



CHAPTER 9:

MITIGATION, MONITORING, AND MOVING TOWARD SUSTAINABLE DEVELOPMENT PATHWAYS

Several sections of this report have summarized emerging recommendations and proposed mitigation measures for aquatic and terrestrial biodiversity and the social aspects of the valued environmental components (VECs). (See the “Proposed Mitigation” sections in Chapters 5 and 6 and the “Proposed Mitigation” subsections under “Religious and Cultural Sites” and “Livelihoods” in Chapter 7.) This section summarizes the monitoring regime based on emerging recommendations identified for selected VECs for the Trishuli River Basin (TRB) in order to mitigate cumulative impacts on valued ecosystem components (upstream, midstream, and downstream).

Cumulative Impact Management Framework

Each river reach of the TRB (municipalities within specific districts) can implement a localized impact management and monitoring framework that will address the following issues in order to mitigate impacts from multiple project development and construction projects: population influx, water resources, and health implications.

This framework will be developed as a component of the high-management action as recommended in Table 9.2—in particular, it can be part of the Developer’s Charter on Sustainable Hydropower Development in the basin. Actions and measures described as follows will be addressed by hydropower project (HPP) developers to manage their contribution to cumulative impacts.

- Ensure at least all mainstem HPPs operate in a run-of-river mode to maintain natural hydrology and water quality.
- Manage riparian landscapes surrounding reservoirs and areas upstream of reservoirs to minimize hypoxia in reservoirs.

- Monitor extent of in-migration and target local benefit-sharing/community investment funds to increase infrastructure and services capacity.
- Coordinate with rafting agencies to maintain flows suitable for recreational use, if any, and potentially provide suitable flows on specific days during the peak recreation period.
- Provide sufficient flows to maintain water levels for irrigation intakes during the dry season.

The proposed monitoring mechanism (see Table 9.1) provides a framework for developing the scope and framework for the implementation of the high-management action outlined in Chapter 10 and includes monitoring elements that can adapt pressure-state-response (PSR) models in Cumulative Impact Assessments as described in Neri et al. (2016) as well as the ESG Gap Analysis Tool (IHA 2018).

The Proposed High-Management Action

Ecological and social VECs in the TRB are presently under pressure from business as usual hydropower development, and they increase with the intensity of identified stressors. The recommended mitigation measures for each VEC can collectively contribute toward a high-management action that balances energy needs, environmental protection, stakeholder concerns, livelihoods, and management of water resources.

Here we present such actions as a road map to improving the ecosystem integrity of the TRB through collaboration and willingness across stakeholder groups (including developers and the government authorities) and through a commitment around actions that will cumulatively enhance the environmental and social aspects of the basin. The outcomes on

Table 9.1 Summary of Cumulative Impacts in TRB: Mitigation and Monitoring

Identified VEC	Key non-HPP stressors	Cumulative impact from HPPs	Cumulative impact significance	Proposed mitigation measures		
				Hydropower developers	Government authorities	Local communities
Terrestrial biodiversity: Langtang National Park (LNP)	<ul style="list-style-type: none"> Infrastructure developed associated with upgrading of the Prithvi Highway and the proposed One Belt, One Road initiative road infrastructure connecting into the China border 	<ul style="list-style-type: none"> Declining populations of species of conservation significance through illegal extraction, exploitation, and export No significant impacts envisaged on wildlife dispersal and migratory bird corridors 	<ul style="list-style-type: none"> Access roads and transmission lines will provide improved access and potentially increase illegal entry into the LNP, resulting in the loss and degradation of habitat from logging and wildlife through poaching. Lower capacity transmission lines within the park have a minimal footprint and thereby do not impact habitat for threatened or endemic species. Transmission line network is unlikely to endanger any major flyway for migratory bird species. 	<ul style="list-style-type: none"> Contractor Management Plans to raise awareness of contractors engaged, in coordination with local access road contractors 	<ul style="list-style-type: none"> Increased funding and resources to LNP forest guards 	<ul style="list-style-type: none"> Shared access road development plan by adjoining municipalities to reduce access and disturbance in park
Aquatic habitat: Habitat quality	<ul style="list-style-type: none"> Sand and gravel mining and processing Soil from landslides and dumping of spoil from road construction degrading aquatic habitat 	<ul style="list-style-type: none"> Alteration of aquatic habitats and deterioration of water quality as indicated by ecosystem integrity results across project development scenarios 	<ul style="list-style-type: none"> Significance was evaluated on the basis of ecosystem integrity as predicted by the DRIFT model at different EFlows sites. Ecosystem integrity is expected to progressively deteriorate based on the three scenarios modelled from existing ecosystem integrity categories B, C, and D (slightly, moderately, and largely modified) to categories D and E (largely and seriously modified) for the full-development scenario. 	<ul style="list-style-type: none"> Release of adequate EFlows for aquatic biodiversity Development and testing of robust methodology for aquatic baselines and monitoring Training of environmental staff in survey and monitoring methods Researching and testing novel survey/monitoring methods (for example, eDNA). 	<ul style="list-style-type: none"> Fish surveys carried out by the Fisheries Research Stations Habitat Restoration Plans to be prepared Capacity building for staff for aquatic baseline surveys and monitoring Reviewing and updating of regulations for aquatic habitat protection as needed 	<ul style="list-style-type: none"> Regulating sand mining through municipality level governance Community-based protection and stewardship of river reaches within their area of influence/use Implementing actions for controlling erosion and runoff into the river, with emphasis on those pertaining to access roads

Continued on the next page

Identified VEC	Key non-HPP stressors	Cumulative impact from HPPs	Cumulative impact significance	Hydropower developers	Government authorities	Local communities
Aquatic Habitat contiguity	<ul style="list-style-type: none"> Sand and sediment mining Access roads that may render stretches of the river upstream accessible with potential increase in unregulated fishing Climate change resulting in long-term temporal changes in flow in diversion reaches already compromised by low flows caused by dams 	<ul style="list-style-type: none"> Impediments to upstream and downstream migration in both main stem and tributaries as a result of multiple HPP dams leading to declines of Snow Trout and Mahseer populations Degradation of aquatic habitats and lowered water depths from modification of natural flow regimes leading to impediments to upstream migration 	<ul style="list-style-type: none"> Significance is evaluated based on DRIFT modeling. Fish integrity is expected to progressively deteriorate based on the four scenarios modelled. Existing integrity ranges from ecosystem integrity category B (slightly modified) to category C or D (moderately or largely modified). These are predicted to deteriorate to categories E (seriously modified) and F (Critically or extremely modified) for the full-development scenario. 	<ul style="list-style-type: none"> Provision of fish passes with design validation by a fisheries expert (For most existing projects, the expectation to retrospectively add a fish pass or fish ladder has been considered likely not practical.) Enhancing connectivity between main stem and tributaries, including river training, to be maintained Mahseer and Snow Trout sanctuaries Provision of appropriate EFlows based on holistic assessments of affected river segments Development and testing of robust monitoring methodology: training of environmental staff Monitoring of fish passage and abundance during migratory season 	<ul style="list-style-type: none"> Monitoring and enforcement of functioning fish ladder and EFlows releases Capacity building for monitoring fish passages and migratory fishes Enforcement of fishing and mining regulations Enhancement of fish breeding areas in tributaries Additional research on fish hatcheries to international standards 	<ul style="list-style-type: none"> Community-based regulation of capture fisheries for Snow Trout and Golden Mahseer Community-based protection of fish breeding areas in tributaries
Cultural and religious sites: Uttargaya and Devighat	<ul style="list-style-type: none"> Sand- and gravel-mining activities resulting in degradation of river banks with river subsidence altering water quality 	<ul style="list-style-type: none"> Reduction in flow in specific river segments (for example, diversion reaches) 	<ul style="list-style-type: none"> Significance is evaluated based on water quality and flow. Flow impacts are expected to be more project-specific rather than cumulative and best managed as part of individual project EIA review process. 	<ul style="list-style-type: none"> Undertaking an assessment of the actual requirements for water flow in dewater reaches for normal rituals as well as during specific times through the year, especially during the dry season period 	<ul style="list-style-type: none"> Regional policy directives to temporarily stop mining activities at least during key festivals and pilgrimages and regionally significant rituals 	<ul style="list-style-type: none"> Raising awareness among local communities and sand- and gravel-mining entities for management of waste along with specific zones being declared for muck/spoil disposal

Continued on the next page

Identified VEC	Key non-HPP stressors	Cumulative impact from HPPs	Cumulative impact significance	Hydropower developers	Government authorities	Local communities
Cultural and religious sites: Uttargaya and Devighat (continued)	<ul style="list-style-type: none"> Quality of water linked to increased fecal coliform and pollution load untreated sewage from nearby towns will further contribute toward loss of heritage resources and intangible cultural services relative to the baseline condition 	<ul style="list-style-type: none"> In the full development scenario, fish integrity likely to be significantly impacted in the upstream reach, indicating a general decline in the possibility of fishing-based livelihoods Livelihood impacts on certain vulnerable social groups (Rai, Magar, and Dalit) that may depend on fishing more than other communities may increase 	<ul style="list-style-type: none"> Significance is evaluated based on DRIFT-modelled changes to overall fish integrity. Assessment indicates that fish abundance will be impacted, although relatively few families rely exclusively on fishing as a livelihood. Overall significance of impacts upstream is linked to economic displacement and will be significant in view of multiple projects. Overall significance of impacts midstream is minor, but specific communities such as Rai, Magar, and Dalit may be impacted due to loss of livelihoods linked to fishing. Overall significance of impacts downstream is minor; other than for local communities that support rafting and tourism activities—localized impact linked to Super Trishuli HPP. 	<ul style="list-style-type: none"> Granting reservoir area fishing rights and licenses based on district allocations Developing focused livelihood support plans for specific communities of cold-water aquaculture schemes Agree on principles of avoidance measures, compensation, and livelihood restoration Good grievance redress mechanism 	<ul style="list-style-type: none"> Developing Sustainable Fishing Plans for specific sections of the basin Coordinating with individual hydropower developers to ensure livelihoods are restored 	<ul style="list-style-type: none"> Education to stop disposing solid waste in riverbed and tributaries Construction of septic systems
Livelihoods	<ul style="list-style-type: none"> Sand and sediment mining leading to degradation of aquatic habitat and with implications on fish resources 	<ul style="list-style-type: none"> Additional projects in concert with increased intensity of existing stressors likely to further degrade habitats, but may tend to be spatially restricted (other than in the midstream reach) 	<ul style="list-style-type: none"> Significance analysis of water quality based on turbidity and coliform levels at various sections along the river indicates that the impacts of stressors such as sand and gravel mining and disposal of soil seem more significant. 	<ul style="list-style-type: none"> Implementing domestic wastewater treatment for towns currently discharging untreated sewage into the river 	<ul style="list-style-type: none"> Implementing of regulations on sand and gravel mining Exploring sewage treatment options 	<ul style="list-style-type: none"> Building awareness of household waste disposal through municipal authorities and community-based organizations
Water resources: Surface water quality	<ul style="list-style-type: none"> Sand and sediment mining Spoil disposal from construction activities Solid waste and untreated sewage from major or urban settlements along the banks of Trishuli River 	<ul style="list-style-type: none"> Additional projects in concert with increased intensity of existing stressors likely to further degrade habitats, but may tend to be spatially restricted (other than in the midstream reach) 	<ul style="list-style-type: none"> Significance analysis of water quality based on turbidity and coliform levels at various sections along the river indicates that the impacts of stressors such as sand and gravel mining and disposal of soil seem more significant. 	<ul style="list-style-type: none"> Granting reservoir area fishing rights and licenses based on district allocations Developing focused livelihood support plans for specific communities of cold-water aquaculture schemes Agree on principles of avoidance measures, compensation, and livelihood restoration Good grievance redress mechanism 	<ul style="list-style-type: none"> Developing Sustainable Fishing Plans for specific sections of the basin Coordinating with individual hydropower developers to ensure livelihoods are restored 	<ul style="list-style-type: none"> Education to stop disposing solid waste in riverbed and tributaries Construction of septic systems

ecosystem integrity are thereafter inferred based on extrapolation of the DRIFT model results.

The high-management action comprises a combination of quasi-regulatory, incentive-based, and technical measures to manage fish populations in the basin along with regulation of sediment mining and watershed management, which will contribute to the improvement of habitats and consequently reduction of cumulative impacts across VECs. This scenario suggests measures to be jointly implemented by hydropower developers, municipalities, and local communities, facilitated by the perception of shared benefits until a basin-level sustainable hydropower strategy for Trishuli is adopted by the government of Nepal.

The high-management action packages and complements the actions provided in Table 9.1 and enables the formation of a local institutional and community-based framework to implement the actions.

Assumptions

The high-management action is premised on the following assumptions:

- Hydropower developers across the TRB will sign on to a Cumulative Impacts Management Charter that goes beyond compliance requirements of Environment Management Plan (EMP) implementation of individual HPPs. This charter will form the basis of a formal structure to set up the Trishuli Hydropower Developer's Forum (THDP) as a developer-driven institution to manage cumulative impacts.
- Municipalities will be empowered under the proposed revisions to the Environment-Friendly Local Governance Framework (2013) to form Local Impact Management Committees (LMCs), which will include participation from hydropower developers and local nongovernmental organizations and community-based organizations.
- A Technical Resource Group (through participation by government ministries and conservation and research agencies) will provide strategic support and guidance for approval by the THDF and implementation by the LMCs.

Summary of Sustainable Development Pathways

Table 9.2 summarizes sustainable development pathways that can be conceptualized and implemented under the high-management action.

Changes in Ecosystem Integrity in the High-Management Action

This section compares the ecosystem integrity across project development scenarios (existing, under construction, and full development) to extrapolate implications for the high-management action.

The present ecological status (PES) of the river was first established on the basis of the recommendations of the EFlows assessment team, which visited the basin in March 2018. Available ESIA reports for HPPs in the basin, including that for the UT-1 project and baseline studies conducted as a part of the CIA, also provided a basis for determination of the PES of the basin.

The DRIFT modelling presents impacts as changes in the abundance of indicators that represent the river ecosystem compared to the present day status of the indicators. The indicators include fish species and other elements in the food chain, such as the macroinvertebrates and algae, and habitat characteristics such as flow, hydraulics, and river morphology. In addition to the impacts of hydropower development in the basin, there are a number of anthropogenic pressures that reduce fish populations on the river ecosystems, such as fishing, itself; extraction of sediments, including sand, gravel, and boulders forming the riverbeds, that damages aquatic habitats; and disposal of polluted water and solid waste in the river, which affects the water quality and consequentially the habitat quality.

As indicated in Figure 9.1, the PES of the TRB was assessed as 67% or slightly/moderately modified. The PES is shown as a horizontal line for reference purposes. Thereafter, changes in PES over time and with increasing hydropower development, represented in the project development scenarios, are predicted across the set-ups indicated.

Table 9.2 Proposed High-Management Action

Theme	Description	Responsibility
<p>Developer’s Charter on Sustainable Hydropower in the Trishuli River Basin</p>	<p>This is anticipated to be a vision- and commitment-driven document that will include the following:</p> <ul style="list-style-type: none"> • Applying a uniform set of standards for including fish passes in the design of projects based on a review of contemporary and innovative designs for fish passes in conjunction with leading experts in this discipline • Developing guidelines to prepare and implement an environmental flow management framework for each HPP based on available secondary guidance on adaptive management (This should be project- or reach-specific, keeping in mind ecological, cultural, and social sensitivities inherent for the river reach.) • Researching and developing a robust standard methodology for aquatic baseline surveys and monitoring for Environmental and Social Impact Assessments (ESIAs) to be used by all HPPs and possibly adopted into government regulations (and training HPP and government staff in methodologies) • Assessing land-based and livelihood impacts from projects in order to develop and fund livelihood restoration measures (focused on fishing, skills development, and agricultural intensification schemes as identified in the recent free, prior, and informed consent agreement for UT-1) as a form of local community development around HPPs • Expanding the regulatory EMPs into a comprehensive Environment and Social Management Plan (such as in the case of Upper Trishuli-1), which will incorporate safeguards to manage localized social impacts linked to in-migration, resource requirements, and community health and safety • Conducting issue- and theme-specific studies for sensitivities within the area of influence of the HPP, such as assessment of flows for cultural practices; inventory of springs, and so forth • Developing principles for all future land acquisition based on avoidance measures, compensation at replacement cost, informed consultation and participation, and emphasis on livelihood restoration of affected communities • Supporting suppliers of sand, gravel, and aggregates to implement sustainable mining techniques • Creating overarching framework on contractor management with specific safeguards to manage unregulated fishing, access into forest areas, muck disposal, and any other waste dumping related to project-induced influx • Developing and monitoring project-specific grievance redress mechanisms <p>Representatives from key developers; such as NWEDC, Super Trishuli, and NEA, may come together to agree on provisions of the charter. The Technical Resource Group can help the THDF formulate a charter. The charter will be monitored by a subgroup of each LMC. Based on the recommendations outlined in the CIA, the Developer’s Charter on Sustainable Hydropower can be prepared within a three-month timeline, after which, each HPP can develop an implementation plan for relevant commitments.</p>	<p>Trishuli Hydropower Developers Forum (THDP) with support from Local Impact Management Committees (LMCs) as per Chapter 10</p>

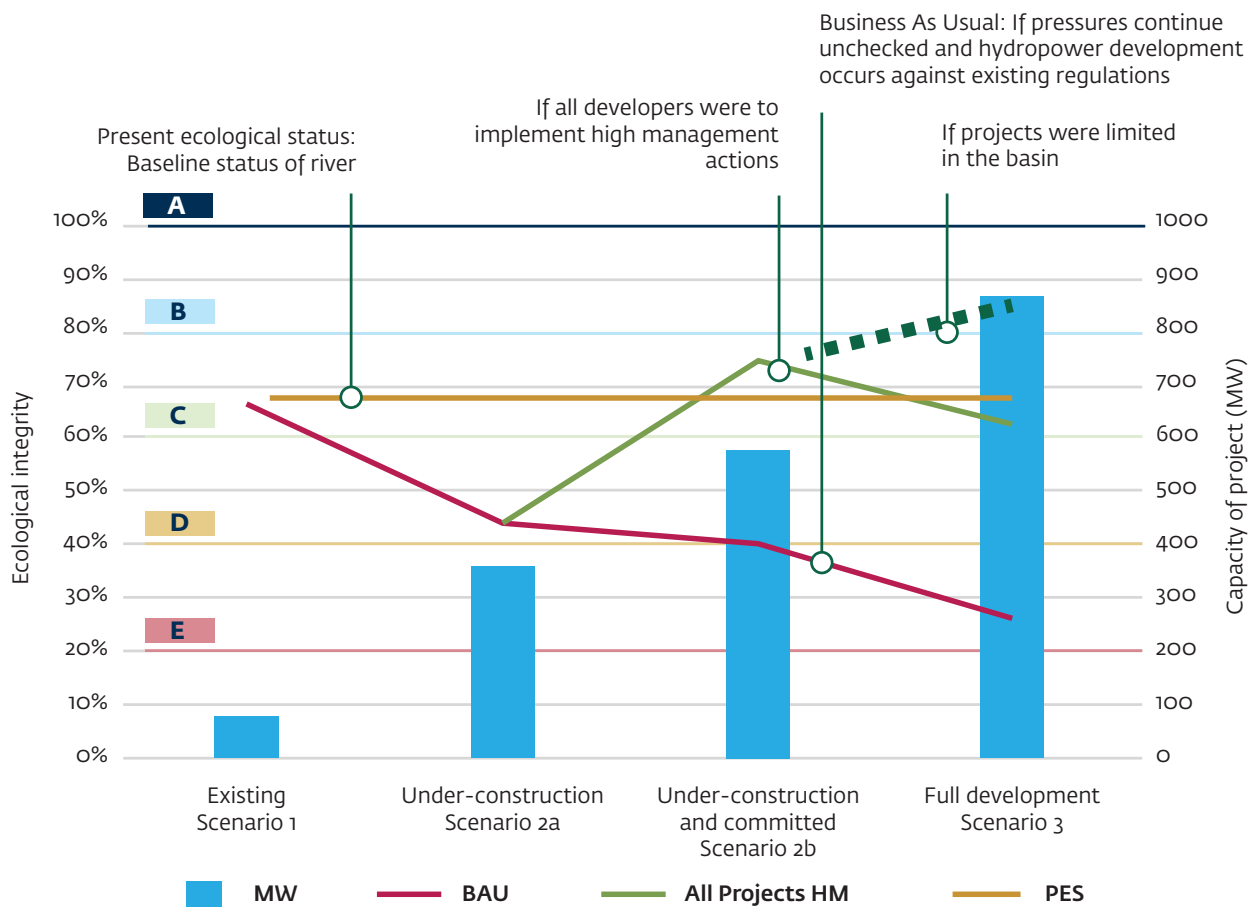
Continued on the next page

Theme	Description	Responsibility
Community-based river guards across river reaches	<p>Each LMC will deploy community-based river guards and associated field-level supervision to undertake the following:</p> <ul style="list-style-type: none"> • Detect violation of restrictions, rules, and regulations approved by the LMC for protection of the river and tributaries and take corrective actions as permissible • Maintain contact with the local community and promote awareness and education on the importance of natural resources (including illegal sand mining and unregulated fishing) • Support implementation of incentive-based measures such as community-based sustainable fishing • Collect data on status of protection and awareness, record grievances, and report 	LMCs as per Chapter 10
Preparation and implementation of Sustainable Fishing Plans	Mechanisms on regulated fishing managed by local communities in coordination with hydropower developers can be prepared by LMCs with support from the Technical Resource Group. The basic principles followed include establishing a conservation program, conducting research to estimate sustainable harvesting quotas, setting up a system of permitting for harvesting, utilizing the revenues generated to manage the conservation and harvesting program, and monitoring to ensure the program objectives—including protection of fish populations and sustainability of the program—are met.	LMCs as per Chapter 10
Development of indigenous fish hatcheries for fish stocking	Where an HPP limits the access of the fish to its breeding areas that are generally located in the tributaries, stocking of fish bred in a hatchery can be considered as a means for mitigating the loss of breeding areas. It is advisable to consider captive breeding and stocking as a measure that is supplemental to other management measures such as protection, habitat management, and fish passes, rather than a substitute for them.	LMCs as per Chapter 10 supported by Fishery Research Center (Fisheries Research Stations Nuwakot and Dhunche).
Farming of commercially valuable fish species	Providing alternative means of incomes or livelihoods through promotion of fish farming can help reduce anthropogenic pressures on the river ecosystems. There are several Brown Trout (<i>Salmo Trutta</i>) and Rainbow Trout (<i>Oncorhynchus mykiss</i>) farms, some of them started with international assistance (for example, JICA) with considerable capacity and commitment. Such farms should be developed in areas where indigenous fish stocks are depleted due to overfishing. It is to be emphasized here that farming of indigenous fish species is far more preferable than farming invasive trout species that may compete and suppress wild populations of indigenous species.	LMCs as per Chapter 10 supported by Fisheries Research Centre
Preparation and implementation of Sustainable Sediment Mining Plans	<p>Given that it is entirely plausible that the demand for sediment will continue to increase in the foreseeable future, achieving the high management will necessitate management and control that will limit the impact of mining on the river and its tributaries in the face of increased demand and volumes being abstracted. These mining plans will be elaborated to include the following:</p> <ul style="list-style-type: none"> • Ban of mining in sensitive areas and identifying nonsensitive areas to focus mining activities • Implementation of on-site control of mining activities related to equipment and techniques used, manage spoil disposal, and so forth • Rehabilitation and restoration of habitats already degraded by mining, especially in the midstream reach 	LMCs as per Chapter 10 with potential assistance from the District Coordination Committee

Continued on the next page

Theme	Description	Responsibility
Preparation and implementation of Sustainable Sediment Mining Plans <i>(continued)</i>	<ul style="list-style-type: none"> • Identification of alternative sources of aggregate for construction, including (i) reuse of spoil from construction of HPPs and (ii) use of open rock quarries on hillsides (with due recognition of any springs) as source of gravels • An important component of the sustainable sediment-mining plans will be to appoint community-based mining supervisors and river guards from within the LMCs to enforce restrictions on mining. Depending on the level of pressure from mining, the number of supervisors and guards assigned for this purpose can vary, and where pressures are low, the responsibilities for implementation of the sustainable sediment-mining plan can be assigned to the river guards. • These mining plans should be developed by municipalities, as sand and sediment mining enterprises are a major source of revenue. There is also an overlap between owners of sand-mining entities and key local leaders (including municipality representatives). Municipalities may seek support from the Technical Resource Group for (i) the identification of mining areas through modelling (to predict the location, quality, and quantity of sediment deposits linked with HPPs); (ii) identification of key ecological sites or reaches within the system, to ascertain no-go or restricted use areas; and (iii) define the necessary engagement with the affected mining and local community. 	
Watershed management	<p>A watershed management program can help improve water quality in the basin and play a critical role in protection of biodiversity and river-based livelihoods. Actions that can be supported by the THDF and LMCs include (i) programs focusing on areas needing reforestation to meet community requirements for fuel wood and timber, while being watchful of the limits of sustainable harvesting to reduce erosion and risk of landslides; and (ii) land use management. The watershed management program should also have a link to any basin-level plans, benefit-sharing plans. It should be developed and implemented in partnership with the provincial government to allow for the coordinated planning and implementation of watershed and community investment initiatives. Suggestions for management of water use in both agriculture and households and management of water quality at the local level must also be included.</p>	LMCs as per Chapter 10
Delineating no-go areas for hydropower development	<p>Management committees should strongly advocate for the setting aside of stretches of river and tributaries that are of high ecological importance and can help in preservation of key features of aquatic biodiversity in the basin. They can include spawning grounds of fish and stretches and certain tributaries that are still in pristine condition. An example is the undammed Nyam khola, a tributary of the Mailung Khola, which is an important source site for Common Snow Trout of the Mailung Khola downstream of the dewatered area of the Mailung Khola HPP. LMCs, through the THDF, will recommend certain no-go areas for consideration by DoED, NEA, and MoEWRI. The Technical Resource Group will support in capacity building and in reaching out to the provincial and national government ministries and departments to identify and manage these no-go areas.</p>	LMCs as per Chapter 10
Mahseer and Snow Trout sanctuary	<p>Consider designating one or more important fish spawning tributaries (for example, the Tadi Khola) as a Mahseer and Snow Trout sanctuary, which would remain free flowing (that is, no hydropower development) and develop and foster domestic wastewater treatment and solid waste management to improve water quality and riparian and river health.</p>	THDF with support from the LMCs

Figure 9.1 Comparison of Business-as-Usual and High-Management Development Action



Results from the Jhelum-Poonch Basin, Pakistan, were used to prepare indicative predictions for impacts of the high-management actions to control anthropogenic pressures in the TRB on the ecosystem integrity of the river.

Explanations for the management actions are provided in Table 9.3.

The comparison of project development scenarios (Table 9.3) by incorporating high-management actions suggests that a concerted effort across stakeholders, facilitated by a perception of shared benefits, can help restore ecosystem integrity of the TRB to the PES level.

Table 9.4 summarizes changes in ecosystem integrity under the different management scenarios.

In summary, this analysis indicates the following (refer to Table ES.3 and Table ES.4 for details on ecosystem integrity ratings A to F):

- *Present Ecological Status (PES)* shows the Trishuli River maintaining its existing ecosystem integrity of B/C assuming no new hydropower development or increase in external stressors.
- *Business-as-Usual (BAU)* Scenario shows ecosystem integrity of the Trishuli River degrading from existing B/C conditions to C/D as under-construction HPPs come on line, decreasing further to D as the committed project (UT-1 HPP) is constructed, and ultimately falling to D/E as future planned projects are developed. Clearly this would not be a sustainable outcome.

- *All Projects High-Management Action* also shows the ecosystem integrity of the Trishuli River degrading to C/D as under-construction HPPs come on line, but then an improvement to a B ecosystem integrity rating as high-management measures are required for all new HPPs and retro-fitted on the existing HPPs. In the full-development scenario, given the sheer magnitude of the impacts associated with 23 additional HPPs (committed and planned), the Trishuli River ecosystem integrity is ultimately predicted to degrade back to a C, even if all projects

apply good international industry practice (GIIP) per International Finance Corporation Performance Standards. An ecosystem integrity rating of B could be maintained, however, if the future number of HPPs in the basin were limited.

Based on the DRIFT model results, the analysis above suggests that implementation of a high-management action can help maintain, or even improve, the ecosystem integrity of the TRB.

Table 9.3 Interpretation and Inference

Set-up/ scenario	Description	Responsibility
Hydropower impacts only	This set-up represents the predictions of changes in ecological integrity of the river system in the basin using the DRIFT model on the basis of impact of HPPs alone, and ignoring the impact of anthropogenic pressures or the improvement in ecological integrity due to measures introduced to manage the pressures. This is necessary as all results obtained for the other scenarios refer to this.	For this scenario, over a 30-year period, the ecological integrity is predicted to decline from the PES of 67 percent (slightly modified/moderately modified) with <i>existing projects</i> to 64 percent with <i>under-construction projects</i> , to 59 percent with <i>committed projects</i> , and to 47 percent (moderately/largely modified) under <i>full development</i> .
Business as usual	This set-up presents a condition in which anthropogenic pressures on the river ecosystem continue unchecked and increase in line with present trends. This scenario reflects the current state of management in the Trishuli River supported by the observations made by the EFlows assessment team in March and April 2018. The salient anthropogenic pressures considered are unsustainable fishing practices leading to depletion of fish stocks and unchecked sand and gravel mining.	Assuming <i>full development</i> of hydropower in the basin as represented by the <i>planned scenario</i> , the ecological integrity is predicted to decline to seriously/critically modified due to the combined impact of hydropower projects and resource extraction.
High-management actions by all developers	This set-up models the predicted change to ecosystem integrity if all hydropower developers implement high-management measures.	If all the projects in the basin were to implement the high-management action, the ecological integrity of the basin is expected improve by about 35 percent as compared to the business-as-usual scenario with <i>committed developments</i> . This will result in improvement of ecological integrity slightly above the PES, maintaining it as slightly modified/moderately modified.
Limiting project development	This set-up assesses the implications if case projects located in ecologically sensitive areas are avoided.	It will be possible to improve the ecological integrity of the basin to category B, or slightly modified, if some of the projects located in ecologically sensitive areas could be avoided.

Table 9.4 Changes in Ecosystem Integrity under Different Management Scenarios

Project development scenarios	Existing (Scenario 1)	Under-construction (Scenario 2a)	Under-construction and committed (Scenario 2b)	Full development (Scenario 3)
Business-as-usual	B/C	C/D	D	E
All projects high-management action	B/C	C/D	B/C+	C
Limiting projects in the basin, with remaining projects under high-management action, supported by the government of Nepal and other stakeholders	B/C	C/D	B/C+	B/C+