Kamala River Basin Water Resources Development Strategy: Implementation Action Plan

Government of Nepal

Water and Energy Commission Secretariat

Singhadurbar, Kathmandu, Nepal

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FOREWORD

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The Water and Energy Commission Secretariat (WECS) plays a leading role in basin planning in Nepal. Based on Integrated Water Resource Management (IWRM) approach, the secretariat has recently prepared River Basin Plans of whole country. Nepal's abundant water resources are both a vital asset and a significant challenge. The Kamala River Basin, in the Southeast of Nepal, exemplifies these complexities. This area faces seasonal extremes, from water scarcity and drought during the dry season to floods, erosion, and inundation in the monsoon. Compounding these issues are the degradation of the Chure region and the pressing need for sustainable management of the basin's natural resources.

The Kamala Water Resources Development Strategy: Implementation Action Plan represents a transformative step toward addressing these challenges. This document aims to position the Kamala Basin as a model for sustainable and integrated water resources management, combining technical innovation with community-driven approaches. The Plan outlines three primary goals identified in the Kamala Water Resources Development Strategy launched in 2021: sustainable management of the Chure region, improved water resource availability and allocation, and the promotion of commercial and scientific agriculture for economic and livelihood security. Achieving these objectives requires a holistic approach that integrates conservation with practical solutions, such as enhancing disaster preparedness systems, improving water infrastructure, and promoting agroforestry and more advanced agriculture practices.

The foundation of the Plan is its commitment to inclusivity. It embraces gender equality and social inclusion as central principles, ensuring that the benefits of sustainable water management reach all members of the community. The participatory approach adopted in developing this Plan underscores the importance of engaging stakeholders at all levels—from local communities to national policymakers—in shaping and implementing effective actions. The Plan not only charts a clear path for the Kamala Basin but also provides a replicable framework for other river basins in Nepal. Its success depends on coordinated efforts among government entities, community stakeholders, and international partners.

I extend my deep appreciation to the Australian government for its financial support and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for its technical support. I also acknowledge the dedication of Jalsrot Vikas Sanstha (JVS), the communities of the Kamala Basin, and all organisations and group of people that contributed to the formulation of the document. This Plan represents a shared vision for a resilient, equitable, and sustainable water future, and I look forward to its effective implementation and the continued strengthening of Nepal-Australia collaboration in the water sector.

Ram Prasad Ghimire
Secretary
10th December 2024

Australian Embassy
Nepal

AMBASSADOR

Australia and Nepal share a rich history of collaboration in sustainable water resource management, underscored by a commitment to fostering resilience and prosperity through inclusive and effective partnerships between our two countries.

Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Nepal's Water and Energy Commission Secretariat (WECS) have been working since 2014 to support Nepal's investment in river basin planning with a focus on the Kamala River Basin, a region of vital importance supporting approximately 610,000 people. In 2021, our joint efforts culminated in the launch of the *Kamala Water Resources Development Strategy*. This strategy established a comprehensive, participatory framework for addressing water resource challenges and opportunities, aiming to balance development with ecological sustainability.

The *Kamala Water Resources Development Strategy: Implementation Action Plan* offers a roadmap for transformative action. Developed collaboratively with local partner JVS, basin communities, and an array of experts, the joint CSIRO/WECS Plan outlines actions required to implement the Strategy's main priority areas, including the sustainable management of the Chure region, improving water availability and allocation, promoting scientific agriculture, and enhancing disaster preparedness.

The Plan encompasses gender-transformative practices and through its focus on community-based initiatives and stakeholder engagement, it seeks to empower local populations while addressing critical challenges such as water-induced disasters and sustainable resource management. The innovative methodologies and collaborative models detailed in this Plan have the potential to serve as a template for the development and management of other river basins in Nepal and beyond.

On behalf of the Australian Government, I commend the *Kamala Water Resources Development Strategy: Implementation Action Plan* to all stakeholders and wish the Government of Nepal every success in realizing the vision of a resilient, inclusive, and sustainable water future.

Her Excellency Ms Leann Johnston
Australian Ambassador to Nepal

Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Descriptions
AKC	Agriculture Knowledge Centre
AULL	Agriculture Units at Local Unit
BCC	Behaviour Change Communication
BRCRN	Building a Resilient Chure Region in Nepal
CBDRM	Community Based Disasters Risk Management
CC	Cross Cutting
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CERP	Critical Ecosystem Restoration Plan
CFUG	Community Forest User Group
CI	Cropping Intensity
CLTS	Community Led Total Sanitation Approach
CMIP	Coupled Model Inter-comparison Project
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CT	Conventional Till
DCC	District Coordination Committee
DEWATS	Decentralised Waste Water Treatment System
DFO	Division Forest Office
DHM	Department of Hydrology and Meteorology
DoA	Department of Agriculture
DoFSC	Department of Forest and Soil Conservation
DS	Diversion Scheme
DWRI	Department of Water Resources and Irrigation
DWSSM	Department of Water Supply and Sewerage Management
FAO	Food and Agriculture Organisation
FECOFUN	Federation of Community Forestry Users Nepal
FMIS	Farmer Managed Irrigation System
FSTU	Fecal Sludge Treatment Unit
FUG	Forest Users' Group
GCF	Green Climate Fund
GESI	Gender Equality and Social Inclusion
GIS	Geographic Information System
GoA	Government of Australia
GoN	Government of Nepal
GW	Groundwater
GWP	Global Water Partnership
GWRDB	Ground Water Resource Development Board
HA	Hectare
HCF	Health Care Facilities
HEM	Hydro Economic Model
ICIMOD	International Centre for Integrated Mountain Development
IKC	Integrated Knowledge Centres
ISF	Irrigation Service Fee
ISNM	Integrated Soil Nutrient Management
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Programme

Abbreviation	Descriptions
JVS	Jalsrot Vikas Sanstha
KIP	Kamala Irrigation Project
KIP-MO	Kamala Irrigation Project Management Office
KIPR	Kamala Irrigation Project Revitalisation
KRB	Kamala River Basin
Lpcd	Litres per capita per day
MCM	Million Cubic Meters
MDG	Millennium Development Goal
MoALD	Ministry of Agriculture and Livestock Development
MoFE	Ministry of Forests and Environment
MoHA	Ministry of Home Affairs
MoWS	Ministry of Water Supply
MSP	Multi-Stakeholder Platform
MW	Mega Watt
NARC	Nepal Agriculture Research Centre
NGOs	Non-governmental Organisations
NPR	Nepalese Rupees
NTFP	Non -Timber Forest Products
NWP	National Water Plan
ODF	Open Defecation Free
O & M	Organisation and Management
PAM	Provincial Agriculture Ministry
PCC	Program Coordination Committee
PCTMCDB	President Chure Terai-Madhesh Conservation Development Board
PMU	Project Management Unit
PPMU	Provincial Project Management Unit
PVA	Poverty and Vulnerability Assessment
RBO	River Basin Office (replaces the term 'River Basin Organisation' used in the Strategy)
SAF	Sustainable Assessment Framework
SDG	Sustainable Development Goal
SDIP	Sustainable Development Investment Portfolio
SESA	Strategic Environmental and Social Analysis
SKIBT	Sunkoshi Kamala Inter Basin Transfer scheme
SOP	Standard Operating Procedure
SRR	Seed Replacement Rate
SSP	Shared Socio-Economic Pathway
STW	Shallow Tube Well
UMMB	Urea Molasses Mineral Block
VHLSEC	Veterinary Hospital and Livestock Services Expert Centre
WASH	Water Sanitation and Hygiene
WECS	Water and Energy Commission Secretariat
WGs	Working Groups
WRD	Water Resource Development
WRIDD	Water Resources and Irrigation Development Division
WRS	Water Resources Strategy Nepal
WUA	Water Users' Association

Key terms and definitions

Term	Definition
Basin level	Refers to people or institutions, operating in the Kamala River Basin, whose authority is derived from the local or provincial level of governance in Nepal or non-state actors.
BRCRN	Building a Resilient Chure Region in Nepal (BRCRN) Project is the first GCF (Green Climate Fund) Project in Nepal and is implemented by the Ministry of Forests and Environment (MoFE) in collaboration with Food and Agriculture Organisation (FAO). The project is being implemented in 26 river systems of Chure Region in the Provinces of Bagmati, Madhesh and Koshi. Out of these 26 river systems, 9 river systems are within the Kamala River Basin.
CERP	Critical Ecosystem Restoration Plan (CERP) in Nepal is a tool applied in conserving biodiversity, enhancing ecosystem services, mitigating climate change impacts, and improving the resilience of ecosystems and communities to environmental challenges.
Climate scenario	A plausible future climate state.
Development pathway	A development pathway is an argument for public and private action. It takes the form of a 'practical' argument whose components include values; goals (descriptions of the future in which values are realised); knowledge about the development context; and means-to-goal actions. Perspectives on these components will differ among stakeholders, requiring reasoned communication to reach agreement.
Exploratory scenarios	Refers to a set of 4 contrasting storylines about the future development of the Kamala River Basin. Each scenario represents one alternative future for the Basin's agricultural and non-agricultural sectors for the period 2025 to 2045. Each scenario explores alternative futures of the economy, climate, and society of the Basin, influenced by forces beyond the control of basin planners.
Federal level	Refers to state actors or institutions whose authority is derived from the federal level of governance in Nepal or non-state actors operating primarily at national level.
GESI	Gender Equality and Social Inclusion. By promoting GESI, development initiatives become more equitable, inclusive, and effective in addressing the diverse needs and priorities of all members of society.
Institution	Institution is a stable and collective pattern of dealing with basic social functions (e.g. rules for how people may access water). It may be 'formal' (officially recognised) or 'informal' (e.g., self-organised and resourced, not always recognised by higher levels of governance). Institutions do not have a physical presence and are *not* identical to organisations.
MSP	Multi-stakeholder platform (MSP) is a process designed to support state and non-state actors to communicate for the purpose of exploring a public issue. Ideally, MSP is socially inclusive and supports sincere and reasoned communication.
RBO	River Basin Office (RBO) is an organisation which supports communication and coordination among diverse state and non-state actors with interests in a river basin. (Note that the Kamala River Basin WRD Strategy used the term ‘River Basin Organisation’).
SAF	Sustainable Assessment Framework is a set of tools and metrics that help evaluate a system's sustainability based on its social, economic, and environmental aspects.
Strategic Action	A strategic action is a set of means-to-goal actions
the Basin	In the context of this report, the Kamala River Basin
the Plan	In the context of this report, the Kamala Water Resources Development Strategy Implementation Action Plan; when used in other implementation action planning documents, it refers to the relevant implementation action plan
the Strategy	In the context of this report, the Kamala Water Resources Development Strategy
Water Resources Development Option	Refers to socio-technical options for water resources development.

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We are very thankful to the officials of the Water and Energy Commission Secretariat (WECS) Nepal for their support and cooperation during this work assignment and for entrusting us to undertake this project. We extend our special thanks to the current and former Secretaries of WECS, Mr Gopal Prasad Sigdel, Mr Sushil Chandra Tiwari, Mr Dinesh Kumar Ghimire, the Joint Secretary Kalanidhi Paudyal for their kind cooperation and openness and contribution to this implementation plan. We thank the Nepal–Australia Joint Advisory Committee (JAC) on Water Resources Management members for guiding the Kamala River Basin Initiative and supporting the elaboration of the Kamala Water Resources Management Strategy Implementation Plan.

We thank the representatives of the thematic Working Groups (WGs) and the Project Coordination Committee (PCC) for their valuable input and ideas for the Plan and from the reviewers that helped to improve the quality of the document.

We are also grateful to all local, provincial and project level officials of Dhanusha, Sindhuli, Siraha and Udayapur districts and local communities for their kind support during our field visits and providing us with data and information.

We thank the Australia Department of Foreign Affairs (DFAT) and CSIRO for financial support. We thank the former Australian Ambassador to Nepal, Her Excellency Felicity Volk, for her active engagement and deep interest in these activities, and especially for her chairing of the Nepal-Australia Joint Advisory Committee on Water Resources Management which has guided our activities in the Nepal water sector.

We thank the support of Kavitha Kasynathan and Sofila Vaidya from DFAT/Nepal and Sagar Prasai. We also thank the CSIRO colleague, Shahriar Wahid and Santoshi Aryal for their reviews of the report and Arun Shrestha (ICIMOD), Divas Basnyat and Girish Lamsal (NDRI) for their contribution on the hydro-economic modelling.

The CSIRO team extends its gratitude to Richard Hopkins (in memoriam) for his extraordinary contributions to shaping the Kamala River Basin Water Resources Development Strategy. His visionary leadership and optimism have inspired a brighter future for water resources management in Nepal.

Gender and diversity

Development of this Kamala Strategy Implementation Action Plan and related activities have been supported by the Australian aid program initially through its Sustainable Development Investment Portfolio and later as a specific project which has the goal of increasing water, food and energy security in South Asia to support climate resilient livelihoods and economic growth, benefiting the poor and vulnerable, particularly women and girls. Gender equality and women's empowerment is a priority of Australia's foreign policy and both Nepal and Australia are signatories to the United Nation’s Sustainable Development Goals, with SDG 5 being to achieve gender equality and empower all women and girls.

Inclusive basin planning, of which the development of this Strategy Implementation Plan is a key component, should benefit all, regardless of gender and social and economic status, and those benefits should be distributed equitably. When reading and interpreting the information in this Plan, the reader is reminded of the need to be gender-aware when considering impacts and anticipated outcomes to avoid reinforcing gender inequities.

Executive summary

The Kamala River Basin Water Resources Development Strategy: Implementation Action Plan[1] is designed to transform the Kamala River Basin as an example of sustainable and integrated water resources management in Nepal. The Plan is a collaborative effort between the Water and Energy Commission Secretariat (WECS), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, the people of the Basin and a range of experts. This Plan builds on previous strategies and reports developed through Nepal-Australia collaboration that address challenges and opportunities within the Basin which supports a population of around 610,000 across an area of approximately 2,100 km² in Nepal's eastern provinces.

Plan goals

- Sustainable management of the Chure within the Basin and its natural resources to support livelihoods and reduce vulnerability to water-induced disasters
- Improvement of water resource availability, utilisation, and allocation for livelihoods, well-being, and economic growth
- Promotion of commercial and scientific agriculture for local economic prosperity and livelihood security.

Plan approach

The Plan underscores the need for a multifaceted approach encompassing policy development, stakeholder engagement, and practical initiatives to address challenges and promote sustainable practices. One key aspect involves the formulation of a basin policy framework, led by the WECS, to guide water use and watershed protection. Additionally, Critical Ecosystem Restoration Plans are being updated for the Kamala River Basin to ensure the implementation of targeted conservation measures.

The Plan aims to achieve sustainable outcomes while addressing community needs, leverage local knowledge by integrating conservation and traditional practices with livelihood needs. Conservation initiatives include activities such as building check dams, constructing water conservation ponds, and promoting agroforestry. Furthermore, the Plan describes efforts towards the sustainable management of river resources, including the establishment of guidelines for riverbed material extraction and erosion control measures. The Plan recognises the importance of generating specialist knowledge and enhancing capacity among basin actors to facilitate informed decision-making and effective implementation following gender transformative approach.

The Plan indicates actions for improving water resources management, promoting better distribution of water across the basin, enhancing irrigated agriculture practices and productivity and mitigating the impacts of water-induced disasters such as floods and landslides. It incorporates the mainstreaming of gender equality and social inclusion, ensuring that these principles are integrated throughout the Plan's development and implementation to promote equity.

Plan key components

The key components include sustainable management of the Chure (NPR 8,172 million), hydro-meteorology data enhancement (NPR 25 million), disaster preparedness systems (NPR 100 million), structural and non-structural measures (NPR 4,534 million), community-based disaster management (NPR 60 million), and capacity building and enforcement, over a period of 20 years.

The Plan also focuses on securing and developing water supply, sanitation, and hygiene (WASH) services to meet current and future household requirements.

[1] Throughout this document, the Implementation Action Plan is referred to as ‘the Plan’ or ‘the Action Plan’.

This involves preparing and operationalising WASH plans (NPR 12 million), providing universal access to safe water (NPR 2,060 million), providing universal access to safely managed sanitation facilities (NPR 90 million), managing wastewater (NPR 5,500 million) and promoting hygiene practices (NPR 40 million).

Supporting water resources development

The Water Resources Development (WRD) options in the Kamala River Basin Strategy provide a structured approach to meet both immediate and long-term water needs. These options are crucial for ensuring sustainable water management that support irrigated agriculture and improve water supply reliability.

- The revitalisation of the Kamala Irrigation Project (KIPR), with a budget of NPR 15,111 million, aims to enhance water management efficiency through comprehensive planning and large civil works.
- The groundwater and conjunctive use option, budgeted at NPR 1,200 million, focuses on sustainable groundwater use for irrigation.
- The upper Kamala River Basin's irrigated agricultural options, costing NPR 2,730 million, involve small and medium water storages and pump-gravity systems.
- The Sunkoshi-Kamala diversion scheme, with a budget of NPR 125,720 million, aims to divert water from the Sunkoshi River to the Kamala River Basin.

Supporting agriculture development

In terms of agriculture development, the Plan aims to advance commercial and scientific agriculture to enhance local economic prosperity and livelihood security. This includes:

- improving farming practices and productivity (NPR 7,220 million),
- supporting marginalised farmers (NPR 820 million), and
- establishing Integrated Knowledge Centres to enhance technical knowledge and capacity building.

Each of these initiatives is designed as a long-term intervention requiring significant budget allocations and are all considered high priority due to their potential impact on agricultural productivity and economic prosperity in the Kamala River Basin. The success of these activities depends on the acceptance and adoption by local farmers, availability of funds, and effective collaboration among various governmental and non-governmental entities.

Need for foundational change

The Plan for the cross-cutting themes in the Basin Strategy underscores the necessity for foundational changes to facilitate successful WRD. These themes include the co-production of knowledge and decision-making, institutional reform, and comprehensive policy-making. The Strategy proposes establishing Multi-Stakeholder Platforms (MSPs) at both basin and sub-basin levels, developing a Sustainability Assessment Framework (SAF), and creating a Kamala River Basin Office (KOP) to oversee the development and equitable utilisation of water resources within the Basin.

Initial activities to establish MSPs and develop the SAF are estimated to require budgets ranging from NPR 2 million to NPR 10 million, with additional significant investments needed for ongoing capacity building and policy development.

Costs timeframe

The overall cost of the Plan is NPR 173,776 million, equivalent to US$ 1,306.6 million (1 US$ = 133 NPR) over 20 years. The annual budget requirement gradually increases to the peak of NPR 21,714 million in 2032 which again gradually decreases as the Plan moves to completion in 2045.

Figure 1shows the predicted annual costs distribution of the proposed actions from 2025 to 2045.

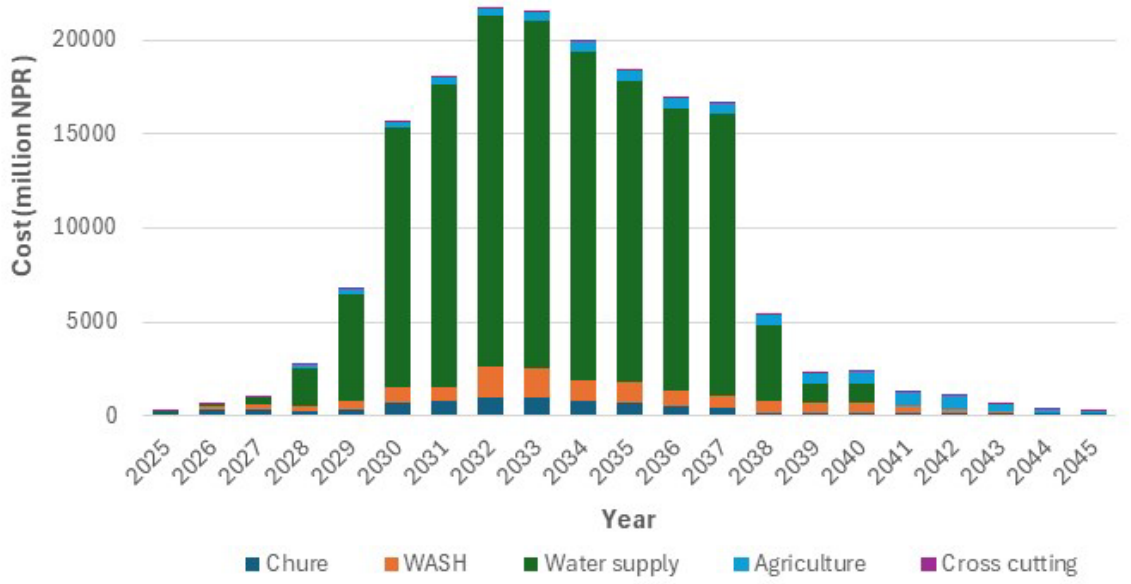


Figure 1 Annual cost distribution of the proposed implementation actions, by class

Upon the Government of Nepal's acceptance of the Plan, the Water and Energy Commission Secretariat (WECS) is entrusted with the mandate and responsibility to coordinate and promote the Implementation Action Plan. This effort will be supported by various organizations across different levels of government as well as non-governmental entities.

कार्यकारी सारांश

कमला नदी जलाधार जलस्रोत विकास रणनीति: नेपालमा दिगो र एकीकृत जलस्रोत व्यवस्थापनको उदाहरणका रूपमा कमला नदी जलाधार क्षेत्रलाई रूपान्तरण गर्न यो कार्यान्वयन कार्ययोजना डिजाइन गरिएको छ । यो योजना जल तथा ऊर्जा आयोगको सचिवालय (WECS), Commonwealth Scientific and Industrial Research Organisation (CSIRO), अष्ट्रेलिया, जलाधार क्षेत्रका स्थानीय जनताहरू र विभिन्न विज्ञहरूको सहकार्यमा तयार गरिएको हो । यस योजनाले कमला नदी जलाधार क्षेत्रभित्र रहेका विद्यमान चुनौतीहरू र उपलब्ध अवसरहरूलाई सम्बोधन गर्नेगरी यस अघि नेपाल-अष्ट्रेलिया सहकार्यद्वारा विकास गरिएका रणनीतिहरू र प्रतिवेदनहरूको आधारमा तयार गरिएको छ जसले नेपालका पूर्वी प्रदेशहरूमा लगभग २,१०० वर्ग किलोमिटर क्षेत्रफलमा फैलिएको र करिब ६,१०,००० जनसंख्या रहेको समुदायलाई सहयोग पुऱ्याउने छ ।

योजनाका लक्षहरु

- जीविकोपार्जनलाई टेवा दिन र जलजन्य विपद्हरूप्रतिको जोखिम घटाउन जलाधार क्षेत्र भित्र अवस्थित चुरे क्षेत्र र यसको प्राकृतिक स्रोतहरूको दिगो व्यवस्थापन
- जीविकोपार्जन, जीवनस्तर सुधार, र आर्थिक वृद्धिका लागि जलस्रोतको उपलब्धता, उपयोग, र वितरणमा सुधार।
- स्थानीय आर्थिक समृद्धि र जीविकाको सुरक्षाका लागि व्यवसायिक र वैज्ञानिक कृषिको प्रवर्द्धन।

योजनाको दृष्टिकोण

योजनाले चुनौतीहरूको सामना गर्न र दिगो अभ्यासलाई प्रवर्द्धन गर्न नीतिहरुको विकास, सरोकारवालाहरूको सहभागिता, र व्यवहारिक पहलहरू समावेश हुने बहुआयामिक दृष्टिकोणको आवश्यकता रहेको कुरा प्रष्ट पार्दछ । यसको एक प्रमुख पक्ष भनेको पानीको उपयोग र जलाधार संरक्षणलाई मार्गदर्शन गर्न जल तथा ऊर्जा आयोगको सचिवालय(WECS) द्वारा नेतृत्व गरिने जलाधार क्षेत्र नीतिगत रूपरेखाको निर्माण हो। साथै, कमला नदी जलाधार क्षेत्रका लागि महत्त्वपूर्ण पारिस्थितिक प्रणाली(Eco System) पुनर्स्थापना योजनाहरू लक्षित संरक्षण उपायहरूको कार्यान्वयन सुनिश्चित गर्न यसलाई अद्यावधिक गरिँदैछ।

योजनाले समुदायको आवश्यकतालाई सम्बोधन गर्दै दिगो परिणामहरू हासिल गर्ने लक्ष्य राखेको छ। यसले संरक्षण र परम्परागत अभ्यासलाई जीविकोपार्जनका आवश्यकतासंग एकीकृत गर्दै स्थानीय ज्ञानको प्रवर्धन गर्न खोजेको छ। संरक्षणका पहलहरूमा चेक ड्याम निर्माण, पानी संरक्षण पोखरीहरूको निर्माण, र कृषि-बनको प्रवर्द्धन जस्ता गतिविधिहरू समावेश छन् । यसको साथै, यस योजनाले नदी स्रोतहरूको दिगो व्यवस्थापनतर्फको प्रयासहरूको वर्णन गर्दछ, जसमा नदीजन्य सामग्री उत्खननका लागि निर्देशिका निर्माण र कटान नियन्त्रणका उपायहरूको स्थापना समावेश छ । योजनाले जलाधार क्षेत्रका सरोकारवालाहरूबीच विशेषज्ञ ज्ञानको सृजना र क्षमता अभिवृद्धिको महत्त्वलाई अंगिकार गर्दछ, जसले लैङ्गिक रूपान्तरणकारी दृष्टिकोण अनुसार सूचित हुने निर्णय लिन र प्रभावकारी कार्यान्वयन गर्न सहज बनाउनेछ ।

योजनाले जलस्रोत व्यवस्थापनमा सुधार गर्न, जलाधार क्षेत्रभरि पानीको राम्रो वितरण प्रवर्द्धन गर्न, सिंचाइयुक्त कृषि अभ्यास र उत्पादकत्व बढाउन तथा बाढी र पहिरो जस्ता जलउत्पन्न प्रकोपहरुको प्रभाव न्यूनीकरण गर्नका लागि आवश्यक कार्यहरू सम्बोधन गर्नेछ । यसमा लैङ्गिक समानता र सामाजिक समावेशीकरणलाई मूलधारमा समावेश गरिएको छ,

फलस्वरुप यी सिद्धान्तहरू योजनाको विकास र कार्यान्वयनका सम्पूर्ण चरणहरुमा समाहित हुने सुनिश्चितता प्रदान गर्नेछ ताकि समतामूलक रुपमा यसको प्रवर्द्धन गर्न सकियोस्।

योजनाका मुख्य अवयवहरू

मुख्य अवयवहरूमा चुरेको दिगो व्यवस्थापन (नेरु ८,१७२ मिलियन), जल तथा मौसम विज्ञान डेटा सुधार (नेरु २५ मिलियन), विपद् पूर्वतयारी प्रणाली (नेरु १०० मिलियन), संरचनात्मक र गैर-संरचनात्मक उपायहरु (नेरु ४,५३४ मिलियन), समुदायमा आधारित विपद् व्यवस्थापन (नेरु ६० मिलियन) र क्षमता अभिवृद्धि तथा कार्यान्वयन समावेश छन्, जसलाई २० वर्षको समयावधिमा कार्यान्वयन गरिनेछ।

योजनाले वर्तमानका र भविष्यका घरेलु आवश्यकताहरू पूरा गर्नका लागि पानी आपूर्ति, सरसफाइ र स्वच्छता (WASH) सेवाहरूको सुरक्षा र विकासमा पनि आफुलाई केन्द्रित गरेको छ ।

यसमा (WASH) योजनाहरुको तयारी र कार्यान्वयन (नेरु १२ मिलियन), सबैका लागि सुरक्षित पानीको पहुँच उपलब्ध गराउने (नेरु २,०६० मिलियन), सुरक्षित रूपमा व्यवस्थित सरसफाइ सुविधा उपलब्ध गराउने (नेरु ९० मिलियन), फोहोर पानी व्यवस्थापन (नेरु ५,५०० मिलियन) र स्वच्छता अभ्यासको प्रवर्धन (नेरु ४०० मिलियन) समावेश छ ।

जलस्रोतको विकासलाई टेवा दिने

कमला नदी जलाधार क्षेत्र रणनीतिभित्रका जलस्रोत विकास (WRD) विकल्पहरूले तत्काल र दीर्घकालीन रुपमा पानीका आवश्यकताहरू पूरा गर्नका लागि संरचनागत दृष्टिकोण प्रदान गर्छन् । दिगो जल व्यवस्थापन सुनिश्चित गर्नका लागि सिंचाइयुक्त कृषिलाई टेवा दिन र पानी आपूर्तिको भरपर्दो व्यवस्थालाई सुधार गर्नका लागि यी विकल्पहरू अत्यन्त आवश्यक छन्।

- कमला सिंचाइ परियोजना पुनरुत्थान(KIPR), जसको बजेट नेरु १५,१११ मिलियन रहेको छ, जसबाट समष्टिगत योजना निर्माण र ठूला सिभील निर्माण कार्यमार्फत जल व्यवस्थापनको दक्षता बढाउने लक्ष्य रहेको छ ।
- भूमिगत जलको संयोजनात्मक प्रयोगको विकल्प, नेरु १,२०० मिलियनको बजेटमा, सिंचाइका लागि दिगो भूमिगत जल उपयोग केन्द्रित छ ।
- कमला नदी जलाधारको माथिल्लो सिंचाइयुक्त कृषि विकल्पहरू, नेरु २,७३० मिलियन लागतमा, साना र मध्यम जल भण्डारण तथा पम्प-गुरुत्व प्रणाली समावेश छ ।
- सुनकोशी-कमला डाइभर्सन योजना, जसको बजेट नेरु १,२५,७२० मिलियन छ, सुनकोशी नदीबाट कमला नदी जलाधारमा पानी मोड्ने लक्ष्य राखेको छ ।

कृषि विकासमा टेवा दिने

कृषि विकासको सन्दर्भमा, योजनाले स्थानीय स्तरमा आर्थिक समृद्धि र जीविकोपार्जन सुरक्षा बढाउन ब्यापारिक एवं वैज्ञानिक कृषि प्रवर्द्धन गर्ने उद्देश्य राखेको छ । यसमा निम्नकुराहरु समावेश छन्:

- कृषि अभ्यास र उत्पादनशीलता सुधार गर्ने (नेरु ७,२२० मिलियन),
- सीमान्तकृत किसानहरुलाई टेवा प्रदान गर्ने (नेरु ८२० मिलियन), र
- प्राविधिक ज्ञान र क्षमता विकास बढाउन एकीकृत ज्ञान केन्द्र स्थापना गर्ने।

माथी उल्लिखित प्रत्येक पहलहरू दीर्घकालीन हस्तक्षेपका रूपमा डिजाइन गरिएका छन्, जसका लागि उल्लेखनीय बजेट विनियोजनको आवश्यकता रहने छ, र ती सबैलाई उच्च प्राथमिकतामा राखिएको छ, किनभने यसले कमला नदी जलाधार क्षेत्रमा कृषि उत्पादनकत्व बृद्धि गर्न र आर्थिक समृद्धि उपलब्धीमा महत्वपूर्ण प्रभाव पार्न सक्छ । यी गतिविधिहरूको सफलता स्थानीय किसानहरूबाट यसको स्वीकृति गरी लागु गर्ने कुरा लगायत कोषको उपलब्धता तथा विभिन्न सरकारी र गैरसरकारी निकायहरूबीचको प्रभावकारी सहकार्यमा निर्भर गर्दछ।

आधारभूत परिवर्तनको आवश्यकता

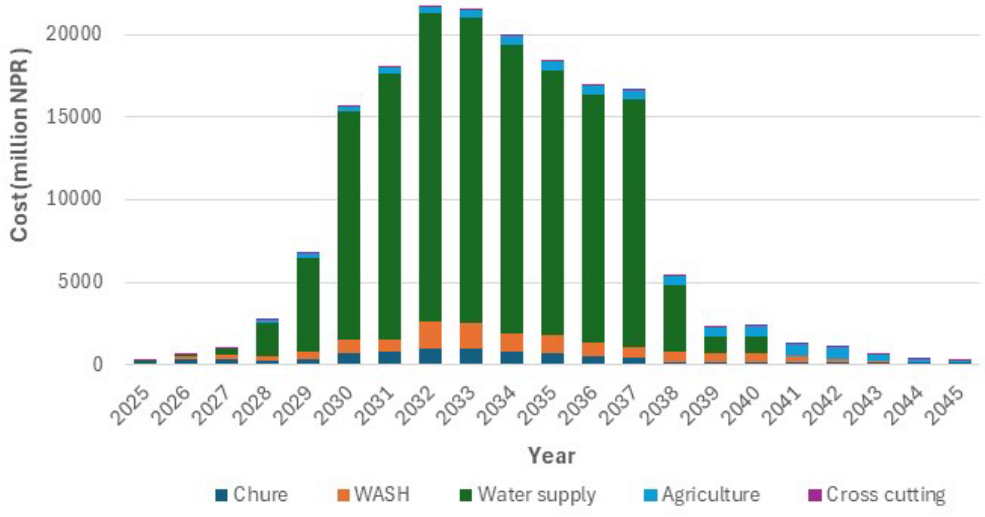
सफल जलस्रोत विकास (WRD) लाई सहज बनाउन जलाधार क्षेत्र रणनीतिमा रहेका विभिन्न विषयगत क्षेत्रहरूका लागि योजनाले आधारभूत परिवर्तनको आवश्यकता औंल्याएको छ । यी विषयहरूमा ज्ञान र निर्णय-निर्माणको सह-उत्पादन, संस्थागत सुधार, र समग्र नीतिनिर्माण समावेश छन्। रणनीतिले जलाधार क्षेत्र र उप-जलाधार क्षेत्र दुवै स्तरमा बहु-सरोकार मञ्चहरू (MSPs) स्थापना गर्ने, दिगोपन मूल्याङ्कन संरचना (SAF) विकास गर्ने, र जलाधार क्षेत्रभित्रका जलस्रोतहरूको विकास र न्यायपूर्ण प्रयोग अनुगमन गर्न कमला नदी जलाधार क्षेत्र कार्यालय (KBO) स्थापना गर्ने प्रस्ताव राखेको छ।

MSPs स्थापना र SAF विकासका प्रारम्भिक गतिविधिहरूका लागि अनुमानित बजेट नेरु २ मिलियनदेखि नेरु १० मिलियनसम्म आवश्यक पर्नेछ भने क्षमतावृद्धि र नीतिगत विकासका लागि थप उल्लेखनीय लगानीको आवश्यकता रहनेछ।

खर्चको समयावधि

यो योजनाको कुल लागत नेरु १७३,७७६ मिलियन, अर्थात् १,३०६.६ मिलियन अमेरिकी डलर (१ अमेरिकी डलर = १३३ नेपाली रुपैयाँ) हुनेछ। यसको अवधि २० वर्षको हुनेछ । आवश्यकताका हिसाबले वार्षिक बजेट क्रमिक रूपमा वृद्धि हुँदै सन् २०३२ मा सबैभन्दा बढी नेरु २१,७१४ मिलियन पुग्नेछ र सन् २०४५ मा योजना समाप्त हुने समयसम्म फेरि क्रमिक रूपमा घट्नेछ ।

सन् २०२५ देखि सन् २०४५ सम्म प्रस्तावित कार्यहरूको अनुमानित वार्षिक खर्चको वितरण चित्र (१) मा दिइएको देखाइएको छ।



चित्र (१): बिभिन्न वर्ग अनुसार प्रस्तावित कार्यान्वयन गतिविधिहरूको वार्षिक खर्च वितरण।

नेपाल सरकारद्वारा योजनाको स्वीकृति प्राप्त भएपछि, जल तथा उर्जा आयोगको सचिवालय(WECS) लाई यो कार्यान्वयन कार्य योजनाको समन्वय र प्रवर्द्धन गर्ने म्यान्डेट तथा जिम्मेवारी सुम्पिइनेछ। यस प्रयासलाई विभिन्न स्तरका सरकारी तथा गैरसरकारी संस्थाहरूबाट सहयोग प्राप्त हुनेछ।

1 Introduction

The Kamala River Basin Water Resources Development Strategy Implementation Action Plan (the Plan) is the result of a collaborative initiative led by Nepal's Water and Energy Commission Secretariat (WECS) and Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO). Developed with input from government and private-sector stakeholders, this plan outlines a coordinated set of actions to implement the Kamala River Basin Strategy, adopted by WECS in August 2021. The Plan reflects extensive consultations with stakeholders across local, provincial, and federal levels to address water challenges and enhance water availability in the Basin.

1.1 Overview of the Water Resources Development Strategy for the Kamala River Basin

The Kamala River Basin (the Basin), covering approximately 2,100 km^2, includes diverse geographical regions: the Middle Mountains, Chure and Terai. Located within Nepal's eastern provinces of Koshi, Bagmati, and Madhesh. The Basin supports a population of about 610,000, with a population density 40% higher than the national average. Administratively, it covers 4 districts: Sindhuli and Udayapur in the upper Basin and Dhanusha and Siraha in the lower Basin (WECS and CSIRO, 2020).

The *Water Resources Development Strategy for the Kamala River Basin* (the Strategy) (CSIRO and WECS, 2021) represents a significant milestone in the collaboration between the Government of Nepal (GoN) and the Government of Australia (GoA), focusing on sustainable water resources management in the Kamala River Basin. This partnership, spanning over 5 years, highlights the importance of basin-scale planning in Nepal, especially in the context of the nation's 2015 constitutional reforms.

Initiated at the request of the GoN, the Strategy is the culmination of earlier efforts between the two governments, with a particular emphasis on the Kamala River Basin in southeast Nepal. Preceded by two foundational documents, the Strategy builds upon the *State of the Kamala River Basin* report (WECS and CSIRO, 2020) and the *Recommendations on Policy and Legal Instruments* (Dyson et al., 2020), both of which shaped the strategic direction and the framework for its implementation plan, which involves consultation with local, provincial, and federal stakeholders about the issues and alternatives and goals to improve water availability in the Basin.

The Strategy emphasises a sustainable, participatory approach to water resources management, moving away from traditional top-down planning models. Instead, it promotes active community engagement, ensuring local stakeholders have a voice in setting basin management goals and objectives.

1.1.1 Stakeholder participation

Participants in the formulation of the Strategy were selected from a range of stakeholder groups, including:

- Local Government representatives: Officials and senior staff from each of the 15 local government bodies within the Basin
- National Government agencies: Members of the project's Advisory Committee from national agencies.
- Academic and professional experts: Water and agricultural professionals from academia and consulting areas.
- Kamala Irrigation Project Officers: Representatives from the Department of Water Resources and Irrigation.
- Civil Society organisations: Communities representatives who would benefit from Basin development.
- Private sector enterprises: Representatives from business operating within the Basin.
- Community representatives: Individual women and men representing various beneficiary communities.

Specific organisations in these categories were identified through a stakeholder analysis. Most actual participants came from the first 4 categories. These individuals contributed to structured small group discussions in one or more of the following workshops: 6 visioning and goal setting workshops (July and November 2018), and a multi-criteria

analysis workshop (May 2019). In contrast, participants from the last 3 categories engaged through field interviews and focus group discussions on selected topics (e.g. livelihoods and water use), as opposed to direct participation in formulating the text of the Strategy.

1.1.2 Kamala River Basin Goals

In 2018, participants identified 3 overarching goals for the Basin:

Goal 1: Sustainable management of the Chure and its natural resources for livelihood support and reduced vulnerability to water-induced disasters.

Goal 2: Improved water resource availability, utilisation and allocation of water resources for livelihood generation, well-being, and economic growth.

Goal 3: Commercial and scientific agriculture for local economic prosperity and livelihood security.

These goals are further refined into specific objectives and actionable items, paving the way for a targeted and systematic approach to development.

The Strategy evaluates 4 water resources development options:

- Revitalisation of the existing Kamala Irrigation Project
- Sustainable utilisation of groundwater
- Construction of small to medium water storage in the upper Basin
- Development of an inter-basin water transfer scheme (the Sunkoshi-Kamala diversion and multipurpose project).

Quantitative modelling and scenario analysis assessed the feasibility and potential impacts of each option, considering factors such as water demand, supply, and economic viability. The baseline and 4 scenarios assessed are:

- Business as usual
- Commercial smallholder agriculture
- Agribusiness
- Stagnant agriculture.

The Strategy identifies common themes and challenges emerging from stakeholder consultations, emphasising the importance of institutional reform, cross-boundary collaboration, policy enhancement, and supportive organisational structures. Recognising the complex interdependencies within the Basin, the strategy advocates for coordinated efforts across governmental, non-governmental, and community levels to achieve mutually agreed objectives.

The Strategy sets the foundation for compiling a Basin Plan, which will provide a roadmap for future development initiatives in the Kamala River Basin. It underscores the importance of continued stakeholder engagement and participatory approaches during implementation phase, ensuring that development efforts are responsive to local needs and conditions.

The Strategy represents a forward-thinking and collaborative approach to addressing complex water resource challenges. By prioritising inclusivity, innovation, and adaptive management, the Strategy aims to unlock the Basin's potential while ensuring the sustainability of its water resources and ecosystems.

The main outcomes are summarised in Table 10.1 (Annex 1) of the Strategy. It shows the pathways involving Sub-Goals, Actions and responsibilities with key attributes and constraints for additional attention in the decision-making for implementation.

The Strategy recommends preparing an implementation plan based on the following themes:

- Chure Conservation

- Water Demand and Supply
- WASH
- Agricultural Development
- Cross cutting.

1.2 Objective of the Implementation Action Plan

The Plan prioritises implementation of practical and feasible projects and respective actions at short, medium, and long term.

Implementing the actions outlined in the Plan is anticipated to improve the government's capacity to design and execute socially inclusive, gender-aware, and investment-ready basin development initiatives. This effort is expected to improve Nepal's decision-making processes for water infrastructure development, aligning sector policies, regulations, strategies, planning, and governance in line with the National Basin Plan.

1.3 Methodology

The GoN through WECS and the GoA through the CSIRO have collaborated to formulate a plan to implement the recommended strategic actions outlined in detail in the Strategy. Four thematic working groups were formulated. The thematic experts guided their respective working groups in formulating the implementation plan, while the team leader supervised overall activities and finalised the report with input from CSIRO for submission to WECS.

Activity 1: Formation of Working Groups (WGs) and Project Coordination Committee (PCC)

PCC comprising of senior officials of the government ministries has been established. The PCC is mandated to direct WGs on policy issues, review and monitor the progress of the works and facilitate approval of the Implementation Plan by the Government of Nepal. Similarly, 4 thematic WGs consist of officials from various government entities and representatives from non-government organisations, and the private sector.

To encourage maximum female participation, the head of the water related institutions were requested to nominate a relevant representative for the WGs. Twelve women and 16 men participated in the WGs (Annex 1). Each group reviewed the status of activities related to the theme relevant to the Strategy and formulated the implementation plan under the guidance of thematic experts.

The composition of the PCC and WGs is presented in Annex 1.

Activity 2: Inception meeting with WGs

The first meeting of each thematic WG discussed and finalised their respective Terms of Reference (ToR) and the framework of the Implementation Action Plan. They formulated the methodology for the development of the Plan.

Activity 3: Formulation of Implementation Action Plan and review meeting with WGs

The second meeting of the WGs was conducted again to finalise the Plan. The thematic experts conducted several consultations with WG members before the meeting.

Activity 4: Compilation of agreed Implementation Action Plan and review meeting with WGs

Thematic experts conducted meetings with the WGs to further refine the actions and activities in the Plan. A consultative meeting was held in Janakpur, attended by representatives from 12 municipalities within the Basin. The Plan was presented, and their comments were incorporated.

Activity 5: Finalisation of the Implementation Action Plan

The conceptual framework of the methodology applied to build the implementation plan is shown in Figure 2.

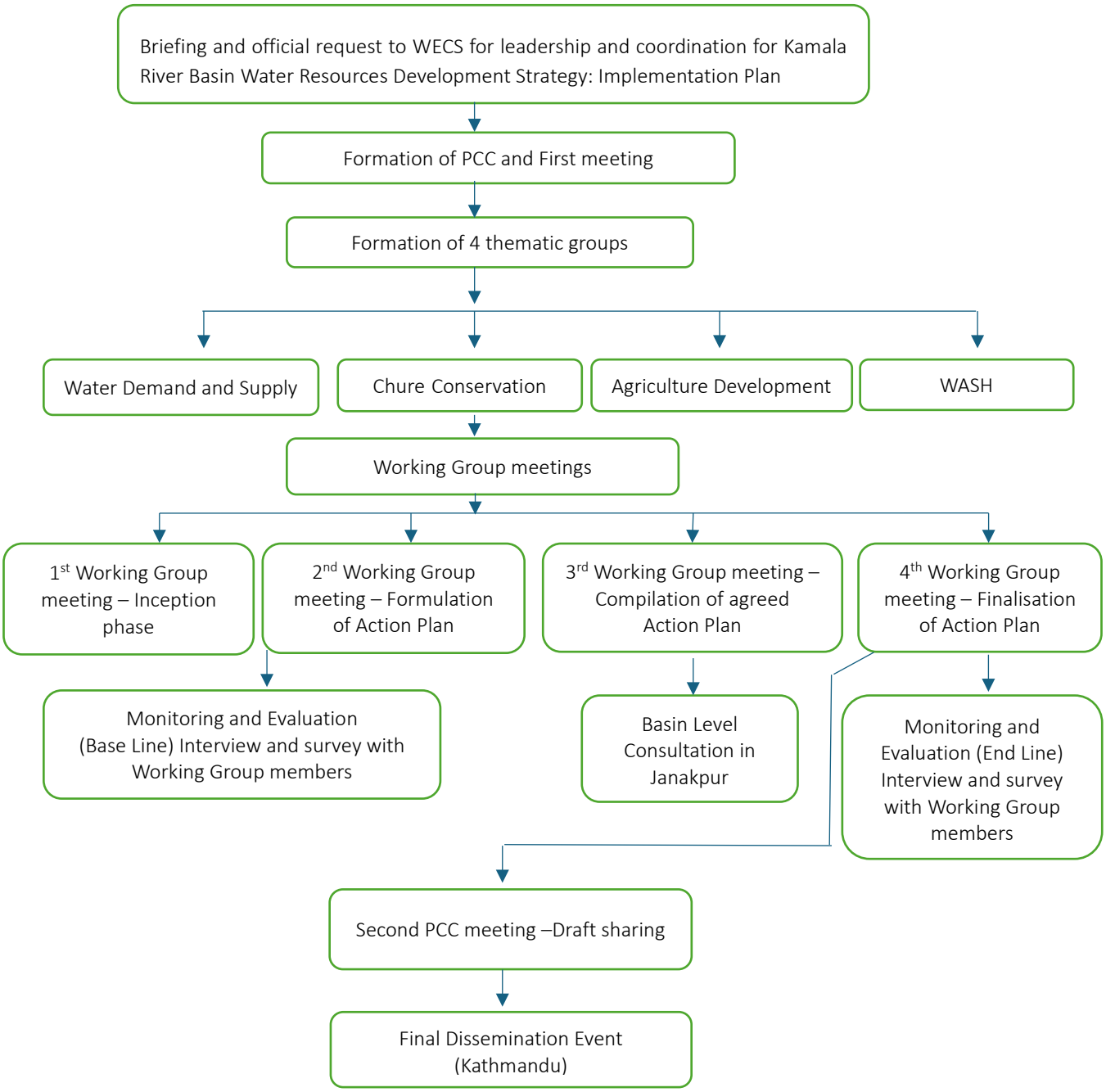


Figure 2 Applied methodological framework to produce the Implementation Action Plan

1.4 Contextual setup of the Kamala Strategy Implementation Action Plan

The Implementation Action Plan is based on Nepal's constitutional provisions, governance structure, policies, and institutional framework, emphasising gender representation and inclusion of people with disabilities and disadvantaged groups.

Water resources are crucial for Nepal's economic and social development, serving as a lifeline across sectors. While the country is endowed with abundant water resources, their potential remains underutilised. Beyond large-scale applications such as irrigation and hydropower generation, water resources support vital needs in drinking water supply, navigation, environmental conservation, recreation, and religious practices, all of which significantly contribute to Nepal's socio-economic fabric. Therefore, the sustainable development and effective management of water resources are fundamental to the nation's progress.

Nepal's water resources not only benefit its own populace but also hold strategic importance for neighbouring riparian countries, particularly in terms of flood control and maintaining downstream flow during dry periods.

Following the Earth Summit in 1992 and the adoption of Agenda 21, Nepal developed its Water Resources Strategy in 2002, which emphasised IWRM. This approach recognises river basins as fundamental units for the sustainable utilisation of water resources and environmental conservation. While the National Water Plan (2005) was developed in line with this strategy, its implementation has faced challenges due to limitation in financing and coordination, compounded by political instability. Despite these hurdles, the strategy facilitates significant improvements in legal and institutional frameworks, integrating water resources development into the national agenda as reflected in the 2015 constitution.

IWRM has emerged as a key policy principle, highlighted by the formulation of the National Water Resources Policy 2020 and the drafting of a new Water Resources Bill, both prioritising IWRM and river basin plan implementation. At the operational level, efforts are underway to develop River Basin Management Plans, complemented by the Irrigation Master Plan (2019, updated 2024), which aligns with IWRM principles.

Various policies and strategies intersect with water resources management, including the SDG 6.5.1 IWRM Action Plan, Nepal's Irrigation Policy (2014), Water Supply and Sanitation Policy (2014), Water-Induced Disaster Management Policy (2015), National Agroforestry Policy (2019), among others. However, the full integration of IWRM into these instruments remains a work in progress, with a conventional sectoral approach persisting in practice.

In essence, while Nepal acknowledges the pivotal role of water resources in its development further efforts are necessary to fully integrate IWRM principles into all relevant policies and strategies. Achieving this integration will not only ensure sustainable water management but also contribute to the country's socio-economic development and foster regional co-operation.

1.5 Gender Equality and Social Inclusion (GESI) integration in the water resources sector in Nepal

Since the 1980s, Nepal has made significant strides in advancing gender equality and social inclusion in water resources development. This progress has paralleled an increasing international focus on gender issues.

A landmark study, *The Status of Women in Nepal* (Centre for Economic Development and Administration, Tribhuvan University, 1981) highlighted women's unrecognised contributions to the economy and natural resources management. This paved the way for moving towards actions that promote integrating gender equality into water resources management during the late 1990s and early 2000s. The Ninth Five-Year Plan (National Planning Commission, Nepal), aligning with global initiatives like the Beijing Platform for Action, was the first to prioritise women's development in national strategies. This led to incorporating GESI principles within national development programs.

Despite recent efforts, mainstreaming gender equality across sectors is still challenging. Initiatives often treat Nepali women as a homogenous group facing similar disadvantages, overlooking the diverse and complex gender dynamics within the country. To address these gaps, the government established GESI units in several ministries, following the Gender Responsive Budgeting and Planning Directive of 2012. This directive ensured gender equality efforts aligned with international commitments under Convention on the Elimination of All Forms of Discrimination Against Women, 1979 (CEDAW), the Beijing Platform, and the Millennium Development Goals (MDGs.).

Despite these structures, many initiatives rely heavily on donor funding, raising concerns about sustainability after external support ends. In the water sector, policies like the 1992 Irrigation Policy mandated quotas for women's participation in Water User Associations (WUAs), aiming for at least 20% female membership. Subsequent policies have built upon this, increasing quotas and establishing more structured participation requirements. For instance, sectoral policies mandate up to 33% female representation on WUA executive committees. The WASH sector policy is promoting significant female participation in planning, budgeting, and operation of water infrastructure projects.

Although these policy advancements are important and necessary, implementation often falls short. Legal quotas, while valuable, do not always translate into a meaningful power or decision-making opportunities for women. Water management strategies often overlook women's specific water needs for domestic use and agriculture, highlighting the gap between policy and practice.

The ongoing challenge lies in ensuring the quotas and formal opportunities are not merely symbolic but genuinely empower women within their communities. Addressing this requires shifting underlying social norms and ensuring that policies are not only implemented but also bring tangible changes to the realities on the ground. The actions presented in this plan aim to close the social gap, empower women and promote social inclusion.

2 Prioritisation of the Water Resources Development Options

2.1 Water Resources Development (WRD) Options and Exploratory scenarios

The WRD options and exploratory scenarios outlined in the Strategy reflect the farming practices and crop systems that mirror the development potential and the aspirations of the population in the Basin. Each scenario incorporates specific variation in the maximum command areas and cropping patterns across different irrigation command areas within the Basin. The primary objective of each WRD option is to enhance the availability and reliability of water for agriculture, as irrigation accounts for approximately 94% of water use while domestic use, livestock and industry uses are only 4%, 1% and less than 1% respectively. To facilitate a basis for comparison with the potential future of the Basin, the Strategy also considers options of 'No intervention or development (WD)' in water resources infrastructure development and a 'Baseline (BL)' exploratory scenario which depicts the current agricultural water supply and demand.

Table 1 List of Water Resources Development options and exploratory scenarios

Development Options	Exploratory scenarios
No intervention or development (WD)	Baseline: Current agricultural trends (BL)
Revitalisation of the existing Kamala Irrigation Project (KIPR)	Business as usual (S1)
Sustainable utilisation of groundwater (GW)	Commercial smallholder agriculture (S2)
Construction of small and medium water storages in the upper Basin (SS)	Agribusiness (S3)
Development of Sunkoshi-Kamala Diversion Scheme (DS)	Stagnant agriculture (S4)

The 5 exploratory scenarios are described in detail in CSIRO and WECS, (2021), it is synthesised here as:

- Baseline (BL): traditional farming methods relying on manual labour. Low crop productivity.
- Business-as-Usual (S1): conventional farming techniques with high input requirements, limited by labour constraints.
- Commercial Smallholder Agriculture (S2): based on Conservation Agriculture-based Sustainable Intensification (CASI) practices, are labour-efficient but has seasonal labour limitations for harvesting.
- Agribusiness (S3): large corporate farms using mechanized systems that reduce manual labor reliance.
- Stagnant Agriculture (S4): reflects subsistence farming focused on self-sufficiency, with minimal surplus and limited access to modern inputs and labour limitation.

Among the 5 exploratory scenarios, the 'Agribusiness (S3)' scenario exhibits the highest water demand. The 'Diversion Scheme (DS)' stands out as the only option capable of nearly eliminating the water shortages within the Basin across all 5 exploratory scenarios. 'Sustainable utilisation of groundwater (GW)' option is second in overall reduction in water shortages across all scenarios, followed by 'Revitalisation of the existing Kamala Irrigation Project (KIPR)' option. Although the small-medium storages (SS) option has no impact on reducing water shortages, in the lower Basin, it marginally increases the irrigated area in the upper Basin by 3,890 hectares.

2.2 Quantifying water availability and requirement – the hydro-economic modelling

The International Centre for Integrated Mountain Development (ICIMOD) collaborated with CSIRO to assess, quantify and analyse the costs and economic value of development scenarios proposed in the Strategy. Additionally, it aimed to enhance the capacities of collaborators and stakeholders in mainstreaming gender in the basin model conceptualisation and information generation in Nepal. As part of this initiative, a node-based Hydro-Economic

Model ('HEM') has been developed for the Kamala River Basin (ICIMOD and CSIRO, 2024). The results of the study are supporting this plan and are briefly below.

The HEM analysis of the WRD options with respect to the 5 exploratory scenarios indicates that the combined intervention option, 'GW+KIPR+SS+DS' for 'Commercial smallholder agriculture (S2)' and the Agribusiness (S3) scenarios are the two with most economically beneficial outcome. This combined WRD option has the highest potential net benefit of NPR 41,900 million for S2 and NPR 40,256 million for S3 representing an incremental net annual benefit of NPR 6,650 million for S2 and NPR 4,097 for S3 when compared to the net annual benefit of NPR 35,250 and NPR 36,159 million of the baseline option under these respective development scenarios. The S2 scenario generates the highest incremental benefit among all the scenarios while balancing at the same time the cropping patterns with command areas, maximising economic returns and ensuring efficient water allocation and management.

The scenario with the highest command area, 'Agribusiness (S3)', has the higher incremental costs incurred for infrastructure development, which increase with a larger command area. The groundwater use (GW) option is the next most effective measure in reducing water shortages and hence shallow tubewell irrigation as the first to develop because it can attain within a very short time an incremental net benefit of NPR 39,657 million under the S2 and NPR 42,117 for S3 scenario. However, groundwater irrigation becomes redundant once the diversion scheme together with the revitalised KIPR become fully functional. An adequate investment sequence includes initial shallow tube well GW development by Year 2, small storage completion by Year 3, KIPR by Year 4, GW capital replacement by Year 12, and DS by Year 14. Beyond Year 14, surface water availability reduces the need for GW capital replacement (ICIMOD and CSIRO, 2024).

2.2.1 Planned and selected scenarios for implementation actions

The thematic WGs assessed priorities related to water resources agencies at various levels of governments in the Basin and identified gaps between the Basin's needs and ongoing or planned activities. Based on this assessment, an indicative Action Plan was developed and shared with the key stakeholders during a consultation meeting, held on 26 November 2023 in Janakpur, the headquarter of the Madhesh Province. The meeting brought together local governments (mayors), senior officials from provincial governments and the major water users in the Basin to prioritise areas for WRD development.

Relevant outcomes of the consultation meeting were:

- The Sunkoshi-Kamala diversion scheme (DS) is the only long-term solution to meet water demand for the economic wellbeing within and beyond the Basin, particularly in a high-demand future scenario characterised by extensive human participation in agriculture and the intensification and expansion of agricultural activities. However, KIPR is a prerequisite for the diversion scheme to provide timely benefits. Given the diversion scheme's complexity, high cost, environmental implications, political sensitivity, and extended timeframe, a detailed feasibility study is essential. Preparations for KIPR should begin immediately accompanied by capacity-building programs to ensure sustainable management and governance.
- Sustainable utilisation of groundwater (GW) ranked as the second-highest priority action for the Basin. Developing shallow tubewell (STWs) is recommended as an initial action, targeting the KIP command area for conjunctive use. However, caution is necessary to avoid overexploitation of groundwater, which is also a critical source of domestic water supply. Establishing institutional mechanisms and a groundwater monitoring system is necessary to ensure sustainable groundwater use for both irrigation and domestic needs.
- Small to medium sized storage facilities in the upper Basin could add 3,890 hectares of irrigated agriculture land. Preliminary viability studies for such schemes should commence promptly to enable their operation by 2030.

Additionally, other priority areas for intervention were identified:

- Prevention, protection, and management of risks from floods, landslides, and bank erosion.

- Establishment of institutional mechanisms and mechanisms for concerted decision-making among key stakeholder in the basin.

2.2.2 Sequencing of the actions

Based on the results of ICIMOD and CSIRO (2024) and the input received from consultation meetings the most beneficial development implementation pathways are:

- Groundwater development completed and target achieved by 2030
- Small and medium storage projects completed and in operation by 2035
- KIPR + Diversion Scheme completed and in operation by 2040
- Small and medium storages + KIPR + Diversion Scheme together in full operation by 2045.

The command areas available under various options, as assessed by ICIMOD and CSIRO (2024) are outlined in Table 2. The proposed development pathway incorporating the Sunkoshi Kamala Diversion Scheme would provide sufficient water to an area ranging from 220,833 ha to 223,133 ha, depending on the development scenario, which goes well beyond the boundary of Basin. For effective planning of irrigation development, this entire area must be considered. The existing conveyance system currently serves only 25,000 hectares under KIP, necessitating the development of a new system to cover the remaining 197,107 hectares.

Table 2 Predicted command area under water resources development options

	Development baseline	Water resources development options			
		Revitalisation of the Kamala Irrigation Project	Groundwater Development	Small and medium storages1	Inter-basin water transfer2
Exploratory Scenarios	High water leakages /losses	Upgraded KIP with reduced water leakages	Upgraded groundwater infrastructure extraction	3 small and medium storages of 16.4 MCM capacity	Sunkoshi barrage and diversion pipeline. Increased capacity of the KIP system
Baseline (ha)	48,800	48,800	48,800	52,690	222,200
Business as usual (ha)	32,920	32,920	32,920	36,810	220,833
Commercial smallholder Agriculture	48,449	48,449	48,449	52,339	222,107
Agribusiness (ha)	60,500	60,500	60,500	64,390	223,133
Stagnant agriculture (ha)	39,100	39,100	39,100	42,990	221,316

Source: ICIMOD and CSIRO, 2024

The modelled water supply and demand shows that the demand is most suitably met with the implementation pathway as suggested. Table 3 shows the supply and demand situation in the Basin in the dry season and Table 4 shows the demand during the monsoon season. Further, the tables show that WRD option 'KIP revitalisation + Diversion scheme + Small and medium storages', has the maximum command area that can meet 98% of the projected demand in the dry season while it meets 100% of the demand in the monsoon season.

The Water supply, Sanitation, and Hygiene (WASH) and Chure Conservation programs can be implemented independently over the plan period.

Table 3 Modelled water supply for dry-season baseline conditions and some combined WRD options (MCM)

WRD option	Baseline		Business as usual		Commercial smallholder agriculture		Agribusiness		Stagnant agriculture	
	Demand	Diverted	Demand	Diverted	Demand	Diverted	Demand	Diverted	Demand	Diverted
KIP revitalisation +diversion scheme + groundwater	288.15	283.83	281.12	279.86	609.15	605.06	614.43	607.75	283.86	281.52
	98%		100%		99%		99%		99%	
Groundwater +small-medium storages	127.92	108.48	168.42	151.63	476.26	135.61	590.30	98.75	196.25	160.26
	85%	90%	28%	17%	82%	85%	90%	28%	17%	82%
KIP revitalisation + diversion scheme + small-medium storages	308.17	293.76	301.14	287.05	629.17	614.85	634.44	618.24	303.87	289.79
	95%	95%	98%	97%	95%	95%	95%	98%	97%	95%
KIP revitalisation + diversion scheme + ground water + small-medium storages	308.17	293.76	301.14	287.05	629.17	614.85	634.44	618.24	303.87	289.79
	95%	95%	98%	97%	95%	95%	95%	98%	97%	95%

Note: Figures in percentage refer to share of demand met.

Source: ICIMOD and CSIRO (2024)

Table 4 Modelled water supply for monsoon-season baseline conditions and some combined WRD Options (MCM)

WRD options	Baseline		Business as usual		Commercial smallholder agriculture		Agribusiness		Stagnant agriculture	
	Demand	Diverted	Demand	Diverted	Demand	Diverted	Demand	Diverted	Demand	Diverted
KIP revitalisation + diversion scheme + groundwater	528.55	528.55	524.15	524.15	528.25	528.25	531.56	531.56	525.86	525.86
	100%		100%		100%		100%		100%	
Groundwater + small and medium storages	166.55	165.90	116.43	116.11	165.43	163.35	203.65	196.36	135.91	135.60
	100%		100%		99%		96%		100%	
KIP revitalisation + diversion + small and medium storage	541.08	540.76	536.68	536.36	540.78	540.47	544.09	543.77	538.39	538.08
	100%		100%		100%		100%		100%	
KIP revitalisation + diversion scheme + groundwater + small and medium storages	541.08	540.76	536.68	536.36	540.78	540.47	544.09	543.77	538.39	538.08
	100%		100%		100%		100%		100%	

Source: ICIMOD, and CSIRO, 2024

3 Kamala Strategy Implementation Action Plan

3.1 Framework of Goal, Sub-Goal and Actions

In the Strategy's framework (described in Table 10.1 of the Strategy), the sets of actions represent the necessary steps to achieve the desired goals. Under the 3 overarching goals, there are 13 Actions as presented in Table 5. Each action is further delineated into an Implementation Action Plan, as detailed in the following sections.

Table 5 Goals, sub-goals and actions in the Implementation Plan

Goal	No	Sub-goal	No	Action
Goal 1: Sustainable management of Chure and its natural resources for livelihood support and reduced vulnerability to water induced disasters.	1.1	Watershed conservation and improvement	1.1.1	Develop a new policy framework and basin-level strategy to guide watershed protection planning and investments
			1.1.2	Conduct annual planning, prioritisation and implementation of watershed conservation options
	1.2	Sustainable management and utilisation of natural resources	1.2.1	Improve conservation-livelihood linkages (through reforestation, and promotion and production of non-timber forest products)
			1.2.2	Regulation and sustainable riverbed mining/ extraction
Goal 2: Improved availability, use, allocation of water resources for livelihood generation, well-being, economic growth.	2.1	Reliable measurement of water cycle for effective management	2.1.1	Measure and maintain reliable hydro-meteorology data on the basin for evidence-based water resources management
	2.2	Reduced vulnerability from water induced disasters and control of bank erosion	2.2.1	Provide an early warning system and preparedness to mitigate impacts of flood and landslide events
			2.2.2	Minimise impacts of water induced disaster events with structural and non-structural measures
	2.3	Conservation, development, and management of existing and potential water resources for improving all consumptive uses, and water use efficiency	2.3.1	Secure and develop water supply, sanitation and hygiene (WASH) services and facilities for current and future household requirements
			2.3.2	Quantitatively assess existing basin water resources, water supplies and likely future demand for irrigation, and scope for improvement
			2.3.3	Identify and assess 4 major water supply improvement options as follows
				1. Revitalisation of existing Kamala Irrigation Project (KIP)
				2. Groundwater and conjunctive use with surface water
				3. Small and medium water storages upstream
				4. Sunkoshi Kamala inter-basin transfer scheme
			2.3.4	Improve efficiency of existing water use in irrigation
Goal 3: Commercial and scientific agriculture for local economic prosperity and livelihood security	3.1	Improve farming practices and productivity	3.1.1	Support the sustainable intensification of crop production systems
	3.2	Support marginalised (land poor) farmers	3.2.1	Support collective farming to improve access to land, water, knowledge and resources for marginalised farmers

Source: CSIRO and WECS, 2021

4 Implementation Action Plan for Goal 1: Sustainable management of Chure

Goal 1 of the Strategy focuses on the sustainable management of Chure and its natural resources to support livelihoods and mitigate water-induced disasters. This Goal is pursued through 4 actions and 15 implementation activities as shown in Table 6.

Table 6 Implementation Plan activities related to Goal 1

Goal	Sub-goal	Action	Activity	Activity description
1	1.1 Watershed conservation and improvement	1.1.1	1.1.1.1	Formulate whole of basin policy framework with federal leadership
			1.1.1.2	Collaboratively agree on common basin-wide watershed conservation strategy, including identifying and prioritising areas requiring protection
			1.1.1.3	Support sub-national governments to set sector governance frameworks within their jurisdiction
			1.1.1.4	Establish and make use of a Kamala RBO, with annual Multi-stakeholder Platform (MSP)
		1.1.2	1.1.2.1	Convene basin-level actors for annual dialogue and intermediate reviews, prioritising annual investments and initiatives, resource mobilisation, delivery favouring partnerships, generating knowledge from monitoring and evaluation
			1.1.2.2	Build check dams where relevant and possible, by using and promoting indigenous technologies and locally sourced materials to make structural interventions affordable and sustainable
	1.2 Sustainable management and utilisation of natural resources	1.2.1	1.2.1.1	Development of cattle grazing rules and promotion of alternative energy sources
			1.2.1.2	Identify, develop, and promote plantation of varieties suitable for Chure region, and supporting livelihood requirements
			1.2.1.3	Multiyear nurseries to ensure saplings can adapt to local conditions for regeneration
		1.2.2	1.2.2.1	Initiate a national consultative process for all 3 levels of government to ratify policies and practices for sustainable extraction and improved sector governance
			1.2.2.2	Establish coordinated oversight at district and provincial levels (DCCs)
			1.2.2.3	Generate specialist basin-level knowledge and capabilities
			1.2.2.4	Plan river channelisation and implement the necessary works
			1.2.2.5	Allow extraction of riverbed materials within sustainable limits
			1.2.2.6	Identify, map and classify areas with high susceptibility of erosion and sedimentation transport, establish and implement a plan of erosion control and reduce the risk

Source: CSIRO and WECS, 2021

4.1 Develop a new policy framework and basin-level strategy to guide watershed protection planning and investments (Action 1.1.1)

4.1.1 Formulate a whole-of-basin policy framework with federal leadership (Activity 1.1.1.1)

Current status: Recently WECS has prepared River Basin plans for Nepal's major river basins, including the Kamala River Basin. These plans will serve as the basin provide a policy framework for the water utilisation, watershed protection and disaster risk management.

The Chure-Terai Madhesh Conservation and Management Master Plan, 2017 identified 164 river systems. As part of this effort, the President Chure Terai Madhesh Conservation Development Board (PCTMCDB) has developed integrated resource management plans for Chure conservation of Nepal including Kamala River Basin.

The Building a Resilient Chure Region in Nepal (BRCRN) project prepared the Critical Ecosystem Restoration Plans (CERPs) for the eastern Chure region, including those for Kamala (BRCRN 2023).

Plan of action: Update and implement CERPs and integrated resources management plan. The 9 CERPs prepared for the Basin were endorsed for implementation. The PCTMCDB has prepared 3 integrated resource management plans for the Kamala River Basin. The program's activities and financial arrangements need to be updated based on site specific changes and the time of implementation.

Implementing agency: The BRCRN project under the federal GoN will lead the updating and implementation of CERPs in collaboration with the Ministry of Forests and Environment (MoFE). The project consists of Project Management Unit (PMU) at the federal level and provincial Project Management Unit (PPMU) at all 3 provinces of Bagmati, Madhesh and Koshi (BRCRN, 2023).

Similarly, PCTMCDB is one of the 21 'National Pride Projects' of the Government of Nepal to prepare and implement river system integrated resource management plans. The PCTMCDB has 5 Program Implementation Units (PIUs) at field level.

Duration and time of completion: The Kamala Basin Plan has been prepared by WECS for a planning horizon up to 2045.

Budget requirements: While the CERPs for the Basin were endorsed in June 2023, no budget has yet been allocated for their update. The estimated cost for the update is estimated in NPR 2 million.

Priority: High, as implementation of the CERPs is considered of high priority by the GoN.

Risks and challenges: Potential overlapping jurisdictions and responsibilities that require clarification of the whole-of-basin cooperation and coordination.

4.1.2 Collaboratively agree on common basin-wide watershed conservation strategy, including identifying and prioritising areas requiring protection (Activity 1.1.1.2)

Current status: WECS has finalised the basin plans for Nepal's major river basins including the Kamala River Basin. These basin plans include scenario evaluations to assess the reliability, resilience, and vulnerability of the water resources sector.

Plan of action: Carry out an updated disaster risk assessment and mapping for the Basin focusing on climate change impacts, Chure conservation and water management. This will help formulating a basin-wide watershed conservation strategy, identifying and prioritising areas for protection.

Implementing agency: WECS is the lead agency to prepare the basin plans supported by MoFE (including BRCRN), PCTMCDB, and provincial governments.

Duration and time of completion: The activity will commence in 2025 and conclude in 2026.

Budget requirements: NPR 5 million is proposed for vulnerability risk assessment and mapping.

Priority: High, as it underpins overall planning and management.

Risks and challenges: Clarifying overlapping jurisdictions and responsibilities and the whole-of-basin cooperation and coordination.

4.1.3 Support sub-national governments to set sector governance frameworks within their jurisdiction (Activity 1.1.1.3)

Plan of action: Support the formulation, amendment and implementation of Community Forests Management Plans (CFMPs). Over 200 community forests in the Basin require updated management plans (BRCRN, 2023) for implementation. BRCRN started the process for supporting Community Forests Users Groups (CFUGs) to formulate Forest Management Plans. As the management of major areas of the forests in the Basin is carried out by the Forest Users Groups (FUGs), it is therefore necessary to support them in updating the management plans and their implementation. These plans should be aligned with the CERPs and the Kamala Implementation Plan.

Implementing agency: Division Forest Offices (DFOs) and the FUGs will have the primary responsibility for updating and implementing CFMPs.

Duration and time of completion: Two years starting in 2025 are proposed for updating plans for 250 FUGs.

Budget requirements: NPR 1 million per plan, totalling NPR 25 million for 250 FUGs.

Priority: High, as CFUGs play a key role in sustainable forest management

Risks and challenges: Potential duplication of tasks, as CFUGs periodically update plans independently.

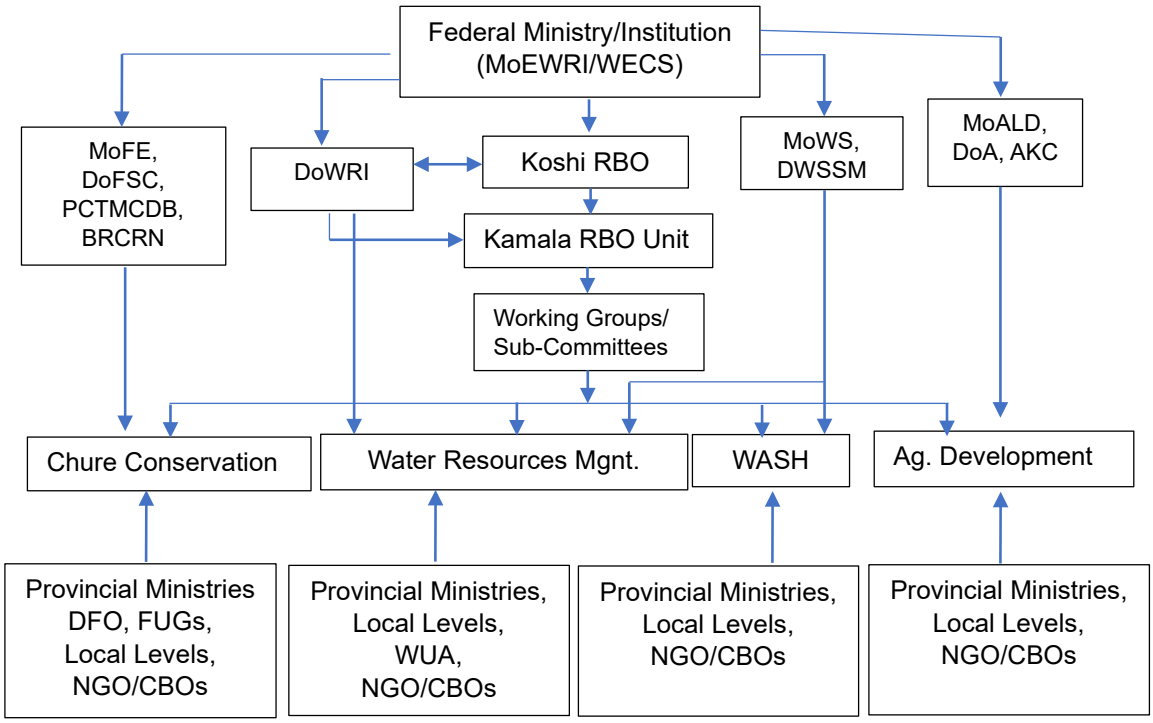
4.1.4 Establish and make use of a Kamala RBO with annual Multi-stakeholder Platform (MSP) (Activity 1.1.1.4)

Current status: IWRM has been recognised in the 2002 Water Resources Strategy (WRS). The implementation plan of that Strategy has been formulated as a National Water Plan (NWP) which emphasises the concept of river basin planning and management as a hydrologic unit of the available water resources development and management (National Water Plan, 2005). However, the implementation of the NWP has not yet materialised. The National Water Resources Policy 2020 states that water resources utilisation and management shall be carried out based on river basin plans. A set of river basin plans is being prepared by WECS under the project 'Preparation of River Basin Plans and Hydropower Development Master Plans and Strategic Environmental and Social Assessment (SESA)'.

In 2021 the Government of Nepal drafted a Water Resources Act based on the National Water Resources Policy. With respect to water governance in the Kamala River Basin, several water-related government agencies exist within the Basin, including: Irrigation Division Offices, Water Supply and Sanitation Division Offices, Kamala Irrigation Project, Provincial Ministry for Public Works, and Groundwater Division Offices. However, no single entity is responsible for sustainable development for the entire Basin. The establishment of a River Basin Office (RBO) for the Basin will form the platform for effective implementation of river basin plans based on IWRM principles. RBO is an institutional mechanism to facilitate IWRM implementation. It involves all stakeholders in the river basin and will bring in coordination of their activities for effective utilisation, reduce duplication and resolve conflicts of the available water resources.

IWRM implementation requires environmental and institutional arrangements, and management instruments. With respect to an enabling environment there is no pre-existing legal base to form RBOs in Nepal, nor an institutional arrangement which defines the roles and responsibilities of the RBO.

The 2020 National Water Resources Policy has set a framework for establishing river basin offices. WECS has proposed the establishment of River Basin Offices, initially in 3 major river basins (Koshi, Gandaki and Karnali) of Nepal to effectively utilise available water resources.. A structure for the RBO unit for the Kamala River Basin is shown in the proposed organogram (Figure 3).



Abbreviations:

MoEWRI: Ministry of Energy, Water Resources and Irrigation

MoFE: Ministry of Forests and Environment

MoALD: Ministry of Agriculture and Livestock Development

MoWS: Ministry of Water Supply

WECS: Water and Energy Commission Secretariat

DoWRI: Department of Water Resources and Irrigation

DoFSC: Department of Forests and Soil Conservation

DoA: Department of Agriculture

DWSSM: Department of Water Supply and Sewerage Management

PCTMCDB: President Chure Terai Madhesh Conservation Development Board

BRCRN: Building a Resilient Chure Region in Nepal

AKC: Agriculture Knowledge Centre

FUGs: Forest Users' Groups

RBO: River Basin Office

WUA: Water Users Association

NGO/CBOs: Non-Governmental Organisation/Community Based Organisations

Figure 3 Proposed organogram of the Kamala RBO unit under the Koshi RBO

Plan of action: Restructuring of WECS is expected to get approval from the GoN till the end of the 2024..

The main functions of the RBOs are to:

- provide consent to water use licences issued by the provincial and local level offices (municipalities)

- monitor and examine the allocation, utilisation and pollution of the licensed uses of available water within the river basin
- maintain, coordinate and update data and information on climate, surface and groundwater within the river basin, if necessary
- work under the directives of WECS and report to it.

However, the roles and responsibilities of the proposed RBOs are not yet in line with the implementation of IWRM based on river basin plans. It is expected that the proposed RBO should perform effective regulating, managing and operating services of the available water resources. Hence, the RBOs should be strengthened with additional roles and responsibilities.

Considering the relatively small size of the Kamala River Basin (208,446 ha), to create a functional RBO, it is suggested to establish a multi-stakeholder platform in the Basin. This multi-stakeholder platform shall form an advisory committee to support the activities of the Kamala RBO unit under the Koshi RBO. The proposed structure of the Kamala RBO Advisory Committee is:

Chairman: To be nominated by WECS

Members:

- Member of Federal parliament of all 4 districts (Udayapur, Sindhuli, Dhanusha and Siraha) (18)
- Member of provincial parliament of all 4 districts (24)
- Chairperson of District Coordination Committee (4)
- Chief District Officers (4)
- Chief Police Officers (4)
- Chief of Koshi river basin Office (1)
- Chairperson of municipality (12)
- Chief of district level line agencies (Irrigation, Water supply and sanitation, Agriculture Knowledge Center) (12)
- Member secretary - Chief of Kamala River Basin Unit Office (1)

A total of around 80 multi-stakeholder representatives will form the Kamala RBO Advisory Committee, with fair representation of women to be ensured. In line with the functions of the RBOs, the primary responsibilities of the Advisory Committee responsibilities are to ensure that the objectives of RBO are fulfilled, these include:

- water allocation to all stakeholders
- resolution of conflicts related to water resources uses
- prevention of pollution on the surface and groundwater resources
- mitigation of drought
- protection of watershed from soil erosion, deforestation, and human encroachments
- provide approval to all new water and watershed related projects within the Basin.

Implementing agency: WECS is the lead agency in implementing the Strategy, and in establishing and making use of the RBO for effective and sustainable use of available water resources based on IWRM principles.

Duration and time of completion: RBOs could be established within the fiscal year 2025, subject to approval of the proposed WECS's restructure, and approval of the Water Resources Bill by Parliament.

Budget requirements: Once the RBO is formed, a formal branch office must be established. A regular budget shall be required for the smooth operation of RBOs and to conduct the biannual meeting of the Advisory Committee. In addition, the budget requirement shall also be based on the functionality of the proposed responsibilities of the RBO. A total of NPR 2,255 million is estimated for the period of 21 years.

Priority: High, as it is a critical mechanism for effective basin governance.

Risks and challenges: Overlapping roles and responsibilities of the newly established office with old water sectoral offices. Despite the recognition of IWRM in the 2022 Water Resources Strategy, the implementation of IWRM is still at risk. Policy makers and decision makers of the Government would need to accept its necessity.

4.2 Conduct annual planning, prioritisation and implementation of watershed conservation options (Action 1.1.2)

4.2.1 Convene basin-level actors for annual dialogue and intermediate reviews (Activity 1.1.2.1)

Activity description: This activity will convene basin-level actors for annual dialogue and intermediate reviews. It aims to prioritise annual investments and initiatives, mobilise resources, enhance delivery through partnerships, and generate knowledge from monitoring and evaluation efforts.

Plan of action: The formation of a Multi-Stakeholder Platform (MSP) to facilitate annual dialogues. Conduct 2 meetings annually to ensure consistent review and dialogue on progress.

Implementing agency: WECS will be the lead agency, with support from PCTMCDB, BRCRN and FECOFUN.

Duration and time of completion: Formation and operation of the Chure/Kamala MSP is an ongoing, long-term initiative.

Budget requirements: NPR 21 (NPR 1 million annually is proposed to cover the costs of 2 annual meetings).

Priority: Formation of MSP is of high priority for basin level dialogue and coordination.

Risks and challenges: Potential conflicts of interest among the stakeholders.

4.2.2 Build check dams and water conservation ponds (Activity 1.1.2.2)

Activity description: Build small-, medium-, and larger scale check dams, prioritising the use of indigenous technologies and locally sourced materials to mitigate water-induced disasters.

Promotion of bioengineering technique/measures for Chure conservation (sub-activity 1)

Plan of action: Employ bioengineering techniques such as landslide treatment and gully stabilisation, utilising locally available materials, following PCTMCDB and BRCRN plans.

This activity involves the use of locally available materials and appropriate technologies such as Bamboo (*Bambusa vulgaris*), Amriso (*Thysanolaena maxima*) cultivation, Kush/Vetivar (*Vetiveria*) bioengineering, check-dams, contour plantation and other techniques. Similarly, for riverbank stabilisation and protection, including engineering structures, the riverbank and stream banks are to be stabilised with locally available materials and resources. A total of about 250 active landslide areas are identified in the Chure region of Basin expanding over 160 ha (BRCRN, 2023).

Implementing agency: BRCRN and PCTMCDB will lead this activity, with support from Division Forest Offices (DFOs) and FUGs.

Duration and time of completion: The project is expected to run for 10 years starting 2028.

Budget requirements: NPR 930 (NPR 500 million is proposed for landslide treatment, and NPR 430 million for gully stabilisation.

Priority: High priority is accorded to landslide treatment and gully stabilisation.

Risks and challenges: Extreme climatic events pose a significant risk to the longevity and effectiveness of the dams.

Construct and improve conservation ponds to enhance water retention and soil moisture in the Chure region.

Plan of action: The CERP has identified a total of 79 new conservation ponds for construction and another 30 existing ponds for improvement within the Basin (BRCRN 2023). Consultation with local communities is required to determine the size and location of the conservation ponds depending on the site conditions.

Implementing agency: BRCRN and PCTMCDB, with support from Division Forest Offices (DFOs) and FUGs.

Duration and time of completion: Construction of new ponds and improvement of existing ones is expected to be completed within 5 years.

Budget requirements: Approximately NPR 70 million is required for pond construction and improvement. The unitary cost of construction of a new conservation pond of dimension of 20 m length, 20 m width and 2 m depth is estimated to be NPR 0.7 million. The unitary cost for improvement of existing ponds is estimated as NPR 0.5 million in accordance with the budgets proposed by CERPs.

Priority: High. Conservation ponds are pivotal for watershed management and thus highly prioritised.

Risks and challenges: Periodic maintenance of the ponds is a major challenge requiring consistent funding and community engagement.

4.3 Improve conservation-livelihood linkages (through reforestation, and promotion and production of non-timber forest products (Action 1.2.1)

4.3.1 Development of cattle grazing rules and promotion of alternative energy sources (Activity 1.2.1.1)

Activity description: This activity focuses on developing rules to regulate cattle grazing, particularly in revegetation areas, and promoting alternative energy sources.

Plan of action: Fence degraded forest areas to prevent cattle grazing. A total of 152 km of fencing has been identified as necessary under the CERPs.

Implementing agency: BRCRN and PCTMCDB, with support from DFOs and FUGs.

Duration and time of completion: Estimated to be completed in 5 years starting 2025.

Budget requirements: NPR 80 million is allocated for fencing works.

Priority: High, as fencing is crucial for protecting revegetation areas and facilitating natural forest regeneration.

Risks and challenges: Potential disruption of local or migratory wildlife routes.

4.3.2 Identify, develop, and promote plantation of varieties suitable for Chure region, and supporting livelihood requirements (Activity 1.2.1.2)

Activity description: Promote agroforestry systems by planting suitable species in the Chure region, prioritising local trees and grass species.

Plan of action:

- Establish 14 agroforestry nurseries across the Basin.
- Develop approximately 600 ha of riverside degraded land as agroforestry sites.
- Promote mixed cropping systems with a focus on fodder, fruit, and multi-purpose species.
- Agroforestry systems in lower river valleys will integrate horticulture and fodder species, linking conservation with livelihood enhancement.
- Prioritise indigenous and locally suitable species, as outlined in Table 7 below.

Table 7 Potential species for plantation in agroforestry system

SN	Fruit species	Fodder species	Multipurpose species
1	Mango	Kimbu (*Morus alba*)	Amala (*Phyllanthus emblica*)
2	Citrus species including lemon	Bakaino (*Melia azedarach*)	Jamun (*Syzygium cumini*)
3	Papaya	Moringa (*Moringa oleifera*)	Khayar (*Acacia catechu*)
4	Jackfruit	Nimaro (*Ficus sp.*)	Satisal (*Dalbergia latifolia*)
5	Lichi	Koiralo (*Bauhinia variegata*)	Harro (*Terminalia chebula*)
6	Banana	Badhar (*Artocarpus lacucha*)	Barro (*Terminalia bellirica*)
7	Sugarcane	Tanki (*Bauhinia purpurea*)	Bamboo (*Bambusa vulgaris*)
8	Others: Tejpat (*Cinnamomum tamala*), ginger/turmeric, legume crops	Others: Kus or vetiver (*Vetiveria zizanioides*), Amriso/broom grass (*Thysanolaena maxima*), Babiyo (*Eulaliopsis binata*)	Neem (*Azadirachta indica*)

Source: BRCRN, 2023

Implementing agency: BRCRN in coordination with PCTMCDB.

Duration and time of completion: 5 years starting 2025.

Budget requirements: NPR 310 million is proposed for establishing nurseries and promoting agroforestry.

Priority: High, as agroforestry is crucial in conservation and addressing community livelihoods.

Risks and challenges: The development of new agroforest areas can be suitable habitats for wildlife and can generate conflicts with the local population due land limitation for crops expansion.

4.3.3 Multiyear nurseries to ensure saplings can adapt to local conditions for regeneration (Activity 1.2.1.3)

Activity description: Develop multiyear nurseries to produce saplings that are well-adapted to local conditions, supporting long-term regeneration and reforestation efforts.

Plan of action: Small scale annual nurseries are in place at district levels. Most of these nurseries are maintained by the division and sub-division forest offices. The Kamala WRD Strategy has highlighted the need for multiyear nurseries as one of the means to improve the conservation-livelihood linkages through reforestation and promotion of Non-Timber Forest Products (NTFP) in the Basin.

The CERPs prepared by BRCRN for the Chure within the Basin has prescribed the establishment of a total of 25 multi-year nurseries with annual seedling production capacity of 1.35 million. The type of species of the tree/NTFPs are to be selected in consultation with the users groups with higher preferences to native species.

Implementing agency: Division Forest Offices (DFOs) in collaboration with BRCRN. FUGs, DOFSC and PCTMCDB.

Duration and time of completion: 5 years starting 2027.

Budget requirements: NPR 25 million.

Priority: High, as multiyear nurseries are essential for sustainable reforestation and conservation.

Risks and challenges: Unavailability of appropriate site (water, access to plantation site).

4.4 Sustainable management and utilisation of river natural resources (Action 1.2.2)

There are 6 activities identified under this action as described in the following sections.

4.4.1 Initiate a national consultative process for sustainable riverbed material extraction and improved sector governance (Activity 1.2.2.1)

Activity description: Initiate a national consultative process for all 3 levels of government to ratify policies and practices for sustainable riverbed material extraction and improved sector governance.

Plan of action: Conduct assessments and consultations at various government levels to establish sustainable riverbed extraction policies. Organise 7 consultative meetings annually (one central, 3 provincial, and 3 local) within the Basin.

Implementing agency: WECS, with support from PCTMCDB.

Duration and time of completion: Two years for assessments and consultations, with annual consultation meetings thereafter.

Budget requirements: NPR 25 **(**NPR 3 million/year for the first 2 years plus NPR 1 million annually for consultation meetings for 19 years).

Priority: High.

Risks and challenges: Overlapping jurisdiction among the government levels and clear sharing of the benefits.

4.4.2 Establish coordinated oversight at district and provincial levels (Activity 1.2.2.2)

Activity description: Development and incorporation of practices to improve coordination between district and provincial levels.

Plan of action: Strengthen District Coordination Committees (DCCs) to oversee river management through regular coordination meetings.

Implementing agency: WECS in coordination with support from DCCs.

Duration and time of completion: Ongoing on an annual and semi-annual basis.

Budget requirements: NPR 63 (NPR 2 million annually for DCC capacity enhancement and NPR 1 million for coordination meetings.

Priority: High.

Risks and challenges: Ensuring continuity and sufficient budget allocation.

4.4.3 Generate specialist basin-level knowledge and capabilities (Activity 1.2.2.3)

Activity description: Improve local capabilities to manage water resources.

Plan of action: Enrich expertise among basin actors through training and exposure to improve river basin management.

Implementing agency: WECS.

Duration and time of completion: Continuous.

Budget requirements: NPR 21 million (1 million annually).

Priority: High.

Risks and challenges: Sustaining long-term human resource development initiatives.

4.4.4 Plan and implement necessary river channelisation works (Activity 1.2.2.4)

Activity description: Improve river channelisation.

Plan of action: Stabilise and protect over 140 km of riverbanks using bioengineering and structural interventions as outlined in the CERPs.

Implementing agency: BRCRN and PCTMCDB.

Duration and time of completion: 10 years starting 2029.

Budget requirements: NPR 4,290 million for stabilisation and protection works.

Priority: High.

Risks and challenges: River morphology changes could damage interventions. A holistic approach is required for effective planning.

4.4.5 Allow extraction of riverbed materials within sustainable limits (Activity 1.2.2.5)

Activity description: Establish processes and rules to sustainably extract riverbed material.

Plan of action: Develop and implement guidelines for sustainable riverbed mining and extraction.

Implementing agency: PCTMCDB, BRCRN would serve as the lead agencies, with MoHA and MoFAGA as support agencies.

Duration and time of completion: Annually starting 2025.

Budget requirements: NPR 21 (1 million annually).

Priority: High.

Risks and challenges: Potential for untimely amendments influenced by political or other interests. rather than the technical sustainability.

4.4.6 Establish and implement a plan of erosion control and risk reduction (Activity 1.2.2.6)

Activity description: Develop a comprehensive plan to identify, map, and address erosion-prone areas and mitigate sedimentation transport risks. (See vulnerability mapping, Section 4.1.2, Activity 1.1.1.2.)

Plan of action: The strategy involves conserving soil and water sources, enhancing water retention, and reducing the risk of erosion and sedimentation through the construction of water harvesting structures. Additionally, rainwater harvesting systems will be implemented upstream to bolster water availability during dry seasons. A total of 30 water harvesting structures are proposed in the Chure region of the Basin as identified in the CERPs of the BRCRN Project.

Implementing agency: BRCRN and PCTMCDB are the lead agencies, with coordination from the MoFE.

Duration and time of completion: Ongoing, with the construction to be completed by 2028.

Budget requirements: NPR 30 million for water harvesting structures.

Priority: High.

Risks and challenges: Logistical and technical challenges in integrating water harvesting with other watershed conservation activities.

5 Implementation Action Plan for Goal 2: Improved availability, use, allocation of water resources for livelihood generation, well-being, and economic growth

Goal 2 of the Kamala Strategy is 'Improved availability, use, allocation of water resources for livelihood generation, well-being, and economic growth'. The Goal is achieved through 7 Actions and 21 implementation activities illustrated in Table 8 and detailed in the following sections.

Table 8 Implementation Plan activities related to Goal 2

Goal	Sub-goal	Action	Activity	Implementation activities
2	2.1 Reliable measurement of water cycle for effective management	2.1.1	2.1.1.1	Maintain the existing hydrological stations and establish additional hydro-meteorological stations in the Basin
			2.1.1.2	Upgrade key hydrological stations for sediment monitoring, data analysis and dissemination system, according to the Sediment Monitoring Guidelines and Plan of DHM
	2.2 Reduced vulnerability from water induced disasters and control of bank erosion	2.2.1	2.2.1.1	Develop flood warning system with flood forecasting model and communication strategy
			2.2.1.2	Prepare flood and landslide hazard, risk assessment maps and risk management plans
		2.2.2	2.2.2.1	Implement flood and landslide hazard and risk management plans
			2.2.2.2	Establish and operationalise Community Based Disaster Risk Management (CBDRM) system
	2.3 Conservation, development, and management of existing and potential water resources for improving all consumptive uses, and water use efficiency	2.3.1	2.3.1.1	Prepare and operationalise WASH Plans
			2.3.1.2	Provide universal access to safe water and improve service level
			2.3.1.3	Provide universal access to safely managed sanitation facilities and services
			2.3.1.4	Manage wastewater
			2.3.1.5	Promote hygiene
		2.3.2	2.3.2.1	Develop database and decision support model to quantitatively assess existing and future water resources supply and demand
		2.3.3	2.3.3.1	Develop a plan for the future of the KIP
				Establish a statutory framework for management of the KIP
				Design and implement of large civil works, in conjunction with GW and augmentation from local sources to feed into the KIP canal
				Develop capacity of KIP staff and Water User Association (WUA) members
			2.3.3.2	Prepare Inventory of all GW wells and estimates of current volume of water use at district level
				Establish and maintain a registry of construction/development of new GW wells
				Establish a user-oriented GW monitoring system
				Develop rules to limit (over) extraction at sensitive locations in the basin
				Plan, design and implement a GW irrigation program for conjunctive use in the KIP command area.
			2.3.3.3	Establish and maintain a registry of existing and planned water withdrawal and storage schemes

Goal	Sub-goal	Action	Activity	Implementation activities
				Establish a sustainability assessment framework for approval of new storage or pump-gravity schemes
				Conduct pre and detailed feasibility studies, and detail design and construction of potential storage and/or pump-gravity schemes
			2.3.3.4	Carry out detailed feasibility study of Sunkoshi Kamala inter-basin transfer (SKIBT) scheme
				Implement SKIBT scheme
		2.3.4	2.3.4.1	Develop and implement on-farm water management program for efficient water use in agriculture

5.1 Measure and maintain reliable hydro-meteorology data on the basin for evidence-based water resources management (Action 2.1.1)

5.1.1 Maintain the existing stations and establish additional hydro-meteorological stations in the Basin (Activity 2.1.1.1)

Activity description: Enhance the reliability of hydrological and meteorological records to quantify the climate variability's impact on water availability and manage risks from water induced disasters effectively.

Current status: The Department of Hydrology and Meteorology (DHM) currently operates 2 hydrological and 8 meteorological stations in the Basin. For the fiscal year 2025, DHM plans to install an additional 2 meteorological and 5 hydrological stations. However, the existing hydrological and meteorological monitoring network in insufficient to support a reliable assessment of water availability and flow variability across the Basin

Plan of action: Install 2 rainfall and 5 hydrological stations by 2025. Assess the adequacy of the station network for hydrological network, flood forecasting. The installation of additional stations is necessary. Properly maintain and operate the stations with reliable data recording and analysis system.

Implementing agency: DHM (Lead Agency), KIP Management Office and Department of Water Resources and Irrigation (DWRI) (supporting Agency).

Duration and time of completion: New stations by 2025. Assessment and potential station additions by 2026. Sediment monitoring stations on the KIP canal system by 2026-2027.

Budget requirements: NPR 10 million for sediment monitoring stations on the Kamala River and KIP canal system. Costs to be covered by KIP Management Office via DWRI's budgetary resources.

Priority: High, considering its critical importance for water resources management and disaster mitigation.

Risks and challenges: Low prioritisation by the GoN for primary data acquisition. Difficulty in allocating budget from KIP Management Office for investing on equipment and data management.

5.1.2 Upgrade key hydrological stations for sediment monitoring, data analysis and dissemination system, according to the Sediment Monitoring Guidelines and Plan of DHM (Activity 2.1.1.2)

Activity description: Enhance the reliability of hydrological and meteorological records to quantify the climate variability's impact on water availability and manage risks from water induced disasters effectively.

Current status: The DHM currently operates 2 hydrological and 8 meteorological stations in the Basin. For the fiscal year 2025, DHM plans to install an additional 2 meteorological and 5 hydrological stations. However, no sediment monitoring stations currently exist despite the high sediment load in the Kamala River. Risks such as bank erosion and channel shifting, aggravated by riverbed mining, remain unaddressed.

Plan of action: Install automatic 2 rainfall and 5 hydrological stations, including data recording and transmission, by 2025 as planned. Assess the adequacy of the station network for flood forecasting, sediment transport, monitoring

and hydrological assessment. Based on the assessment, install additional stations where necessary, including sediment monitoring stations on the KIP canal system and in the Kamala River.

Implementing agency: DHM (Lead Agency), KIP Management Office and Department of Water Resources and Irrigation (DWRI) (supporting Agency).

Duration and time of completion: New stations by 2025. Assessment and potential station additions by 2026. Sediment monitoring stations on the KIP canal system and Kamala River by 2026-2027.

Budget requirements: NPR 15 million.

Priority: High, considering its critical importance for water resources, sediment management and disaster mitigation.

Risks and challenges: Low prioritisation by the GoN for primary data acquisition. Difficulty in allocating budget from KIP Management Office for investing on equipment and data management.

Risks and challenges: Low prioritisation by the GoN for primary data acquisition. Difficulty in allocating budget from KIP Management Office for investing on equipment and data management.

5.2 Provide an early warning system and preparedness to mitigate impacts of flood and landslide (Action 2.2.1)

5.2.1 Develop flood warning system with flood forecasting model and communication strategy (Activity 2.2.1.1)

Activity description: Develop effective flood early warning system to minimise loss of life and property and control riverbank erosion.

Current status: Floods and landslides frequently impact the Basin. Current flood forecasting system relies on generic models, with no specific model for the Basin, leading to low accuracy predictions.

Plan of action: DHM to prepare a flood hazard and flood risk management system based existing data and new data collected in the upgraded stations.

Duration and time of completion: From 2026 to 2027.

Budget requirements: NPR 50 million.

Priority: High.

Risks and challenges: DHM may face challenge in securing budget allocation from the federal government.

5.2.2 Prepare flood and landslide hazard, risk assessment maps and risk management plans (Activity 2.2.1.2)

Flood and hazard risk map and risk management plan (sub-activity 1)

Activity description: DHM to prepare a Flood Hazard and Risk Map, develop a customised Flood Forecast Model, and enhance the existing Flood SMS Polygons.

Current status: Landslide hazard mapping and information systems remain underdeveloped.

Duration and time of completion: Flood hazard and flood risk management plan to be carried out in 2026-2027.

Budget requirements: NPR 25 million

Priority: High, given the need to prevent loss of life and property.

Risks and challenges: DHM may face difficulty in securing adequate federal funding for comprehensive modelling and mapping efforts.

Landslide hazard map and risk management plan (sub-activity 2)

Activity description: Map landslide-prone areas and develop risk management plans, including recommendations for structural interventions.

Current status: The landslide hazard map and risk management plan do not exist for the Basin.

Duration and time of completion: Landslide hazard and risk map and landslide risk management plan to be carried out from 2026 to 2027.

Budget requirements: NPR 25 million.

Priority: Medium.

Risks and challenges: DWRI's limited activity in hazard management, given its focus on irrigation infrastructure.

5.3 Minimise impacts of water induced disaster events with structural and non-structural measures (Action 2.2.2)

5.3.1 Implement flood and landslide hazard and risk management plans (Activity 2.2.2.1)

Activity description: Based on the Flood Risk Management Plan (Section 5.2.1, Activity 2.2.1.1) and the Landslide Risk Management Plan (Activity 5.2.2), DWRI to implement of the priority structural and non-structural measures, in consultation with the provincial and local governments.

Implementation arrangements:

- Flood and landslide prevention structures shall be constructed according to DWRI recommendations, with implementation by federal, provincial, and local governments as specified within their respective jurisdictions, according to prevailing policy, rules and regulations.
- Provincial governments shall formulate and enforce policy and rules on river waterways and land use zoning.
- DWRI shall support the provincial and local governments by building their capacity in implementing the plan.
- Capacity building with a target of engaging women as 50% of participants in all training activities.

Duration and time of completion:

- The flood and landslide risk management plans are expected to be available in 2027.
- Preparation of a basin-wide structural and non-structural intervention plan for flood and landslide risk management (including guidelines and type-design of structures) should take approximately 2 years and is scheduled for completion in 2028.
- Construction of the flood control structures must be completed by 2033 when the revitalisation of KIP is in progress.
- DWRI can complete the task of delineating waterways of Kamala River and its tributaries in one year (in 2027) once the flood hazard and risk map become available from DHM in 2026.

Budget requirements: NPR 4,532 million.

Priority: Medium.

Risks and challenges: Budget constraints and competing federal priorities.

5.3.2 Establish and operationalise Community Based Disaster Risk Management (CBDRM) system (Activity 2.2.2.2)

Activity description: The engagement and ownership of the community is crucial and more effective to manage disaster risk than relying on governmental agencies. To be effective the CBDRM requires a common effort to bring together all players affected by natural disasters.

Current status: The National Disaster Risk Reduction and Management Authority (NDRRMA) is the apex body established under the Disaster Risk Reduction and Management Act, 2074 BS. Its main objective is to function as the national resource centre for disaster risk reduction and management in the country. It has operating arms at province and local government levels and carries out pre-, during- and post- disaster operations by mobilising various government agencies including security forces and medical instructions and non-government organisations (e.g. Nepal Red Cross) and the local communities. It has already formulated guidelines, a strategic action plan (2018-2030) and standard operation procedures (SOPs) for preparedness, rescue, relief and rehabilitation operations for different types of natural disasters in the country. In the event of natural disasters like flood and landslides, the best way to prevent loss of life and property is enhance the capacity of the local communities in their preparedness and preventive actions. There are examples of CBDRM in Nepal although no in the Basin.

Plan of action: Establish a CBDRM system in vulnerable areas to enhance local preparedness, preparedness, resilience, and recovery from disasters.

Implementation agency: NDRRMA is the recommended agency to implement CBDRM.

Duration and time of completion: from 2027 to 2029.

Budget requirements: NPR 60 million (30 million over a period of 2 years and a recurrent annual cost of NPR 2 million thereafter).

Priority: High

Risks and challenges: Limited funds; culture of reliance on external development partners.

5.4 Secure and develop water supply, sanitation, and hygiene (WASH) services and facilities for current and future household requirements (Action 2.3.1)

The implementation plan for this Action consists of 5 activities:

- Prepare and operationalise WASH Plans
- Provide universal access to safe water and improve service level.
- Provide universal access to safely managed sanitation facilities and services.
- Manage wastewater.
- Promote hygiene.

5.4.1 Prepare and operationalise WASH Plans (Activity 2.3.1.1)

Activity description: (a) evaluate and analyse the coverage and functionality of existing water supply systems; (b) plan for extending services to currently uncovered areas; (c) integrate stormwater drainage systems with water supply, sanitation, and hygiene components, (d) conduct an inventory of water sources to ensure availability (e) design and implement training programs and awareness campaigns to promote sustainable practices.

Current status: Only Sabaila Municipality has a WASH plan, which requires updating. All 12 municipalities need comprehensive WASH plans.

Plan of action:

- Prepare WASH plans for all municipalities focusing on establishing a basin level regulatory agency, updating guidelines, technical standards, SOP and Manuals, delivery of WASH services in special situation like flood, wastewater reuse, and capacity building at local and provincial levels.
- Operationalise and improve Nepal WASH System for monitoring the implementation of WASH Plans.

Implementing agency: All 12 municipalities (Katari, Kalyanpur, Mirchaiya, Siraha, Karjanha, Ganeshman Charnath, Sabaila, Kamala, Sahidnagar, Janak Nandini, Kamalamai and Dudhauli). DWSSM, as a federal agency experienced in the preparation of WASH Plans will provide support for plan preparation, implementation tracking.

Duration and time of completion: Plan preparation: 2025–2026 Tracking: 2026–2043.

Budget requirements: NPR 12 million, with each municipality contributing NPR 1 million per year.

Priority: High.

Risks and challenges: Success depends on municipal commitment and expert engagement

Capacity building needs: Focus on enhancing municipal planning and operational capacity.

5.4.2 Provide universal access to safe water and improve service level (Activity 2.3.1.2)

Activity description: Deliver basic water supply services to 100% of the population, ensuring at least 100 lpcd of safe drinking water at any time.

Current status: 89% of the population has basic or medium level water supply, leaving 11% of the population without water supply. Among the population having water supply services, 39% have safe water and the remaining 61% need quality improvement by developing water treatment plants and introducing water safety plans.

Plan of action:

- Develop new water supply facilities for unreached population in all municipalities, considering the caste dynamics related to water in Nepal.
- Complete distribution networks from Overhead Tank systems for providing household service connections (one house one connection).
- Rehabilitate, repair and maintain existing water supply systems with one house one connection.
- Improve SW and DWs by elevating, covering, sealing and adding proper drainage.
- Construct water treatment plants for removing heavy metals like Arsenic, Iron, Manganese, and biological contamination from groundwater (Terai).
- Develop treatment plants for removing turbidity and biological contamination from surface water (Hills).
- Introduce water safety plan in each water supply scheme.
- Strengthen DWSSM laboratories with water laboratory mounted caravans.
- Provide each municipality with access to a laboratory or testing facility.
- Establish small scale water quality lab with field test kits in each system.

Implementing agency: DWSSM will play the role of implementing agency with support from sub national governments, users, communities, and development partners. Local governments will take responsibility for implementation with support from federal and provincial governments, service providers and private sectors.

Duration and time of completion: The implementation of various infrastructures development activities will take around 11 years (2025-2036). Other minor activities continue up to the end of project period, 2043.

Budget requirements: NPR 2,060 million and will be funded by DWSSM, provincial and local governments.

Priority: High.

Risks and challenges: Reliance on external funding and additional resources from the federal government.

5.4.3 Provide universal access to safely managed sanitation facilities and services (Activity 2.3.1.3)

Activity description: Ensure all households, public spaces, healthcare facilities, and schools have access to safe toilets.

Current status: 52.48% of households use safe toilets, 7% lack toilets, 0.65% of households use shared toilets and the remaining 39.8% have unsafe toilets. Similarly, 109 public places, 15 Health Care Facilities (HCF) and 9 schools are without toilets. Despite declaration of open defecation free Nepal, defecating and urinating in open spaces are still witnessed.

Plan of action:

- Build new toilets for unserviced households and upgrade existing facilities.
- Install toilets in schools, Health Care Facilities (HCFs) and public places in all municipalities with separate toilets for male and female.

Implementing agency: Municipalities for public toilets.

Duration and time of completion: 2025–2030.

Budget requirements: NPR 90 million, supported by local governments and development partners.

Priority: High.

Risks and assumptions: Community awareness and sustainable management of public facilities.

5.4.4 Manage wastewater (Activity 2.3.1.4)

Activity description: Protect environmental and public health through effective wastewater management. Disposing of or reusing household wastewater (black water) by developing sewer networks, decentralised wastewater treatment systems, and faecal sludge management units.

Current status: It has been estimated (based on 2021 Census Data and expert judgement) that 62 million litres/day of wastewater is generated in the Basin. However, only 2% of households are connected to sewers, wastewater collection, conveyance, treatment, and safe disposal of reuse is long awaited. Wastewater management infrastructure is minimal.

Plan of action: Develop and operate Faecal Sludge Treatment Units (FSTU) for rural and peri-urban settlements of all municipalities and develop and operate Sewer Networks and Decentralised Wastewater Treatment Systems (DEWATS) with gas recovery in town areas to minimise greenhouse gas emission.

Implementing agency: DWSSM is the federal agency with the necessary experience in wastewater management and entrusted by the government for developing wastewater infrastructures. Sub-national governments will be supporting in planning and implementation and private sector will also support in service operation.

Duration and time of completion: 2031–2043.

Budget, time frame: NPR 5,500 million, requiring federal investment and external funding agencies such as the Asian Development Bank, the World Bank, UN agencies and other development partners.

Priority: Medium.

Risks and challenges: Dependence of external funds.

5.4.5 Promote hygiene (Activity 2.3.1.5)

Activity description:

- Ensure access to handwashing facilities.
- Raise awareness of sanitation and hygienic.
- Sustain open defecation free (ODF) status.

Current status: 40% households lack handwashing facilities with adequate water and soap, and current WASH awareness programs undertaken by governments, development partners and communities are still inadequate to meet the desired hygiene conditions (JMP 2020).

Plan of action:

- Install handwashing facilities with adequate water and soap in households in all municipalities.
- Conduct WASH awareness campaigns highlighting importance of safe water, safely managed sanitation facilities and hygiene using school led total sanitation (SLTS), community led total sanitation (CLTS), behavioural change communication (BCC) and other tools in mass gatherings and media.

Implementing agency: Households for installations; municipalities for awareness campaigns.

Duration and time of completion: The installation of handwashing 2025–2030, and WASH awareness campaign continues until 2043.

Budget requirements: NPR 40 million for household installations, supported by NGOs and local budgets.

Priority: High.

Risks and challenges: Dependence of external funds.

5.5 Quantitatively assess existing basin water resources, water supplies and likely future demands for irrigation, and scope for improvements (Action 2.3.2)

5.5.1 Develop database and decision support model to quantitatively assess existing and future water resources supply and demand (Activity 2.3.2.1)

Activity description: To ensure Basin water resources meet present and future demands for economic development by quantifying water availability and future needs. A hydro-economic study (ICIMOD and CSIRO, 2024) highlights the importance of aligning water demand with economic goals.

Current status: Existing water resources in the Basin have been assessed in the Kamala WRD Strategy (CSIRO and WECS, 2021). The hydro-economic modelling (ICIMOD and CSIRO, 2024) has provided further details and economic perspectives. It has analysed the additional water resources that can become available through inter-basin water transfer from a water-surplus basin, i.e. Sunkoshi. WECS has also prepared a Water Resources Development Plan for Kamala River Basin using a different hydrological model (MIKE Hydro BASIN software). However, its reliability can be enhanced, validated and updated as more hydrological data become available from additional stations (planned under this Implementation Plan) in the existing hydro-meteorological data recording network in the Basin.

Plan of action: Update and upgrade the hydrological model periodically by incorporating data from the enhanced network of hydro-meteorological stations in the Basin and update the water demand projections developed and analysed in the Basin WRD Strategy (CSIRO and WECS, 2021) accordingly.

Implementing agency: DHM will upgrade and periodically update its hydrological model for hydrological assessment of the Basin. WECS is responsible for updating the hydrological model that was developed by CSIRO and WECS (2021) for the Basin and periodically apprising the water use and periodic water demand projections based on updated hydro-meteorological data and water extraction information.

Duration and time of completion: Initial model updates in 2026, following the establishment of an expanded hydro-meteorological station network in 2025. Subsequent updates scheduled every 5 years.

Budget requirements: NPR 2 (NPR 1 million each for DHM and WECS, primarily for model operation).

Priority: Medium.

Risks and challenges: Low prioritisation without immediate results or budget constraints. Successful implementation depends on stakeholder demand from institutions like DWRI and, KIP Management Office, and planners and developers in the local and provincial governments.

5.6 Identify and assess 4 major water supply improvement options (Action 2.3.3)

Purpose: Implement 4 major water resources development (WRD) options in an optimal sequence to meet long-term water demands efficiently and sustainably while minimizing adverse impacts.

Current status: Through expert consultation in the Working Group and a stakeholder consultative workshop, development pathways and timelines for implementing WRD options in the Basin have been proposed. The WRD Strategy for the Kamala River Basin (CSIRO and WECS, 2021) and hydro-economic analysis (ICIMOD and CSIRO, 2024) outline proposed pathways, timelines, and WRD options for the Basin.

5.6.1 Revitalisation of KIP (WRD Option 1, Activity 2.3.3.1)

Context: The hydro-economic modelling analysis (ICIMOD and CSIRO, 2024) has shown that revitalisation of KIP is not economically beneficial without implementing the Sunkoshi-Kamala Diversion Scheme. Hence, though high in priority, this activity needs to be scheduled for completion only in 2035, that is, when the Sunkoshi-Kamala Diversion Project is in its mid-way to completion.

Plan of action:

- Develop a future plan for the KIP.
- Establish an effective statutory framework for management of the KIP, and resolve longer-term operation and maintenance constraints, including user charges and sedimentation.
- Design and implement large civil structures, in conjunction with GW and augmentation from local sources.
- Develop capacity of the KIP staff and the WUAs.

Develop a plan for the future of the KIP (sub-activity 1)

Activity description: The sustainability of the KIP depends on management that is influenced by the beneficiaries who contribute to efficient and effective management of the irrigation system. The KIP deficiencies and/or inadequacies of the infrastructure or water supply and also the weaknesses among beneficiaries in fulfilling their responsibilities. The KIP requires rehabilitation as well as addition of new structures and, most importantly, innovative management tools and participatory approach.

Implementing agency: DWRI takes the lead of KIP Management Office (KIP-MO). The KIP-MO must prepare this plan jointly with the WUAs considering the augmentation of the local water sources and the conjunctive use of groundwater.

Duration and time of completion: Consultation and plan preparation from 2026 to 2027.

Budget requirements: NPR 10 million, which can be arranged from the annual budgetary source of DWRI.

Priority: High.

Risks and challenges: The risk is the lack of engagement from the current beneficiaries.

Establish a statutory framework for management of the KIP (sub-activity 2)

Activity description: The KIP system is being managed by the KIP-MO and WUAs. Rules and regulations have been formulated under a constitution as guided by the Irrigation Policy. However, implementation of these rules and regulations are weak, particularly in water allocation, irrigation service fee collection and control of human activities detrimental to functioning of the canal system. A framework for managing the KIP needs to be reinforced by statutory instruments, involving of the local and provincial governments.

Implementing agency: KIP-MO will lead with active participation of the WUAs. KIP-MO developed as a partnership with the local and provincial governments in formulating policy and rules for managing the irrigation system including the fixation of irrigation service fees (ISF) and setting a mechanism for fees collection.

Duration and time of completion: 2 years, 2026–2028.

Budget requirements: NPR 10 million, arranged through the budget from DWRI.

Priority: High.

Risks and challenges: ISF collection remains a big challenge that is politicised at times. The assumption is that the WUAs and the farmers see the benefit in complying with the rules of canal operation and ISF collection for a better irrigation service.

Design and implement large civil structures, in conjunction with groundwater and augmentation from local surface water sources (sub-activity 3)

Activity description: The construction of civil structures, both rehabilitation and new constructions, identified in the process of crafting the plan for the desired future KIP system will be designed and constructed under this action.

Implementing agency: KIP-MO following the Irrigation Policy for cost sharing with the irrigation water users.

Duration and time of completion: Once the plan for the future KIP system is prepared in 2027, detailed design of the civil structures should start simultaneous to the process of formulating statutory framework and be completed in 2 years, by 2029. The construction work should initiate in 2030 and complete in 2035.

Budget requirements: This is a high-cost but high net benefit project and is estimated to cost about NPR 353,466 per hectare or NPR 15,111 million (ICIMOD and CSIRO, 2024). Bilateral or multi-lateral financial assistance will be needed together with the GoN funding for implementing this project.

Priority: High.

Risks and challenges: Getting financial assistance from foreign development partners in time and for the required amount. Potential high net benefit could be attractive enough for the interest of external financing institutions in the project.

Develop capacity of KIP staff and Water User Association (WUA) members (sub-activity 4)

Activity description: Capacity building of the KIP-MO staff, the WUAs and the farmers are necessary for efficient, effective and sustainable management of the future KIP system in partnership with the WUSs and the farmers.

Implementing agency: KIP-MO/DWRI will be the lead agency. Local and provincial governments to provide institutional support, and the KIP-MO, WUAs and farmers will participate in this activity.

Duration and time of completion: Begins in 2025 and will continue for at least 5 years in the initial phase. However, periodic refresher programs will be needed during and after the construction and rehabilitation of the civil structures.

Budget requirements: NPR 50 million over a period of 5 years, to be funded by the annual budget resources of the DWRI/KIP-MO.

Priority: High

Risks and challenges: Obtaining budgetary allocation for capacity building program may be challenging.

5.6.2 Groundwater and conjunctive use with surface water (WRD Option 2, Activity 2.3.3.2)

Context: Groundwater is the easily accessible and quick-to-realise water resource, especially in the lower part of the Basin, and in the water scarce parts of the KIP command area. Both the earlier studies *(*CSIRO and WECS 2021, and ICIMOD and CSIRO, 2024*)* have identified groundwater development as a priority intervention to ease the water shortage during the winter and spring crop seasons. All 3 tiers of governments are currently supporting farmers in tubewell irrigation through various programs, but there is no particular focus or coordination between their programs. However, groundwater potentials in the Dhanusha and Siraha districts are not as abundant as in other Nepal Terai districts. There is no account of tubewell developments and their impact on the available annual groundwater recharge. Care must be taken while expanding the withdrawal of groundwater in this area, as most of

households depend upon shallow aquifers for their domestic water needs. Sustainable groundwater withdrawal management must accompany the expansion of groundwater usage.

Plan of action:

- Inventory of groundwater tubewells, irrigation as well as drinking water wells, level and estimate their volumes of groundwater extraction.
- Institutional mechanism for registry of new groundwater wells, categorised into irrigation and drinking water wells, at municipality level. Update the well inventory annually and provide the data update to the respective Provincial governments.
- User-oriented groundwater monitoring system at Palika level and provide them to the provincial governments for further data processing and interpretation at provincial scale.
- Formulate GW utilisation policy to limit groundwater extraction at a sustainable level.
- Plan, design and implement GW irrigation program for conjunctive use in KIP command area.

Prepare an inventory of all GW wells and estimates of current volume of water use at district level (sub-activity 1)

Activity description: Groundwater tubewell construction is not regulated at present. Tubewells are being installed under various programs by the federal, provincial and local governments for both drinking water and irrigation purposes. In addition to government supported tubewell programs, individuals can also install wells at their own cost without any information to any of the three levels of government. As a result, there is no record of groundwater wells nor their status. It is important to know the status of annual groundwater recharge and withdrawal before planning any further expansion of groundwater irrigation. The first step towards sustainable development and management of groundwater resources is to prepare an inventory of the tubewells and their rates of groundwater extraction.

Implementation agency: Each municipality within the Basin and particularly within the KIP command area will undertake the task of preparing and maintaining a GIS-based inventory of GW wells within their administrative territory.

Implementation arrangements: All the municipalities in the Basin will undertake this activity as a specific project and will be carried out through its ward offices. DWRI will provide the technical guidance to the municipalities. Once the inventory is completed at municipality level, it will be used as the beginning point for updating with the information of registration of any new well that will be constructed within their municipality (see Section 5.6.2.2). The municipalities need to maintain the record and provide this information annually to the provincial government for their record, analysis and GW management planning.

Duration and time of completion: One year to complete and will be carried out in 2025.

Budget requirements: The main cost of this action is field data collection, data archival system and data analysis. Hence, the budget requirement would be nominal and is estimated at NPR 0.5 million at each municipality. The municipalities and the provincial governments should be able to fund this activity from their annual budget resources.

Priority: High.

Risks and challenges: Low prioritisation by the provincial and municipal governments. However, there is ground to assume that groundwater depletion is sensitive political issue and may receive more quantitative approach from the local and provincial governments.

Establish and maintain a registry of construction/development of new GW wells (sub-activity 2)

Activity description: There is no policy or legislation mandating tubewell registration outside Kathmandu Valley, leading to unregulated groundwater extraction.

Several steps are envisioned in the process of groundwater well registration. (a) registration of the drilling companies and the local well boring technicians; (b) well construction permit to the would-be owners of new wells; (c) record of well design and well performance. The local government shall maintain records of all these information and a copy of this shall be submitted to provincial government for data processing and record.

Implementing agency: Provincial governments to lead in policy formulation and regulation in consultation with the local governments. They may seek technical support from the WECS process for groundwater management along with law. The local governments shall enforce the policy and the law.

Implementation arrangements: Provincial governments to lead policy development with local governments enforcing regulations. The provincial government shall assess the state of groundwater reserve every year and prescribe a policy directive which will be implemented through the permit system by the local governments.

Duration and time of completion: The provincial and local government must designate in 2025 one of its departments or sections as responsible body to carry out this function. Issue of well permits is a continuous activity.

Budget requirements: Minimal, utilizing existing technical departments. Additional staffing may be needed in some cases.

Priority: High.

Risks and challenges: Registration process is a routine work which may soon become a monotony for the people who do this work. Regular monitoring and awareness can help maintain focus.

Establish a user-oriented GW monitoring system (sub-activity 3)

Activity description: Establishing a user-oriented groundwater monitoring system will encourage local users to contribute data on local well and relevant surface water storages levels, and water quality. This arrangement would raise awareness among local people of possible adverse impacts of over-use. Improved knowledge among users and authorities of specific local use could contribute to conflict resolution. A monitoring system is a quantitative way to establish limits of extraction aiming at sustainable use of the resource. This action contributes to generate compliance with withdrawal limits, enhancing knowledge required to establish any permit-based system to regulate existing and new wells.

Implementing agency: With technical assistance of the WECS the provincial governments shall take the lead, with support of the local governments and the tubewell owners, in establishing a system for monitoring of groundwater at local level.

Implementation arrangements:

- Provincial governments seek technical guidance from WECS for the design of a network of monitoring wells among existing wells, in consultation with tubewell owners.
- Establish monitoring rules and enforce them through the local governments by incentivising the well owners to collect and report the monitoring data to the local governments.
- In the cases of new wells, reporting the well monitoring data can be made a mandatory condition for obtaining a permit for new well construction.
- The provincial government body shall assess the status of groundwater abstraction based on the analysis of data collected through the local governments.
- The provincial governments shall provide policy directives necessary for sustainable groundwater management to the local governments (within the KIP command area, KIP-MO and outside the KIP command area, local governments should monitor the wells through the WUAs and provide the information to the provincial government) for data analysis and archive, based on which the provincial governments provide necessary policy directives to the local governments to manage the groundwater resources sustainably.

Duration and time of completion: Once the inventory of the tubewells is prepared and the institutional mechanism for registration of the tubewells is in operation in 2025, design of monitoring network will be prepared, and periodic monitoring will be started according to the monitoring rules from 2026 onwards.

Budget requirements: Periodic monitoring and data processing is a continuous activity for which the cost will be the salary of staff, equipment and field transportation. About NPR 10 million will be required for this activity which can be arranged by the provincial governments from their annual budgets.

Priority: High.

Risks and assumptions: The quality of monitoring data may be compromised if the staff doesn't understand the real value of accuracy in data. Staff motivation is a big factor in assurance of data quality. The assumption is that the province governments places high importance keeping in view the welfare of the people through sustainable use of groundwater resource.

Develop rules to limit (over) extraction at sensitive locations in the Basin (sub-activity 4)

Activity description: Groundwater in Dhanusha and Siraha districts is at risk of over exploitation if management efforts are not made in time (GDC Consultants 1994). Implementing large-scale extraction of GW for conjunctive use in KIP area must be based on sustainable groundwater management strategy supported by policy and regulations which are substantiated by monitoring data and maintained at limit.

Implementing agency: Formulation of policy and regulatory instruments for groundwater management will be carried out by the provincial government as the lead agency. The local governments shall be the supporting agencies in the process of formulation and enforcement.

Supporting agency: WECS as supporting agency by formulating an umbrella policy and acts, and by providing technical assistance where necessary.

Duration and time of completion: Start in 2025. Formulation of policy and law involves a time-consuming process requiring consultation and discussion at several levels. It must be targeted to be completed by 2027.

Budget requirements: NPR 1 million over a period of 2 years to cover the costs of meetings and workshops.

Risks and challenges: Nepal's draft Water Resources Act contains provisions on groundwater resources management. Once this bill becomes the law, the provincial governments should prepare, in consultation with the local governments, a policy and a law for the province.

Plan, design and implement a GW irrigation program for conjunctive use in the KIP command area (sub-activity 5)

Activity description: Until the Diversion Scheme comes into operation, the KIP must integrate groundwater with surface water to reduce water shortages in its command area. The KIP has not been able to supply sufficient water to irrigate its entire command area even for the monsoon crop. Water shortage is even more acute during the post-monsoon seasons. The Basin Strategy has proposed groundwater development in a planned way for reducing water shortage and conjunctive use on 12,825 ha (about 30%) in the KIP command area. The action is first to prepare a plan for developing groundwater irrigation after a thorough survey and understanding of the nature and extent of water shortage within its command area. The next step is to design and implement the plan.

Implementing agencies: The KIP Management Office as the lead agency for preparing a plan and designing the groundwater development project for conjunctive use with surface water in its command area.

Implementation arrangements: Local and provincial governments are involved in tubewell development for both drinking water and irrigation uses. The federal government is also involved in construction of shallow or deep tubewells in the form of projects for the purpose of drinking water supply and irrigation development. This action should be implemented by all 3 levels of government, driven by the groundwater development plan prepared by the KIP Management Office. The responsibility of developing tubewells according to the plan will be divided among the 3 tiers of governments according to their technical and financial capacities.

Duration and time of completion: The plan for the future of KIP, including the conjunctive groundwater development plan, shall be completed by 2027. Soon after, the tubewell installation program should be started and is predicted to be completed by 2030.

Budget requirements: NPR 1 million for preparation of a detailed GW conjunctive use plan. The cost of tubewell installation is estimated at NPR 1,186 million over a period from 2027 to 2030 (ICIMOD and CSIRO, 2024). This budget shall be financed at 3 levels of governments from domestic resources, as it is being done at present. However, this budget amount is much higher than the current value of annual allocation at the 3 levels of the governments. Hence, the federal government would need to increase budget allocation for DWRI/KIP-MO.

Risks and challenges: The risk is that the provincial and local governments may ask for KIP Management Office to bear the entire cost even though these governments are already investing in tubewells to serve their political interests (which may not align with investment needs for coordinated conjunctive use). The assumption is that the local and provincial governments see the advantage of planned approach to tubewell installation to attain a common goal of better serving the KIP system.

5.6.3 Irrigated agricultural options for upper Kamala River Basin (WRD Option 3, Activity 2.3.3.3)

Activity description: To develop irrigated agriculture in the upper Kamala River Basin using small and medium water storages and piped systems with pumps or gravity flow. This includes promoting small farm ponds and optimizing water use.

The Basin Strategy estimated a potential to develop 3,830 ha of irrigated land through possible storage schemes in the upper basin. Similarly, the Irrigation Master Plan (2019, updated 2024) has estimated 8,353 ha of land. These technologies must be explored and evaluated for development. In addition, farm-scale small sized pond should also be promoted. These initiatives aim to address water scarcity and improve agricultural productivity by 2030.

Plan of action:

- Establish and maintain a registry of existing and planned water extraction and storage schemes in the basin.
- Establish a sustainability assessment framework for approval of new storage or pump-gravity schemes in the basin.
- Conduct pre-feasibility and detailed feasibility studies for potential storage and/or pump-gravity irrigation schemes and development of those schemes.

Establish and maintain a registry of existing and planned water withdrawal and storage schemes (sub-activity 1)

Activity description: Water resource is limited in the upper part of the Basin. There are already several Farmer Managed Irrigation Systems (FMISs) and drinking water supply systems operating in this area. It is important that the existing uses are properly recorded, and their water use rights are fully protected while developing new schemes. With the devolution to local government of funding and authority to implement small and medium water resource projects, instances of rapid development of such infrastructures have been known in the upper Basin without consideration of cumulative impacts on the Basin's social, economic and ecological systems.

This action involves establishing a database (registry) of all existing and planned small and medium storages, including key design parameters, their operating rules and the volume of water withdrawal seasonally. This database will be a vital part of an information system supporting sustainability assessments and decisions on new water extraction schemes.

Implementing agency: Provincial government shall be the lead agency for preparing an inventory of the existing and planned water withdrawal systems and their users.

Duration and time of completion: From 2025 to 2026.

Budget requirements: NPR 3 million. The provincial government to arrange this fund from its annual fiscal resources.

Risks and challenges: Provincial government commitment to prepare the inventory.

Establish a sustainability assessment framework for approval of new storage or pump-gravity schemes (sub-activity 2)

Activity description: Competition over water is increasing in Basin. Therefore, construction of any new water withdrawal, diversion or storage, schemes must be sustainable. In the absence of ground rules agreed by all different levels of government, competition could easily lead to conflict. The sustainability assessment framework (SAF) is a set of principles for science-based assessment of sustainability agreed by all parties before agreeing to construction of new water resources projects in the basin. A SAF is essentially an instrument to support collaborative governance. The intent of a SAF is to facilitate consultation and negotiation among governments at different levels and locations of the basin, aimed at reaching agreement about the operation of existing storages, or a proposed project. A SAF should guide the production or review of specific assessments (thematic studies) which describe significant environmental, social and economic impacts of proposed storages including the state of knowledge regarding impacts (CSIRO and WECS, 2020 and 2021). Implementation of SAF requires joint local, provincial and federal action which can result in the development and application of an agreed framework for decision-making about small and medium storages and/or pump-gravity irrigation schemes.

Current status: There is no established mechanism for making collective decisions among the concerned governments. Environment Protection Act 2019 is the only existing regulatory instrument which requires a detail analysis of possible adverse effects and their mitigation measures. It also requires the preparation of an environmental management plan. SAF is a more comprehensive approach to collective decision making while considering a science-based sustainability assessment. Development of a SAF is a cross-cutting action (see Section 7.2).

Implementing agency: WECS will lead this action coordinating the 3 province governments and 12 Municipalities. WECS is planning to establish 3 River Basin Offices, one of which is in Koshi Basin. As described in Section 4.1.4, a unit shall be established for the Basin (a sub-basin unit) in the Koshi River Basin Office to carry out this function on SAF.

Duration and time of completion: Preparing the framework and obtaining agreement by all parties starts in 2025, it will take at least 2 years to reach a formal agreement, which will be in 2027.

Budget requirements: NPR 5 million over a period of 2 years to cover expenses for meetings and travels. WECS to arrange this fund from its annual budget for Koshi Basin Office from the federal government.

Conduct pre and detailed feasibility studies, and detail design and construction of potential storage and/or pump-gravity schemes (sub-activity 3)

Activity description: No feasibility studies have been conducted for potential small and medium water storage or pump-gravity schemes, except for the Gwang Khola storage project for Sindhuli. This activity involves identifying project sites, conducting studies, and implementing schemes in alignment with the SAF.

Current status: A storage scheme has been planned on Gwang Khola and is already being developed to support town water supply in the Sindhuli region (CSIRO and WECS, 2021). Three other potential sites were suggested for further evaluation in the Kamala WRD Strategy.

Implementing agency: As storage projects are likely to involve more than one municipality, it is appropriate for the provincial governments to take the lead. Pump-gravity schemes can be implemented by the local governments.

Duration and time of completion: Identification of potential sites for storage and pump-gravity schemes to completed by 2026. Pre-feasibility studies of a project usually take about one and a half years to complete (in 2027), and detailed feasibility and detailed design of a project by 2028. Construction of these schemes shall be completed by 2032.

Budget requirements: NPR 5 million for site identification. NPR 5 million for prefeasibility study (for at least 3 schemes). Detailed feasibility study and detailed design of each project would cost about NPR 10 million (for at least

3 schemes). The development of the three storage schemes is estimated to cost around NPR 2,672 million (CSIRO and WECS, 2021 and ICIMOD and CSIRO, 2024).

Risks and challenges: The local and/or provincial governments might push forward the construction of new projects before sustainability assessment framework is in place.

5.6.4 Sunkoshi-Kamala Diversion Scheme (WRD Option 4, Activity 2.3.3.4)

Carry out detailed feasibility study of Sunkoshi-Kamala inter-basin transfer (SKIBT) scheme

Activity description: Construct and operationalise the Sunkoshi-Kamala Diversion Scheme to address water demands in the KIP system and beyond.

Current status: The Scheme was first studied in the Master Plan on the Koshi River (JICA study 1985) and re-emphasised in Irrigation Master Plan (2019, updated 2024). The Department of Water Resources and Irrigation commissioned a pre-feasibility study of Sunkoshi-Tawa (a tributary of Kamala River) diversion project in 2023 to assess the water availability at the diversion point (at Sota) with reference to other ongoing and planned irrigation and hydropower projects on Sunkoshi River and assess water requirements for year-round irrigation in the Basin.

Plan of action:

- Establish a sustainability assessment framework (SAF) for approval of the infrastructure
- Conduct a feasibility study of the Sunkoshi-Kamala Diversion Project
- Develop the scheme (assuming that findings from the SAF and feasibility study align with this action).

Implement the Sunkoshi-Kamala inter-basin transfer (SKIBT) scheme

Activity description: Developing a large-scale inter-basin water transfer project like Sunkoshi-Kamala scheme is complex. It requires reconciling water demands for irrigation, hydropower, and ecology needs while addressing cross-sectoral challenges across multiple political jurisdictions. SAF is a decision support system for achieving the desired development goal while striking balance between those dimensions as much as possible (Section 7.2).

Guidelines from the World Commission on Dams (2000), Mekong River Commission Rapid Sustainability Assessment Tools (MRC 2016) and the Hydropower Sustainability Assessment Protocol (International Hydropower Association 2010) will be used to establish the SAF.

Current status: Department of Water Resources and Irrigation initiated a pre-feasibility study of this project in 2023. Based on its viability, this study will be followed by detailed feasibility and detailed design of the project. These studies shall produce sufficient knowledge for taking an informed decision that satisfies the various dimensions of the project and its impacts. At present, Environmental and Social Impact Assessment is the only framework that is being applied in assessing the cross-sectoral issues related to new projects in Nepal.

Implementing agency: Department of Water Resources and Irrigation, under the Ministry of Energy, Water Resources, and Irrigation, is the lead agency for feasibility studies and construction of this diversion scheme.

Duration and time of completion:

- Pre-feasibility study: 2025–2026.
- Detailed feasibility and design: 2027–2028.
- Construction initiation: 2029 or 2030.
- Headwork completion: By 2032.
- Irrigation system completion: By 2040.

Budget requirements: The development of the scheme would require NPR 125,720 million over a period of 16 years from 2025 to 2040 (ICIMOD and CSIRO, 2024). Partial funding of the project through multi-lateral financial institutions would be needed for this project.

Risks and challenges: Large project with high cost that requires multilateral collaboration and financial resources.

5.7 Improve efficiency of existing water use in irrigation (Action 2.3.4)

Develop and implement on-farm water management program for efficient water use in agriculture (Activity 2.3.4.1)

Activity description: To optimise water use and enhance crop productivity by transitioning from traditional irrigation methods and crops to modern, efficient practices. The action plan envisages optimum use of irrigation water for maximum agricultural benefits, regardless of which agricultural development scenario (Section 2) is realised.

Context: The hydro-economic modelling (ICIMOD and CSIRO 2024) simulated the cost benefits of 4 development hypothetical scenarios considering different crops and the development options (isolated and combined). The results show that the net benefit of the development options are highly dependent on the future of agriculture in the Basin.

Plan of action: Improving water efficiency in agriculture is one of the objectives of the action plan for Goal 3. The action plan and implementation arrangements are described in Section 6.1.1, Activity 3.1.1.8.

Duration and time of completion: This program should follow the agricultural development program which should be conducted in tandem with the water resources development program. For example, the agriculture development program should accompany the groundwater development program in the KIP, which is the first to be implemented in the lower Basin. The small and medium storage schemes and/or pump-gravity schemes are scheduled next in the upper Basin. These schemes must be accompanied by the agricultural development programs along with the on-farm water management program.

The on-farm water management program needs to be repeated periodically for building confidence in farmers with the techniques of crop-water optimisation.

6 Implementation Action Plan for Goal 3: Commercial and scientific agriculture for local economic prosperity and livelihoods security

Goal 3 of the Strategy focuses on enhancing local economic prosperity and securing livelihoods by transitioning to commercial and scientifically managed agriculture. This goal may be achieved through 2 primary actions and 9 specific implementation activities as outlined in Table 9 and detailed in the subsequent sections.

These agricultural programs are divided into 3 batches, with each batch covering the area being brought under irrigation with water that will become available from completion of the WRD options.

- Batch 1 is predicted to start in 2030 when the groundwater and conjunctive use with surface water (WRD Option 2) can provide additional water to 12,825 ha and will continue until 2035.
- Batch 2 may start in 2035 when Revitalisation of KIP (WRD Option 1) and Irrigated agricultural options for upper Kamala River Basin (WRD Option 3) bring additional water to irrigate 46,641 ha and will be completed by 2040.
- Similarly, Batch 3 covering 175,000 ha will start from 2040 when Sunkoshi-Kamala Diversion Scheme (WRD Option 4) is predicted to be implemented and will continue till the year 2045.

Table 9 Implementation Plan related to Goal 3

Goal	Sub-goal	Action	Activity	Implementation activity
3	3.1 Improve farming practices and productivity	3.1.1 Support the sustainable intensification of crop production systems	3.1.1.1	Demonstration on cropping pattern (integrated with modern agriculture inputs and farming practices)
			3.1.1.2	Seed production enterprise development
			3.1.1.3	Breed improvement program
			3.1.1.4	Demonstration on urea molasses mineral block
			3.1.1.5	Demonstration on shed improvement and compost making
			3.1.1.6	Promotion of conservation agriculture
			3.1.1.7	Mixed farming/organic farming
			3.1.1.8	On-farm water management program
			3.1.1.9	Sustainable soil management program
	3.2 Support marginalised farmers	3.2.1 Support collective farming to improve access to land, water, and knowledge for marginalised farmers	3.2.1.1	Promote cooperative farming
			3.2.1.2	Promote contract farming/lease farming

6.1 Improve farming practices and productivity (Sub-goal 3.1)

The Basin Strategy outlines a comprehensive approach to modernizing agriculture, improving productivity, and supporting marginalised farmers. The interventions focus on sustainable intensification, enhancing input quality, and adopting modern farming techniques. Below are detailed activities under Action 3.1.1.

6.1.1 Support the sustainable intensification of crop production systems (Action 3.1.1)

The farming system in the Basin is predominantly traditional and subsistence-based, characterised by low levels of cropping intensification and external input use, the cultivation of staple food crops, reliance on local varieties, and

the use of conventional farming and irrigation practices. To improve farming practices and increase productivity, a recommended variety of extension activities are detailed below.

Demonstration on cropping pattern (integrated with modern agriculture inputs and farming practices) (Activity 3.1.1.1)

Activity description: Subsistence farming dominates, characterised by low cropping intensity (CI) and traditional practices. Rice-wheat based subsistence farming predominates across most of the Basin, supplemented by the cultivation of vegetables, mung beans, pigeon peas, and oilseeds. Use of more advanced agricultural inputs such as improved seeds, fertilisers, pesticides, herbicides, and farm machinery have the potential to significantly increase crop yields, boost farmers' productivity, incomes, and enhance food security. To promote the adoption of modern inputs and practices, well-planned demonstrations should focus on improving cropping patterns and optimising the timing, quantity, and application methods for modern inputs.

Plan of action: The demonstrations are aimed at improving the existing cropping patterns and scientifically applying modern inputs to increase production on selected sites. These demonstrations need to be carried out in areas where irrigation is available for 3 crop seasons (monsoon, winter, and spring) and CI is less than 150%. The demonstrations sites would consist of a double rice system and integrating pulses, oilseeds, vegetables, and other crops into the rotation. They would feature short-duration, high-yielding, and high-value crops, as well as climate-resilient varieties, including indigenous crops like millet and market-demanded fine and aromatic rice.

The Nepal Agricultural Research Council (NARC) has developed several high-yielding and climate-resilient crops, varieties, and technologies tailored for different physiographic regions of Nepal. These technologies can be leveraged in the cropping pattern demonstrations to enhance yield and resilience.

Measures of the program's success include: increases in CI and farmers' income; levels of input usage relative to recommended standards; and increases in productivity.

Implementing agency: Agriculture Knowledge Centres (AKCs) in respective districts will lead these demonstrations in collaboration with Agriculture Units at Local Levels (AULL) within municipalities. Support is expected to be provided by Provincial Agriculture Ministries (PAMs) of Madhesh, Koshi, and Bagmati provinces, as well as to the Ministry of Agriculture and Livestock Development (MoALD) and NARC. Partners, including NGOs and INGOs, will also play supportive roles.

Duration and time of completion: From 2025 to 2045. The program will commence as basin areas receive irrigation water, with each implementation phase spanning five years.

Budget requirements: NPR 2,000 million.

Priority: High, aiming to improve existing low cropping intensity, traditional farming practices, and low crop productivity.

Risks and challenges: Lack of coordinated efforts, manpower, budget and resistance from farmers to accept and adopt new varieties and technologies.

Seed production enterprise development (Activity 3.1.1.2)

Current status: Low-quality local seeds dominate farming, with an 8–10% seed replacement rate (SRR), leading to poor yields.

Plan of action: Establish seed production enterprises to ensure high-quality seed availability. Improve SRR and link seed producers to markets. Measures of success include level of adoption of high-quality seeds by farmers, and increases in crop yields. Train seed entrepreneurs in collaboration with provincial seed laboratories

Implementing agency: AKCs in respective districts will lead these demonstrations in collaboration with AULL within municipalities. Support to be provided by PAMs of Madhesh, Koshi and Bagmati provinces and relevant ministries at

the federal level, including the MoALD and the NARC. Partners, including NGOs and INGOs, should also play supportive roles. AKC in collaboration with provincial seed laboratories.

Duration and time of completion: From 2025 to 2045. The program will commence as basin areas receive irrigation water and will span 5 years per implementation phase.

Budget requirements: NPR 1,000 million.

Priority: High.

Risks and challenges: High initial costs and stakeholder coordination challenges.

Breed improvement program (Activity 3.1.1.3)

Current status: Livestock and fish farming face low productivity due to local breeds, poor husbandry, and weak market linkages.

Plan of action: Breed improvement programs should consist of a livestock insemination program, with a comprehensive capacity-building plan on animal husbandry to improve productivity. The success of the program will be measured by increased livestock and fish productivity and farmers' income.

Implementing agency: Veterinary Hospital and Livestock Service Expert Centres (VHLSECs) in the respective districts will lead this program in collaboration with AULL within municipalities. Support will be provided by PAMs of Madhesh, Koshi, and Bagmati provinces and support from relevant federal ministries, including the MoALD, NARC, NGOs and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 500 million.

Priority: High.

Risks and challenges: Lack of technical knowledge and training to improve capabilities.

Demonstration of urea molasses mineral block (UMMB) (Activity 3.1.1.4)

Activity description: Free grazing and crop residue feeding dominate, resulting in low livestock productivity. UMMB offers a supplementary feed to enhance digestion and productivity.

Plan of action: . Conduct UMMB demonstrations with leader farmers. Promote UMMB as an accessible, nutrient-rich supplement for ruminant animals. The objective is to increase the productivity of ruminant animals by improving the quality of their feed.

Implementing agency: VHLSECs in the respective districts, in collaboration with AULL within municipalities. Support by PAMs of Madhesh, Koshi, and Bagmati provinces, and participation and support from MoALD, NARC and NGOs and INGOs.

Duration and time of completion: From2025 to 2045.

Budget requirements: NPR 70 million.

Priority: High.

Risks and challenges: Potential dependence on imported urea; measures to ensure consistent supply will be essential.

Demonstration of shed improvement and compost making (Activity 3.1.1.5)

Current Status: Cattle and buffalo sheds in Nepal are generally in poor condition, with mud floors that create unhygienic environments. This results in a mixture of mud, dung, urine, and fodder accumulating in the sheds, leading to increased livestock diseases. Simple modifications, such as improving shed flooring and incorporating separate urine drainage systems, can drastically enhance the environment. These upgrades promote healthier livestock, enable the production of high-quality compost, and facilitate the use of urine as a natural pesticide. Reducing

dependence on chemical fertilisers and showcasing these techniques are critical for improving shed conditions and optimising compost production.

Plan of action: The VHLSEC, in collaboration with AULL, will select leader farmers from the livestock sector to demonstrations in the Basin areas. These demonstrations will aim to improve shed conditions to reduce pests and diseases. It also intends to produce high-quality compost using dung and fodder waste within the shed.

Implementing agency: The VHLSECs in the respective districts in collaboration with AULL will lead the initiative within municipalities. Support will be provided by PAMs of Madhesh, Koshi, and Bagmati provinces, federal ministries like MoALD and the NARC and NGOs and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 300 million.

Priority: Medium.

Risks and challenges: Minimal risk, as necessary materials are widely available in rural areas.

Promotion of conservation agriculture (Activity 3.1.1.6)

Activity description: Agriculture in the Basin relies heavily on human and animal labour, resulting in limited mechanisation. The mechanisation rate is only 0.8 kW/ha, significantly lower than India's 3.0 kW/ha and other highly mechanised countries. Labour shortages due to rural out-migration have further increased farming difficulties and costs. Conservation agriculture offers a solution by enhancing productivity, reducing costs, and improving resource efficiency. The initiative will focus on reducing labour dependency, improving soil fertility, and lowering cultivation costs. Farmers will be encouraged to adopt these practices with minimal government support.

Plan of action:

Demonstrations will be conducted for leader farmers to showcase advanced agricultural machinery and conservation techniques, including:

- Precision equipment like drones and seed/fertiliser drills.
- Climate-resilient irrigation systems including drip, sprinklers and others.
- Tools for conservation tillage, vertical drying, and efficient crop management.

Implementing agency: AKCs in districts, in collaboration with AULL and PAMs of Madhesh, Koshi and Bagmati provinces, supported by MoALD, NARC,NGOs and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 200 million.

Priority: Medium.

Risks and challenges: Farmers may show reluctance to adopt minimum tillage and precision agriculture due to high initial costs.

Mixed farming / organic farming (Activity 3.1.1.7)

Activity description: Conventional agriculture, dominated by monocropping, is prevalent in the Basin. Limited use of green manure and reliance on chemical inputs have negative impacts on soil health, biodiversity, and sustainability. Mixed and organic farming practices offer a pathway to address these issues while increasing market value and farm income.

Plan of action:. These interventions should include:

- Promote the use of vermicomposting to convert organic waste into nutrient-rich compost which enhances soil fertility and reduces reliance on chemical fertilisers

- Encourage the use of green manure crops that can be ploughed back into the soil to add organic matter and improve soil structure and fertility
- Advocate for composting crop residues rather than burning them. Compost can improve soil organic content and reduce environmental pollution
- Introduce and support mixed cropping systems, such as combining sugarcane with potato, mustard with lentil, and integrating fruits and vegetables. Mixed cropping can lead to better utilisation of resources, reduced pest and disease incidence, and enhanced biodiversity.
- Actively promote organic farming practices, which escape synthetic chemicals in favour of natural alternatives.

Such initiatives require coordination with other activities such as:

- Conducting trainings for farmers on the benefits and techniques of mixed and organic farming.
- Providing necessary infrastructure support such as compost bins, vermicomposting units, and tools for crop residue management. Access to organic seeds and natural pest control agents should also be facilitated.
- Developing and strengthening market linkages for organic produce.
- Advocating for supportive policies that incentivise sustainable farming practices.

Implementing agency: AKCs, in collaboration with AULL, PAMs, MoALD, NARC, NGOs, and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 50 million.

Priority: Medium.

Risks and challenges: Farmers may hesitate to shift from chemical inputs, and organic produce may not always secure premium prices.

On-farm water management program (Activity 3.1.1.8)

Activity description: Inefficient irrigation practices in the Basin limit agricultural productivity. Modern irrigation techniques and better water management are necessary to address water scarcity and improve sustainability.

Plan of action: To address the current issues of poor access to irrigation, water scarcity and the limited use of modern irrigation techniques in the Basin, an on-farm water management program is essential. The proposed actions intend to optimise water use and enhance agricultural productivity and include:

- Promote the adoption of drip and sprinkler irrigation systems to ensure precise and efficient water delivery to crops, reducing wastage and improving crop yields.
- Implement systems to capture and store rainwater, providing an additional source of irrigation water and reducing dependency on groundwater.
- Promote the use of solar-powered pumps to provide a sustainable and cost-effective solution for irrigation, reducing the reliance on conventional energy sources.
- Develop ponds for irrigation, for recreation and agro-eco-tourism, thereby integrating agricultural productivity with tourism and leisure activities.
- Integrate fish farming within irrigation ponds to diversify income sources for farmers and promote sustainable aquaculture practices.
- Enhance groundwater recharge by promoting vegetation and afforestation efforts.

Integrated crop water management activities should encompass a holistic approach. These include:

- Choose crops that are suitable for the local climate and water availability, optimising water use and enhancing productivity

- Accurately estimate the water needs of different crops to prevent over or under-irrigation.
- Develop a detailed schedule for water allocation and distribution to ensure timely and adequate irrigation for all crops.
- Provide training to farmers on the operation and maintenance of modern irrigation systems and water management practices.
- Implement systems to measure and monitor water flow to ensure efficient distribution and identify areas for improvement.
- Utilise soil moisture sensors to monitor soil water levels and adjust irrigation practices accordingly.

These actions will contribute to the sustainable development of agriculture in the basin, ensuring long-term productivity and resilience against water scarcity.

Implementing agency: WRIDDs, in collaboration with AKCs, AULL, provincial irrigation ministries, NGOs, and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 3,000 million.

Priority: High. On-farm water management practices is expected to enhance agricultural productivity of marginalised farmers.

Risks and challenges: Micro-irrigation technologies may be cost-prohibitive for smallholders.

Sustainable soil management program (Activity 3.1.1.9)

Current status: Minimal adoption of green manuring and organic nutrient management highlights a need for improved soil fertility practices.

Plan of action: The following actions aim to promote the adoption of sustainable soil management practices:

- Provide farmers with soil test kits to enable them to assess soil health and nutrient levels accurately. This will help them make informed decisions about soil management and nutrient application.
- Deploy mobile soil testing vans, offering on-the-spot soil analysis and personalised advice based on test results.
- Provide training for farmers on sustainable soil management practices, including the benefits and methods of using organic fertilisers and green manure. These programs should be tailored to address the specific needs and challenges of different regions within the Basin.
- Implement Integrated Soil Nutrient Management (ISNM) practices that combine the use of organic and inorganic fertilisers to optimise soil fertility and crop yield. This approach ensures balanced nutrient supply and enhances soil health over the long term.
- Promote the use of green manure crops which can improve soil structure, enhance nutrient content and increase organic matter in the soil.
- Encourage the use of beneficial microorganisms such as mycorrhizae and nitrogen-fixing bacteria to enhance soil fertility and plant health.
- Promote vermi-composting, particularly among farmers engaged in commercial cultivation to reduce dependency on chemical inputs and to produce high-quality organic fertiliser.

Implementing agency: AKCs, AULL, and Soil and Fertilizer Testing Laboratories, with support from PAMs, MoALD, NARC, NGOs, and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 100 million.

Priority: High. Sustainable soil management practices have proved beneficial for improving the agricultural productivity of marginalised farmers.

Risks and challenges: Initial investments may pose challenges for smallholders.

6.2 Support to marginalised farmers (Sub-goal 3.2)

The Thematic Agriculture Working Group has outlined activities, interventions, and outcomes to achieve the sub-goal of supporting marginalised farmers. Building on the Basin Strategy, Agricultural Development Strategic Action 2 labelled as Action 3.2.1, aims to support collective farming by improving access to land, water, and knowledge for marginalized farmers.

6.2.1 Support collective farming to improve access to land, water and knowledge for marginalised farmers (Action 3.2.1)

Agricultural production by the smallholder farmers is small and widely scattered areas, resulting in little surplus for sale. This fragmentation implies low economies of scale for transportation, processing, and sale, necessitating the involvement of multiple agents to attain these economies. Farmers have no or limited access to knowledge, facilities like electricity, and services like insurance.

Actions to promote collective farming practices aim to facilitate better access to land by allowing farmers to pool their resources and work together. This collective approach increases the availability of land for marginalised farmers and enhances their negotiation power. Specific activities include promoting cooperative farming to enable shared resources and joint decision-making and encouraging contract farming or lease farming to provide farmers with more stable and predictable income sources.

The initiative may provide access and improve use efficiency of water resources by working collectively, , implement irrigation systems, and ensure a more equitable distribution of water, particularly in regions prone to scarcity. Additionally, farm electrification initiatives can support the efficient use of water resources by powering irrigation systems and other essential farming equipment.

Enhancing knowledge and information dissemination is a core component of this action. Through collective farming, marginalised farmers can share best practices, access training programs, and benefit from agricultural extension services. This collaborative approach fosters an environment of learning and innovation, enabling farmers to adopt modern techniques and improve their agricultural output. Establishing integrated knowledge centres can play a pivotal role in providing continuous education and support to farmers.

Furthermore, to support the resilience and sustainability of farming operations, the strategy includes promoting crop and livestock insurance to protect farmers against losses due to adverse weather conditions, pests, and diseases.

Promote cooperative farming (Activity 3.2.1.1)

Current status: Most smallholders operate independently leading to low mechanisation levels and limited economies of scale. Protected agriculture in greenhouses is practised minimally.

Plan of action: To enhance economies of scale, cooperative farming should be promoted, particularly by organising marginalised farmers through land consolidation. This involves merging small plots into larger farms and providing necessary support in terms of inputs, technology, and services. The key practices include:

- Establish custom hiring centres and agricultural mechanisation service centres.
- Create water harvesting user groups.
- Implement drip irrigation and protected agriculture in greenhouses.
- Set up rice, oil, flour and pulse mills. These efforts should involve local institutions, such as cooperatives, to ensure effective implementation.
- Initiate protected horticulture in areas with low water availability and high land elevation.

Implementing agency: AKCs, AULL, and Soil and Fertilizer Testing Laboratories, with support from PAMs, MoALD, NARC, NGOs, and INGOs.

Duration and time of completion: From 2025 to 2045.

Budget requirements: NPR 267 million.

Priority: Medium.

Risks and challenges: Land consolidation and operationalisation involve complex administrative and legal procedures, which may deter smallholders from adopting this approach. To address this reluctance, strong policy and legal directives will be necessary, specifically to facilitate land consolidation, development, and the redistribution of ownership certificates.

Promote contract farming/lease farming (Activity 3.2.1.2)

Current status: Cultivation of crops like papaya, banana and guava is scattered and unorganised, lacking high-yield varieties and commercialisation potential.

Plan of action: Promote contract farming and lease farming. This approach will support the establishment of model farms focusing on high-value crops, which are well-suited to the local climate and soils and present low production risks. Local market cooperatives could play a significant role.

Implementing agency: AKCs, AULL, and Soil and Fertilizer Testing Laboratories, with support from PAMs, MoALD, NARC, NGOs, and INGOs.

Duration and time of completion: From 2025 to 2045

Budget requirements: NPR 553 million.

Priority: Medium.

Risks and challenges: Despite its potential to improve production and productivity for the commercialisation of selected high-value crops, this intervention may not be readily accepted by or fully feasible for marginalised farmers. Successful implementation will require concerted efforts from various stakeholders, including producer farmers, transporters, value chain actors, and market operators.

7 Cross-cutting themes

The success of the proposed implementation action plans relies heavily on the implementation of 5 recurring, cross-cutting (CC) themes. These themes address institutional, policy, and collaborative challenges to ensure sustainable and equitable water resource management:

- Co-produce knowledge to enhance decision-making processes.
- Undertake institutional reforms to establish a Sustainability Assessment Framework (SAF) for planning and implementing infrastructure projects.
- Establishing a River Basin Office (RBO) to facilitate intergovernmental collaboration, alongside the creation of a new apex body for the KIP.
- Develop policies and planning procedures to evaluate demand- and supply-side options under the SAF framework, including assessments of current and future infrastructure projects or conservation actions.
- Strengthen vertical and horizontal coordination among the three tiers of governments, empowering local authorities to approve small and medium scale infrastructures projects.

Context: No single organisation can achieve maximum effectiveness in isolation. Institutional reform is essential for fostering collaborative planning efforts that result in sustainable outcomes. Addressing existing legal and policy limitations while promoting cooperation through the SAF and participatory Multi-Stakeholder Platforms (MSPs) is critical to achieving these goals.

Plan of action:

- CC 1. Establish MSPs at basin and sub-basin levels to co-produce knowledge for informed decision-making.
- CC 2. Develop and implement SAF for planning and developing new water infrastructure by all the local, province and the federal government.
- CC 3. Create and operationalise a Kamala River Basin Office (RBO) to oversee all the future development of water infrastructures and sustainable utilisation of its water resources equitably within the basin.
- CC 4. Formulate policies, procedures, and laws to enforce SAF through the Kamala RBO.
- CC 5. Build capacity within provincial and local governments to operate the SAF effectively under the RBO.

7.1 CC 1. Establish Multi-Stakeholder Platforms (MSPs)

Purpose: To co-produce knowledge and to foster collective decision-making for sustainable development and management of the Basin's resources.

Context: River basin management involves multiple stakeholders with varied interests. Decision-making processes should integrate scientific data with indigenous and local knowledge for sustainable resource use. MSPs provide a structured mechanism for collaboration and accountability, ensuring stakeholder participation in all critical decisions.

Plan of action: Before establishing and operationalising the MSPs at basin and sub-basin levels, the following activities needs to be undertaken:

- Identify the key stakeholders involved in water resource development, management and utilisation.
- Define scope of action, terms of reference, functions, responsibilities, resources and respective funding sources, roles and obligations, linkages with local, provincial and river basin organisations supported by statutory instruments.
- Capacity building, assessing knowledge gaps and training MSP members in communication and collaboration.

- Operationalise the MSPs, under the guidance and supervision of the WECS initially and later the provincial and local governments.

Implementing agency: WECS must play the lead role in all these activities until the MSPs are established. It will guide and supervise the initial phase of MSPs operations after which the responsibilities are handed over to the provincial and local governments for basin level and sub-basin level MSPs respectively.

Duration and time of completion: 2 years to complete, starting in 2028 for completion in 2029. Capacity building starts 2026 and will be continued afterwards including the MSPs.

Budget requirements: NPR 2 million for activities (a) and (b), and annual budget of NPR 10 million for activities (c) and (d).

Risks and challenges: MSP is a new concept to Nepal. It might not be understood and accepted initially at the bureaucratic and political levels. The MSP brings together government agencies, local communities, NGOs, the private sector, and international donors to manage the country's abundant water resources sustainably. This collaborative approach promotes IWRM, balancing the needs of agriculture, hydropower, drinking water, and ecosystems. It ensures that marginalised groups, such as indigenous communities, women and those with disabilities, have a voice in decision-making. There is a risk of stakeholders don't utilise the platform correctly. A clear definition of its rules of functioning and limitations, responsibilities and authorities need to be established at the beginning to reduce this risk.

7.2 CC 2. Action for Sustainability Assessment Framework (SAF)

Purpose: To sustainably manage and utilise the available water resources within the Basin.

Context: Currently, there is no mechanism for coordination or consultation among or between municipalities and the provincial governments for new water resources development projects. There is the potential risk of conflicts over water use rights or interfering with the existing water users. To avoid this, there is a need for a mechanism of joint approval of new projects based on a SAF which provides an agreed basis for water sharing and utilisation within the Basin. Hydrologic assessment will be conducted with the use of the hydrologic models which have already been developed for Basin by WECS.

A need exists for a common forum where all parties, including all municipalities and the provincial governments, coming together and agreeing to a set of ground rules for maintaining the sustainable supply from the available water resources in a way that does not lead to adverse environmental, social, and economic impacts before approving development of any new water projects in the basin collectively.

Implementing agency: WECS, in collaboration with local and provincial governments. WECS will initially lead the operations of the SAF, once it has been prepared and agreed by all parties.

Duration and time of completion: This action involves an intensive process of consultation, discussion and negotiation among the parties involved. Once there is agreement, the respective parties must go through the endorsement process from their respective assemblies to become their statutory policy. This process is estimated to take at least 2 years to complete. The SAF should be in place before detailed feasibility and design of small and medium storage schemes or the pump-gravity schemes are carried out, this action must be started in 2025 and completed in 2027.

Budget requirements: NPR 10 million over a period of 2 years.

Risks and assumptions: Lack of political interest and will among the local and provincial governments to commit to a SAF is a big risk. It is assumed that proper confidence building and awareness programs would overcome the risk.

7.3 CC 3. Actions for instituting Kamala River Basin Unit (in RBO)

Purpose: To achieve integrated water resources management (IWRM) within the Kamala River Basin.

Context: IWRM at river basin scale has been a policy goal since the Nepal government's endorsement of the National Water Resources Strategy. River basin management plans prepared under WECS more recently have also recommended the same approach. WECS is undergoing institutional re-structuring and plans to establish 3 river basin offices (RBOs) in Koshi, Gandaki and Karnali Basins. It is proposed that a unit be established in the Koshi Basin Office which functions as a Kamala River Basin Office. This sub-basin office, could be the first such organisation in Nepal and be used as a pilot to be applied to the other basins in the country.

Implementing agency: WECS will lead establishment efforts.

Duration and time of completion: This political process requires consultations, coordination and understanding at different levels of political hierarchy. It is going to be a demanding process which requires vision, persistence, patience, determination and support from political actors. This activity should start in 2025.

Budget requirements: NPR 10 million. The expenditures of conducting meetings among the concerned line ministries and stakeholders could be managed with the regular (operating cost) budget of WECS.

Risks and challenges: Political acceptance for the river basin organisation is a real risk. Proper lobbying among the politicians and legislators at all levels of government is required to overcome this risk.

7.4 CC 4. Actions for policies, procedures, and laws to enforce SAF through the Kamala RBO Unit.

Purpose: To institutionalise the SAF as model for sustainable water management across Nepal.

Context: The SAF requires legal baking to ensure its adoption and application. Federal, provincial, and local governments must align their policies with SAF principles to guarantee its success.

Implementing agency: WECS as lead agency in developing a SAF in partnership with the provincial and local governments. At the same time, WECS also must be the lead in preparing an umbrella policy, procedures, and legislation related to operationalising the SAF based on which the province and the local governments develop and promulgate their own respective policies, procedures, and legislations.

Duration and time of completion: Preparing the umbrella policy, procedures, and legislation will take at least 2 years for WECS to complete. These policies and legislation in particular need adoption by the federal government which may require a year. The provincial governments would also require at least one year to frame their respective policies, procedures, and legislation and another year for adaptation by their assemblies. Thus, it would require at least 5 years to complete this action. The provincial and local governments must be equipped with these policies, procedures, and legislations when the small and medium storages and groundwater pump-gravity schemes are ready for approval, which is in 2030. The action should start in 2025 and must be completed by the year 2030.

Budget requirements: NPR 20 million from each of the 3 provincial government. A total of NPR 80 million is needed for this activity.

Risks and challenges: As in the case of SAF, this activity is also totally dependent on the political will at both provincial and local level of governments. Adequate awareness building among the political entities is required to mitigate the risk.

7.5 CC 5. Actions for capacity building of the provincial and local governments for operationalising SAF

Purpose: To equip provincial and local governments with the skills and knowledge to implement SAF effectively.

Context: Agreeing to SAF at political level and abiding by the agreed rules for collective approval of new water resources development projects is the key to sustainable management of available water resources in the Basin. Awareness and confidence in the benefits of a collective decision-making process backed by science and technology

is the pre-requisite for sustainable development and management of water resources. This demands a capacity building of the key players at provincial and local levels.

Implementing agency: WECS would be the lead agency for this action. Once the Koshi River Basin Office is established, its Kamala Sub-basin unit will conduct a series of capacity building programs for key players at provincial and local government levels. This activity needs to be carried out while preparing the SAF and must be continued afterwards.

Duration and time of completion: This initial phase of this program will be aimed at capacity building for the development of a SAF and therefore will be carried out simultaneously. This phase will start in 2025 and will be continued for 5 years until 2029. After the SAF comes into existence, this activity will be continued for the effective implementation of the SAF.

Budget requirements: NPR 5 million in the first phase. For the second phase, when the frequency of such capacity development programs decreases gradually, an annual budget of NPR 2 million will be required for the remaining period of the project.

Risks and challenges: The main risks are the political commitment and budgetary resource allocation. It is assumed that WECS play a very active role to overcome them.

8 Implementation schedule and estimated cost

Based on the descriptions in Chapters 4 to 6, an implementation schedule has been prepared and is presented in Table 10, together with the cost of each activity. The starting point of the project has been taken as 2025 and its ending point as 2045.

The overall cost of the Implementation Plan is estimated at NPR 173,776 million, equivalent to US$ 1,306.6 million (1 US$ = 133 NPR). The annual budget requirement gradually increases to the peak of NPR 21,714 million in 2032 which again gradually decreases as the project moves to its end in 2045.

Several cost figures are based on ICIMOD and CSIRO (2024) estimations, some were taken from the feedback from the WG members and some by taking reference from the existing ongoing similar projects in Nepal. Activities and their corresponding cost are presented in Table 10.

Table 10 Implementation activities, their start and end years, and estimated activity cost (NPR million)

	Activity	Start year	End year	Cost NPR million
4	**Implementation Plan to Goal 1: Sustainable management of Chure**			
4.1	**Develop a new policy framework and basin-level strategy to guide watershed protection planning and investments (Action 1.1.1)**			
4.1.1	Formulate a whole-of-basin policy framework with federal leadership (Activ. 1.1.1.1)	2025	2026	2
4.1.2	Collaboratively agree on common basin-wide watershed conservation strategy, including identifying and prioritising areas requiring protection (Activ. 1.1.1.2)	2025	2026	5
4.1.3	Support sub-national governments to set sector governance frameworks within their jurisdiction (Activ. 1.1.1.3)	2025	2026	25
4.1.4	Establish and make use of a Kamala RBO, with annual Multi-stakeholder Platform (Activ. 1.1.1.4)	2025	2026	2,255
4.2	**Conduct annual planning, prioritisation and implementation of watershed conservation options (Action 1.1.2)**			
4.2.1	Convene basin-level actors for annual dialogue and intermed. reviews (Activ. 1.1.2.1)	2025	2045	21
4.2.2	Building check dams and water conservation ponds (Activ. 1.1.2.2)	2028	2038	1,000
4.3	**Improve conservation-livelihood linkages (through reforestation, and promotion and production of non-timber forest products (Action 1.2.1)**			
4.3.1	Development of cattle grazing rules and promotion of alternative energy sources (Activ. 1.2.1.1)	2025	2030	80
4.3.2	Identify, develop, and promote plantation of varieties suitable for Chure region, and supporting livelihood requirements (Activ. 1.2.1.2)	2025	2030	310
4.3.3	Multiyear nurseries to ensure saplings can adapt to local conditions for regeneration (Activ. 1.2.1.3)	2027	2032	25
4.4	**Sustainable management and utilisation of river natural resources (Action 1.2.2)**			
4.4.1	Initiate a national consultative process for sustainable riverbed material extraction and improved sector governance (Activ. 1.2.2.1)	2025	2045	25
4.4.2	Establish coordinated oversight at district & provincial levels (Activ. 1.2.2.2)	2025	2045	63
4.4.3	Generate specialist basin-level knowledge and capabilities (Activ. 1.2.2.3)	2025	2045	21
4.4.4	Plan and implement necessary river channelisation works (Activ. 1.2.2.4)	2029	2039	4,290
4.4.5	Allow extraction of riverbed materials within sustainable limits (Activ. 1.2.2.5)	2025	2045	21
4.4.6	Establish and implement a plan of erosion control and risk reduction (Activ. 1.2.2.6)	2024	2030	30
	Total of Goal 1			**8,173**

	Activity	Start year	End year	Cost NPR million
5	Implementation Plan to Goal 2: Improved availability, use, allocation of water resources for livelihood generation, well-being, and economic growth			
5.1	Measure and maintain reliable hydro-meteorology data on the basin for evidence-based water resources management (Action 2.1.1)			
5.1.1	Maintain the existing stations and establish additional hydro-meteorological stations in the Basin (Activity 2.1.1.1)	2026	2027	10
5.1.2	Upgrade key hydrological stations for sediment monitoring, data analysis and dissemination system, according to the Sediment Monitoring Guidelines and Plan of DHM (Activity 2.1.1.2)	2026	2027	15
5.2	Provide an early warning system and preparedness to mitigate impacts of flood and landslide (Action 2.2.1)			
5.2.1	Develop flood warning system with flood forecasting model and communication strategy (Activity 2.2.1.1)	2026	2027	50
5.2.2	Prepare flood and landslide hazard, risk assessment maps and risk management plans (Activity 2.2.1.2)	2026	2028	50
5.3	Minimise impacts of water induced disaster events with structural and non-structural measures (Action 2.2.2)			
5.3.1	Implement flood and landslide hazard and risk management plans (Activity 2.2.2.1)	2028	2045	4,532
5.3.2	Establish and operationalise Community Based Disaster Risk Management System	2027	2045	60
5.4	Secure and develop water supply, sanitation, and hygiene (WASH) services and facilities for current and future household requirements (Action 2.3.1)			
5.4.1	Prepare and operationalise WASH Plans (Activity 2.3.1.1)	2025	2026	12
5.4.2	Provide universal access to safe water and improve service level (Activity 2.3.1.2)	2025	2036	2,060
5.4.3	Provide universal access to safely managed sanitation facilities and services (Activity 2.3.1.3)	2025	2030	90
5.4.4	Manage Wastewater (Activity 2.3.1.4)	2031	2043	5,500
5.4.5	Promote Hygiene (Activity 2.3.1.5)	2025	2030	40
5.5	Quantitatively assess existing basin water resources, water supplies and likely future demands for irrigation, and scope for improvements (Action 2.3.2)	2026	2045	20
5.5.1	Develop database and decision support model to quantitatively assess existing and future water resources supply and demand (Activity 2.3.2.1)	2025	2045	2
5.6	Identify and assess 4 major water supply improvement options (Action 2.3.3)			
5.6.1	Revitalisation of KIP (WRD Option 1, Activity 2.3.3.1)	2026	2035	15,111
5.6.2	Groundwater and conjunctive use with surface water (WRD Option 2, Activity 2.3.3.2)	2025	2030	1,200
5.6.3	Irrigated agricultural options for upper Kamala River Basin (WRD Option 3, Activity 2.3.3.3)	2025	2032	2,730
5.6.4	Sunkoshi-Kamala Diversion Scheme (WRD Option 4, Activity 2.3.3.4)	2025	2040	125,720
5.7	Improve efficiency of existing water use in irrigation			
	Total of Goal 2			157,202
6	Implementation Plan to Goal 3: Commercial and scientific agriculture for local economic prosperity and livelihood security			
6.1	Improve farming practices and productivity (Action 3.1.1)			
6.1.1	Support the sustainable intensification of crop production systems (Action 3.1.1)	2026	2045	7,220
6.2	Support to marginalised farmers (Action 3.1.2)			

	Activity	Start year	End year	Cost NPR million
6.2.1	Support Collective Farming to Improve Access to Land, Water and Knowledge for Marginalised Farmers (Action 3.2.1)	2026	2045	820
	Total of Goal 3			**8,040**
7	**Cross cutting issues**			
7.1	CC 1. Action for establishing Multi-Stakeholder Platforms (MSPs)	2028	2029	204
7.2	CC 2. Action for Sustainability Assessment Framework (SAF)	2028	2029	10
7.3	CC 3. Actions for instituting Kamala River Basin Unit (in Koshi Basin Office)	2025	2025	10
7.4	CC 4. Actions for policies, procedures, and laws to enforce SAF through the Kamala RBO	2025	2030	80
7.5	CC 5. Action for capacity building of the provincial and local governments for operationalising SAF	2025	2030	57
	Total of cross cutting issues			**361**
	TOTAL			**173,776**

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Annex 1 Composition of Working Groups and Project Coordination Committee

Working groups

Thematic Group	Name	Institution
	Mr. Shiv Kumar Sharma	Team leader JVS
	Mr, Tejendra GC	Project coordinator JVS
	Ms. Sirjana Khanal	Program Officer JVS
Water demand and supply	Dr. Dibya Ratna Kansakar	Thematic Expert, JVS
	Ms. Ezee GC, Group Leader	Department of Water Resources and Irrigation, Federal
	Ms. Sristy Maharjan	Department of Hydrology and Meteorology, Federal
	Ms. Manina Baidya	Department of Water Supply and Sewerage, Federal
	Ms. Gayatri Joshi	WECS
	Ms. Nisha Wagle	ICIMOD
	Mr. Shailendra Shakya	ICIMOD
	Mr. Suman Kumar Jha	Ministry of Energy, Irrigation and Water Supply, Madhesh Pradesh
Chure Conservation	Mr. Prakash Gaudel	Thematic Expert, JVS
	Ms. Srijana Shrestha, Group Leader	President Chure Terai Madesh Conservation Development Board
	Mr. Raj Kumar Gupta	Building a Resilient Churia Region in Nepal (BRCRN) Project
	Ms. Saroja Adhikari	Department of Environment (DoE)
	Mr. Jiut Raut Ahir	Ministry of Forest and Environment- Madhesh Province
	Ms. Juhi Jha	WECS
	Mr. Brikha B Shahi	Fecofun
Agriculture Development	Mr. Basu Dev Lohani	Thematic Expert, JVS
	Dr. Jeet Bahadur Chand, Group Leader	Prime Minister Agriculture Modernization Project
	Mr. Janak Kumar Jha	WECS
	Dr. Ujjawal Kumar Singh Kushwaha	Nepal Agricultural Research Council
	Mr. Roshan Kumar Mehta	Ministry of Land Management, Agriculture & Cooperative- Madhesh Province
	Ms. Sangita Shrestha	Ministry of Agriculture and Livelihood Development
	Ms. Bhawani Khatiwada	Department of Agriculture
	Mr. Samir Shrestha	PMAMP, Khumaltar
	Ms. Namrata Basnet	Agri Nepal
	Ms. Kabita Sharma	Department of Agriculture
	Ms. Sunita Nhemaphuki	Agri Nepal
WASH	Mr. Nirmal KC	WECS
	Mr. Ram Chandra Devkota	Thematic Expert, JVS
	Mr. Narayan Prasad Acharya	Ministry of Water Supply
	Dr. Rajit Ojha	Department of Water Supply and Sewage Management
	Mr. Bikesh Wadhasthachhya	Department of Water Supply and Sewage Management
	Mr. Rabin Shrestha	Ministry of Water Supply, Energy and Irrigation-Bagmati Province
	Mr. Umesh Basnet	Nepal Water for Health (NEWAH)

Thematic Group	Name	Institution
	Ms. Rojina Manandhar	Nepal Water for Health (NEWAH)
	Mr. Lok Bahadur Chaulagain	Department of Water Supply and Sanitation, Bagmati Province
	Ms. Arinita M Shrestha	UNICEF

Project Coordination Committee

The PCC is composed of the following members:

- Secretary, Water and Energy Commission Secretariat (WECS)- Coordinator
- Joint Secretary, National Planning Commission – Member
- Joint Secretary, Ministry of Energy, Water Resources and Irrigation - Member
- Joint Secretary, Ministry of Forest and Environment – Member
- Joint Secretary, Ministry of Water Supply and Sanitation – Member
- Joint Secretary, Ministry of Agriculture and Livestock Development – Member
- Province Secretary, Ministry of Energy, Irrigation and Water Supply, Mahesh Pradesh
- Province Secretary, Ministry of Energy, Irrigation and Water Supply, Bagmati Pradesh
- Joint Secretary, WECS – Member Secretary

Annex 2 Details of the implementation schedule and respective estimated costs

Ref	Activity	NPR million	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	
4	**Implementation Plan to Goal 1: Sustainable management of Chure**																								
4.1	**Develop a new policy framework and basin-level strategy to guide watershed protection planning and investments (Action 1.1.1)**																								
4.1.1	Formulate a whole-of-basin policy framework with federal leadership (Activity 1.1.1.1)	2		1	1																				
4.1.2	Collaboratively agree on common basin-wide watershed conservation strategy, including identifying and prioritising areas requiring protection (Activity 1.1.1.2)	5		2	3																				
4.1.3	Support sub-national governments to set sector governance frameworks within their jurisdiction (Activity 1.1.1.3)	25		10	15																				
4.1.4	Establish and make use of a Kamala RBO, with annual Multi-stakeholder Platform (Activity 1.1.1.4)	2,255		55	200	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
4.2	**Conduct annual planning, prioritisation and implementation of watershed conservation options (Action 1.1.2)**																								
4.2.1	Convene basin-level actors for annual dialogue and intermediate reviews (Activity 1.1.2.1)	21		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4.2.2	Building check dams and water conservation ponds (Activity 1.1.2.2)	1,000					10	70	100	150	150	150	150	100	50	50	20								
4.3	**Improve conservation-livelihood linkages (through reforestation, and promotion and production of non-timber forest products) (Action 1.2.1)**																								
4.3.1	Development of cattle grazing rules and promotion of alternative energy sources (Activity 1.2.1.1)	80		5	15	25	20	15																	
4.3.2	Identify, develop, and promote plantation of varieties suitable for Chure region, and supporting livelihood requirements (Activity 1.2.1.2)	310		50	100	100	50	10																	
4.3.3	Multiyear nurseries to ensure saplings can adapt to local conditions for regeneration (Activity 1.2.1.3)	25				5	5	5	5	5															
4.4	**Sustainable management and utilisation of river natural resources (Action 1.2.2)**																								
4.4.1	Initiate a national consultative process for sustainable riverbed material extraction and improved sector governance (Activity 1.2.2.1)	25		3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4.4.2	Establish coordinated oversight at district & provincial levels (Activity 1.2.2.2)	63		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
4.4.3	Generate specialist basin-level knowledge and capabilities (Activity 1.2.2.3)	21		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4.4.4	Plan and implement necessary river channelisation works (Activity 1.2.2.4)	4,290						100	500	500	750	740	500	500	400	250	50								

Ref	Activity	NPR million	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	
4.4.5	Allow extraction of riverbed materials within estimated sustainable limits (Activity 1.2.2.5)	21		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4.4.6	Establish and implement a plan of erosion control and risk reduction (Activity 1.2.2.6)	30	6	6	6	6	6																		
5	**Implementation Plan to Goal 2: Improved availability, use, allocation of water resources for livelihood generation, well-being, economic growth**																								
5.1	**Measure and maintain reliable hydro-meteorology data on the basin for evidence-based water resources management (Action 2.1.1)**																								
5.1.1	Maintain the existing stations and establish additional hydro-meteorological stations in the Basin (Activity 2.1.1.1)	10			10																				
5.1.2	Upgrade key hydrological stations for sediment monitoring, data analysis and dissemination system, according to the Sediment Monitoring Guidelines and Plan of DHM (Activity 2.1.1.2)	15			6.5	8.5																			
5.2	**Provide an early warning system and preparedness to mitigate impacts of flood and landslide (Action 2.2.1)**																								
5.2.1	Develop flood warning system with flood forecasting model and communication strategy (Activity 2.2.1.1)	50			20	30																			
5.2.2	Prepare flood and landslide hazard, risk assessment maps and risk management plans (Activity 2.2.1.2)	50			5	25	20																		
5.3	**Minimise impacts of water induced disaster events with structural and non-structural measures (Action 2.2.2)**																								
5.3.1	Implement flood and landslide hazard and risk management plans (Activity 2.2.2.1)	4,532						102	502	502	1002	1002	502	402	52	52	52	52	52	52	52	52	52	52	
5.3.2	Establish and operationalise Community Based Disaster Risk Management System	60					15	15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
5.4	**Secure and develop water supply, sanitation, and hygiene (WASH) services and facilities for current and future household requirements (Action 2.3.1)**																								
5.4.1	Prepare and operationalise WASH Plans (Activity 2.3.1.1)	12		6	6																				
5.4.2	Provide universal access to safe water and improve service level (Activity 2.3.1.2)	2,060		10	100	150	300	300	300	200	200	150	150	100	100										
5.4.3	Provide universal access to safely managed sanitation facilities and services (Activity 2.3.1.3)	90		10	15	20	20	20	5																
5.5.4	Manage wastewater (Activity 2.3.1.4)	5,500								100	400	400	500	600	600	600	600	500	500	400	200	100			
5.4.5	Promote hygiene (Activity 2.3.1.5)	40		2	10	10	10	5	3																
5.5	**Quantitatively assess existing basin water resources, water supplies and likely future demands for irrigation, and scope for improvements (Action 2.3.2)**	20			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5.5.1	Develop database and decision support model to quantitatively assess existing and future water resources supply and demand (Activity 2.3.2.1)	2																							
5.6	**Identify and assess 4 major water supply improvement options (Action 2.3.3)**																								
5.6.1	Revitalisation of KIP (WRD Option 1, Activity 2.3.3.1)	15,111			15	20	20	25	1,000	3,500	3,500	3,500	2,500	1,031											
5.6.2	Groundwater and conjunctive use with surface water (WRD Option 2, Activity 2.3.3.2)	1,200		1	10	200	500	400	89																

Ref	Activity	NPR million	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	
5.6.3	Irrigated agricultural options for upper Kamala River Basin (WRD option 3, Activity 2.3.3.3)	2,730		10	10	60	500	700	700	600	150														
5.6.4	Sunkoshi-Kamala Diversion Scheme (WRD Option 4, Activity 2.3.3.4)	125,720		15	15	90	1000	4600	12000	12000	5000	5000	15000	15000	15000	15000	4000	1000	1000						
5.7	**Improve efficiency of existing water use in irrigation**																								
6	**Implementation Plan to Goal 3: 'Commercial and scientific agriculture for local economic prosperity and livelihood security'**																								
6.1	**Improve farming practices and productivity (Action 3.1.1)**																								
6.1.1	Support the sustainable intensification of crop production systems (Action 3.1.1)	7,220			10	50	100	260	300	300	400	400	500	500	500	500	500	500	600	600	600	300	200	100	
6.2	**Support to marginalised farmers (Action 3.1.2)**																								
6.2.1	Support collective farming to improve access to land, water and knowledge for marginalised farmers (Action 3.2.1)	820			5	10	10	20	20	40	40	40	50	50	50	70	70	80	80	80	80	15	5	5	
7	**Cross Cutting Issues**																								
7.1	CC 1. Action for establishing Multi-Stakeholder Platforms (MSPs)	204			10	10	12	12	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
7.2	CC 2. Action for Sustainability Assessment Framework (SAF)	10		5	5																				
7.3	CC 3. Actions for instituting Kamala River Basin	10		10																					
7.4	CC 4. Actions for policies, procedures, and laws to enforce	80			10	20	20	20																	
7.5	CC 5. Action for capacity building of the provincial	57		5	5	5	5	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	