Management Institute (IWMI): has been at the forefront of research aimed at exploring opportunities for improved groundwater development and management for poverty alleviation and improving groundwater governance across SE Asia. IWMI will be one of the implementing partners.

International Groundwater Resources Assessment Centre (IGRAC): is UNESCO's and WMO's groundwater expertise and resources centre that facilitates and promotes information and knowledge sharing required for sustainable development, management and governance of transboundary groundwater.

Multilateral Implementing Entity (MIE)
As endorsed by the signatories from the five participating countries, UNESCO through its Regional Sciences Bureau for Asia in close coordination with its offices in Bangkok, Hanoi, Phnom Penh and Yangon will serve as MIE for the project. Firstly, a short overview of UNESCO's track record in the subject matter is presented. Secondly, it is elaborated in what way UNESCO, as MIE, will manage the project

UNESCO and water management, including groundwater
UNESCO works to build the scientific knowledge base to help countries manage their water resources in a sustainable way through:

- the activities of its International Hydrological Programme (IHP),
- the Secretariat of the UN-wide World Water Development Programme
- the "UNESCO Water Family", which links over 30 member state-funded and operated centres of expertise in water-related research, education, capacity development and cooperation, as well as a wide network of UNESCO Chairs at at universities and research institutions globally.

The IHP is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. Since its inception in 1975, IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic programme to facilitate education and capacity building, and enhance water resources management and governance. IHP facilitates an interdisciplinary and integrated approach to watershed and aquifer management, which incorporates the social dimension of water resources, and promotes and develops international research in hydrological and freshwater sciences. IHP is in its eighth phase covering 2014-2021. IHP-VIII brings innovative methods, tools and approaches into play by capitalizing on advances in water sciences, as well as building competences to meet the challenges of today's global water challenges.

Under IHP-VIII, groundwater is one of the main areas where IHP is continuing its pioneering work to learn more about the complexity of aquifer systems, the increasing global risk to groundwater depletion, quality deterioration and pollution, and the resilience of communities and populations dependent on groundwater sources.

Objectives include promoting measures addressing the principles of sustainable management of groundwater, addressing methods for the sound development, exploitation and protection of groundwater resources, developing new groundwater resource maps, and strengthening groundwater governance policy and water user rights in emergency situations. These challenges call for comprehensive research, implementation of new science-based methodologies and the endorsement of principles of integrated management, and environmentally-sound protection of resources.

Focal Areas of IHP-VIII under the theme of "Groundwater in a Changing Environment"
Focal area 2.1 - Enhancing sustainable groundwater resources management
Focal area 2.2 - Addressing strategies for management of aquifers recharge
Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
Focal area 2.4 - Promoting groundwater quality protection
Focal area 2.5 - Promoting management of transboundary aquifers

Key current and recent IHP initiatives include:

GRAPHIC (Groundwater Resources Assessment under the Pressures of Humanity and Climate Change) is a UNESCO-IHP project seeking to improve our understanding of how groundwater interacts within the global water cycle, how it supports ecosystems and humankind and, in turn, responds to complex and coupled pressures of human activity and climate change. GRAPHIC was developed to successfully achieve these objectives within a global context and represents a collaborative effort that serves as an umbrella for international research and education.

Through a variety of regional working groups and case studies, GRAPHIC outlines areas of international research, covering major geographical regions, groundwater resource topics, and methods to help advance the knowledge required to address both the scientific and social aspects of this field. Comprehensive information is provided in:
http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/2015_GRAPHIC_GWandCC.pdf

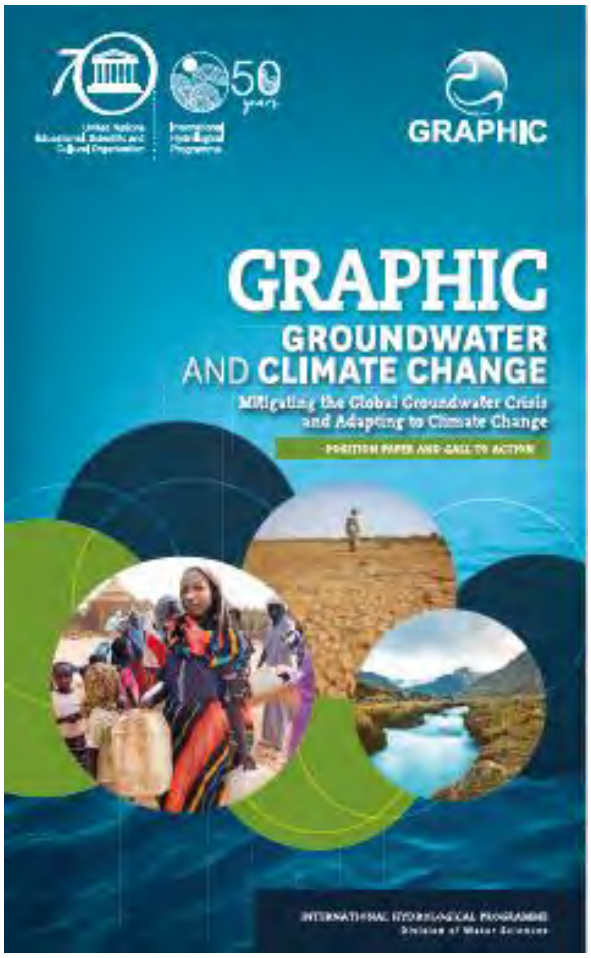


Figure 15: The Graphic Programme of UNESCO-IHP Groundwater and Climate Change (Brochure cover).

The **worldwide ISARM (Internationally Shared Aquifer Resources Management)** Initiative is an UNESCO and International Association of Hydrogeologists (IAH) led multi-agency effort aimed at improving the understanding of scientific, socio-economic, legal, institutional and environmental issues related to the management of transboundary aquifers (http://isarm.org/).

The issue of shared international waters is as old as the national borders that make those waters international. During the last century, significant progress was made in regulation of joint management of surface watercourses; many international river-, lake- or basin commissions have been set up and the legal treaties signed. Although some of these activities address "a groundwater component" as well, major comparable efforts related to the invisible groundwater have started just a few years ago with the ISARM Programme.

Since its start in 2002, ISARM has launched a number of global and regional initiatives. These are designed to delineate and analyse transboundary aquifer systems and to encourage riparian states to work cooperatively toward mutually beneficial and sustainable aquifer development. Comprehensive information is provided in: (http://en.unesco.org/themes/water-security/hydrology/programmes/isarm/general-information).

The World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) was created in 1999 in order to contribute to worldwide efforts towards better managing the Earth's water resources, particularly groundwater. It is a joint programme of UNESCO, the Commission for the Geological Map of the World, the IAH, the International Atomic Energy Agency and BGR. General information is provided at:
http://en.unesco.org/themes/water-security/hydrology/programmes/whymap/resources

'Groundwater for Emergency Situations' (GWES). The aim of the GWES project is to consider natural catastrophic events that could adversely influence human health and life and to identify in advance emergency groundwater resources resistant to natural and man-made disasters that could replace damaged public and domestic drinking water supplies. A very important aspect of the GWES project, in drawing the attention of governments, organizations and individuals to the concept of preparedness for establishing alternative drinking water supplies, is empowerment. Very often a local population is rendered helpless following a disaster, cut off from its traditional water supplies and faced with delays in aid from outside. This may lead to destabilization and demoralization at a time when people need to rebuild their lives (http://unesdoc.unesco.org/images/0019/001921/192182e.pdf).

UNESCO Regional Sciences Bureau for Asia and the Pacific
Located in Jakarta, Indonesia, the UNESCO Regional Sciences Bureau for Asia and the Pacific was established as a field office for South-East Asian Science Cooperation (SEASCO) in 1951. In 1967 it became the Regional Office for Sciences and for South East Asia (ROSTSEA). Since 2001, UNESCO Jakarta has served as the Regional Science Bureau for Asia and the Pacific. Today, the UNESCO Regional Sciences Bureau for Asia and the Pacific also serves as representative office for Brunei Darussalam, Indonesia, Malaysia, the Philippines and Timor-Leste.

As Regional Bureau for Science, UNESCO Jakarta provides strategic expertise, advisory, monitoring and evaluation functions to Member States, other UNESCO Field Offices and United Nations Country Teams in the

area of Science across the entire Asia and the Pacific. In the 48 UNESCO Member States and 2 Associate Members of the Asia-Pacific, UNESCO is present with a network of 13 Field Offices serving at the regional, sub-regional and country levels.

For the implementation of the project, the UNESCO Regional Sciences Bureau for Asia and the Pacific will serve as MIE, in close coordination with the UNESCO Office in Bangkok – as representative office to Lao PDR, Myanmar and Thailand – as well as the UNESCO National Offices in Hanoi and Phnom Penh, and the UNESCO Bangkok Antenna Office in Yangon.

UNESCO Bangkok Asia and Pacific Regional Bureau for Education
Since 1961, UNESCO Bangkok Office has served the UNESCO Bangkok Asia and Pacific Regional Bureau for Education as well as representative office to the five participating countries (joined by Singapore in 2007). The office covers all UNESCO's fields of competence: education, sciences, culture, communication and information. It is responsible for UNESCO activities directly in Thailand, Lao PDR Singapore and Myanmar (through its Antenna Office in Yangon), and indirectly in support of UNESCO Country Offices in Hanoi and Phnom Penh.

Through its network of field offices at the regional, sub-regional and national level, UNESCO has a strong and permanent presence in the region and in the participating countries. In the field of Science, UNESCO's field offices in the participating units collaborate closely and strategically under the overall coordination of the Regional Bureau for Science.

MIE Management tasks
The following implementation support under the MIE modality will be provided by UNESCO for the project:

- Overall coordination and management of UNESCO's MIE functions and responsibilities, and the facilitation of interactions with the Adaptation Fund Board and other relevant parties;
- Oversight of project implementation through close interaction with the project Executive Entity CCOP-TS and with the Project Steering Committee (PSC) and reporting to AF on progress and on budget performance;
- Quality assurance and accountability for outputs and deliverables during project implementation and upon completion;
- Receipt, management and disbursement of AF funds in accordance with the financial standards of the AF;
- Assurance of national government support, continued participation and uptake of results.
- Assurance of continuous compliance with the project's Social and Environmental Management Plan.

UNESCO as MIE and as part of its project management responsibility will appoint through an open competition a **Project Manager** (**PM**) who will oversee the implementation of the project along the tasks outlined above. There will be close cooperation between the PM and the project executive and operational levels (i.e., with Project Director, Coordinating Technical Advisor CTA and CCOP-TS support staff). Through the official network of UNESCO and its field offices in the five participating countries and its Head Office UNESCO as MIE, the PM will be able to actively support project implementation and have regular contact with the Executing Agency (CCOP-TS in Bangkok) over the course of the AF project implementation.

Project Execution
In accordance with its standards and procedures, UNESCO will enter into a contractual agreement with the coordinating executing partner, CCOP-TS, towards the execution of the AF project activities and delivery of the proposed outputs.

The **Project Director (PD)** will be responsible for the overall management of the AF project. The PD (a part-time position taken by CCOP-TS Executive Director will ensure that the project is run transparently and effectively in accordance with AF and UNESCO's guidelines and approved work plans and budgets. The PD will receive project support from the CCOP-TS project finances manager as well as additional staff members within CCOP-TS. The key functions of the PD will be:

- Facilitating the day-to-day functioning of the project support staff;

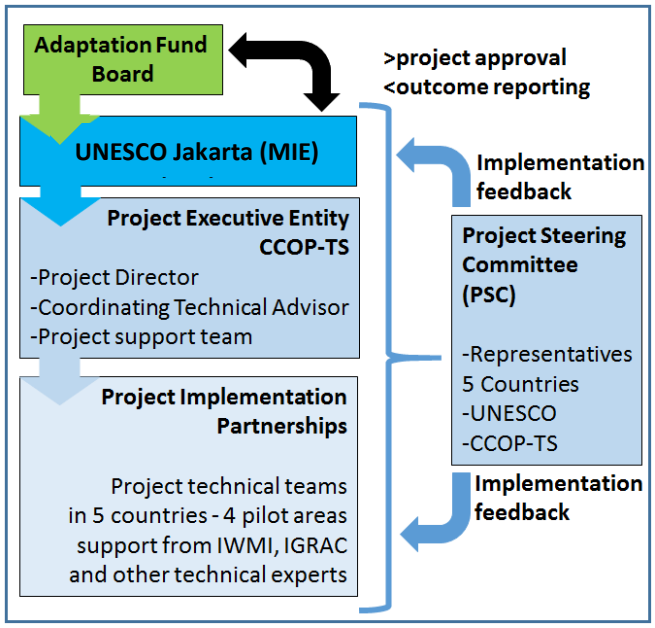
- Managing human and financial resources in consultation with UNESCO and the project CTA to achieve results in line with the outputs and activities outlined in the project document;
- Ensure gender analysis and gender monitoring are undertaken by experts;
- Leading the preparation and implementation of annual results-based work plans and logical frameworks as endorsed by the management of UNESCO;
- Monitoring project activities, including financial matters, and preparing monthly and quarterly progress reports, and organising monthly and quarterly progress reviews;
- Together with UNESCO, organizing PSC meetings;
- Regular reporting and providing feedback on project strategies, activities, progress, and barriers to UNESCO, PSC and project partners; and
- Supporting UNESCO to manage relationships with project stakeholders including donors, NGOs and government agencies

A **Coordinating Technical Advisor (CTA)** will be hired by CCOP-TS to assist the PD and provide technical guidance and support for the implementation of the project. The CTA will:

- Prepare Annual Work plans, TORs for technical consultancies and supervision of consultants' work;
- Assist in monitoring the technical quality of project M&E systems, including annual work plans, indicators and targets;
- provide advice on suitable approaches and methodologies for achieving project targets and objectives;
- provide a technical supervisory function to the work carried out by any other technical consultants hired by the project; and
- assist in knowledge management, communications and awareness raising.

The CTA position will be filled through a transparent and competitive recruitment process that will commence as soon as the Full Project Proposal is approved.

Figure 19: AF project management arrangements.



Step-by-step implementation strategy

- Organise an executive project team consisting of national experts from the five partner countries, and experts from the supporting Technical Assistance partners (CCOP-TS, IWMI, IGRAC). As MIE, UNESCO will convene a PSC.
- Develop a common view and understanding of the role that improved groundwater management shall play in strengthening climate resilience in multiple sectors; identify additional opportunities through transboundary collaboration; sharing information, expertise and collaborative policies for climate resilience.
- Resource assessment: common methodology to be adopted and approach to data collection/sharing; agree on protocols for sharing available data on transboundary aquifers.
- Compile various maps / information services and products available from countries/organisations and further demarcate the recharge and extraction zones and consider transboundary issues.
- Identify data gaps and need for new data; collaborative monitoring approach, initiate base-level monitoring.
- Common approach for groundwater resources management information system, basic functions and operations, training expert users, dissemination to end-users in the five countries.
- Raise stakeholder and public awareness on groundwater vulnerability through development of tailored information for sectoral users and multi-media awareness for urban and rural populations.

- Build capacity of local groundwater management professionals, planners and policy makers in the pertinent national government organisations.
- Consult stakeholders and develop a process of ongoing engagement with the specific actors with interest in groundwater from government, donors, NGO's and the private sector.

These activities collectively serve to create the environment needed to achieve positive change on the ground throughout the GMS by reducing vulnerability and increasing adaptive capacity to the impacts of climate change, including climate variability. Clear indicators to track and demonstrate these outcomes will be developed at an early project stage and monitored by the PSC and activities adjusted as needed.

Terms of Reference for Project Steering Committee (PSC)

The PSC will be formed to keep abreast of the project progress and to facilitate the implementation of the project, while direct implementation of the project and decisions regarding the allocation of resources and assistance under the project will be taken by UNESCO as the MIE and CCOP-TS as EE. The PSC will:

- Facilitate the implementation of the project to achieve progress on time, on scope and on budget
- Review progress reports submitted by the Project Team
- Support the broader dissemination of the project's results, especially towards government entities and policy-makers.

PSC Members: One PSC member from each participating country will be invited through the appropriate governance channels. Hence, the PSC will have five (country) members. Chair will rotate every year. UNESCO as MIE and CCOP-TS will attend, as well as CTA.

PSC Meetings: The PSC will meet quarterly throughout the lifetime of the project and may meet more often as required. A calendar of meetings will be developed at the project inception workshop. Whether virtual meetings can serve after at least two successful in-person meetings have been held will be assessed.

Secretariat function: CCOP-TS as EE will provide secretariat services for the PSC by coordinating meetings, producing documentation and meeting minutes, managing correspondence, information management/ dissemination and related tasks.

Documents will be made available to PSC members at least one month prior to the meetings. Minutes of the meetings will be prepared by UNESCO & CCOP-TS. Members of the PSC will share information with non-member stakeholders.

CCOP-TS for project execution

For this project CCOP-TS is the designated project Executive Entity (EE) . Below, CCOP-TS is briefly introduced and its project management and coordination qualifications highlighted. For a useful introduction and overview, please also consult www.ccop.or.th

CCOP, established in 1966, is one of the oldest intergovernmental organisations in East and Southeast Asia. Its mission is to contribute significantly to the economic development and sustainable management of the environment of the quality of life of its Member countries by the application of Earth sciences knowledge. Its focus is on:

- **Outreach**: to enhance influence with decision-makers, investors and the general public through the provision of relevant earth system science information and to develop appropriate skills to communicate effectively with stakeholders in the CCOP member countries.
- **Cooperation and partnerships**: to enhance the internal and external partnerships to improve the quality, reach, application and impact of earth sciences information and knowledge
- **Knowledge enhancement and sharing**: to manage, promote, share and exploit the region's earth sciences information and skills
- **Data and information:** to advance sharing of data and information and integrate earth sciences data across national boundaries
- CCOP's primary network consists of the 15 member countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste and Vietnam. Additionally, it maintains close ties with a considerable number of Cooperating Countries and Cooperating Organisations. The management and organization structure of

CCOP and CCOP-TS is presented below. At the beginning of 2016 CCOP-TS had 10 permanent staff, including four earth science experts and six support staff.

Technical cooperation and tasks of CCOP-TS

In response to the requests of the member countries CCOP-TS has organized, coordinated and supported a number of capacity building and technical cooperation workshops, training courses and case studies in three technical sectors, geo-resources, geo-environment and geo-information. Most of these activities have multilateral participation and support, and often include attention for transboundary issues (resource management, data and information sharing, harmonization). CCOP-TS also supports specific bilateral technical cooperation. For instance, in 2014 there were 26 training/ workshop activities were carried out that were attended by over 890 participants from all member countries. One of the tasks of CCOP-TS is to ensure workshop results and deliverables are prepared and disseminated (reports, books, database content, website, etc.). CCOP-TS also prepares a regular Newsletter.

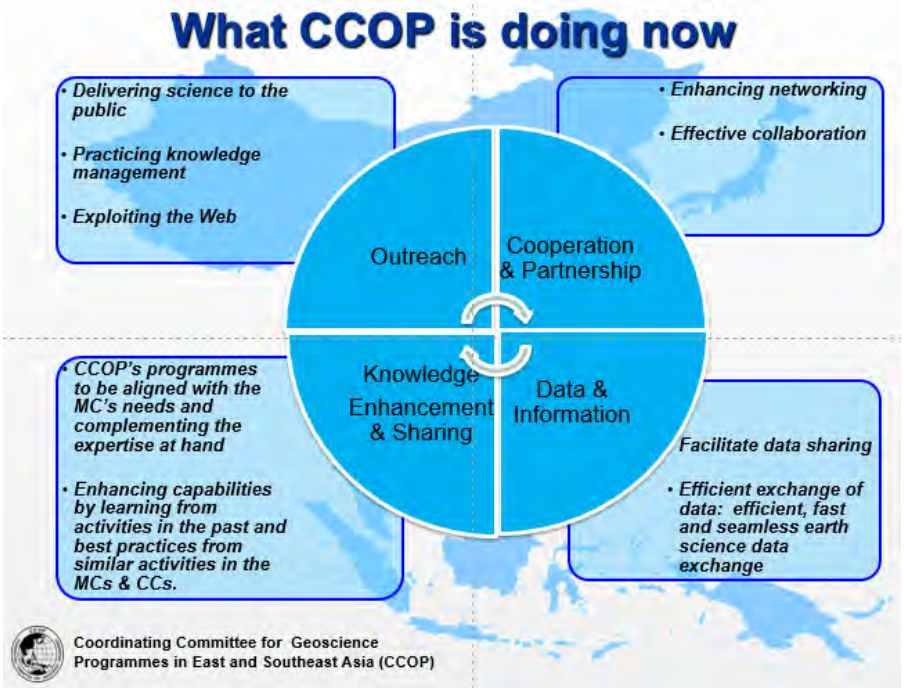


Figure 20: Tasks and coverage of CCOP's activities

CCOP-TS Director and senior experts have the responsibility to continuously liaise with member countries and organisations, ensure donor support and prepare technical meetings. CCOP-TS budget derives mainly from membership fees, income from project execution and support and occasional grants, while its expenditure consists of personnel expenses and operational costs. Its offices are provided by the Royal Thai Government through an arrangement with MoENR and include office workspace and facilities, meeting rooms and services.

CCOP-TS capabilities as a network organization are complemented with thorough and high-level expertise in the subject matter. As part of the 'Geo-Resources' CCOP-TS and its partners have worked on sustainable management of groundwater for a considerable time. There is also relevant expertise in the 'Geo-Information' programme. In all, CCOP-TS is well placed to be tasked with execution of the proposed project.

CCOP-TS Groundwater related project involvement (since 2004)

1. **General Groundwater Resources**
   CCOP-GSJ/AIST Groundwater Project (2004-2015)
   - Phase I: Groundwater Assessment along Great River Basins in East and Southeast Asia (2004-2009)
   - Phase II: Groundwater Assessment and Control in the CCOP Region (2010-2014)
   - Phase III: As a groundwater component of the CCOP-GSJ Project "Development of Geo-Information sharing infrastructure for ASEAN/CCOP countries" (started 2015)
   - Project: "Development of Renewable Energy for Ground-Coupled Heat Pump system in CCOP Regions"
   - Groundwater and Bottled water market

- CCOP-BGR-NAWAPI, Vietnam Workshop, Integrated water resource management in coastal zones with a focus on Groundwater Experiences in East and Southeast Asia Countries, Can Tho, Vietnam, 19-21 January 2016
- CCOP-KIGAM Workshop (Sihanoukville, Cambodia), 1-4 June 2016 Groundwater management and Climate Change Adaptation in the Lower Mekong Basin.

2. Groundwater – Environmental and Geohazard Issues

- CCOP-KIGAM Project "Solutions for Groundwater problems in CCOP region" (2013-2017)
- CCOP-Panya Consultant-DGR Land Subsidence Monitoring System Design Project Workshop/Meeting, 16-22 January 2011, Bangkok, Thailand
- The 6th JPDC-KIGAM-CCOP Jeju Water Forum on 6-9 October 2014 in Jeju, Republic of Korea
- BGR – CCOP Workshop "Integrated water resource management in coastal zones with a focus on groundwater – experiences in East and Southeast Asia countries"

3. Deep Groundwater Programme

- PETRONAS-PETRAD-INSTOCK-CCOP Deepwater Subsea tie-back in Kuching, Malaysia on 24-26 January 2011
- Deep Groundwater Resources (project proposal ready, implementation waiting for external funding)

Figure 21: Scope of activities of CCOP in various relevant fields (Geo-Resources, Geo-Environment and Geo-information). The five lines of work are applied for the Groundwater topic, especially in the less-developed member countries in the network.

Collaboration with groundwater user organizations

In the proposed pilot areas groundwater user organizations (if existing) or other stakeholder groups will be engaged in the project. They may be regarded the primary beneficiaries of the project and will be involved in the development, application, evaluation and wider dissemination of groundwater-based resilience strengthening measures. Groundwater user organizations will be supported (stimulated when they are embryonic or not yet set up), and subsequently will be:

- Actively supporting collection of groundwater data
- Participating in development of groundwater management information products
- Supporting validation of resilience strengthening measures
- Strengthened to be able continue contributing to sustainable groundwater management as part of CCA resilience
- Evaluating and providing feedback on project interventions and impact

For the project management groundwater user organizations are the most important group of project stakeholders that will validate the impact of the project.

NB. groundwater user organizations are not directly involved in Project Management *sensu stricto* (as this comment is raised under the Section related to Project Management.

2. Project and Financial Risk Management

A number of potential project and financial risks have been considered and analysed in the process leading up to this Adaptation Fund proposal. These are summarized in Table 10 below. The risk management strategy of this AF project will be further fine-tuned during the project Inception Phase.

No	Risk	Classification	Impact/ Probability 1: Low 5: High	Mitigation Measure
1	National policy and institutional practices undermine the development of concrete resilience measures in the pilot areas	Institutional	Impact: 4 Probability: 1	The project will work on different intervention levels, from national natural resources management and CCA policy in the five countries (national ministerial level), as well as on regional (responsible agencies and sub-ministerial) level and stakeholder group organisations, to local level through direct interaction with primary stakeholder groups.
2	Data availability and consistency is inadequate to design trusted and acceptable resilience measures.	Environmental	Impact: 3 Probability: 3	The project will follow a step-by-step approach, with simple and low-threshold initiatives first, and then gradually develop more complex and higher impact practices.
3	Resilience measures increase inequity in communities	Environmental and Social	Impact: 3 Probability: 2	Local level implementation through farmer and other groundwater user groups will ensure that resilience measures are demonstrated on the basis of participative processes which are gender-sensitive and enable participation of vulnerable and marginalized groups.
4	Political and safety situation is not supportive of field visits and working with stakeholders in pilot areas	Social, Political	Impact: 4 Probability: 1	Pilot areas have been selected with this in mind. Different pilot areas can be selected, but only if this has to be done early on in the project.
5	Technical support capabilities and budgets from the project are inadequate.	Institutional	Impact: 3 Probability: 2	The project is relying on a participative approach through its engagement with national partners and local stakeholders in the pilot areas. This will stimulate ownership and allow for collaboration with local initiatives and will muster support from national and international partners.

Table 14: Project risks and mitigation measure

3. Project Environmental and Social Policy (ESP)
(Measures for Environmental and Social Risk Management)

Introduction
During the preparation stage of this proposal, UNESCO, as lead applicant and designated IE, in collaboration with partner and representatives from the GMS countries, has conducted a screening and self-assessment in order to determine if the project construct and scope will comply with the ESP principles of the Adaptation Fund. This process and its outcomes are summarized below (Figure 22). In the following section, in short, the measures for environmental and social risk management are described in line with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

The applicant takes note that the Adaptation Fund finances climate adaptation projects and programmes for vulnerable communities in developing countries that are Parties to the Kyoto Protocol. The project acknowledges, and has been designed in accordance with, the Adaptation Fund's Environmental and Social Policy (AF ESP document; March 2016 documentation). Full adherence to the Policy will ensure that the project promotes positive environmental and social benefits, and that a maximum effort is made to mitigate and/or avoids adverse environmental and social risks and impacts.

The project's categorization and compliance with the ESP has been outlined in Part II, Section E. In line with AF guidelines, the project has followed a stepwise approach (depicted in the Figure below) towards setting up and applying an ESMP. The proposed Environmental and Social Management Plan is further introduced below.

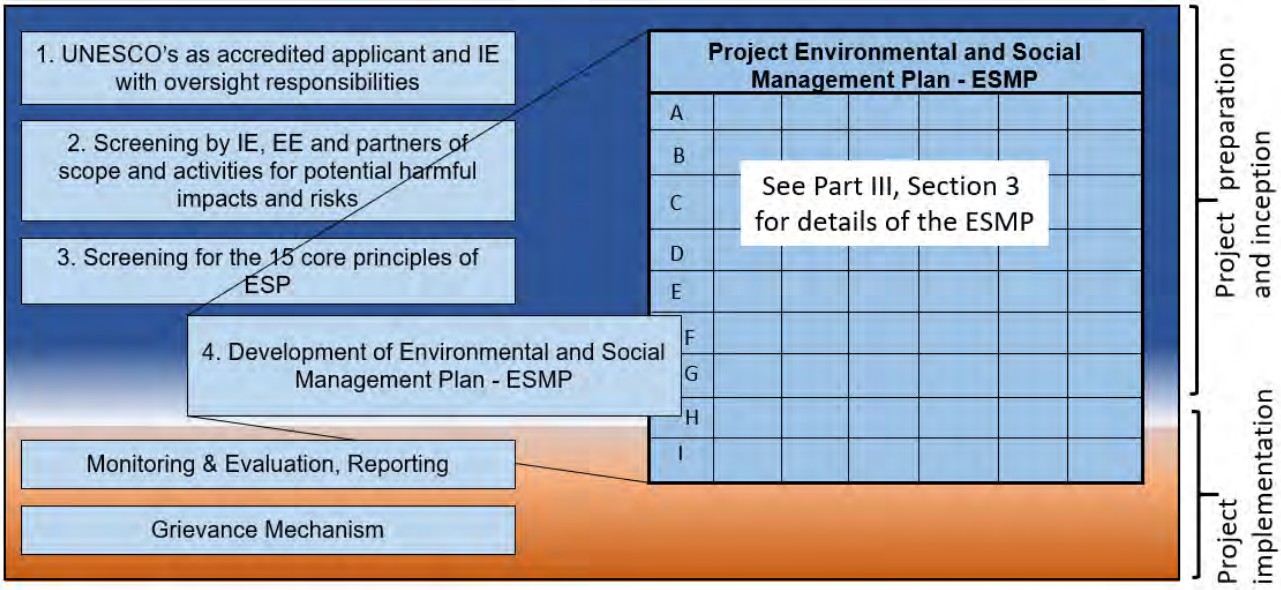


Figure 22: Schematic overview of the project ESP compliance approach. The upper part 1-4 components were developed and applied during project preparation and will be further improved in the project's Inception Phase. The ESMP will be applied during project implementation, as well as monitoring and evaluation, reporting and, when required, activation of the grievance mechanism.

As lead applicant UNESCO strives to apply four key mechanisms to comply with the ESP:

1. Programme-Level Quality Assurance; As elaborated in Part II, Section E. UNESCO's as accredited applicant and IE with oversight responsibilities and core policy to lead in application of environmental, gender and social principles.
2. Project-Level Quality Assurance; As elaborated in Part II, Section E. Screening, by IE, EE and partners in the five countries, of proposed project scope and activities for potential harmful impacts and risks.

3. Project-Level Social and Environmental Screening Procedure; As elaborated in Part II, Section E. Screening of impacts and possible risks of proposed project in relation to the 15 core principles of ESP; Categorization of the project as “B” .
4. Development and application of ESMP; As per guidelines of the Adaptation Fund. The ESMP is further elaborated below.

Finally, in accordance with the project Monitoring and Evaluation approach, progress reporting will pay specific attention to the compliance issues. And following from the project concept and set-up, there is already a high level of stakeholder involvement and this also ensures a low risk of non-compliance for several key principles. Whenever potential non-compliance issues arise, the Grievance mechanism can be activated.

Environmental and Social Management Plan - ESMP

In line with the guidelines of the AF the project applicants have developed an Environmental and Social impacts and risks Management Plan (ESMP). The risks recognized have been assessed for impact and mitigation and proper management measures are identified at project level and at pilot level. The ESMP includes the relevant components, i.e. mitigation plans, institutional arrangements, stakeholder consultation, capacity building, monitoring and evaluation and reporting. The ESMP, tailored for each pilot area will comply with the ESP of the AF and the national technical standards of the relevant country. Once formulated and approved, the status of ESP issues will be reported in the applicable progress and evaluation reports prepared for the AF and national stakeholders.

The proposed ESMP consists of a number of fixed core elements, and is also dynamic, e.g. it can be improved and adapted in the course of the project (especially after the Inception Phase).

Core elements of the Environmental and Social impacts and risks Management Plan (ESMP) are as follows:

	ESMP elements	Who	When
A	Project team awareness and training on compliance with ESP and gender guidelines, monitoring process and related issues.	Core project team and executive partners, pilot coordinators	During project Inception Phase
B	Awareness and training for key project stakeholders, in particular: a) government partners, and b) pilot area teams, with particular reference to vulnerable groups, indigenous peoples.	Core project team and executive partners, pilot coordinators	In the first year of project implementation.
C	Re-assessment of impacts and risks on two levels: 1) integral project and 2) for the four pilots	1) IE and EE 2) Pilot area teams coordinated by EE	Inception Phase
D	Updated reporting on compliance with ESP and gender guidelines and update of monitoring system	Supervision IE and EE	Part of Inception Phase reporting
E	Validation of the monitoring and evaluation approach, and reporting with clear and verifiable indicators and Means of Verification	Supervision IE and EE	Towards the first M & E reporting instant
F	Periodical progress reporting as prescribed in the project management plan	1) IE and EE 2) Pilot area teams coordinated by EE	According to M & E and progress reporting schedule (Section 3, M & E)
G	Gender issues assessment and ensuring positive impacts and compliance	Dedicated gender expert engaged from/through IE	After project Inception, Year 1 and towards completion, Year 4
H	M & E; Systematic progress monitoring, collection of stakeholder feedback and reviews	Supervision IE and EE	At least twice during the project with one survey at the end of the project.
I	Project Steering Committee assessment of compliance	Invited by IE to assess and give feedback	At least twice during the project

J	Awareness and activation of Grievance Mechanism	IE and pilot area coordinator	In the first year of project implementation

Table 15: Core elements of the Environmental and Social impacts and risks Management Plan (ESMP).

Elaboration of ESMP elements

A: UNESCO, as the IE, will provide an introduction and training to the EE and coordinators at the onset of project implementation in order to ensure that all principal project partners have the required knowledge and awareness level regarding their responsibilities with regards to the provisions of the Environmental and Social Policy of the AF as well as the promotion of human rights, including specifically the complaint handling mechanism of the Fund. The ESP of the AF will be used as the main guidance to ensure compliance. The introduction and training on the relevant concept and tools for compliance will be used for the project team, and also for the wider community of participants and key stakeholders.

B: In order to prevent the exacerbation of existing inequities, the project will identify vulnerabilities in pilot areas during the Inception Phase and will monitor the impact during the whole project implementation period. As part of the participative processes, community dialogues, training and close collaboration with national and local authorities will enable participation of vulnerable and marginalized groups and successful signaling, management and mitigation of risks.

C: For each pilot area, the comprehensive risk screening and mitigation plan will be re-visited, following further detailing of the work plans (i.e. project locations, target groups, groundwater management activities and project interventions to be defined in greater detail during the project Inception Phase). Where deemed necessary, project scope and interventions will be adjusted to ensure risks are mitigated and potential negative impacts avoided. As much as possible the risk screening will be done in a participatory manner, with the involved groundwater user and community groups.

D: As part of the compliance approach, ESMP and progress monitoring, the status and issues arisen will be reported at the end of the Inception Phase. The Inception Phase, as a go/no-go moment can be used to improve on any inadequate environmental and social risk monitoring or mitigation.

E: Validation of the monitoring and evaluation set-up, and reporting with clear and verifiable indicators and means of verification. The implementers will build on the proposed M&E approach and, when required, can update the M&E approach in accordance with the latest AF guidelines.

F: Periodical progress reporting as prescribed in the project management plan, and as per AF guidelines. UNESCO and CCOP-TS as IE and EE will prepare the final environmental and social assessment reporting for AF and in a suitable format for people, communities and other stakeholders involved in the project. A special section of the progress reports will be dedicated to stakeholders and vulnerable groups in each pilot area.

G: Gender issues assessment and ensuring positive impacts and compliance. The Terms of Reference for a gender specialist engaged for the project by the IE will be prepared during the IP and the involvement ensured.

H: M&E; Systematic progress monitoring, collection of stakeholder feedback and reviews

I: Project Steering Committee assessment of compliance; following on the partner country consultations on the ESP compliance issues, the project Steering Committee (again composed of representatives from the five countries) will be asked to pay specific attention to this subject.

J: Awareness and activation of Grievance Mechanism (see below).

4. Monitoring and Evaluation, Reporting

As IE, UNESCO will establish a project M&E and reporting mechanism through which to monitor and report, with at least, 1) project progress and results (on the basis of verifiable indicators and MoV's) and 2) impact assessment and compliance with ESP Principles. This will be done throughout implementation of the project. As the project will focus on implementation of activities in four pilot areas, monitoring and reporting processes will place particular emphasis on the (sub)national and regional levels, in the following manner:

For the project as a whole and for each pilot area (4x):

1. Semi-annual workplan preparation and approval assessed by means of checklist on potential negative impact and risks and for each of the fifteen Environmental and Social Core Principles. Activities (Tables 10 & 11); Apply screening measures as introduced in Tables 10 and 11.
2. Upon completion of semi-annual workplans, implementing units will be specifically requested to report any issues pertaining to adverse environmental and social impacts, and/or mitigation actions implemented or considered.
3. An annual summary statement / communique will be prepared on the basis of which further public consultations and associated activities can take place.
4. In each pilot area, a small representative committee of local and national stakeholders will be involved. This committee will approve/endorse:
    a. the overall outcome of the environmental and social impact assessments, and
    b. possible mitigation actions for unforeseen adverse impacts.

   Since the project will focus implementation in the pilot areas, consultation and mobilization of project support and understanding by local stakeholders and their representatives is essential. If necessary, a grievance mechanism can be applied (see below).
5. National partners, in their supporting roles for the implementation of the project, will be involved in and support steps 1-4. This process is overseen by UNESCO as IE and reported on at semi-annual project meetings. The ultimate responsibility for implementation of the M&E mechanism rests with the implementing entity.

UNESCO and the project partners have in the project formulation and initial screening process (Concept Note and Proposal stage) carefully considered any potential direct, indirect, transboundary, and cumulative impacts in the project's area of influence. This assessment is supported and substantiated by considerable earlier and ongoing groundwater work by the project partners in the countries and regions involved.

On this basis, it is concluded that project interventions are unlikely to have any serious adverse environmental or social impacts. Hence the project has been classified in Category B. The monitoring approach outlined in the section above will ensure - in case of doubt or due to unforeseen developments - that any potential risks can be mitigated and any associated negative impacts prevented.

If, against expectations, project implementation generates negative environmental or social impacts, this will be addressed through the M&E mechanism and reflected in the periodical project reporting. The annual project performance report will include a section detailing the status of the ongoing environmental, social impacts and risks, as well as consideration of gender issues. Reports will include, where necessary, a description of any corrective actions taken during the reporting period. The mid-term and terminal evaluation reports will also include a detailed evaluation of the project's performance with respect to gender, and environmental and social risks.

5. Grievance mechanism

All direct beneficiaries of the project and other related stakeholders will be informed about the grievance mechanism and the complaint-handling mechanism of the project. The IE with project partners will produce public information materials (leaflets and brochures) that explain the project, complete with detailed contact information of persons in charge (name, position, address, phone, email), and including access to information regarding the mechanism for handling complaints of the AF (https://www.adaptation-fund.org/page/mechanisms-handling-complaints). These public information materials will be distributed during community consultations and general awareness activities.

As part of the project's ESMP as well as progress and results monitoring, stakeholder feedback and reviews will be collected systematically. Focus will be placed on the results evaluation of tangible measures and activities in the four pilot areas (where the closest connections occur between stakeholder interests and needs and the intended effects and impacts of the project).

As part of the monitoring and evaluation process, a grievances modality will be set up - both for the project as a whole (as part of the project's website and information portal), and as part of the specific evaluation and progress data collection (M&E) in the pilot areas. This approach will allow concerned stakeholders to raise issues (anonymously if they wish), to the project management implementers at all levels of implementation.

Figure 23 depicts the grievance mechanism process to be implemented in the project. The grievance mechanism process will support receiving, evaluating, and addressing project-related grievances from local communities and other stakeholders. It will be possible to express grievances via submission on the website or by phone. Receipt of the grievance will always be acknowledged, recorded and subsequently investigated in a timely manner. Where relevant, resolved grievances will be included among the Frequently Asked Questions on the project website in order to prevent any future misunderstandings.

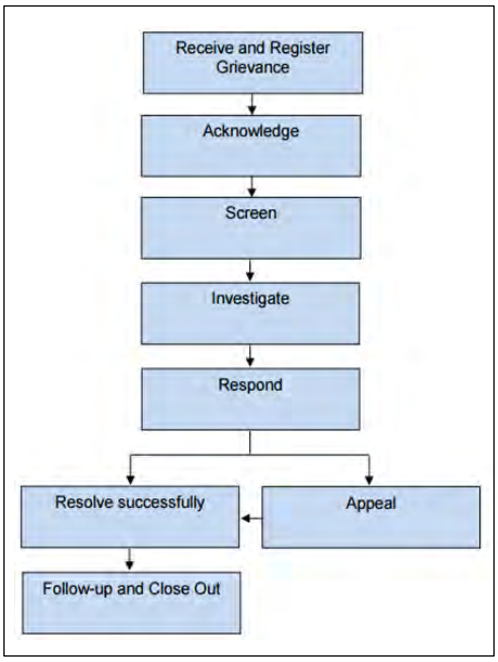


Figure 23: Grievance mechanism activation process.

4. Monitoring and Evaluation

The monitoring and evaluation (M&E) scheme of the project will be applied in accordance with established UNESCO procedures throughout the project lifetime. The M&E plan will be implemented as summarized in Table 16. Integral management and oversight will be provided by the UNESCO project holder and the CCOP-TS project team. The following are a number of essential ingredients for project M&E.

Project Inception: A Project Inception Workshop will be held within the first three months of the project and with participation of all persons and organizations that have been assigned roles and responsibilities in the project organization. Representatives from the national agencies, technical advisors and stakeholders from the region will contribute to the Inception Workshop. The Inception Workshop is crucial to generate momentum for project implementation and to develop the work plan for the first year of the project.

The Inception Workshop will address a number of key issues including:

a. Assist all national partners to fully understand and take ownership of the project;
b. Specify the roles, support services and complementary responsibilities of the project team and the national partners in the five countries;
c. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms;
d. Confirm the procedures and arrangement to engage project staff;
e. Based on the proposed project results framework, review and finalize the first annual work plan;
f. Verify and agree on project indicators, targets and their means of verification, and recheck assumptions and risks;
g. Provide a detailed overview of reporting, as well as M&E requirements. The M&E work plan and budget should be agreed and scheduled;
h. Discuss financial reporting procedures and obligations, and arrangements for audits; (i) Plan and schedule PSC meetings.
i. Roles and responsibilities of all project organization structures will be clarified and meetings planned. The first PSC meeting will be scheduled directly following the Inception Workshop.

Following the Inception Workshop, an Inception Report will be prepared as a key reference document. The Inception Report will serve as an Annex to the signed project document and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly reporting: Quarterly project progress will be monitored by UNESCO on the basis of concise project progress reports.

Comprehensive annual reports: Annual project progress reports are comprehensive key reports which are prepared to monitor progress made since project start and in particular for the previous reporting period. The annual progress reports will include at least the following: (a) Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of- project targets (cumulative); (b) Project outputs delivered per project outcome (annual); (c) Lesson learned/good practice; (d) Annual work plan and other activity and expenditure reports; (e) Risk and adaptive management. UNESCO will assess the quality of annual progress reports for completeness, comprehensiveness, analytical rigor and lessons learned.

Periodic monitoring through site visits: UNESCO and CCOP-TS will participate in project work visit and activities on location (activities as in the agreed schedule in the project's Inception Report and Annual Work Plan) to assess first hand project progress. Members of the PSC and Technical Advisory Group may join these visits incidentally. A Field/Activity Visit Report will be prepared by CCOP-TS for circulation no less than one month after the visit to the project team and PSC members.

Mid-term of project cycle: The project will undergo an independent Mid-Term Evaluation which will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management.

Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for the Mid-term evaluation will be prepared by UNESCO based on guidelines from the AF and in line with UNESCO's evaluation policy as updated in 2016 which calls for a minimum of 3% of project costs to be allocated to the evaluation function.

External final project evaluation: An external final project evaluation will take place during the final three months of the project and prior to the final PSC meeting. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the achieved contributions to capacity development in the country and pilot areas, and the SDG's, as well as the project's relevance, effectiveness and efficiency. The Terms of Reference for this evaluation will be prepared by UNESCO and the project management based on AF programme guidelines and in line with UNESCO's evaluation policy as updated in 2016.

Financial audit: Project audits will follow UNESCO's financial regulations, rules and applicable audit policies. A final certified and audited financial statement will be sent to the AF Board once the project is completed. The external financial audit will be conducted in line with the financial regulations, rules and directives of UNESCO.

Project final reports: During the last three months of the project, CCOP-TS and the implementation team will prepare the Project Final Report. This comprehensive report will summarize the results achieved (Objectives, Outcomes, Outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Description	Responsible party	Budget (tentative) excluding staff time	Time frame
Project Inception Workshop	Project management team	15,000	Project start
Inception Report	Project management team		Two weeks after the Inception workshop
Periodic status/ progress reports	Project management team		Quarterly
Meetings of PSC	Project management team, MIE	40,000	Two times in every year of the project (including virtual/Skype meetings)
Annual Progress Reports	Project management team, MIE		End of each year
Mid-Term Evaluation	External evaluation team	36,700	End of year two
External Audit	External auditor	20,000	At project closing
External Final Evaluation	External evaluation team	110,300	In the final three months of the project
Project final reports	Project management team and MIE		Final concept one month before the end of the project

Table 16: Project reporting and M&E arrangements. The indicative budget reservations are part of the Executive and Implementing Entity reservations. These will be reviewed during the Inception Phase.

5. Project Results Framework (Logical Framework)

Program Strategy	Objectively verifiable indicators				
	Indicator	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
Component 1: Groundwater resource assessment and monitoring: to obtain and use a harmonised regional GW resource inventory supporting a regional GMS approach to address challenges of climate change and resilience, and enable an information-based policy to manage resources and further develop new GW-based resilience strategies and practical interventions.					
Outcome: A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Extended management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have higher adaptive capacity. At least three services modified per sector (water supply, agriculture, industry).	Regional and local authorities have insufficient knowledge to address challenges of climate change	To increase resilience based on a sound, informed management and harmonised regional policy.	Produced policy documents, agreements made, services modified per sector.	Willingness and commitment of local and national authorities to actively engage in the process. Recognition of importance and necessity of CCA, despite of financial limitation and other obstacles.
	Governments and GW expert community and users refer to this GW inventory and use it.	Governments and user groups have incomplete to severely limited knowledge of GW resources and no consistent assessment exists.	A comprehensive overview of regional GW resources (quality, quantity) is included in an easily accessible inventory (GIS, database).	GW resources inventory tool (database and GIS) with content.	National partners are willing to provide data to be included in database.
	GW information (reports, maps, monitoring data) are used in strategies for climate resilience.	There is some GW-related data, but it is hardly used for this purpose.	GW information forms the basis for specific climate resilience measures.	Documentation and evidence for resilience measures application in the pilots.	GW system might not be suitable to support adequate measures (limited quantity, quality issues).

	Monitoring system in place and data being collected in support of operational tool.	GW seen as a static resource (basic inventories) and little or no data on temporal changes exists.	Monitoring system and information is operational and used for periodic updates.	Hard- and software, data files	Expense of periodic data collection might be too high.
	GW resources information supports further climate adaption policy at high policy levels.	Currently, GW information is hardly used.	Clear and consistent reference to GW in support of climate resilience development.	CCA policy documents with reference to GW; GW experts involved in CCA issues.	Project is able to generate tangible results with clear evidence on the ground.
Component 2: Priority use and Stakeholders: Stakeholders from different GW user sectors increasingly participate in decision-making on resource management issues and have access to information and guidelines that support more sustainable use region-wide.					
Outcome 2: GW users in different economic sectors in the GMS have access to requisite information and guidelines and thus participate in GW management.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	In each of the four pilot areas at least two different local GW users' groups (in total 2500 users) are capacitated to use ground-water sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved (AF core indicator 2.1.1)	Farmers and other users deplete GW resources regardless of CCA challenges.	Multiple users aware of and supported with resource management information and guidelines; support available in transboundary regions.	Attendance of users in resource management meetings/training; guidelines for different water use sectors documented with breakout by sex.	GW users sufficiently aware of CCA challenges.
	GW information is regionally coherent and sufficient to attract interest from users	Information on GW potential is not tangible enough to motivate users to adopt and apply it.	Supporting national partners dedicated to provide users (in-country and transboundary) with adequate information.	Information products and guidelines published and circulated.	National partners sufficiently enabled to achieve the objectives and targets for the transboundary aquifer systems.

Component 3: Resource management, information tools and equipment: will support greater resilience and more sustainable GW resource use, with protection of low income and vulnerable user groups; resource management methodology supports better transboundary GW policies that are more robust and climate change ready.					
Outcome 3: Climate resilience and GW use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Low income and vulnerable groups apply GW based resilience measures. Of targeted population groups 70% is aware of predicted adverse impacts of climate change, and of appropriate responses; 30-50 % of targeted population applying appropriate adaptation responses.	Next to basic resource inventories (GW maps) there is no tailored information to support sustainable resource use or specific measures to support resilience.	Greater resilience and sustainable GW resource use, enabling low income and vulnerable user groups to use GW resources optimally when needed.	Practices of farmers and other user groups that apply resilience measures	Differences in quality of GW system management may be too large to solve within the timeframe of the project.
	Improved exchange of information on transboundary groundwater management issues.	No transboundary cooperation, incompatible resource inventories, no communication.	Joint and coordinated efforts to use information and tools for monitoring to develop and apply GW management	Database, multi-language information products, shared management tools.	Investments in monitoring equipment may be too costly
	Suite of tools, methods etc. have been prepared		Comprehensive information, tools and methods developed and applied		Underlying data availability may be insufficient to develop useful information products.
Component 4: Regional cooperation, coordination and information exchange will result in the development of a regionally coherent policy for climate adaptation through sustainable GW resource management, a level playing field for GW users from all sectors throughout the region and efficiency gains through a common approach and collaborative support tools.					
Outcome 4: A regionally coherent policy for sustainable groundwater management in	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	Multi-country or bilateral arrangements to support and	Despite common CCA challenges countries in the region do not	Regionally coordinated GW use contributes to regional, cross-	Multi-country or bilateral consensus documented in	Bilateral relations or specific resource

support of CCA is adopted based on a level playing field of all users in the GMS.	oversee GW management in support of climate resilience objectives.	optimally share practices, knowledge and resources	border climate resilience for food production, rural water supply, etc.	policy documents and similarities in approach.	conflicts may be too serious to overcome.
	Regional coordination recognizes different vulnerabilities and needs of different users. At least three main GW-related policies introduced or adjusted to address climate change risks (one by sector).	Vulnerable groups in the region and suffer from detrimental impact of resource depletion and increasing climate change vulnerabilities.	Collaborative transboundary approach to protect limited resources and support vulnerable groups.	Database, multi-language information products, shared management tools. Introduced and/or adjusted policy documents.	Project is able to transfer the results of regional pilots to higher policy levels.
Component 5: Capacity building and training will enhance the internal capacity of the GW community of experts in the GMS region to develop and contribute to CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with stakeholders and vulnerable groups.					
Outcome 5: GMS stakeholders capably use project tools on GW use for CCA and resilience.	**Indicator**	**Baseline**	**Target**	**Sources of verification**	**Assumptions and Risks**
	A CoP on user-oriented groundwater management is active Over 25 partnerships and active collaboration set up to support GW management capabilities that strengthen resilience and reduce detrimental climate change impacts.	Within the region different national groups work on rather different knowledge levels and there is little bi- or multilateral cooperation.	CoP of GW experts is able to contribute to CCA policy and practical resilience enhancing interventions.	Proceedings of meetings and collaborative products, joint statements.	Proposed interaction may not evolve to a higher, more effective level.
	Over 120 regional experts support institutional capacity in 5 countries	Although there are regional network meetings there is little coordinated effort to improve	Through regional cooperation GW experts have reached a higher and collaborative knowledge and impact level.	General academic level within CoP is raised significantly (more PhD's, more MSc's). Proceedings of meetings and	There is sufficient support and funding within the region to sustain the envisaged

	(male/female = 60/40%).	overall impact level.		collaborative products, joint statements.	regional collaboration.
	GW CoP is actively engaged with different stakeholder groups and provides tailored information. Over 750 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	As above	GW CoP is regionally active and able to contribute effectively to different GW system, sustainability or CCA challenges.	CoP is visible with contributions and input in the regional CCA debate and multilateral coordination processes. Proceedings of meetings and collaborative products, joint statements.	Risk: The regional CCA debate may be dominated by other groups.

Table 17: Project Logical Framework

6. Alignment with Adaptation Fund Result Framework

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the greater Mekong Subregion through improved groundwater management and transboundary cooperation

Alignment of Project Objectives/Outcomes with AF Results Framework

Project Objective(s)[25]	Project Objective Indicator(s)	AF Fund Outcome	AF Fund Outcome Indicator	Grant Amount (USD-indicative)
Groundwater resources management is improved, thus increasing the CCA and resilience of GMS countries to protect people, livelihoods and ecosystems.	Over 25 partnerships and active collaboration set up to support groundwater management capabilities that strengthen resilience and reduce detrimental climate change impacts. Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	2,500,000
Groundwater users including women from different economic sectors in the GMS have access to requisite information and guidelines and thus participate in groundwater management.	In four pilot areas at least two different local groundwater users' groups are capacitated to use groundwater sustainably for adaptation and climate risk reduction measures. Higher management is also aware and involved.	**Outcome 3:** Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level.	3.1. Percentage of targeted population aware of predicted adverse impacts of climate change, and of appropriate responses. 3.2. Percentage of targeted population applying appropriate adaptation responses.	2,400,000

[25] The AF uses OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (US $ indicative)
A regional GMS approach to address challenges of climate change and resilience is created based on an information-based policy.	Greater groundwater management services made more responsive through improved resource assessments, management capability and information tools and human resources capacity in the sector. Greater water and specifically groundwater management services and supporting hard and soft infrastructure (policy and guidelines, database, monitoring systems, MAR systems) have been improved towards higher adaptive capacity.	**Outcome 4:** Increased adaptive capacity within relevant development sector services and infrastructure assets.	4.1. Responsiveness of development sector services to evolving needs from changing and variable climate. 4.1.1. Number and type of development sector services modified to respond to new conditions resulting from climate variability and change (by sector and scale).	1,000,000
Climate resilience and groundwater use in pilot areas is increased, and low income and other vulnerable groups' needs are prioritized.	Vulnerable people in four pilot areas and five countries will be able to rely on improved water management in support of livelihoods and other water needs.	**Outcome 6:** Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	6.1 Percentage of households and communities having more secure access to livelihood assets. 6.2. Percentage of targeted population with sustained climate-resilient alternative livelihoods.	1,000,000 800,000
A regionally coherent policy for sustainable groundwater management in support of CCA is adopted based on a level playing field of all users in the GMS.	Local interventions and guidelines (at least 3 in each pilot area) support resilience measures that are upscaled to national policies and guidelines. Regional (5 countries) and transboundary cooperation in pilots will generate at least 15 risk policies/guidelines.	**Outcome 7:** Improved policies and regulations that promote and enforce resilience measures.	7.1. Number of policies introduced or adjusted to address climate change risks (by sector).	500,000

Project Outcome(s)	Project Outcome Indicator(s)	Fund Output	Fund Output Indicator	Grant Amount (USD-indicative)
GMS stakeholders and communities capably use project tools on groundwater use for CCA and resilience.	Number of partnerships and active collaboration set up to support groundwater management capabilities that strengthen resilience and reduce detrimental climate change impacts.	**Outcome 1:** Reduced exposure to climate-related hazards and threats.	1.1 Number of projects/ programmes that conduct and update risk and vulnerability assessments by sector and scale.	800,000
	Over 50 regional experts support institutional capacity in 5 countries (male/female = 60/40%). Over 250 participants have increased awareness and skills on climate related impacts (male/female = 60/40%).	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses.	2.1.1. Number of staff trained to respond to, and mitigate impacts of, climate-related events (by gender). 2.1.2 Number of targeted institutions with increased capacity to minimize exposure to climate variability risks (by type, sector and scale).	

Table 18: Alignment of Project Objectives/Outcomes with AF Results Framework

The result framework has been complemented with an overview of core impact indicators (SMART), using the core indicators tables prescribed by AF.

ADAPTATION FUND CORE IMPACT INDICATOR 1: NUMBER OF BENEFICIARIES

Date of Report							
Project Title		Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience					
Country		Cambodia, Lao PDR, Myanmar, Thailand, Vietnam					
Implementing Agency		UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations					
Project Duration		4 years; 2020-2023					
AF Core Impact Indicator 1: "Number of Beneficiaries"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4*				*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
			1	*2*	*3*	*4*	
1. Direct beneficiaries supported by the project	0	2200	500	800	400	500	i.e. people trained or directly involved
1a. GW user groups		115	20	50	20	25	Average size of GW user group is 20 people
1b. GW management provincial – regional level	0	405	50	150	125	80	Participants from selected provinces/districts
1c. GW management & policy national level		230	30	100	60	40	Participants from national and subnational level
Clarification; 500 = No. of people participating in training and/or other awareness raising activities or otherwise directly involved in project activities. It is also reflecting the larger populations in for instance the upper Mekong Delta pilot areas. This is a very conservative estimate; the numbers will be adjusted on the basis of data collected during project Inception and more specific workplans.							
Female direct beneficiaries	0	880	200	320	160	200	Set at 40 % for the GW / water/ natural resources management sector
Youth direct beneficiaries (aged 15-24)	0	220	50	80	40	50	Set at 10 %, for instance through doing a school-oriented awareness/training programme
2. Indirect beneficiaries supported by the project (*in thousands)*	0	1981	175	878	396	532	The communities of the above group (i.e. 5 trainees from 1 village or district of 5000 people, so here the No. of indirect beneficiaries is 5000. Estimated as a reasonable % of the total population in the pilot area = 8-10 %. **The total is about two million.**
Female indirect beneficiaries	0	792	70	351	158	213	Set at 40 % of the total
Youth indirect beneficiaries (aged 15-24)	0	396	35	176	79	106	Set at 20 %, for instance through doing a school-oriented awareness/training programme. At 20 % this means 1/100 = 1% of the total population

AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"

Date of Report							
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations						
Project Duration	4 years; 2020-2023						
AF Core Impact Indicator 2: "Assets Produced, Developed, Improved, or Strengthened"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4* *1*	*2*	*3*	*4*	*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
Sector: Cross-sectoral: Water Management, Food Security, Rural Development, Agriculture, Health			Water supply based on GW resources touches upon all these sectors and it is the explicit aim to develop and apply GW-based resilience measures for different sectoral stakeholders.				
Targeted Services / Assets 1) Development Services (developed/improved)	0	8	8	8	8	8	**Development services;** support for technical and managerial skills and regulatory framework for GW management, improved capacity of regional and local monitoring and oversight, increased capacity of GW use-related extension services.
2) Physical assets/infrastructure *(produced/improved/strengthened)* - *Well systems* - *GW recharge systems* - *Monitoring systems*	0 0 0 0	5 2250 90 18	5 150 10 2	5 1200 30 6	5 400 30 6	5 500 20 4	**Physical assets/infrastructure:** Physical infrastructure to increase resilience and adapt to climate change including: GW exploitation and recharge systems, resource use monitoring networks and necessary data management and processing systems, water harvesting and conservation systems. The number of individual (small) wells could be significantly higher.
Changes in asset status - Development Services; (*Qualit.)* - Training, information and awareness services (Quant.)	0 0	3-5 24	3-5 3	3-5 8	3-5 8	3-5 5	Services and Assets change of status 5: Fully improved, 4: Mostly Improved or 3: Moderately improved

AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"

Date of Report							
Project Title	Groundwater resources in the Greater Mekong Sub-region: Collaborative management to increase resilience						
Country	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam						
Implementing Agency	UNESCO Office Jakarta with UNESCO Office Bangkok, CCOP-TS Bangkok and supporting technical organizations						
Project Duration	4 years; 2020-2023						
AF Core Impact Indicator 3: "Natural Assets Protected or Rehabilitated"							
	Baseline	Total for whole project	Target at project approval *(absolute number), per pilot area 1 to 4*				*1 = Lao PDR; 2=Cambodia-Vietnam Mekong Delta; 3=Cambodia NW-Thailand; 4 = Myanmar*
			1	*2*	*3*	*4*	
Natural Asset or Ecosystem - Improved water retention areas - Aquifer recharge areas	0 0	-	-	-	-	-	The number of designated water retention and aquifer recharge areas is indicated below; size in ha cannot yet be specified, the given number is indicative
Change in state *Effectiveness of protection/ rehabilitation - Scale (1-5*	0	3-5	3-5	3-5	3-5	3-5	5: Fully improved, 4: Mostly Improved or 3: Moderately improved
Total number of natural assets or ecosystems protected/ rehabilitated	0 0	18 21	3 4	4 6	8 8	3 3	Natural areas and ecosystems elements designated as recharge areas

TABLE 19: ADAPTATION FUND CORE IMPACT INDICATORS

7. Project budget

This technical project proposal is accompanied by a comprehensive budget proposal, following Adaptation Fund guidelines. The budget is available in **Annex II** (Excel format). Soft copies can be provided on request.

Project budgets (Excel sheets annexed)
Sheet 1: Summary project budget
Sheet 2: Breakdown of the project execution costs (CCOP-TS)
Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
Sheet 4: Budget disbursement schedule with time-bound milestones.
Sheet 5: Detailed project budget, Excel format (Annex II)

In this main document we present summaries of the different budget sheets

Sheet 1: Summary project budget

No.	Description	Budget (US $)
1.	Programmatic costs, Component 1 - 5	4,200,000
2.	Execution Costs (CCOP-TS) @ 8.5 %	357,000
3.	Subtotal	4,557,000
4.	Management fee MIE @ 7.5 % of Subtotal	341,775
5.	**Total Project budget**	**4,898,775**

Sheet 2: Breakdown of the Project Execution Costs (CCOP-TS)

No.	Description	Budget (US $)
1.	Project Coordinating Technical Advisor	180,000
2.	CCOP-TS Support staff	90,000
3.	Operational costs	40,000
4.	Project related regional travel	26,000
5.	External services (website, accountant)	21,000
	Total	**357,000**

Sheet 3: Budget for the Implementing Entity (MIE, UNESCO) management fee.

No.	Description	Budget (US $)
1.	General programme implementation support	173,000
2.	Finance, budget and treasury support	46,000
3.	Reporting to Adaptation Fund, M&E	49,000
4.	Project related regional travel	25,687
5.	Operational costs, publications costs	26,866
6.	External services (procurement, accountant)	21,222
	Total	**341,775**

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	Upon Agreement signature		Year 1		Year 2		Year 3		Year 4		Total %	Total Amount
											(US $)	
Scheduled Date	12/01/2020		12/01/2021		03/01/2022		03/01/2023		03/01/2024			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$ 549,845.39**		**$ 1,470,565.60**		**$ 1,490,627.25**		**$ 852,736.76**		**$ 4,898,775.00**

[a/]Use projected start date to approximate first year disbursement
[b/]Subsequent dates will follow the year anniversary of project start
[c/]Add columns for years as needed

PART IV: ENDORSEMENT LETTER BY NATIONAL GOVERNMENTS, ACCREDITED SIGNATORIES CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government:

Cambodia: Mr. Tin Ponlok, Secretary-General, National Council for Sustainable Development (NCSD) / Ministry of Environment	Endorsement letter is attached
Lao PDR: Mr. Syamphone Sengchandala, Deputy Director-General, Department of Climate Change (DCC), Ministry of Natural Resources and Environment	Endorsement letter is attached
Myanmar: Mr. U Ohn Winn, Union Minister, Ministry of Natural Resources and Environmental Conservation	Endorsement letter is attached
Thailand: Dr. Wijarn Simachaya, Permanent Secretary, Ministry of Natural Resources and Environment	Endorsement letter is attached
Viet Nam: Dr. Tran Hong Ha, Minister, Ministry of Natural Resources and Environment	Endorsement letter is attached

B. Implementing Entity certification

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (Lao PDR and Vietnam) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

Name and Signature
Implementing Entity Coordinator: **SHAHBAZ KHAN** DIRECTOR UNESCO JAKARTA

Date: 5.8.2019	Tel and email: +6221 7399 818 ext 801 s.khan@unesco.org
Project Contact Person: **Hans Dencker Thulstrup (Jakarta), Benno Boer (Bangkok)**	
Tel. and Email: +62 21 739 9818 x810; h.thulstrup@unesco.org 66-2-3910577 X 343 ; b.benno@unesco.org	

Annexes

Annex I: Comprehensive characterization of the proposed four pilot areas

Annex II: Detailed budget and budget Excel sheets

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation

Annex I: Comprehensive characterization of the proposed four pilot areas

Pilot area 1: Mekong River riparian and transboundary aquifers-Vientiane Plains, Lao PDR - Thailand

Proposed pilot area location
Vientiane Plain (VP), 4,500 km^2 area extending across all or parts of Vientiane Capital, Vientiane and Bolikhamxay provinces, population around 0.8 million people. The area directly borders the Mekong River. There is potential connectivity with adjacent Nong Khai province in Thailand.

Site characteristics
Vientiane Plain is underlain by alluvial infill overlying sandstone/siltstone with outcropping or buried rocksalt (part of the Khorat Plateau system in adjacent Thailand with very similar aquifers). GW serves domestic purposes (most villages and some urban residential), agriculture (small scale irrigation and livestock), industry (packaged water drinking suppliers, and limited harvesting of rocksalt from saline reserves). Transboundary implications of deep GW systems are poorly understood, and not considered for management. The same may be said of interaction of GW systems with Mekong River surface water.

Rationale for selection
This is one of the largest and perhaps most economically important lowland plains in Lao PDR, and the most intensively studied GW resource in the country. A rudimentary monitoring network has been set up and running since 2014; the area is easily accessible from Vientiane Capital.

GW activities carried out in the Vientiane Plan to date
GW resources have been studied by various means: regional drilling investigations, resistivity surveys, recharge and discharge estimation studies, water quality assessments, GW use perception study, participatory management study, community GW irrigation scheme set up and evaluated, GW model constructed, GW management for upper Vientiane Plain was initiated.

Proposed measures for vulnerability reduction and/or GW supply improvement
Increase resilience of local communities through improved conjunctive use of water, creating conditions for more extensive, sustainable GW developments in the region. These developments will offer more water for possible crop and livestock diversification and intensification, industry and domestic supply as well. Local scale GW resource assessment will be implemented, including socio-economic and environmental aspect of developments. Suggested developments will be accompanied with a monitoring network design and piloting and institutional capacity enhancement to ensure sustainable use (i.e. prevent aquifer drawdown and pollution, transboundary effects) and further development of GW resources (in particular where those are connected to and recharge from Mekong or major tributaries). All suggested activities, including awareness raising will be executed by local/national partners, assisted by international specialists.

Proposed partnerships and roles
Natural Resources and Environment Institute (NREI) – GW model development, scenario testing
Department of Water Resources, GW Management Divisions (DWR-GMD) – management plan formulation including stakeholder engagement.
National University of Laos, Faculty of Water Resources (NUOL-FWR) – local scale resource assessments and modelling.
National University of Laos, Faculties of Sciences, Engineering and of Environmental Sciences with graduate student projects on GW related topics.

Linkages to current Capacity building efforts
1) New PhD project on recharge estimation for lower Nam Ngum sub-basin started in 2017
2) MSc study at Hiroshima University by Lao PDR, MONRE, Department of Water Resources Management staff on village level GW quality.
3) Australia's AVID support to further develop curriculum in IWRM and GW at National University of Laos, Faculty of Water Resources

Publications and other resources
1. http://gw-laos.iwmi.org/
2. Suhardiman, D., Pavelic, P., Giordano, M. and Keovilignavong, O. (forthcoming) Agricultural groundwater use in

the Vientiane Plains: Farmers' perceptions of opportunities and constraints. Human Ecology J.

3. Clément, C., Vinckevleugel, J., Naolee, K., Sotoukee, T. and Pavelic, P. (forthcoming) Community-managed groundwater irrigation on the Vientiane Plain of Lao PDR: Trial implementation and results from the first season of operation. IWMI Working Paper.

Proposed Activities

In addition to the proposed and described project activities several focused activities will be carried out by the proposed project consortium, in collaboration with local partners.

No.	Topic	Partners
1	GW management planning (GW use inventory, stakeholder consultations, tailoring GW regulations, decision support tool development, awareness raising).	DWR supported by IWMI & NREI
2	GW planning tool refinement and scenario testing	NREI supported by IWMI or Khon Kaen University
3	Participatory GW management in alluvial areas	IWMI supported by DWR

Overview of the Vientiane Plain (Lao PDR) pilot area (next page)

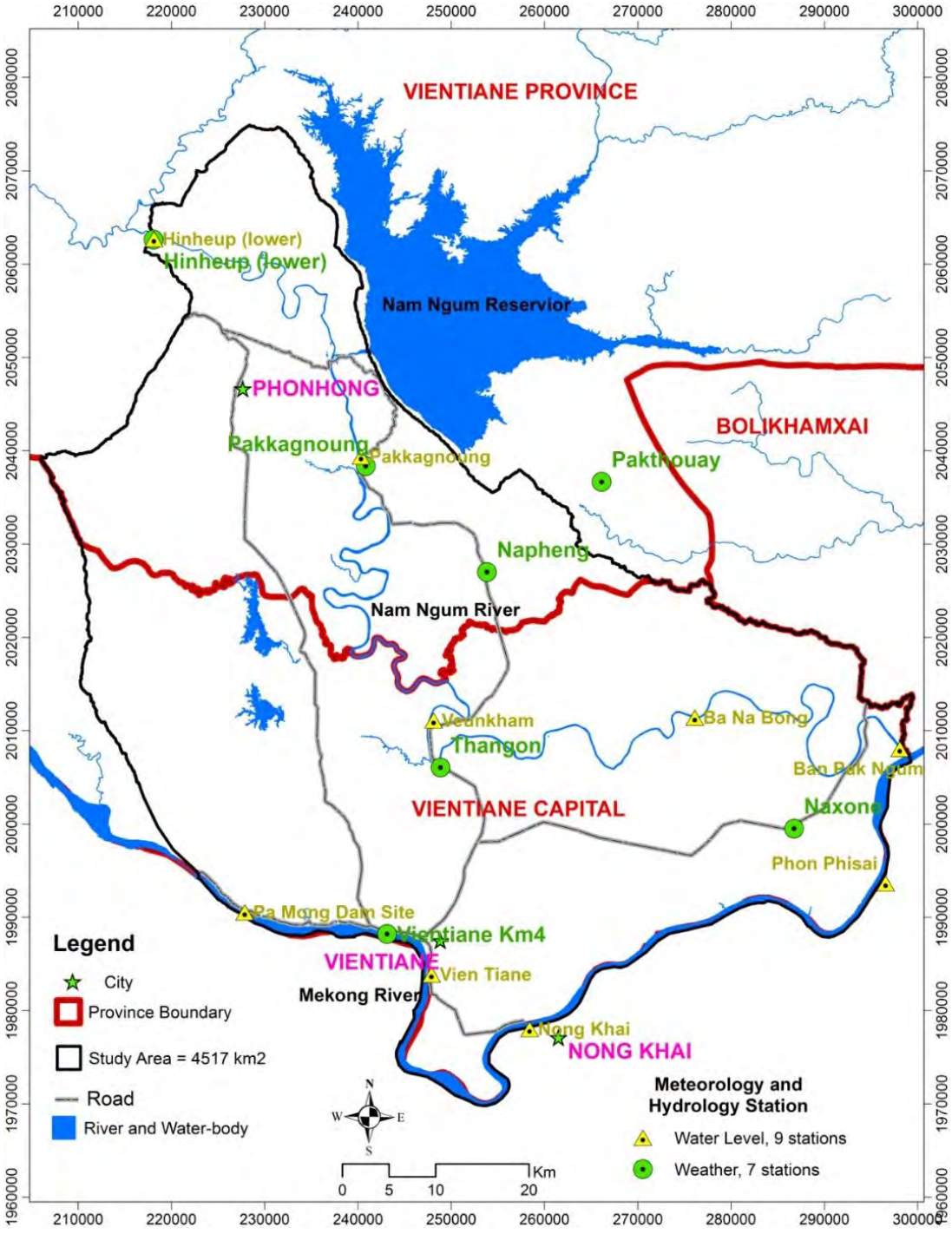


Figure 1: Overview of the Vientiane Plain (Lao PDR) pilot area

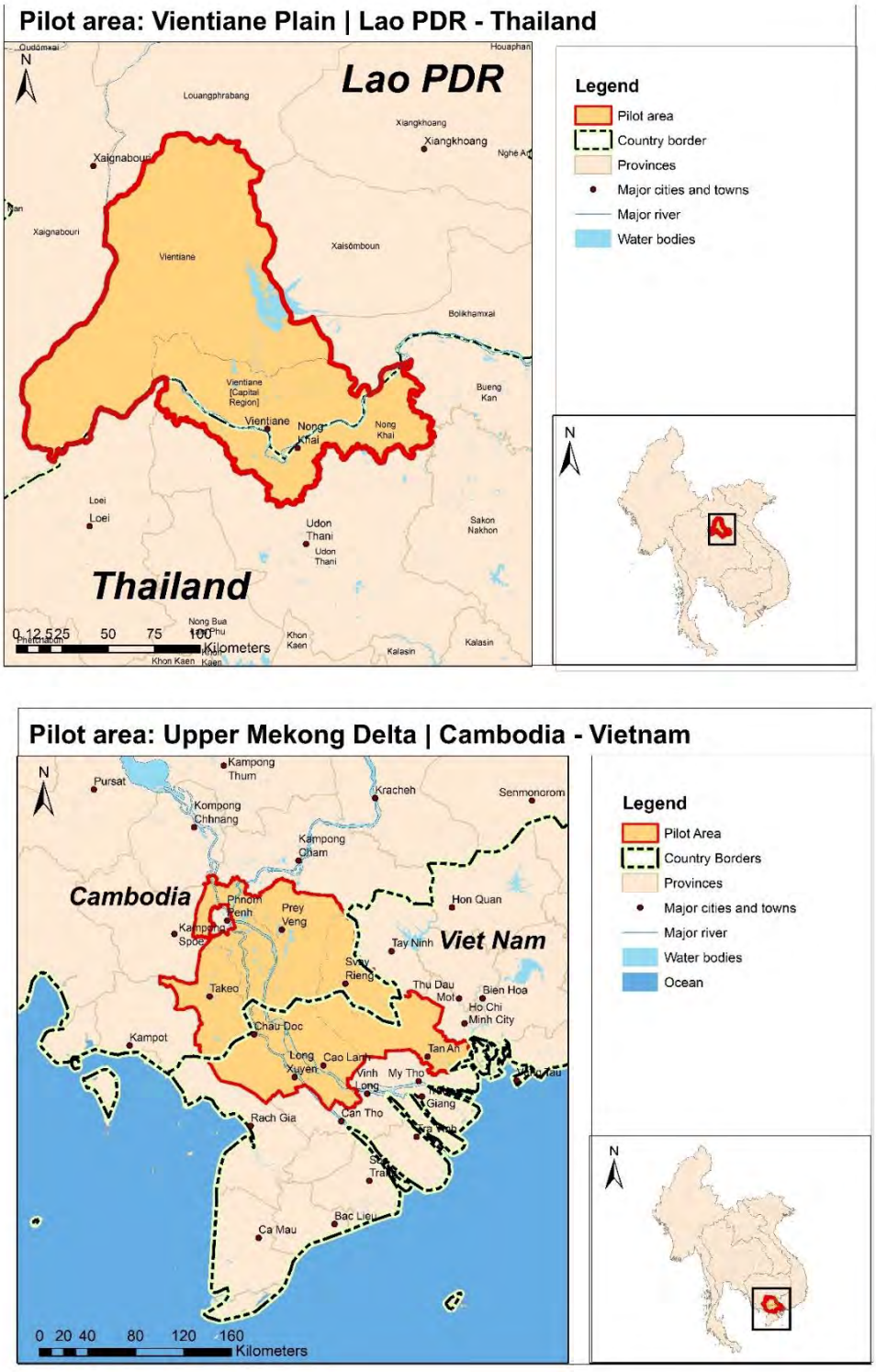


Figure 2; Regional overview of Pilot areas 1 and 2

Pilot area 2: Upper Mekong Delta Transboundary Aquifers (Vietnam + Cambodia)

Proposed pilot area location
Upper Mekong Delta region in Vietnam and adjacent lowlands adjacent to Mekong River in Cambodia, 12,000 km^2 area with a population of an estimated 4 million people. The area is part of major aquifers fed by the Mekong River system. It comprises the provinces Takeo, Kandal and Prey Veng in Cambodia, and the provinces of An Gian, Dong Thap and Long An in Vietnam.

Site characteristics
Subtropical lowland river plain with main channels of Bassac and Mekong Rivers, intensively used for paddy rice and food crop cultivation. Mekong and Bassac River waters intensively used for irrigation and water supply, but in the dry season increasing use of shallow and deep GW from dug wells, shallow and intermediate boreholes. Seasonal floods play a crucial role in natural replenishment of Cambodia and Vietnam Mekong Delta aquifers, but the flooding patterns are strongly affected by changing climate and upstream river developments. At the same time, dependency on reliable and good water supply for food production and domestic use is increasing.

Transboundary implications of deep GW systems are poorly understood, and not considered for management (unlikely for phreatic aquifer). The same may be said of interaction of GW systems with Mekong River surface water.

Rationale for selection
This is one of the largest and perhaps most economically important transboundary aquifer systems in the Lower Mekong Sub-region. The importance of long-term supply of GW (quantity and quality) for food production, both in Cambodia and in southern Vietnam, cannot be overemphasized. The dynamics of the system are explicitly transboundary, while also the effects of regional developments (viz. dam construction, flood control and diversion of Mekong River waters, development of the Tonle Sap basin) are complex and most likely considerable.

GW activities carried out in the upper Mekong Delta to date
GW resources are being exploited and studied quite intensively by provincial government organisations on both sides of the border. In Vietnam this is partly executed and supported by DWRPIS. In Cambodia government policy on GW is not very well developed and there is very limited capacity to engage in active and focused interventions.

Proposed measures for vulnerability reduction and/or GW supply improvement
Increased demand and change in recharge pattern and quantity require additional attention to transboundary aquifers. In this project, transboundary cooperation will be supported by technical and non-technical measures and scaled up. Internationally developed and world-wide used methodology and information systems will be implemented to strengthen information exchange and further build up confidence between the aquifer / riparian parties. The baseline for these activities will be the present GW management practice and the lesson learned. Therefore, a systematic sharing of experience, in particular from Vietnamese Mekong Delta to neighbouring Cambodian Mekong Delta, will be very instrumental for sustainable use of GW resources, anticipating over-exploitation and mitigating risk of transboundary conflict over GW. Methods to increase aquifer recharge, control/regulate abstraction and decrease demand will be assessed for local conditions, prioritised and piloted/tested where feasible. Specifics of transboundary GW governance and options to adjust/change user needs to avoid and/or mitigate current or future constraints will be shared and discussed with wide circle of stakeholders in the region, embedding their active participation in the governance process.

Proposed partnerships and roles
Vietnam's NAWAPI (MONRE) institute and its southern branch, the Division for Water Resources Planning and Investigation in the South of Vietnam (DWRPIS). In view of the underdeveloped situation in Cambodia, the execution of the activities in this pilot area will need substantial support from international experts.

Linkages to current capacity building efforts
There is a unique opportunity to apply and learn from the well-developed GW system knowledge and data management in the Vietnamese provinces for the rather poorly monitored and studied Cambodian aquifers. The Vietnamese experience includes the ongoing efforts to develop IWRM-based approaches to address climate change threats and long-term water supply strategies. The project is the first to address GW-oriented resource management issues in the transboundary area

with inclusion of knowledge transfer, capacity building and regional cooperation.

Publications and other resources

Various DWRPIS reports and publications by DWRPIS

1. Erban, L. S.M. Gorelick & H.A. Zebker, 2014; Groundwater extraction, land subsidence and sea-level rise in Mekong Delta, Environ. Res. Lett. 9.
2. The Mekong Delta System: Interdisciplinary Analysis of a River Delta, F.G. Renaud and Claudia Kuenzer (eds.), Springer 2012, pp. 463; incl.: Frank Wagner, Vuong Bui Tran and F.G. Renaud; Groundwater Resources in the Mekong Delta: Availability, Utilization and Risks, pp. 201-220.
3. Climate Change Adaptation Planning for Urban Water Supply in Soc Trang Province, Dierks, R, 2016, Conference paper

Proposed Activities within the overall project approach

In addition to the proposed and described project activities, several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	Setting up a system of joint GW monitoring; supporting the GW monitoring capabilities in Cambodia	Project, with support of DWRPIS, Vietnam, Cambodia partners
2	Inventory and quantification of GW abstractions and use by different sectors; starting dialogue with main stakeholders	Project, with support of DWRPIS, Vietnam, Cambodia partners
3	Preliminary orientation on resilience enhancing measures in the framework of integrated surface-GW management	Project, with support of DWRPIS, Vietnam, Cambodia partners

Next page: Detailed map of Mekong delta transboundary area

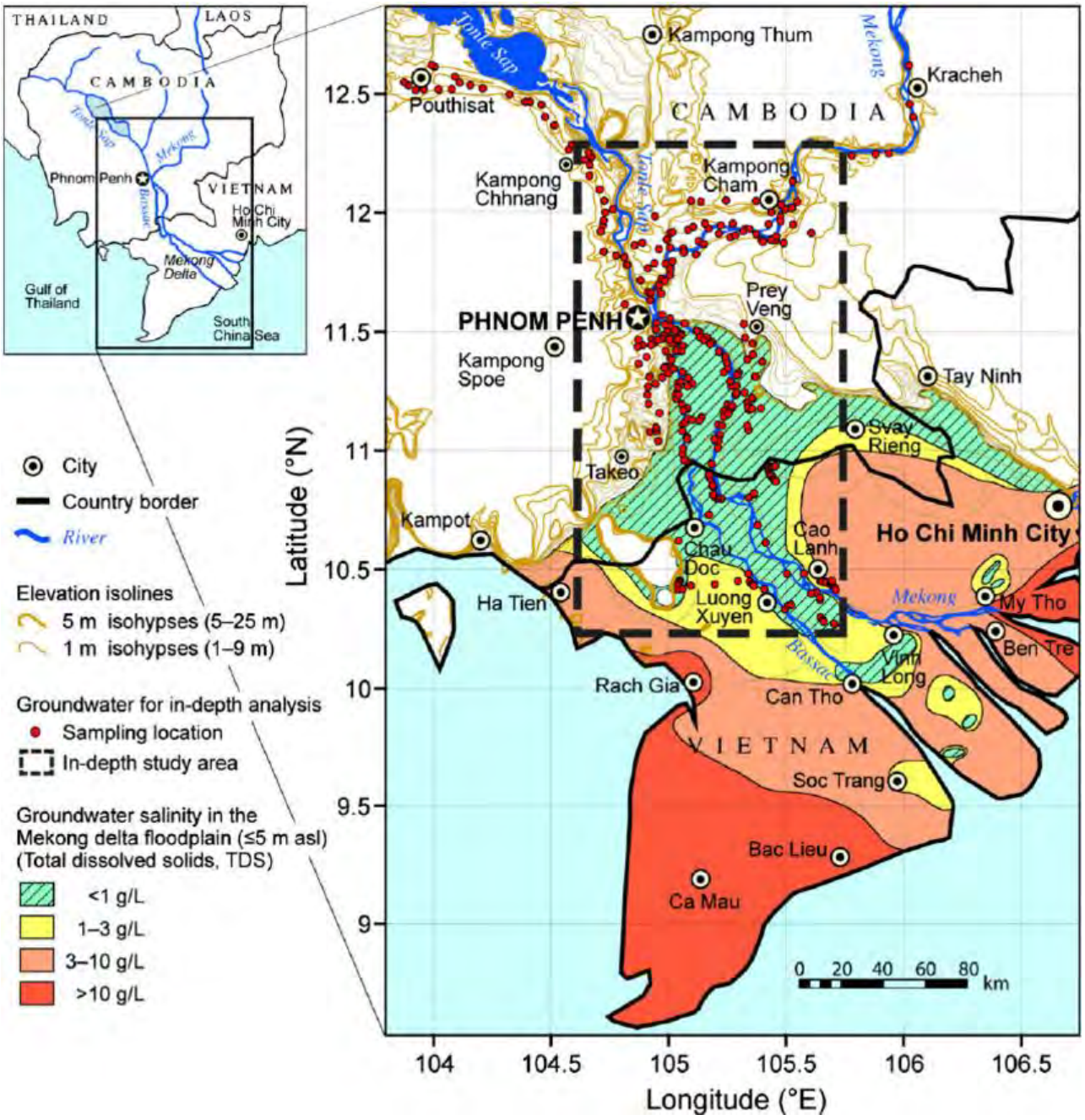


Figure 3: Overview of the Mekong Delta transboundary area

Map of the Mekong Delta depicting GW salinity in the Holocene aquifers. Sampling locations for in-depth GW analysis (n = 352) are indicated by red dots. The contour plot shows the salinity distribution. The salinity data was obtained from the DGMV (Ho Chi Minh City, Vietnam). The flat topography is indicated by elevation lines calculated with ArcGIS from the digital elevation model Gtopo30. Source: Contamination of drinking water resources in the Mekong delta floodplains: Arsenic and other trace metals pose serious health risks to population, Buschmann et al., 2008, Environment International.

The focus of the pilot will be on the transboundary aquifers southeast of Phnom Penh (see regional map in Figure 2).

Pilot area 3: NW Cambodia – Eastern Thailand border area

Proposed pilot area location
Northwest Cambodia – Eastern Thailand border area (Cambodia Banteay Meanchey, Oddar Meanchey, Siem Reap Provinces; adjacent Thailand provinces of Changwat Sa Kaeo, Buriram, and Srin).

Site characteristics
The area is characterized by modest rainfall and a distinct dry season. Increasingly, due to climate change effects, monsoonal rains are late and come in the form of intensive cloudbursts, leading to flooding. GW system are poorly studied, but it is well known that GW use for domestic and agriculture irrigation purposes is widespread. There is a significant water deficiency in the second half of the dry season, viz. March-May, increasing pressures on GW use. Measures for recharge and storage are considered.

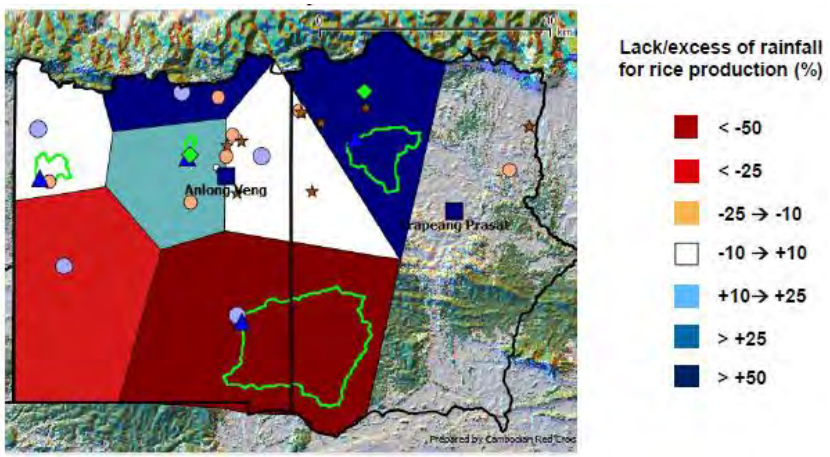


Figure 4: Water needs in north-western part of Cambodia. Regional water deficiencies occur in parts of northwest Cambodia (May 2013 situation). At the same time there is a water surplus in upstream catchments. Integrated surface-GW management and GW recharge can significantly contribute to climate resilient rural land use.

Rationale for selection
Vulnerability of rural population; potential to increase sustainable GW use in support of rural livelihoods, food production and rural (domestic) water supply; significant potential to increase climate change resilience on the basis of improved and more sustainable GW management. The Angkor World Heritage site is on the Heritage in Danger list due to subsidence from excessive GW extraction. The Tonle Sap Lake Biosphere Reserve is also is very much dependent on GW to retain its rich wetland biodiversity.

GW activities carried out in the area to date
Experts of Khon Kaen Groundwater Research Centre (Thailand**)** compiled the hydrogeologic units of Changwat province and Sakaeo province that forms a part of the Siem Reap hydrologic basin (see overview map). Inventories were also made of drill well locations in the border area, on the basis of several databases from the Thai Government offices. For the Thailand side, there is rather comprehensive information regarding surface- and GW resources and wells as shown in the map as well as other relevant data, e.g. land use, soils, communities, etc. The largely rural population in the border area and the rural districts down to Tonle Sap Lake rely on GW resources (with several water wells in every village). The aquifer is meta-sedimentary aquifer, but with a rather variable GW potential across the region. It is assumed that similar aquifer systems extend across the border area in both Thailand and Cambodia and transboundary relationships occur.

Proposed measures for vulnerability reduction and/or GW supply improvement
Intensified development of GW resources is recommended here to increase availability and ensure sustainable use of GW, particularly in dry periods. A joint assessment is required, including the suitability of water recharge/storage methods. GW monitoring network design and piloting is envisaged as well. A customized information system to support assessment and monitoring will be introduced. The system will also serve as an enabling environment for transfer, storage, processing and dissemination of data and information relevant to the specific conditions and aquifers in the Siem Reap basin. This will allow Cambodian water agencies and stakeholders to consolidate knowledge on GW resources and plan informed management measures. A standardised information system will facilitate exchange of information among GW experts from Thailand and

Cambodia, providing the common baseline and platform for common actions at the regional level, including raising awareness about GW resources and climate in the changing world.

Proposed partnerships and roles
The activities in this pilot are will emphasize transboundary (Thai-Cambodia) cooperation and learning, focusing on improved assessment and monitoring of potential GW resources, determining user needs and resilience potential of regional agricultural land use systems on the basis of enhanced GW use. The envisaged partnership will preferably be at user and local level (districts, provinces) emphasizing building up capacity where it is needed and can be used. These activities will be supported by the international and regional expert teams under the project.

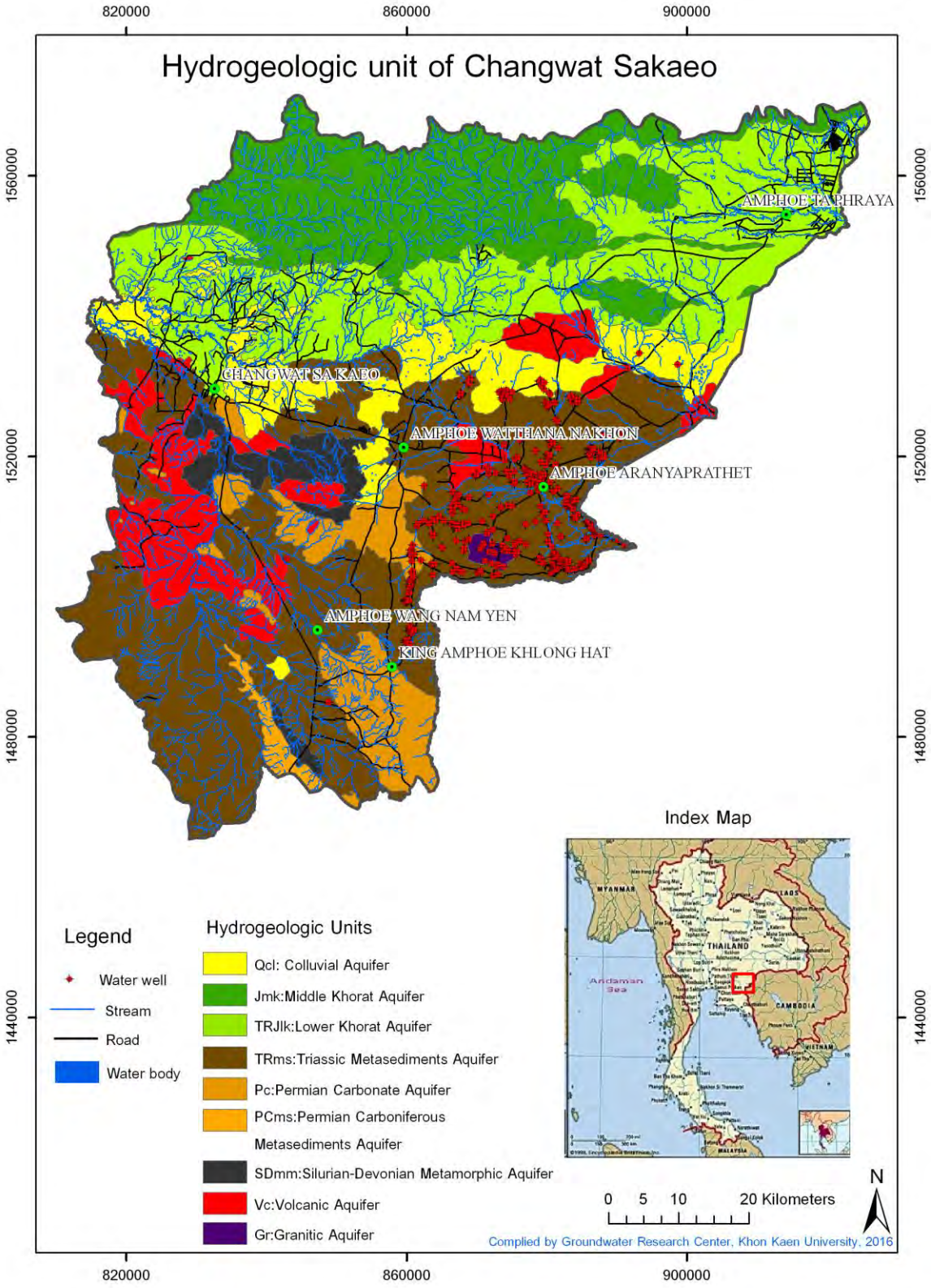
Linkages to current capacity building efforts
The project will use results from earlier GW studies in Cambodia, but in the designated region very little has been done.

Proposed Activities within the overall project approach
In addition to the proposed and described project activities, several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	Conducting a joint GW resource assessment, installing basic monitoring system; supporting the GW management capabilities in Cambodia	Project, with support of Thailand DGR, Cambodia partners
2	Dialogue with main stakeholders, potential to increase GW use in support of food production and rural water supply	Project, with support of Thailand DGR, Cambodia partners
3	Setting up joint task force to develop resilience enhancing measures in the framework of integrated surface-GW management	Project, with support of Thailand DGR, Cambodia partners

Pages below

Figure 5: Overview map of the hydrogeologic units of Changwat province and Sakaeo province, southeast Thailand that form part of the transboundary Thai – Cambodia Siem Reap hydrologic basin. Although highly variable in nature, the aquifer systems locally offer significant potential for sustainable GW use in support of more climate resilient agriculture. There is little confirmed information on the Cambodia side of the border.


Hydrogeologic unit of Changwat Sakaeo
820000
860000
900000
1560000
1520000
1480000
1440000
AMPHOE TAPHRAYA
CHANGWAT SA KAEO
AMPHOE WATTHANA NAKHON
AMPHOE ARANYAPRATHET
AMPHOE WANG NAM YEN
KING AMPHOE KHLONG HAT
Index Map
MYANMAR
LAOS
THAILAND
Andaman Sea
CAMBODIA
VIETNAM
MALAYSIA
Legend
Water well
Stream
Road
Water body
Hydrogeologic Units
Qcl: Colluvial Aquifer
Jmk:Middle Khorat Aquifer
TRJlk:Lower Khorat Aquifer
TRms:Triassic Metasediments Aquifer
Pc:Permian Carbonate Aquifer
PCms:Permian Carboniferous Metasediments Aquifer
SDmm:Silurian-Devonian Metamorphic Aquifer
Vc:Volcanic Aquifer
Gr:Granitic Aquifer
0 5 10 20 Kilometers
N
Complied by Groundwater Research Center, Khon Kaen University, 2016

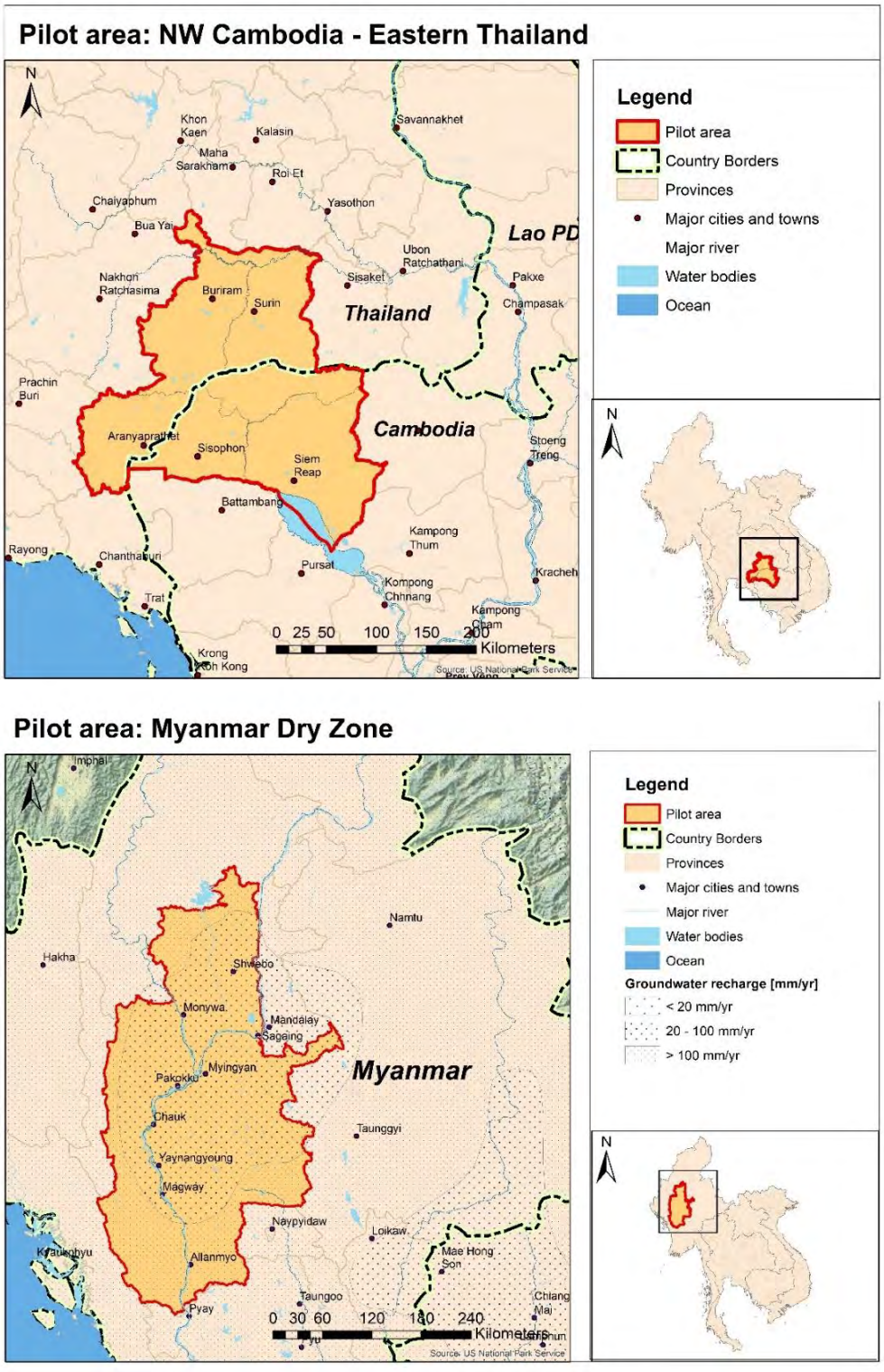


Figure 6: Maps of proposed pilot areas in Cambodia – Thailand and in Myanmar.

Pilot area 4: Myanmar Dry Zone, Yin Mar Bin – 99 Ponds irrigation scheme pilot area

Proposed pilot area location
The 99 Ponds GW irrigation scheme area is located in Central Myanmar at Yin Mar Bin Township, Sagaing Region (900 km^2 area in Myanmar's Dry Zone). The total population of the township is around 137,000 people.

Site characteristics
The area is underlain by alluvial, Irrawaddy and Pegu aquifers, which provide flow at varying depths and flow rates and are used for both domestic purposes and irrigation. Shallower Kokkogon Alluvial aquifer is used mainly for domestic supply. The deeper, semi-confined, high yielding Ywatha Aungban aquifer was developed in 1994-5, with drilling of 417 artesian tube wells supplying water to 99 ponds, to irrigate 8,181 acres. The scheme was extended with a further 32 wells and 8 ponds in 2000. A total of more than 1,980 tube wells (government and private) have been developed in the area. Poor construction and lack of operational flow regulation valves mean that many artesian wells are allowed to flow uncontrolled. Both yield and artesian water levels have declined significantly from pre-development conditions (artesian flow levels have dropped from 439 to 408 feet above mean sea level); and water levels fluctuate seasonally and depending on discharge from other wells. There is increasing concern amongst farmers and water managers about availability of water and wastage from the system; but some well owners are unwilling to cap wells for fear of losing flow.

Rationale for selection
Ministry officials have highlighted the urgency of a) regulating free-flowing wells and b) monitoring of levels to understand the recharge dynamics of the system, in order to prevent wastage and long-term depletion of the aquifers. Both technical and social inputs are required to help communities understand the dynamics of the system and allay fears about capped wells losing water.

GW activities carried out in the 99 Ponds area to date
Some monitoring of GW levels has been conducted by WRUD since 1994 (Tin Win, 2016). Recharge evaluation study of similar aquifers in neighbouring Monywa region has been done (Than Zaw, 2016).

Proposed measures for vulnerability reduction and/or GW supply improvement
Capping of wells and a regular monitoring of GW head are the urgent measures required to preserve GW resources at current level and ensure their informed management. If wells are allowed to continue flowing freely, levels will inevitably decline over time, leaving the communities vulnerable to water shortages. A focussed GW assessment will provide the necessary information on aquifer dynamics, including the recharge and discharge through artesian wells. The outcomes will be translated in layman terms and used in an awareness campaign, specifically developed for the local population, well owners and users. Informed management plans will be developed on use of GW resources, including systematic processing of monitoring data and regulatory measures. Options to adjust/change user needs to avoid and/or mitigate current or future constraints will be considered as well and shared/discussed with stakeholders. Lessons learned will be transferred to other regions (in Myanmar and elsewhere) facing similar issues.

Proposed partnerships and roles
- Department of Irrigation and Water Utilisation (DIWU) – GW monitoring, inputs to resource assessment and recharge studies; management plan formulation.
- Yangon Technical University / Mandalay Technical University – local scale resource assessments and modelling.
- Local NGO, in collaboration with WHH (the German NGO Welthungerhilfe) or Mercy Corps; stakeholder engagement, community consultation and training.

Publications and other resources
-Tin Win (2016) – Fluctuation of water level changes in Yinmarbin Artesian Zone.
-Than Zaw (2016) - Hydrogeological Framework and Spatially Distributed Groundwater Recharge Patterns, A Study around Ayardaw Township (Myanmar) Using Geospatial Approach.
- Presentations at Workshop on reviewing the water well drilling experiences and hydrogeological status in Myanmar. Naypyitaw, March 2016.

Proposed Activities

In addition to the proposed and described project activities several focused activities will be carried out by the AF project consortium, in collaboration with local partners.

No.	Topic	Partners
1	GW resource assessment and study of recharge dynamics	Project, IWMI, DIWU, YTU
2	GW management planning (Inventory of GW use, stakeholder consultations, GW regulations)	Project, IWMI, DIWU, NGO
3	Participatory planning and implementation of well capping and monitoring program in artesian areas	Project, NGO's and DIWU

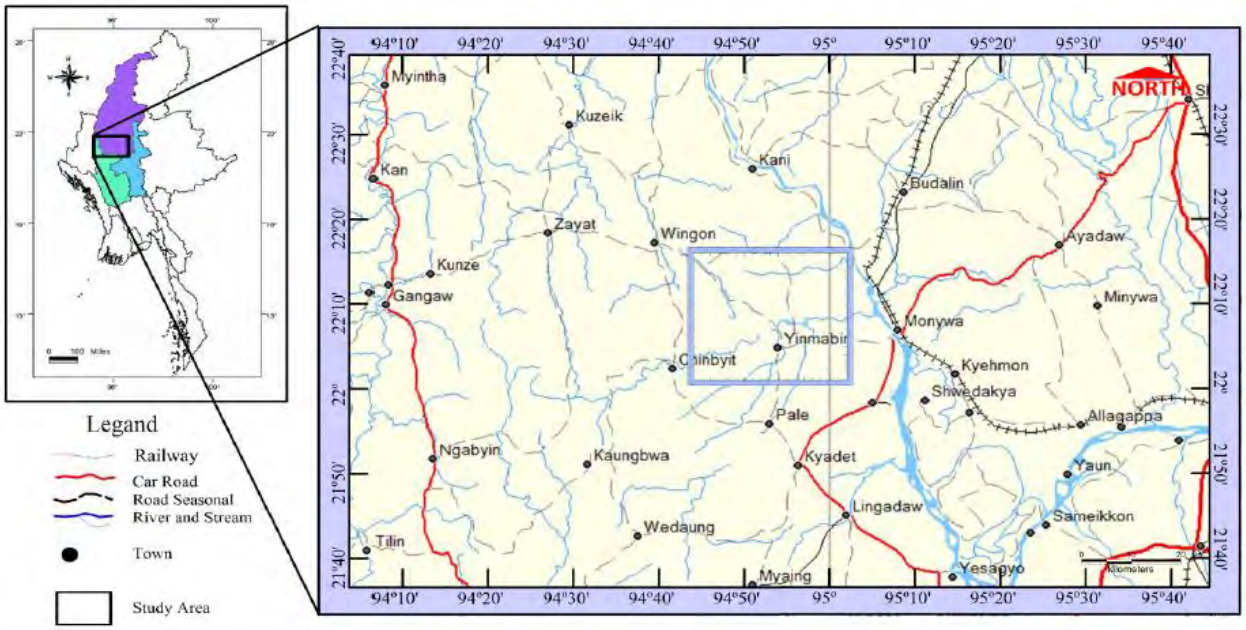


Figure 7: Location of the proposed pilot area in Myanmar, Central Dry Zone

---------- End of additional document----------

Groundwater resources in the Greater Mekong Subregion: Collaborative management to increase resilience

A collaboration of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam to increase climate resilience in the Greater Mekong Subregion through improved groundwater management and transboundary cooperation

Annex II: Detailed budget and budget Excel sheets

Budget (Excel sheets, Annex IV)

Sheet 1: Summary project budget
Sheet 2: Breakdown of the project execution costs (CCOP-TS)
Sheet 3: Implementing Entity (MIE) management fee (UNESCO)
Sheet 4: Budget disbursement schedule with time-bound milestones.
Sheet 5: Detailed project budget, Excel format (Annex)

Sheet 1: Summary project budget

Project Component		2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $
ANNUAL TOTALS PER COMPONENT							
Component 1		510,500	324,200	119,200	246,100		1,200,000
Component 2		101,000	208,500	174,500	16,000		500,000
Component 3		130,900	315,100	413,500	140,500		1,000,000
Component 4		66,000	98,500	175,500	160,000		500,000
Component 5		121,700	314,500	395,300	168,500		1,000,000
	Subtotals	**930,100**	**1,260,800**	**1,278,000**	**731,100**		**4,200,000**
Project Execution Costs 8.5 %		79,059	107,168	108,630	62,144		357,000
	Subtotals	1,009,159	1,367,968	1,386,630	793,244		4,557,000
Management Fee 7.5 %		75,687	102,598	103,997	59,493		341,775
	Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**		**4,898,775**

Sheet 2: Explanation and breakdown of the project Execution costs

			2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $	
	Project/Programme Execution cost 8.5 %								
Exec.-1	Project Coordinating Technical Advisor		40,000	55,000	60,000	25,000		180,000	
Exec.-2	CCOP-TS Support staff		20,809	23,691	23,000	22,500		90,000	
Exec.-3	Operational costs		8,000	17,000	12,000	3,000		40,000	
Exec.-4	Project related regional travel & stay		5,000	6,227	8,380	6,394		26,000	
Exec.-5	External services (website, accountant)		5,250	5,250	5,250	5,250		21,000	
		Subtotal	**79,059**	**107,168**	**108,630**	**62,144**		**357,000**	

CTA Position under CCOP-TS, covered partly by CCOP-TS Execution cost budget	yr 1	yr 2	yr 3	yr 4	
Annual expenses remuneration	75000	75000	75000	75000	$300,000
Housing Allowance	15000	15000	15000	15000	$60,000
					$360,000
Out of CCOP-TS budget					$100,000
					$260,000

Sheet 3: Explanation and breakdown of the MIE Management fee 7,5 %

			2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4		4 year Total US $	
	Project Management Fee charged by the Implementing Entity 7.5 %								
Mngmt-1	General programme implementation support		41,000	46,000	53,000	33,000		173,000	
Mngmt-2	Finance, budget and treasury support		11,250	12,500	15,250	7,000		46,000	
Mngmt-3	Reporting to Adaptation Fund, M & E		12,250	15,500	14,250	7,000		49,000	
Mngmt-4	Project related regional travel		6,187	7,507	6,500	5,493		25,687	
Mngmt-5	Operational costs, publications costs		0	14,366	9,000	3,500		26,866	
Mngmt-6	External services (procurement, accountant)		5,000	6,725	5,997	3,500		21,222	
		Subtotal	**75,687**	**102,598**	**103,997**	**59,493**		**341,775**	

Sheet 4: Budget disbursement schedule with time-bound milestones.

Payment	Upon Agreement signature		Year 1		Year 2		Year 3		Year 4		Total %	Total Amount
											(US $)	
Scheduled Date	12/01/2020		12/01/2021		03/01/2022		03/01/2023		03/01/2024			
Project Funds, incl. Exec. costs	10.97%	500,000	*11.17%*	509,159	*30.02%*	1,367,968	*30.43%*	1,386,630	*17.41%*	793,244	*100.00%*	**4,557,000**
Implementing Entity Fee	10.24%	35,000	*11.90%*	40,687	*30.02%*	102,598	*30.43%*	103,997	*17.41%*	59,493	*100.00%*	**341,775**
Total		**$ 535,000.00**		**$ 549,845.39**		**$ 1,470,565.60**		**$ 1,490,627.25**		**$ 852,736.76**		**$ 4,898,775.00**

Sheet 5: Detailed project Activity budget

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	UNESCO	CCOP-TS	CTA	IGRAC	IWMI	REMAINDER
	Component 1: Groundwater Resource assessment and monitoring	Harmonised regional GW resource inventory supporting regional GMS approach to address challenges of climate change and resilience; information-based policy to manage resources and further develop new GW based resilience strategies and practical interventions.												
Incept-1	Component work package Inception & preparation		National expert time, TA tima	15,000				15,000						
Incept-2	Inception visits 5 countries and data collection		National expert time, TA time, travel & stay, data costs	90,000				90,000						
Incept-3	Inception report contributions		National expert time, TA time	9,600				9,600						
Activ. 1.1	Component techncial coordination and support		national expert time, TA time	7,000	9,600	9,600	7,000	33,200						
Activ. 1.2	Database and GIS systems set-up and management, 4 pilot areas: groundwater related data inputs and costs		GIS expert time, data files	50,000	25,000	25,000	15,000	115,000						
Activ. 1.3	5 Country Workshops on project scope and setting up project network (CoP)		Workshop costs, TA time, travel & stay, consumables	125,000				125,000						
Activ. 1.4	Groundwater resources & aquifer status reports, 4 pilot areas		TA time, national expert time		50,000			50,000						
Activ. 1.5	Development of basic groundwater monitoring system in 4 pilot areas, installation of equipment		National expert time, TA time,	19,200				19,200						
Activ. 1.6	Equipment costs (4 pilot areas)		Equipment costs	120,000	35,000	20,000		175,000						
Activ. 1.7	Pilot area localised data collection approach and practicalities, with paticipation of stakeholders and groundwater users		National expert time, travel & stay, consumables	16,000				16,000						
Activ. 1.8	Pilot areas resilience potential characterization; 1 central workshop for four pilot areas		National expert time, TA, workshop costs, travel & stay		55,000			55,000						
Activ. 1.9	Mid-term evaluation of groundwater resources status of pilot areas, 4 dedicated workshops, at the end of year 2		Workshop costs, TA time, national experts time, travel & stay, consumables		68,000			68,000						
Activ. 1.10	Regional project Conference (Siem Reap, Cambodia) and field visit; participants from 5 countries, national expert teams, TA support team, invited speakers, and supporting resource persons		Workshop costs, TA time, national experts time, travel & stay, consumables				155,000	155,000						
Activ. 1.11	Support Mid-term review and Project Steering Committee meetings		TA time, national expert time		7,000	9,000		16,000						
Activ. 1.12	National technical expert inputs for Project Steering Committee meetings (8 times)		National expert time, TA time	9,200	9,100	9,100	9,100	36,500						
Activ. 1.13	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	10,000	20,000	10,000	20,000	60,000	$60,000					
Activ. 1.14	General consumables and logistics		Consumables	2,000	2,000	2,000	2,000	8,000						
Activ. 1.15	National pool of experts time (5 countries, multiple institutions)		National expert time	27,500	28,500	22,500	26,000	104,500						
Activ. 1.16	International TA support, pool of experts		TA expert time, travel & stay	10,000	15,000	12,000	12,000	49,000						
			Subtotal	510,500	324,200	119,200	246,100	**1,200,000**			$72,000	$120,000	$120,000	$828,000

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number					
	Component 2: Priority use and stakeholders	Increased participation by GW users in different sectors who are aware of resource management issues and have access to information and guidelines that support more sustainable use region-wide.												
Incept-4	Component work package Inception & preparation		national expert time, TA time	6,000				6,000						
Incept-5	4 pilot areas; visits to communities and local government, NGO's		national expert time, travel &	32,000				32,000						
Incept-6	Inception report contributions		national expert time, TA time	3,500				3,500						
Activ. 2.1	Resilience strengthening pilots		national expert time, TA expert time, operational costs, travel & stay		45,000	35,000	15,000	95,000						
Activ. 2.2	Materials & equipment, installation costs in 4 pilots		materials & equipment		40,000	3,000		43,000						
Activ. 2.3	Pilot areas socio-economic and water users characterization		national expert time, external consultant services	28,000	28,000			56,000						
Activ. 2.4	Gender balance programme set-up and implementation		national expert time, TA expert time, operational costs, travel & stay	3,000	11,000	11,000		25,000						
Activ. 2.5	Information products on vulnerability issues for each of the four pilot areas, for different groundwater user groups		national expert time, TA expert time, travel & stay		24,000	36,000		60,000						
Activ. 2.6	Dialogue meetings with national policymakers and experts on strategic importance of groundwater resources in the overall climate change adaptation discussion		national expert time, TA expert time, operational costs, travel & stay		27,000			27,000						
Activ. 2.7	Pilot for regional water-supply companies that use groundwater information on groundwater management tools		time, operational costs, travel & stay			34,000		34,000						
Activ. 2.8	Resilience Agenda, Atlas, interAction in pilot area meetings (product preparation, local workshops)		national expert time, TA expert time, operational costs, travel & stay		14,000	37,000		51,000						
Activ. 2.9	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000		25,000	$25,000					
Activ. 2.10	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000		25,000						
Activ. 2.11	International TA support, pool of experts		TA expert time, travel & stay	10,000				10,000						
Activ. 2.12	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500						
			Subtotal	101,000	208,500	174,500	16,000	**500,000**		30000	50000	50000	$345,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 3: Resource management, information tools and equipment	Greater resilience and sustainable GW resource use, with protection of low income and vulnerable user groups. Transboundary groundwater policies more robust and climate change ready.													
Incept-7	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-8	Expert meeting on resource management information concepts and tools; option and start up development		TA expert time, national expert time, travel & stay	32,000				32,000							
Incept-9	Inception report contributions		national expert time, travel &	3,500				3,500							
Activ. 3.1	Application of database and GIS tools; specialised information products that can be derived from it What do the results tell us (statistics in the database, geographical info: .		TA expert time, national expert time, travel & stay	52,000	32,000	32,000		116,000							
Activ. 3.2	Tailored database and GIS tools development and demonstrations, data hosting and provision services		External services; supporting TA expert time, national expert time, travel & stay;		45,000	45,000	25,000	115,000							
Activ. 3.3	Revisit resilience potential: what can user do with it; how to exploit this ? Prepare Resilience potential asssessment		Supporting TA expert time, national expert time		56,000	42,000		98,000							
Activ. 3.4	Pilots supported with groundwater monitoring and management information and applicatin to develop resilience options		Supporting TA expert time, national expert time, travel &		36,000	56,000	31,000	123,000							
Activ. 3.5	Technical meetings: Co management of Surface and Groundwater, with national expert and MRC, supporting organisations		External services; supporting TA expert time, national expert time, travel & stay;			38,000	22,000	60,000							
Activ. 3.6	Actual Management interventions like MAR or other		Regional TA expert time		42,000	28,000	12,000	82,000							
Activ. 3.7	Supporting reslience measures in 4 pilot areas, including installations and equipment		Material costs; supporting TA expert time, national expert time,		60,000	98,000		158,000							
Activ. 3.8	Output Evaluation and dissemination - visibility products in and outside the region		National expert time, TA time, consumables	5,000	10,000	10,000	25,000	50,000	$50,000						
Activ. 3.9	National pool of experts time (5 countries, multiple institutions)		National expert time	15,000	23,000	33,000	11,500	82,500							
Activ. 3.10	International TA support, pool of experts		TA expert time, travel & stay	13,000	3,600	24,000	8,000	48,600							
Activ. 3.11	General consumables and support services		Consumables	1,400	7,500	7,500	6,000	22,400							
			Subtotal	**130,900**	**315,100**	**413,500**	**140,500**	**1,000,000**			60000	100000	100000	$690,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number						
	Component 4: Regional cooperation, coordination and information exchange.	A regionally coherent policy for climate adaptation through sustainable GW resource management; level playing field for all sectoral users in the region, efficiency gains in common approach and support tools.													
Incept-10	Component work package Inception & preparation		national expert time, TA time	9,000				9,000							
Incept-11	Research and documentation of policy context and practical cases; documentaiton packages for 5 countries		TA expert time, national expert time, travel & stay	24,000				24,000							
Incept-12	Inception report contributions		national expert time, travel & stay, TA expert time	3,500				3,500							
Activ. 4.1	Documentation on transboundary aquifer systems; resource status, transboundary implications and policy reccommendations		National expert time, TA expert time,		16,000	16,000		32,000							
Activ. 4.2	Pilot areas workshops (4x) on transboundary climate policy		Workshop expenses			45,000	40,000	85,000							
Activ. 4.3	Application of TBA Assessment Methodology on the four pilot areas		National expert time, TA expert time, Travel & stay, consumables			27,000	26,000	53,000							
Activ. 4.4	Working group on sharing & co-development of tools		National expert time, TA expert		24,000	24,000	24,000	72,000							
Activ. 4.5	Working group on national policy and strategy		time, Travel & stay, consumables		24,000	19,000	24,000	67,000							
Activ. 4.6	Regional policy coordination; preparation of White paper for ASEAN forum, emphasizing climate adaptation in transboundary regions		National expert time; support services, TA xpert time		12,000	10,000	12,000	34,000							
Activ. 4.7	Documentation materials for pilot regions		National expert time			8,000	8,000	16,000							
Activ. 4.8	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		5,000	10,000	10,000	25,000	$25,000						
Activ. 4.9	National pool of experts time (5 countries, multiple institutions)		National expert time	12,000	7,000	6,000	7,000	32,000							
Activ. 4.10	International TA support, pool of experts		TA expert time, travel & stay	16,000	8,000	8,000	8,000	40,000							
Activ. 4.11	General consumables and support services		Consumables	1,500	2,500	2,500	1,000	7,500							
			Subtotal	**66,000**	**98,500**	**175,500**	**160,000**	**500,000**			30000	50000	50000	$345,000	

Activity	Project Component	Outcome(s)	Cost items	2020 Year 1	2021 Year 2	2022 Year 3	2023 Year 4	4 year Total US $	Remarks Number					
	Component 5: Capacity building and training	Internal capacity in the GMS region to develop CCA policy and practical resilience enhancing interventions, to use state-of-the-art tools and work with CoP, stakeholders and vulnerable groups.												
Incept-13	Component work package Inception & preparation		national expert time, TA time	9,000				9,000						
Incept-14			TA expert time, national expert time, travel & stay					0						
Incept-15	Inception report contributions		national expert time, travel & stay	3,500				3,500						
Activ. 5.1	Training programme in MAR, ASR and other storage and GW potential strengthening techniques, connected to pilots (2x)		Training workshops		37,500	37,500		75,000						
Activ. 5.2	Higher eduction scholarships (10 MSc positions) for promising young BSc graduates		Scholarships for training in the region	50,000	50,000	20,000		120,000						
Activ. 5.3	Transboundary aquifer management; training programme (IGRAC)		Training workshops		42,500	37,500		80,000						
Activ. 5.4	GGMN – the next level training for the Lower Mekong SubRegion; training and learning-by-doing (IGRAC)		Training workshops	42,500		42,500		85,000						
Activ. 5.5	Co-management of surface and groundwater; training workshop with MRC experts		Training workshops		42,500		42,500	85,000						
Activ. 5.6	Information and resources sharing & cooperation on formal training programmes in institutes, recognition of each other certificates, etc.		Training workshops		42,500	40,000	25,000	107,500						
Activ. 5.7	**Learning and knowledge management** subcomponent; Information repository and sharepoint		Web services, resource materials, national expert time,		40,000	40,000	20,000	100,000						
Activ. 5.8	Pilot area (4x) on site training stakeholders and groundwater users; development of training materials for end-users		national experts time, TA time, materials			32,000	18,000	50,000						
Activ. 5.9	Support to professional and higher education formal training programmes in the region		TA expert time, national expert time, travel & stay		20,000	40,000	20,000	80,000						
Activ. 5.10	Regional Conference on Capacity building, Knowledge management, Studies; Groundwater management and Climate Change Adaptation		Conference costs, national expert time, TA expert time			75,000		75,000						
Activ. 5.11	Output Evaluation and dissemination - visibility products in and ouside the region		National expert time, TA time, consumables		15,000	10,000	25,000	50,000	$50,000					
Activ. 5.12	National pool of experts time (5 countries, multiple institutions)		National expert time	8,000	12,000	6,000	6,000	32,000						
Activ. 5.13	International TA support, pool of experts		TA expert time, travel & stay	7,200	8,000	8,000	8,000	31,200						
Activ. 5.14	General consumables and support services		Consumables	1,500	4,500	6,800	4,000	16,800						
			Subtotal	**121,700**	**314,500**	**395,300**	**168,500**	**1,000,000**			65000	100000	100000	$685,000

				2020	2021	2022	2023	4 year							
	Project Component			Year 1	Year 2	Year 3	Year 4	Total US $							
	ANNUAL TOTALS PER COMPONENT														
	Component 1			510,500	324,200	119,200	246,100	**1,200,000**							
	Component 2			101,000	208,500	174,500	16,000	**500,000**							
	Component 3			130,900	315,100	413,500	140,500	**1,000,000**							
	Component 4			66,000	98,500	175,500	160,000	**500,000**							
	Component 5			121,700	314,500	395,300	168,500	**1,000,000**							
			Subtotals	930,100	1,260,800	1,278,000	731,100	**4,200,000**							
	Project Execution Costs 8.5 %			79,059	107,168	108,630	62,144	**357,000**		357,000					
			Subtotals	1,009,159	1,367,968	1,386,630	793,244	**4,557,000**							
	Management Fee 7.5 %			75,687	102,598	103,997	59,493	**341,775**	$341,775						
			Totals	**1,084,845**	**1,470,566**	**1,490,627**	**852,737**	**4,898,775**	**$551,775**	**$357,000**	**$257,000**	**$420,000**	**$420,000**	**$2,893,000**	
									UNESCO	**CCOP-TS**	**CTA**	**IGRAC**	**IWMI**		
												Total of these 5:	**$2,005,775**		
													INDICATIVE ONLY		
				2020	2021	2022	2023	4 year					CHECK	$4,898,775	
Activity	**Project Component**	**Outcome(s)**	**Cost items**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Total US $**				3			
	Project/Programme Execution cost 8.5 %														
Exec.-1	Project Coordinating Technical Advisor			40,000	55,000	60,000	25,000	180,000							
Exec.-2	CCOP-TS Support staff			20,809	23,691	23,000	22,500	90,000							
Exec.-3	Operational costs			8,000	17,000	12,000	3,000	40,000							
Exec.-4	Project related regional travel & stay			5,000	6,227	8,380	6,394	26,000							
Exec.-5	External services (website, accountant)			5,250	5,250	5,250	5,250	21,000							
			Subtotal	**79,059**	**107,168**	**108,630**	**62,144**	**357,000**							
	Project Management Fee charged by the Implementing Entity 7.5 %														
Mngmt-1	General programme implementation support			41,000	46,000	53,000	33,000	173,000							
Mngmt-2	Finance, budget and treasury support			11,250	12,500	15,250	7,000	46,000							
Mngmt-3	Reporting to Adaptation Fund, M & E			12,250	15,500	14,250	7,000	49,000							
Mngmt-4	Project related regional travel			6,187	7,507	6,500	5,493	25,687							
Mngmt-5	Operational costs, publications costs			0	14,366	9,000	3,500	26,866							
Mngmt-6	External services (procurement, accountant)			5,000	6,725	5,997	3,500	21,222							
			Subtotal	**75,687**	**102,598**	**103,997**	**59,493**	**341,775**							