

Thai-German Climate Programme (TGCP) - Water

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Pre-Assessment for River Basin Site Selection

Pre-assessment of five river basins for sub-national implementation
based on the set of prioritization and selection criteria and
recommendation for final decision-making

River basins under assessment:
Sakaekrang, Bangpakong, Phetchaburi, Nan, Yom

Final report

Bangkok, February 2019
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Water
THAI-GERMAN
Climate Programme

Executive Summary

In 2015, Thailand submitted its Nationally Determined Contribution (NDC) under the Paris Agreement. Whereas in the field of mitigation, the NDC prioritizes the energy, transport and waste sectors, adaptation efforts target the water, agriculture and health sectors. In the field of adaptation, the Thai *National Adaptation Plan (NAP)* defines water management, agriculture, health, natural resources management, tourism and human settlements as priority sectors.

The Thai-German Climate Programme (TGCP) is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag. The programme was commissioned in close cooperation with the Thai Ministry of Natural Resources & Environment (MNRE) for the timeframe January 2018 to December 2021. It operates by five sectoral components (climate policy energy, waste, agriculture, water) to offer a holistic approach for the operationalization and implementation of the Thai NDC with regard to the mitigation of climate change as well as adaptation to its impacts. TGCP-Water component fosters enhanced adaptation capacities in the Thai water sector. Therefore, the component targets disaster and climate risks in the water sector with a specific focus on climate-sensitive Integrated Water Resources Management (IWRM) and ecosystem-based adaptation (EbA).

For the implementation of NDC adaptation priorities as set out in the water sector, the National Adaptation Plan (NAP) is the guiding document for NDC implementation and sets forth two water-related goals: (1) Balanced management between water supply and water usage of all river basins, (2) Resilience and readiness for coping with and reducing damages from floods and droughts. Both goals are targeted by TGCP-Water in the implementation of its activities.

At sub-national level, the TGCP-Water component supports the IWRM approach in selected river basins. The key partners of TGCP-Water are namely the Office for National Water Resources (ONWR), the Department of Water Resources (DWR) / MNRE, the Department of Public Works and Town & Country Planning (DPT) / MoI and the Royal Irrigation Department (RID) / MoAC. Key partners of TGCP-Water and other agencies involved in water resources management have selected jointly the assessment criteria and the potential pilot areas that are object of this assessment during the Operational Planning Workshop from 10-11 October 2018 in Bangkok, Thailand.

This report presents the results from the first basin assessment with the aim to (1) prioritize and select five river basins regarding suitability for sub-national implementation in the TGCP-Water, and (2) provide recommendations for future implementation. The basins under assessment are Sakaekrang, Bangpakong, Petchaburi, Yom and Nan River basins. The assessments were conducted from November 2018 to January 2019.

The assessment is based on a multi-criteria evaluation as well as on the consultation missions in cooperation with the respective water authorities in each river basin. Five *selection criteria* were used for prioritization and defined prior to the assessment together with all TGCP-Water partners: *Risk and vulnerability, urban setting / human settlement, socio-economic development, institutional and information landscape, and the environment of change.*

The assessment showed that there is a strong need for better understanding and application of the concept of *Integrated Water Resources Management (IWRM)* and, specifically, of its potential to encompass the adaptation to the impacts of climate change (**climate-sensitive IWRM**). Although River Basin Committees (**RBCs**) are established, planning processes at river basin level lack systematization, joint decision-making between authorities and water users as well as standardization of planning methodologies and instruments, for instance the elaboration of respective River Basin Development Plans (**RBDP**). RBCs are given an important role in water resources management in Thailand, in particular since the new *Water Resources Act 2018* came into force. In the assessed basins, it is assumed that many challenges in IWRM originate from inadequate water resources management rather than limited, physical water availability.

Technical capacities regarding infrastructure and operational monitoring in water resources management is considered high in all five river basins and respective RBCs. Generally, willingness and engagement is high to improve water resources management, especially regarding conservation and protection of water resources. Early warning systems seem to be in place and functional, whereas the communication of warnings and risks is still needed priority.

Future intervention of TGCP-Water on the level of river basins is recommended to target along the lines of **capacity development** both the institutional and technical processes, and be adapted to the needs in each basin:

1. **Institutional/organisational structures** should be strengthened regarding the internal coordination and planning by the **RBCs** and joint decision-making on river basin level amongst authorities and water users. The support to RBCs should aim to prepare them for their tasks under the new *Water Resources Act 2018*.
2. **Technical processes** should be supported regarding the elaboration of **River Basin Development Plans (RBDP)** following a systematized format and methodology. This process can be utilized to mainstream climate change adaptation and ecosystem-based solutions into river basin planning in a systematic manner.

(1) Yom and Sakaekrang River basins are ranked highest and recommended for river basin selection at first priority.

Yom River basin is favourable for selection due to its (1) high engagement and good cooperation between water authorities and communities, (2) their experience on EbA solutions complementary to grey measures, (3) a diverse set of challenges, namely flooding, deforestation, sedimentation, increased water demand and a negative water balance, and (4) partners' high need for support to develop a systematic IWRM planning. Basin partners already showed a good understanding of the IWRM concept but lack implementation.

Sakaekrang River basin is favourable for selection due to (1) remaining flood and increasing drought risk, (2) a rather small, hence less complex planning unit, (3) good understanding and openness on climate change adaptation and EbA solutions amongst partner authorities, and (4) the piloting for *Strategic Environmental Assessment*.

(2) Phetchaburi River basin is recommended for selection at second priority.

The assessment showed a positive environment of change and high awareness amongst stakeholder for green measures complementary to traditional, grey measures in *Phetchaburi*

basin. The latter underlines the remaining importance of structural measures in basin management. Technical capacities in general and the institutional setting are clearly positive. The high relevance of coastal and eco-tourism emphasizes the need for adequate water management as well. If an integrated approach to water resources management (IWRM), in particular in water demand, may be achieved, Phetchaburi River basin may act as a role-model and multiplier for other river basins in Thailand.

(3) Nan and Bangpakong River basins are currently not recommended for selection.

Although *Nan* River basin has a favourable institutional setting and good knowledge on IWRM and EbA solutions, *Yom* River basin has a higher engagement amongst water authorities and users, and good experience in EbA solutions. Therefore, it is recommended that only one of the two large basins of Nan or Yom River are selected due to difficulties of a large spatial planning unit, and their similar environmental conditions.

Bangpakong River basin has a low ranking according to the assessment. Although socio-economic values are highest and expected to increase further due to the *Eastern Economic Corridor*, future intervention in the TGCP-Water context and implementation of EbA measures is not recommended for two main reasons: (1) the diverse causes and impacts of low water quality in an industry dominated setting, and (2) highly complex competition amongst different water users. Easing this situation requires long-term involvement and is not considered feasible in the limited timeframe of TGCP-Water interventions.

1. Introduction

In 2015, Thailand submitted its Nationally Determined Contribution (NDC) under the Paris Agreement. Whereas in the field of mitigation, the NDC prioritizes the energy, transport and waste sectors, adaptation efforts target the water, agriculture and health sectors. In the field of adaptation, the Thai *National Adaptation Plan (NAP)* defines water management, agriculture, health, natural resources management, tourism and human settlements as priority sectors.

The Thai-German Climate Programme (TGCP), commissioned by the German Ministry for the Environment (BMU) and the Thai Ministry of Natural Resources & Environment (MNRE) for the timeframe January 2018 to December 2021, operates by five sectoral components (climate policy energy, waste, agriculture, water) to offer a holistic approach for the operationalization and implementation of the Thai NDC with regard to the mitigation of climate change as well as adaptation to its impacts. TGCP-Water component fosters enhanced adaptation capacities in the Thai water sector. Therefore, the component targets disaster and climate risks in the water sector with a specific focus on climate-sensitive Integrated Water Resources Management (IWRM) and ecosystem-based adaptation (EbA). The water component works with the responsible agencies to improve the national framework conditions for sustainable water resource management focusing especially on the potential of ecosystem-based solutions for preventing and reducing climate and disaster risks.

For the implementation of NDC adaptation priorities as set out in the water sector, the National Adaptation Plan (NAP) is the guiding document for NDC implementation and sets forth two water-related goals: (1) Balanced management between water supply and water usage of all river basins, (2) Resilience and readiness for coping with and reducing damages from floods and droughts. Both goals are targeted by TGCP-Water in the implementation of its activities.

At sub-national level, the TGCP-Water component supports the IWRM approach in selected river basins that covers both the needs of rapidly growing secondary cities regarding the risk of flooding as well as rural communities impacted by loss of income due to drought stress. The key partners of TGCP-Water are namely the Office for National Water Resources (ONWR), the Department of Water Resources (DWR) / MNRE, the Department of Public Works and Town & Country Planning (DPT) / MoI and the Royal Irrigation Department (RID) / MoAC. Key partners of TGCP-Water and other agencies involved in water resources management have selected jointly the assessment criteria and the potential pilot areas that are object of this assessment during the Operational Planning Workshop from 10-11 October 2018 in Bangkok, Thailand.

Key partners of TGCP-Water and other agencies involved in water resources management have defined jointly the *prioritization and selection criteria* as well as selected the potential pilot areas that are object of this assessment during the Operational Planning Workshop from 10-11 October 2018 in Bangkok, Thailand. This report presents the results from the first river basin assessments and selection process between November 2018 and January 2019 noting that institutional changes may apply after this period.

Thailand's water sector currently undergoes restructuring. The most notable changes in the reform process are the *Water Resources Act 2018*, and the *20-year Natural Water Resources Management Master Plan 2018-2037*. Other policy frameworks and strategies relevant in Thailand's water sector are the *National Adaptation Plan (NAP)*, the *Climate Change Master Plan 2015-2050*, the *12th Economic and Social Development Plan 2017-2021* and the *20-year National Strategy 2017-2036*.

2. Objective

Assess and prioritize five pre-selected river basins regarding suitability for the sub-national implementation in the TGCP-Water, and provide recommendations referring to the set priorities and selection criteria.

This analysis presents a preliminary assessment to select river basins. It is not intended as a complete detailed assessment. Further technical assessments will be conducted in the selected pilot basins later throughout the project.

3. Selection methodology

The methodology follows a multi-criteria evaluation categorizing selected values of risk through both qualitative and quantitative assessments (Annex 1). The quantitative data used, where available, is based on the results from detailed risk assessments conducted by the respective authorities in Thailand referencing previous studies and report. Where such information is not available, qualitative data is used to fill these gaps through the assessment missions, surveys and interviews conducted by TGCP-Water partners.

Assessments in all five river basins were conducted in close cooperation with the River Basin Committees (RBCs). The three river basins of Sakaekrang, Bangpakong and Petchaburi were assessed in November 2018, Yom and Nan river basins were assessed in January 2019. Each visit in the river basins was organized through the respective DWR Regional Office, which provided valuable logistical and organizations support.

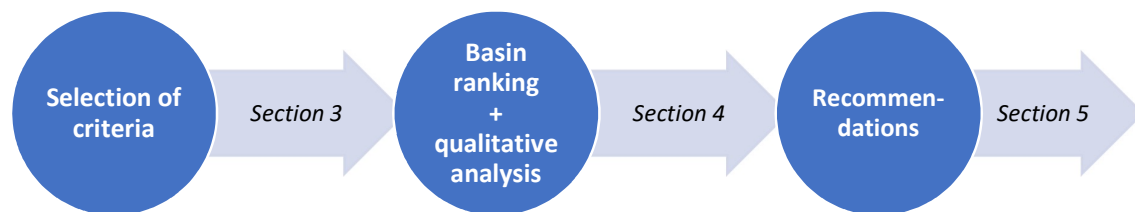


Fig. 1: Steps of selection methodology: criteria, ranking and assessment

Five **selection criteria** have been defined by TGCP-Water key partners:

- Risk and vulnerability profile ,
- Urban setting / human settlement ,
- Socio-economic development ,
- Institutional and information landscape ,
- Environment of change .

Each of the five site selection criteria is described by criteria elements with the aim to help analyze each river basin. Each element is translated into a ranking / scoring as below. The detailed criteria and elements are presented in the Annex.

Criteria 1: Risk and vulnerability profile

A risk & vulnerability profile reflects disaster and climate change impacts as well as socio-economic and environmental exposure and adaptive capacity. The risk profile of an area defines the relevance of action and indicates the opportunity for change.

Hazard exposure	Number of different hazards of high return period Topography: basin relief
Disaster and climate risk	Flood risk: basin area dominant category Drought risk: basin area dominant category
Future climate trends	Change of average rainfall by 2050 Change of maximum temperature by 2050
Sensitivity / area-based	Area-based analysis zone identified Deforestation / land use issues Water quality
Risk related issues	Early Warning System evaluation

Criteria 2: Urban setting / human settlement

Medium-sized cities in Thailand are developing and growing rapidly. An integrated watershed management approach has a direct impact on urban resilience and the way challenges are being addressed in the context of rapid urbanization, disaster risk reduction and climate change adaptation.

Urban population	Urban population in the river basin and/or with direct downstream relation from the river basin
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Criteria 3: Socio-economic development and urban settings

Areas that are characterized by expansion of business areas, investments in critical infrastructures like educational areas, industrial hubs, transport networks etc. may have high and long-lasting impacts on the local and regional economy in case of disruption of operation.

Socio-economic value	Gross product per capita Labour force
Critical infrastructure	Power plants Water supply Waste water treatment Health facilities Transport network & hubs
Public and private investments	Special Economic Zones Industrial parks (planned) Large infrastructure projects (planned) No. of universities (present & planned)

Criteria 4: Institutional and information landscape

The pilot area should reflect a diverse institutional landscape where stakeholder groups show interest to address disaster risks and reduce the impacts of severe hydro-meteorological events through an IWRM, in particular in joint efforts and implementation.

Cooperation with key partners	Number of key partners present Synergies with partner projects
Budget allocation	Budget already allocated for IWRM and EbA measures by project partners
Engagement with private sector	Number of cooperate partners in RBC Rating of private sector cooperation
Adaptive capacity	Institutional capacity Technical knowledge & awareness
Data availability & monitoring	Number of operational monitoring stations Water data time series Gauge types Data sharing between partners

Criteria 5: Environment of change

Whereas an effective planning and management of water resources needs to be based on hydrological units (watershed), the pilot area should not have a too complex governance structure to allow for smooth discussion and decision taking procedures.

Concerned provinces	Number of provinces
Provinces	No of Provinces Definition of basin
Basin Development Planning	River Basin Development Plan (RBDP) established RBDP consideration of IWRM, EbA, DRR, CCA Water user competition & conflicts
Implementation	Operational plan Diversity of implemented measures

4. River Basin Assessment - Results

Overall assessment contains the results of two levels: (a) the assessment scoring based on pre-selected priorities and criteria (section 4.2), and (b) a technical and institutional analysis with reference to the key partners' activities/projects in the field of climate-sensitive IWRM and ecosystem-based adaptation (section 4.3 to 4.7).

4.1. General observations

Climate-sensitive IWRM approach: There is a clear need for a better understanding of the IWRM concept and its relevance for climate change adaptation (**climate-sensitive IWRM**).

Capacity development in this field must include the systematization of river basin planning processes as well as the standardization of planning methodologies and instruments, e.g. of the River Basin Development Plan (RBDP). It is assumed that many challenges in IWRM in the assessed basins originate from inadequate water resources management rather than limited, physical water availability. Climate change adaptation is so far not mainstreamed into water resources management.

Institutional capacity: The institutional setup is rather coherent in each river basin. RBCs are established in each river basin but function rather as an exchange platform amongst RBC members, not as a planning unit with joint decision-making. The RBC Chair is manned by the responsible Province Governor, whereas the RBC Secretary is provided by the DWR Regional Office¹. RBC members consist of both governmental and non-governmental actors. However, there is a lack of understanding of the practical role that an RBC and its members have with regard to the basin planning and implementation process, and to the elaboration of the RBDP. Generally, each river basin has developed a RBDP in line with the *National Water Resources Strategy 2015-2026*. However, the RBDP's content and extent are limited, not fully understood and rather characterized as a list of isolated activities and projects by each partner. At the time of assessment, there was no indication for a complete RBDP that covers strategic goals as well as coordinated and jointly planned actions. The only exception was the Yom River Basin with a rather comprehensive basin action plan until 2021.

Technical capacity: Technical capacities differ amongst the five river basins and respective RBCs. Generally, willingness and engagement is high to improve water resources management especially regarding conservation and protection of water resources. Expertise of technical staff regarding infrastructure & monitoring of water resources is considered high. This is considered very positive as hydro-meteorological data availability is an essential requirement for IWRM. However, multiple water agencies are operating parallel monitoring networks, in particular in hydrological monitoring. Data sharing amongst these agencies was noted to be on an ad-hoc basis but generally with minor resistance for sharing. Early warning systems seem to be in place and functional, whereas the communication of warnings and risks - the *last mile* - is clearly a need.

4.2. Scoring summary

The assessment results are based on the criteria and priorities pre-defined by TGCP-Water key partners, and are presented in Fig. 2 and Tab. 1 below. The detailed calculations for all criteria elements are provided in the Annex. A weighting was applied to represent the programme's priorities, context and timeframe to make an impact at sub-national level. Hence, the weighting favours the criteria of *Risk and vulnerability*, *Institutional and information landscape* and *Environment of Change*. Some criteria elements are equally ranked amongst all basins, such as generally good data availability of hydro-meteorological monitoring throughout the country.

Yom and **Nan** River basins scored highest amongst all river basins due to high institutional knowledge on IWRM, CCA and EbA and adaptive capacity to implement IWRM. However, both basins cover a large area and number of province, which may pose a challenge in basin-wide planning and coordination in the RBCs.

¹ DWR Regional Office was changed to the ONWR Regional Office in 2019

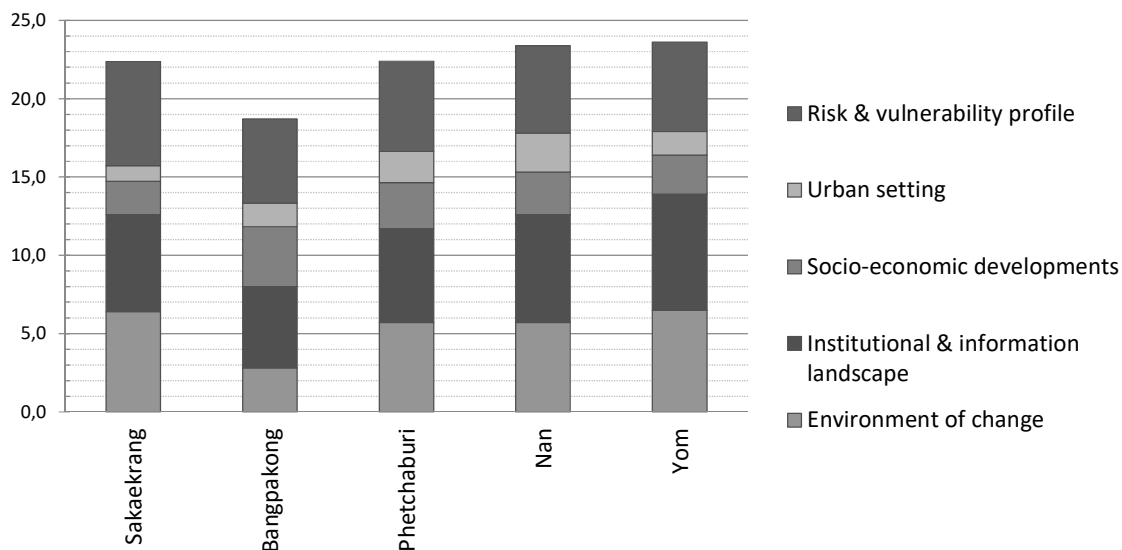


Fig. 2: Scoring results of the pre-assessment in five river basins, TGCP-Water (status as of February 2019)

Sakaekrang and **Phetchaburi** River basins are ranked equally and at medium priority. They have equally positive scoring in the *Environment of Change* category as the Yom and Nan river basins, which should be considered a critical criteria. Both river basins are rather small with a favouring spatial planning unit. Good opportunities for project synergies related to water management and ecosystem-based solutions with other partners exist in both basins.

Bangpakong River basin is ranked at lowest priority. Despite high values in the socio-economic and urban criteria due to its location in the Eastern Economic Corridor, it scores lowest due to low *Environment of Change* as a result of expected conflict potential amongst competing water users.

Key criteria	weight	Sakaekrang	Bangpakong	Phetchaburi	Nan	Yom
Risk & vulnerability profile	2	6,6	5,4	5,8	5,6	5,7
Urban setting	1	1,0	1,5	2,0	2,5	1,5
Socio-economic developments	1	2,1	3,8	2,9	2,7	2,5
Institutional & information landscape	2	6,2	5,2	6,0	6,9	7,4
Environment of change	2	6,4	2,8	5,7	5,7	6,5
Total score		22,4	18,7	22,4	23,4	23,6

Tab. 1: Scoring results and criteria weighting as part of the pre-assessment calculation in five river basins, TGCP-Water (status as of February 2019)

4.3. Sakaekrang basin

Date of assessment visit: 26.11.2018, lead organizer: ONWR Regional Office 6

Disaster and climate profile	<ul style="list-style-type: none"> • Main hazards: drought (++) , flooding (+), water quality (+), erosion and landslides as a result of deforestation. • Flood risk is high in and around Uthai Thani as a result of riverine flooding from both the Sakaekrang and Chao Phraya River. Economic damage from flooding is largely higher as from drought. • Few irrigated rice fields are located in the basin, hence vulnerability to droughts is lower.
Socio-economic	<ul style="list-style-type: none"> • The (eco-)tourism industry is expected to expand, particularly in the upper basin due to the Huai Kha Khaeng Wildlife Sanctuary.
Institutions & information	<ul style="list-style-type: none"> • RBC status: operational, regular meetings (3 per year) with additional meetings at special occasions. River basin committee members: 23 (12 gov. + 11 non-gov.) River basin sub-committees: 4 • Water resources management is a priority; an Integrated Water Management Plan exists but is not implemented. Water supply is a clear target as water consumption is increasing, but water demand is not managed systematically. More water storage was noted as the strongest need. • Implementation: Planning is based on ad-hoc field visits and public hearings. Although a financial plan is in place, it was noted that little budget is available for basin related implementation. • Trainings on IWRM, CCA or EbA are not conducted but noted as needed. Technical knowledge on these topics seems generally good.
Project synergies	<ul style="list-style-type: none"> • Main water infrastructures: 1 reservoir (160m m³) with the intention to build another large reservoir. • A large number of <i>checked dams</i> (>1000) were implemented in the upper Sakaekraeng catchment. • Sakaekrang basin is a pilot site for the <i>Strategic Environmental Assessment</i> (SEA).
Planning environment	<ul style="list-style-type: none"> • A River Basin Development Plan (RBDP) is in place, which is expected to be limited to an activity plan that lists RBC member activities separately. • Awareness of green and grey measures varies strongly amongst stakeholders. Some planners clearly focus on traditional, grey measures, other RBC members see the need and show willingness for green alternatives that consider the entire basin.

4.4. Bangpakong basin, EEC

Date of assessment visit: 27.11.2018, lead organizer: ONWR Regional Office 7

Disaster and climate profile	<ul style="list-style-type: none"> • Main hazards: water quality (++), flooding (+), saltwater intrusion (+) as well as water scarcity, riverbank erosion and deforestation in the upper catchment. • Water quality is a major concern and likely the result of pollution of soil and water resources from the industry. • Flood risk is along the Bangpakong river and in the western basin. • Water supply and water resources management is of high priority as industrial activity is expected to lead to increasing water demand.
Socio-economic	<ul style="list-style-type: none"> • Close vicinity to Bangkok and the Eastern Economic Corridor, therefore future economic investment is expected to increase drastically. • Industrial sectors are diverse and expanding: agriculture, industry, commercial, tourism and aquaculture.
Institutions & information	<ul style="list-style-type: none"> • RBC status: operational, regular meetings (3 per year) River basin committee members: 28 (15 gov. + 13 non-gov.) + 2 advisers (Gov. of Prachin Buri & Chon Buri) River basin sub-committees: 4 • Water users are represented in Water User Organizations from all sectors: agriculture, industry, commercial and tourism. • There is a lack of coordination and joint planning amongst water users and river basin planners on the allocation of water. Severe concerns of low water quality seems to harm the cooperation amongst stakeholder and indicate a high potential for water competition and conflicts amongst public and private users. • A Water Resources Management Plan exists involving a number of over 500 single actions and measures.
Project synergies	<ul style="list-style-type: none"> • Bangpakong basin is a pilot site for the <i>Strategic Environmental Assessment (SEA)</i>. • RID: Planning of five additional reservoirs. • JICA Irrigation project: "Bangpakong Operation and Maintenance Project" • GISTDA focus for data provision and digital information
Planning environment	<ul style="list-style-type: none"> • A River Basin Development Plan (RBDP) is in place. An operational / activity plan is not known. Operational planning is focused on the sub-river basins and respective committees.

A high variety of water users (domestic, agricultural, industry) are operating in the Bangpakong river basin. Although water users are members of the RBC, river basin planning seems to be characterized by a continued lack of coordination unity and a **high potential for water and land use conflicts** amongst the different interest groups. There also seems to be a lack of capacity and willingness amongst stakeholders to develop and implement a joint water resources management strategy, which takes into account and satisfies the interest of all water users (confirmed also by HAI, 2012). With regard to TGCP-Water objectives and timeframe, this context is considered highly complex and a difficult environment to trigger change in the sub-national implementation.

4.5. Phetchaburi basin

Date of assessment visit: 28.11.2018, lead organizer: ONWR Regional Office 8

Disaster and climate profile	<ul style="list-style-type: none"> • Main hazards: water scarcity (++) as a result of a lack of water demand management and overconsumption. Flooding occurs regularly but stakeholders seem to be well prepared. • More water storage was noted as a strong need.
Socio-economic	<ul style="list-style-type: none"> • The tourism sector is strong and expected to grow further. Coastal tourism is particularly important due to the vicinity to Hua Hin Beach and Bangkok. • Eco-tourism is expected to expand, although in smaller numbers as in coastal areas but particularly in the upper basin due to Kaeng Krachan National Park, the largest national park in Thailand, and the Chang Hua Man Royal Project.
Institutions & information	<ul style="list-style-type: none"> • RBC status: operational, regular meetings (3 per year) River basin committee members: 26 (13 gov. + 13 non-gov.) River basin sub-committees: 4 • Water users are represented from all sectors: agriculture, industry, commercial and tourism. Especially tourism is important. Competition amongst users is high but willingness to cooperate seems sufficient. • Participation across many stakeholders from public, private and community sectors is considered good. • Implementation: A diverse set of different measures are implemented, such as checked dams, dredging, reservoirs, ponds and water diversion. • Technical knowledge on IWRM, climate change and EbA seems very good. There is high willingness and openness for further expanding knowledge on EbA solutions.
Project synergies	<ul style="list-style-type: none"> • Chang Hua Man Royal Project, initiated by His Majesty King Bhumibol Adulyadej in 2010 promoting sustainable agriculture and green energy. • Nat. Research Council of Thailand, 2016: Watershed-based Adaptation to Climate Change: The case of the Sirindhorn Internat. Environmental Park.
Planning environment	<ul style="list-style-type: none"> • A comprehensive River Basin Development Plan (RBDP) is not in place. However, a multi-year operational plan is in place indicating immediate, mid-term and long-term measures. • A general focus of basin planning is on water security for industry & production.

Most challenges in the basin arise from the lack of water demand management. The Phetchaburi basin is a good opportunity for TGCP-Water to strengthen an IWRM approach in more detail (see section 5).

4.6. Nan basin

Date of assessment visit: 29.01.2019, lead organizer: ONWR Regional Office 2

Disaster and climate profile	<ul style="list-style-type: none"> • Main hazards: flooding (++), low water quality (+), water scarcity and deforestation. • Challenges in IWRM originate from inadequate water usage resulting in a negative water balance: The basin's water needs (500qm) strongly exceed water resources availability (63qm).
Socio-economic	<ul style="list-style-type: none"> • Nan River is one of the four main contributors (45% of discharge) to the Chao Phraya River. The water resources of Nan River may be a main economic driver with a nation-wide impact if not managed adequately. • Nan River basin is home to seven National Parks and (eco-)tourism is expected to expand in the future. • No major industry or special economic zones are present.
Institutions & information	<ul style="list-style-type: none"> • RBC status: operational, regular meetings (3 per year) River basin committee members: 50% gov. + 50% non-gov. • Water users are represented from the sectors: agriculture, commercial, tourism. With seven national parks, eco-tourism is an important factor. Competition amongst users is high but willingness to cooperate seems sufficient. • Implementation: Planned and implemented measures are diverse despite a strong focus on structural measures, such as checked dams, one large reservoir with water distribution networks, and dredging activities. Future measures are noted to be aimed at reforestation, dredging at reservoirs to increase natural and artificial water storage in the basin.
Project synergies	<ul style="list-style-type: none"> • RID: Planning of small, medium and large reservoirs to increase water storage (15 projects total). • GISTDA focus for data provision and digital information
Planning environment	<ul style="list-style-type: none"> • A comprehensive River Basin Development Plan (RBDP) is not in place. However, an operational plan consisting of a list of planned measures exists. There are no joint activities amongst RBC members so far with few operational coordination. • RBC members expressed high need for joint planning and for technical support to developing a RBDP.

4.7. Yom basin

Date of assessment visit: 31.01.2019, lead organizer: ONWR Regional Office 2

Disaster and climate profile	<ul style="list-style-type: none"> • Main hazards: flooding (++), deforestation (+), erosion / landslides and high sediment yield and increased water demand. • Challenges in IWRM originate from inadequate water usage resulting in a negative water balance. • Out of the four main contributors to the Chao Phraya River, Yom River basin is the only main tributary river without a large reservoir.
Socio-economic	<ul style="list-style-type: none"> • Several National Parks are located in Yom River basin. • No major industry or special economic zones are present.
Institutions & information	<ul style="list-style-type: none"> • RBC status: operational, regular meetings (3 per year) River basin committee members: 50% gov. + 50% non-gov. River basin sub-committees: 11 • Water users are represented from the following sectors: agriculture, health, water supply, tourism. • A large reservoir was previously planned but cancelled due to the long-term resistance and strong engagement by local communities and NGOs in water resources management. As a result, governmental planning shifted focus from large reservoirs towards decentralized, small-scale structures. • Implementation: A diverse set of different measures are implemented, such as checked dams, dykes, decentralized reservoirs, reforestation, erosion control. The planning and implementation of large multi-purpose projects (reactivation of cut-off meanders for water storage, irrigation & recreation) revealed the authorities' strong technical capacity. • Institutional knowledge on IWRM planning is considered high and very favourable for future interventions. Although the IWRM planning process is clearly outlined in theory, RBC members lack a systematic approach and expressed their need for support. IWRM planning has commenced also at sub-district level. • Technical knowledge on IWRM, climate change adaptation and EbA seems very good. There is high willingness and a clearly expressed need for implementing EbA solutions. DWR has a good understanding and high sense for alternatives approaches, e.g. decentralized water storage in contrary to large, central structures.
Project synergies	<ul style="list-style-type: none"> • Yom River Group Networks (98 networks) to support upstream-downstream management. • Preliminary, technical studies are conducted, such as <i>Environmental Impact Assessments</i>. • Other projects: Phrae Water Management Centre; Royal Agricultural project, ADB.
Planning environment	<ul style="list-style-type: none"> • Competing water usage exists in the context of upstream-downstream conflicts on flood management, specifically between Phrae (upstream) and Sukhothai (downstream). Willingness to cooperate seems sufficient and positive for consensus. • Local communities and NGOs play a strong role in water security and conservation project. Their engagement and technical knowledge in various subjects around IWRM and EbA is considered very high.

5. Recommendations

Preliminary recommendations are categorized in (a) the selection methodology, (b) site selection, and (c) principles of implementation.

5.1. Methodology and criteria selection

- The ranking methodology may be applicable in future pilot site selections in the field of IWRM and disaster and climate risk related projects. Where possible, criteria should follow the Thai national standards and guidelines as close as possible.
- Weighting of the five priority criteria can be decided jointly in the River Basin Committees (RBCs) in accordance with the strategies of the *National Water Resources Master Plan 2018-2038* and in close cooperation between the respective Thai authorities of ONWR, DWR, RID and DPT.
- Detailed risk assessments on socio-economic development and critical infrastructure must focus solely on the locations in high-risk areas, such as in floodplains.

5.2. River basin site selection

The three river basins recommended for future targeting of TGCP-Water are Yom and Sakaekrang (1st priority) and Phetchaburi (2nd priority). This selection aims at representing diverse environmental and institutional conditions on the one hand but maintaining high feasibility to trigger a positive impact within the TGCP-Water timeframe on the other.

1st Priority: **Yom** River basin is recommended for selection due to its (1) high engagement and good cooperation between water authorities and communities, and (2) their experience on EbA solutions complementary to grey measures. (3) The main challenges of flooding, deforestation, high sediment yield, increased water demand and a negative water balance are diverse and underline the importance of a basin wide approach. (4) Partners have good technical knowledge on basin planning in theory and expressed high need for support to develop a systematic IWRM planning. Some IWRM approaches were already commenced at sub-district level. Although there are competing interests between a variety of water users up- and downstream, the planning environment is considered positive with high willingness to cooperate.

Sakaekrang River basin is recommended for selection due to (1) remaining flood and increasing drought risk, (2) a rather small, hence less complex planning unit, and (3) the partner authorities' good understanding and openness on climate change adaptation and EbA solutions. Such complementary measures may become particularly relevant in future planning because authorities and water users increasingly face droughts / water scarcity and significant areas (and soils) in the basin are natural disadvantaged in their water storage capacity. (4) In addition, Sakaekrang having been chosen for piloting the *Strategic Environmental Assessment* indicates opportunities for future project synergies and potential for replication to other river basins in Thailand.

2nd Priority: **Phetchaburi** River basin is recommended for selection due to the positive environment of change and high awareness amongst stakeholder for green measures complementary to traditional, grey measures. Although a large reservoir was recently constructed in the basin, underlining the remaining importance of structural measures, the capacity to manage water resources and the institutional setting are clearly positive. The high relevance of coastal and eco-tourism emphasizes the need for adequate water management even further. Hence, if an integrated approach to water resources management (IWRM), in particular in water demand, can be achieved, Phetchaburi River basin may act as a role-model and multiplier for other river basins in Thailand.

3rd Priority: **Nan** River basin is not recommended for selection. Despite a favourable institutional setting and good knowledge on IWRM and EbA solutions, it is recommended that only one of the two large basins of Nan or Yom River are selected due to difficulties of a large spatial planning unit, and their similar environmental conditions. Yom River basin was favoured over Nan River basin due to its higher engagement amongst water authorities and users, higher experience in EbA solutions and the absence of a large reservoir.

Bangpakong River basin has the lowest ranking. Although the socio-economic interest is high expected to increase further due to the *Eastern Economic Corridor*, future intervention with the RBC and implementation of EbA measures is not recommended for two main reasons: (1) the diverse causes and impacts of low water quality in an industry dominated setting, and (2) highly complex competition amongst different water users. Water demand and conflicts amongst water users are expected to increase. Easing this situation requires long-term involvement and is not considered feasible in the timeframe of TGCP-Water interventions.

5.3. TGCP-Water contributions under the IWRM approach

Future intervention of TGCP-Water on the level of river basins is recommended to target along the lines of **capacity development** both the institutional and technical processes (Fig. 3), and be adapted to the needs in each basin:

1. Institutional process: Strengthen water governance and build institutional capacities regarding the internal coordination and planning by the **RBCs** and joint decision-making on river basin level amongst authorities and water users, and provide the planning environment (planning guidelines and tools) to strengthen RBCs. The support should aim at preparing the **RBCs** in their tasks in the new *Water Resources Act 2018*.
2. Technical process: Build technical capacities on the elaboration of the River Basin Development Plan (RBDP) and the application of a complete climate-sensitive IWRM approach, including ecosystem-based solutions for adaptation to climate change.

- **Support the River Basin Committee Secretariat** (high priority): The RBC Secretariat in ONWR plays a vital role in the support of river basin management because it is sought to guide RBCs and strengthen their capacities and cooperation in a standardized and systematic manner. The RBC Secretariat serves as the link between the national and sub-national level and should therefore be a mandatory institutional partner in TGCP-Water's support.

TGCP contribution: Help define the roles and functions of the RBC Secretariat jointly with ONWR with support of TGCP-Water key partners and selected RBC representatives. The roles of the RBC Secretariat could be: (a) Provide standardized, technical and institutional planning tools for river basin management for RBC, such as the "National Guideline on RBDPs", (b) Provide regular technical and institutional support to RBCs on their roles under the new Water Resources Act and IWRM implementation, (c) facilitate the cooperation amongst RBCs, and (d) monitor and evaluate RBC performance and RBDP status, incl. the reporting on climate change adaptation.

- **Prepare River Basin Committees (RBC) for their tasks** (high priority): The preparation of RBCs for their tasks under the new *Water Resources Act 2018* is essential to ensure an integrated management of water resources at basin level.

TGCP contribution:

(1) Foster RBC coordination and joint planning through multi-stakeholder dialogues and participate in regular RBC meetings. The TGCP-Water/GIZ officer responsible for sub-national implementation is sought to participate in all RBC meetings in the selected river basins.

(2) Help clarify the roles and mandates of RBCs and its members in river basin planning in Thailand.

(3) Building knowledge on the climate-sensitive IWRM approach and develop and implement a capacity building scheme for RBC members. Such training sessions can be hosted by TGCP-Water held back-to-back with regular-scheduled RBC meetings to ensure high participation by gov. stakeholders and water users. Training are recommended to be held as practical and as close to the present needs / topics as possible.

- **Support the elaboration of RBDP** (high priority): According to the *Water Resources Act 2018*, RBDPs need to be developed in each river basin following a systematized format and methodology. Elaborating RBDPs and sub-river basin plans should be utilized to advocate for and mainstream climate change adaptation and ecosystem-based solutions into river basin planning in a systematic manner. The elaboration of RBDPs is considered a good opportunity for TGCP-Water to propose and support these solutions.

TGCP contribution:

(1) Technical support to the development of diagnostic analyses (problem identification) and cause-impact chain analyses (problem prioritization) in each river basin. These analyses might include aspects of risk assessment, modelling and economic evaluations (cost-benefits). Technical tasks must clearly be distributed / delegated to the respective technical agencies, e.g. through a decision workshop. The process of identifying, which analyses are required, may be commenced and reviewed at regular RBC meetings.

(2) Support to the standardization of format and methodology in the RBDP elaboration and systematization of planning processes in Yom and Sakaekrang River basins. TGCP-Water should ensure that these planning processes include financing mechanisms for future implementation from the very beginning.

Each RBDP should include the content of: Introduction (objective, vision, legal and institutional framework, IWRM concept, linkages with other plans and policies), Diagnostic analysis and physical assessment, Problem analysis, Action Plan, Implementation Strategy.

(3) Support the operational planning and design of prioritized measures based on objectives and indicators coordinated with all stakeholders.

(4) Support the monitoring & evaluation: development of monitoring criteria and their reporting, including the piloting of climate change adaptation M&E with desired outcomes and performance indicators.

(5) Utilize the experience at river basin scale to support the development of a National Guideline for the elaboration of RBDPs. In order to do so, the planning steps could be organize workshops with RBCs to (a) assess the status and goodness of RBDPs, and (b) gather lessons-learned and best-showcase-RBDPs.

(6) Based on points 1-5, replicate the National Guideline on RBDPs to other river basins if feasibility allows.

- **Use the river basin as the spatial reference** (high priority): Implementation and technical support to RBCs and their members should follow the internationally recognized IWRM approach (GWP, 2000). Consequently, pilot areas for detailed assessments and implementation must be based on the boundaries of a river (sub)basin (rather than political boundaries), preferably with a clear distinction between upstream to downstream processes.

TGCP contribution: Technical support in the definition of (sub)basins and in detailed risk assessments following the methodology of vulnerability assessment, prioritization of EbA measures and causal chain analyses.

- **Improve data management and sharing** (medium priority): use RBCs to promote open data and sharing amongst authorities at river basin and national scale. Consider close cooperation with existing structures and platforms, such as ONWR, HAI, GISTDA and the National Water Command Centre (under development as of this report).

TGCP-Water contribution: Support the dialogue on a national data sharing platform / warehouse and a M&E system for Thailand's reporting on climate change adaptation indicators.

- **Improve water demand management** (medium priority): Comprehensive water demand management and water regulation are essential contributors towards Integrated Water Resources Management and Climate Change Adaptation in Thailand. Given Thailand's advanced development in the water sector, required priorities and steps for water demand management are: detailed water user registration, adequate water pricing, allocation of licenses for the use of raw water according to the demand and availability of water resources following a transparent licensing process, and a

systematic approach to implement water demand management procedures across the country in a standardized manner.

TGCP-Water contribution:

(1) Facilitate water policy dialogue amongst Thai water authorities and bridge policy with practice from national to sub-national (river basin) level;
(2) Technical (operational & research) support on water balancing and demand management from water planners, practitioners and universities; long-term academic cooperation to be considered.

- **Coordinate with sub-basin working groups** (low priority): Working groups are expected to be established in each river basin level. These form the more technical and operational body of river basin planning and implementation and should be closely linked with the respective RBC to support their tasks.

TGCP-Water contribution:

Participate in regular sub-basin working group meetings and offer technical support and capacity building where gaps are identified. Technical support can be provided by Thai or German experts.

- **Strengthen risk communication on the last mile** (low priority): Water resources data and disaster risk information is sufficiently available in all river basins assessed. Whereas early warning and forecasting capacities are considered positive, the communication and distribution of warnings and risks from authorities to communities and individuals is lacking.

TGCP-Water contribution:

Commence or support awareness campaigns and instruments of risk communication at national, sub-national and community level. Consider the application of new technologies, such as mobile apps.

TGCP-Water's recommended technical-institutional approach and framework on climate-sensitive IWRM is visualized in figures Fig. 3 and Fig. 4.

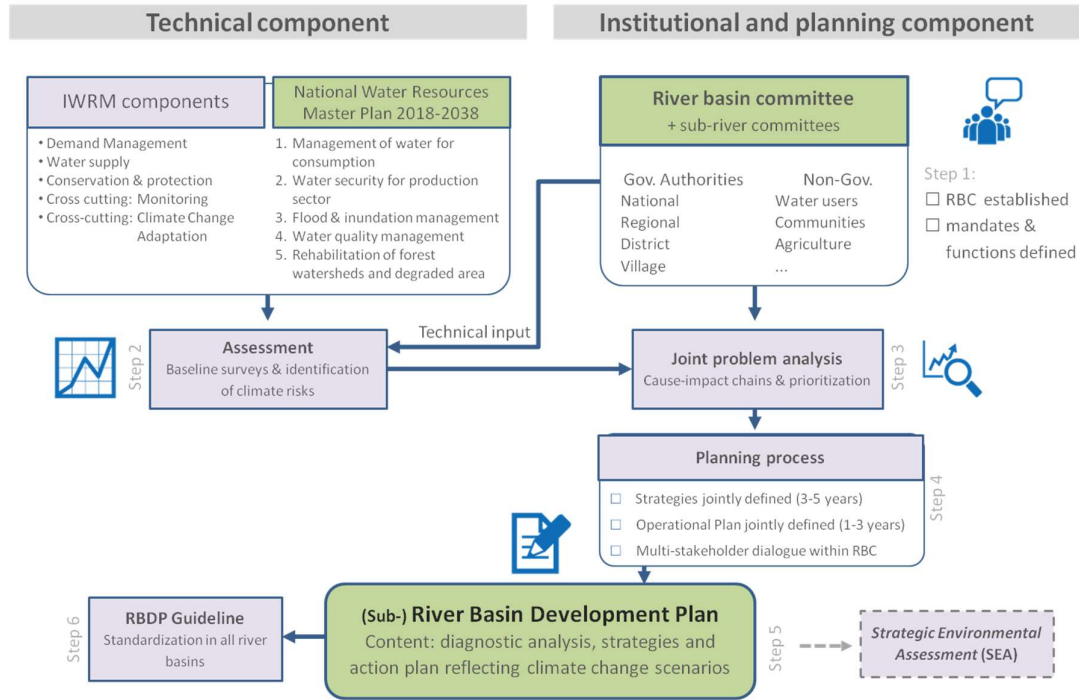


Fig. 3: Technical and institutional approach on climate-sensitive IWRM

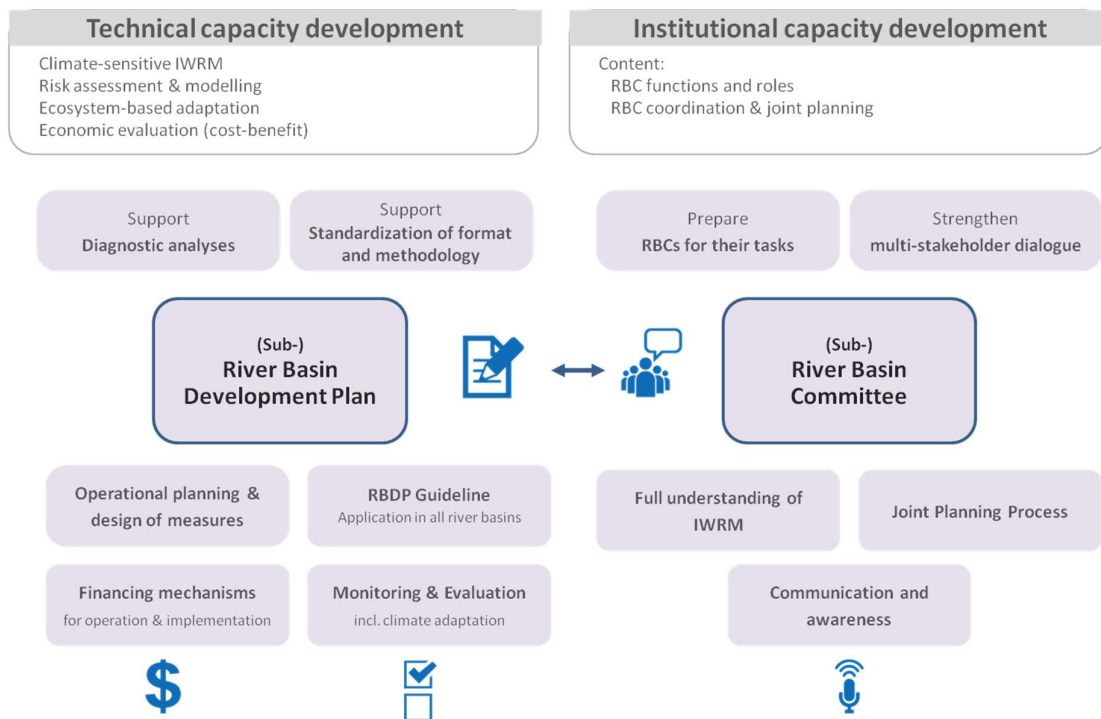


Fig. 4: Supporting framework on climate-sensitive IWRM

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Annex

- Annex 1** Evaluation methodology, criteria and criteria elements
- Annex 2** Basin assessment scoring results per sub-criteria

Annex 1 Evaluation methodology, criteria and criteria elements

The multi-criteria methodology and weighting is used to score and compare the five river basins.

Criteria ranking and weighting

The criteria ranking defines the final score in each criteria element and allows to translate all criteria, be they qualitative or quantitative, in a number-based system for comparison.

Ranking [1;4]	1 = no to low relevance (undesirable status)
	2 = medium relevance
	3 = high relevance
	4 = very high / priority relevance (desirable status)

The weighting factor (WF) allows to weigh / balance the site selection criteria and to target a variety of contexts and anticipated developments.

WF [1;2]	1 = equal importance
	2 = high importance

The following table lists the criteria, ranking conditions and respective references.

Annex 2 Basin assessment scoring results per criteria element

The results presented below are preliminary and data / information gap still remain. Hence, these results may differ from the final report.

Key criteria	weight	Sakaekrang	Bangpakong	Phetchaburi	Nan	Yom
Risk & vulnerability profile						
Hazard exposure	1	3,5	2,5	3,0	4,0	3,0
Disaster and climate risk	2	3,5	2,5	2,5	2,5	3,0
Future climate trends	1	2,5	2,0	3,5	1,5	2,0
Sensitivity	1	2,9	2,6	1,8	2,3	2,1
Other risk-related issues	1	4,0	4,0	4,0	4,0	4,0
Urban setting						
Urban population	1	1,0	2,0	3,0	4,0	2,0
Socio-economic developments						
Socio-economic value	1	2,0	3,5	2,0	2,5	2,5
Critical infrastructure	1	2,8	4,0	3,4	3,4	3,4
Public and private investments	1	1,6	4,0	3,4	2,2	1,6
Institutional and information landscape						
Cooperation with key partners	1	3,5	2,5	3,5	3,5	4,0
Budget allocation	1	2,0	4,0	1,0	2,0	3,0
Adaptive capacity	2	3,5	1,5	3,5	4,0	4,0
Data availability & monitoring	1	3,0	3,5	3,5	3,8	3,5
Environment of change						
Concerned provinces	1	4,0	2,0	3,0	1,0	1,0
Basin planning	2	2,8	1,0	3,0	3,2	4,0
Implementation	1	3,2	1,6	2,4	4,0	4,0