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RIVER ETHICS AND CHINA'S PRACTICES

CONFRONTING THE ULTIMATE CRISIS OF HUMANITY
BUILDING HARMONY BETWEEN HUMANS AND RIVERS

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中国水利水电科学研究院
China Institute of Water Resources and Hydropower Research

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Responsible Editor: Wang Qian

Brief introduction to the book

Rivers play an extremely important role in the process of human civilization and have always been an important basis for supporting the sustainable development of mankind. At present, the global river crisis is intensifying, the implementation of the water-related goals for sustainable development has fallen short of expectations, and the global community with a shared future for mankind is facing major challenges. To solve the river crisis, we need to think systematically and probe into the underlying logic and reasoning, and reflect upon the relationship between humans and rivers from an ethical point of view. River ethics is a new guiding philosophy to understand and deal with the relationship between humans and rivers. This report discusses the theoretical logic, the rules of practice and development path of river ethics, with a view to sharing and communicating with peers around the world. It is hoped that these experiences are useful to solving the river crisis challenging the global sustainable development. Together, let's confront the ultimate crisis of humanity and achieve harmony between humans and rivers.

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Preface

Water is the mother of all life, the foundation of existence and the source of civilization. It is a vital resource for the survival of fauna and flora. Rivers channel water flow on land, sustain life on earth, and nurture human civilization. Rivers are revered and loved as Mother Rivers in many cultures. However, due to the complex interplay of human activities and climate change, among other things, the relationship between humans and rivers has become alarmingly tense. The warning lights for rivers are flashing across the board: flows, water quality, water area, flow regimes, and ecosystems. In some regions, crises like river desiccation, shrinking riverbed, water quality degradation, and wetland contraction take place. The life of rivers is in critical danger, the vitality of watershed is perishing, and sustainable development is in plight. The river crisis is essentially a crisis of living environment and human survival. It is urgent to seek new solutions to the river crisis in line with the United Nations 2030 Agenda for Sustainable Development.

River protection and development has always featured high on the Chinese government's agenda. Eyeing for the strategic significance of human sustainability and a global shared future, President Xi Jinping emphasizes the need to "restore life to rivers and revitalize the watersheds". The concept of river life is established, the status of rivers as a moral entity is recognized, and ethical considerations of mankind are extended to rivers. This paradigm shift marks the commencement of a new era in China's river protection and governance. Implementing the water governance philosophy of "prioritizing water conservation, pursuing spatially balanced development, conducting systematic governance and harnessing the synergy of government and market", China embraces the new development concept of innovation, coordination, greenness, openness and sharing, and has made significant

progress in achieving the water-related goals of the United Nations 2030 Agenda for Sustainable Development. More and more rivers and their watersheds are regaining their vitality. Based on China's practices, the Chinese delegation proposed the initiative of "developing river ethics" when attending the 2023 UN Water Conference. On the occasion of the 2024 World Water Forum, China bring to the world a new report on "River Ethics and China's Practices" and look forward to a wide sharing and exchange of ideas.

Developing river ethics means treating rivers as living entities and respecting their basic rights to survival and health. This perspective necessitates adjusting our values, moral codes, responsibilities and behavioral norms governing the interaction between humans and rivers. The objective is to achieve harmony between us and rivers where rivers thrive and human societies develop sustainably.

We have strong reason to believe that when river ethics becomes a broad moral value, the maintenance of river health and life becomes a conceptual self-consciousness, and the restoration of river ecosystems is established as a behavioral norm, the global river crisis will be effectively mitigated, and new contributions can be made to the United Nations 2030 Agenda for Sustainable Development, to building a community with a shared future for mankind, and to realizing a clean and beautiful world.

LI Guoying

Minister of Water Resources of the People's Republic of China



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Rivers and the Sustainable Development of Mankind

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Water is an essential element of the sustenance of human life and all other life forms on Earth. It circulates ceaselessly in the form of the hydrosphere, and rivers are its terrestrial channels facilitating this process. Rivers untiringly provide freshwater, underpinning, linking and nourishing the economy, society, culture and ecology of different regions. Consequently, rivers are pivotal in the course of human civilization and remain a cornerstone of sustainable socio-economic progress. The preservation of health and life is crucial; without it, the sustainability of our human societies will become as baseless as water without a source or a tree without roots. Therefore, the protection of rivers is tantamount to the protection of humanity itself. Ensuring their vitality is a fundamental condition for the sustainable development of mankind.

1.1 Rivers are central to river ecosystems

Rivers serve as critical links between land and sea within the global water cycle, exhibiting diverse courses and flows that change significantly over time and space. These waterways are vital reservoirs and major transport systems of freshwater resources on Earth.

As the core of river ecosystems, rivers are pivotal in driving the development and evolution of these ecosystems. The life of a river lies in its ability to flow, and the flows in turn breed a myriad of hydrological, physio-chemical and geomorphological processes. While the physical forms of rivers can be a dynamic work in progress, rivers consistently fulfill their fundamental role of supporting life, driving and sustaining the reproduction, growth, and development of the biotic communities within the river ecosystems.

River ecosystems are invaluable because of the wide array of ecological services they provide. These ecosystems emerge from the complex interplay of rivers themselves, the biotic community of fauna, flora, and microorganism sustained by rivers, and various environmental factors. As a cohesive entity, a river ecosystem performs multiple functions: it offers habitats, serves as barriers and/or corridors, and acts as infiltrator and catchment, thereby delivering critical services including provision, regulation, culture and support.

Exhibiting characteristics of a living entity, river ecosystems are dynamic, characterized by growth, development, metabolism and self-regulation, all driven by their natural regimes and rhythms. Any damage to these life-like qualities will affect their structures and functional integrity, thus undermining their value in service provision. Historical evidence, both ancient and contemporary, consistently demonstrates that the health of river ecosystems is integral to maintaining ecological balance and ensuring the vitality of human societies.

1.2 Healthy river ecosystems are a cornerstone of sustainable development

Human societies are highly dependent on river ecosystems. River ecosystems are an important component of the Earth's freshwater ecosystems and an indispensable resource for all life on Earth, playing a vital role in maintaining water supply, irrigation, freshwater fisheries, power generation, navigation, landscape and recreation, and biodiversity. More than one third of the world's food production directly rely on rivers and the majority of cities and industrial areas are planned, built and developed along rivers.

Under the influence of natural and human activities, the world is facing a widespread and aggravating crisis of rivers. The combined effects of growing water withdrawal and use, increasing encroachment upon riverine spaces, and the relentless advancement of climate change impacts have led to a drastic reduction in flows, severe water pollution, shrinking water bodies, withered vitality in the river basins, and consequent declines in biodiversity. Two thirds of the world's major rivers no longer flow freely; about 44% of global domestic wastewater is discharged into rivers without adequate treatment; wetlands are vanishing at three times the rate of forests, with one third already lost since 1970; and the populations of freshwater fauna and flora have plummeted by an average of 83%. The crisis of rivers is a direct recipe for a water crisis. According to United Nations reports, 10% of the global population live in countries with high or critical water stress, and nearly a quarter of the global population have no access to safe drinking water. The global urban population facing water scarcity is projected to double from 930 million in 2016 to 1.7-2.4 billion people in 2050.

Maintaining the health of river ecosystems is fundamental to sustainable development. In the United Nations 2030 Agenda for Sustainable Development, SDG 6 emerges as a focal point, dedicated to water-related objectives while simultaneously intersecting with all other goals. The global water issues that concern the sustainable development, in terms of their causes or direct victims, are all linked to the conditions of river ecosystems. Therefore, on certain level, the vitality of river ecosystems is of paramount importance not only to human health and well-being but also to sustainable socio-economic development and the advancement of human civilization as a whole.

1.3 Sustainable development is fundamental to building a community with a shared future for mankind

Sustainable development has a bearing on the future of mankind. From "Our Common Future" to "the 2030 Agenda for Sustainable Development", sustainable development has become the global consensus that guides the international efforts. The path towards realizing this vision is characterized

by strengthening cooperation and working together to build an ecological system that respects nature and emphasizes green development.

Despite these aspirations, the journey towards global sustainable development faces significant challenges. Midway through the timetable set by the UN 2030 Agenda for Sustainable Development, it has become apparent that progress towards the water-related goals is not meeting expectations. Global water issues have grown to be a major challenge for building a community with a shared future for mankind.

Addressing these challenges requires the joint efforts of all mankind. In the face of ecological and environmental challenges, the mankind either thrive or perish as a whole; no country can remain unaffected. The harmony between humans and rivers is the lighthouse for resolving existential challenges posed by the river crisis. In this regard, concerted international efforts and concrete actions must be taken to turn around the sluggish steps toward achieving the water-related goals, to safeguard the health and life of rivers, to build a community with a shared future for mankind, and to contribute to global sustainable development.

1.4 The fundamental purpose of developing river ethics is to safeguard the sustainable development of human societies

An essential metrics of human rights lies in the interests derived from the human society's sustainability. The right to water is universally recognized as a basic human right. According to the United Nations General Assembly resolutions A/RES/64/292 and A/RES/70/1, we acknowledge the importance of equitable access to safe and clean drinking water and sanitation as an integral component of the realization of all human rights, and are determined to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature. It is broadly understood that water is a precious resource shared by human beings and all other life and ecosystems, and that the human right

to safe, affordable and reliable water is not in contradiction with recognizing and respecting the right to water by all other forms of life and by nature itself.

Only by achieving harmony between humans and rivers, can the sustainable development of human society be truly realized. As an integral part of nature, river ecosystems represent a wealth of benefits for nature, ecosystems, society and economy. Therefore, to protect rivers is to reserve the values of nature and increase the values of natural capital, and is to fuel and sustain the future development of economy and society. In other words, protecting rivers is protecting productivity; improving river ecosystems is developing productivity; and the health of river ecosystems is by nature the well-being of mankind. Ensuring the interests of the sustainable development of human society and preserving the health and life of rivers are essentially one and the same.

River ethics is a new guiding philosophy for dialectically understanding and properly handling human-river relations. The development of river ethics extends beyond the mere preservation of river health and life; it aspires to achieve harmony between humans and rivers where the high-quality socio-economic development of human societies and the protection of river-ecosystem integrity join as one and advance in tandem. The ultimate goal is to foster the sustainable development of human society.

Guided by the new development concept of innovation, coordination, greenness, openness and sharing, China has implemented the top water governance philosophy of “prioritizing water conservation, pursuing spatially balanced development, conducting systematic governance and harnessing the synergy of government and market”. Within this framework, river ethics is developed and action plans for restoring river ecosystems are carried out. As a result, more and more rivers have been rejuvenated, regaining their lost vitality, and more river basins have returned to a healthy state. With such success stories accrued, harmony between humans and rivers has become a driving belief for social development in China.



2

The Ideological Origins of River Ethics

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Understanding and properly managing the relationship between humans and nature is a fundamental premise for the development of human civilization. Since 2012, the Chinese government has made vigorous efforts to promote theoretical, practical, and institutional innovations in building eco-civilization. A series of new concepts, new ideas, and new strategies emerge in this regard.

The cause of building eco-civilization clarifies significant theoretical issues related to river ethics, delineates the path requirements for developing river ethics, and serves as the ideological source, theoretical foundation, fundamental principle, and action guide for the Chinese government's exploration and establishment of river ethics over the past decade.

2.1 Harmony between humanity and nature is at the core of river ethics

Based on the relationship between man and nature, the most fundamental relationship in human society, the thought on eco-civilization elucidates the

inherent laws and essential requirements of concepts such as “harmony between humanity and nature” and “green is gold” (also known as “lucid waters and lush mountains are invaluable assets”). Serving as the epistemology, axiology, and methodology for the construction of eco-civilization, it not only acts as the cornerstone of promoting sustainable development of the Chinese nation, but also offers Chinese wisdom and solutions for the sustainable development of humanity as a whole. Everyone is a guardian, a contributor, and a beneficiary of the ecosystem; no one could stand by or stay unfettered. It is essential to enhance the public’s awareness of conservation, environmental protection, and ecosystems, to cultivate ecological morals and code of conduct, and to launch nationwide green campaigns. The core of eco-culture is a set of behavioral norms and value concepts. To assess whether such culture has taken root in the society, one must check whether these norms and values are consciously reflected in all aspects of social production and life. It is necessary to establish and improve an eco-culture system guided by ecological values, mainstream values of eco-civilization, advocate green values that respect and care for nature, cultivate an ecological awareness centered around loving nature and cherishing life, and actively foster ecological culture and morals, so that eco-culture could evolve into the values and vision shared by the whole society.

River ethics falls into the sphere of eco-culture. “Harmony between humanity and nature”, an important component in China’s eco-civilization drive, buttresses and guides the development of river ethics. This notion calls for achieving harmony and unity between humanity and nature and refraining from attempts to conquer nature. As one community of life, humans must respect, live in harmony with, and protect nature while pursuing their own development, otherwise they will face the retaliation of the latter. Such are objective laws which no individuals or things can disobey. Water governance is no exception—instead of giving way to the false gallantry of conquering nature and taming the waters, we should respect the laws and the ways as they are. In this regard, people need to shift from changing and conquering nature to adjusting their own behaviors and making up their own mistakes;

and fighting against the woes brought by nature and pursuing harmonious coexistence with nature and with water are both desired.

2.2 Revitalizing rivers and their watersheds is the cornerstone for developing river ethics

In the Chinese philosophical discourses on water governance, rivers are regarded as life entities and are therefore moral subjects in their relations to mankind. On March 14, 2014, President Xi Jinping pointed out in his speech on ensuring national water security that water security has great impact on the security of economy, food, society and ecology, and hence the long-term peace and stability of China. He stressed that mountains, waters, forests, farmlands, grasslands, and deserts form an indivisible ecosystem which resembles an organic living entity, and that efforts must be made to allow rivers to recuperate in a safely managed way so that they can be brought back to life and watersheds be revitalized. On other occasions, the concept of life of rivers are further illuminated. For instance, systematic and integrated river management is put forward in face of the worrying conditions of the Yangtze River, including its degrading ecological functions and the desiccating Dongting and Poyang Lakes. Regarding the Yellow River, the wary observation is made that this river, another mother river of China, has been stricken with illnesses for a long time and suffers frequent water-related problems, and the current plight of this river is the result of both natural conditions and human activities. Protecting and reviving this mother river of China has a direct bearing on the sustainability and prosperity of the nation.

Treating rivers as living entities requires mankind to give rivers due respect, follow their laws, guard their lives and maintain their health. This means to include rivers into the subjects of human moral solicitude, which constitutes the theoretical basis for the development of river ethics.

2.3 The crisis of rivers is the crisis of human survival—granting river ethics lasting historic relevance

The crisis of rivers and water sources signifies a threat to the environmental conditions necessary for the survival of the Chinese nation. This judgment explains why river ethics is needed and why it could stand in time. An advertisement warns “the last drop of water on earth might be our tears”, a scenario which must be prevented from happening.

As an old-time saying of the Chinese goes, “water is the most abundant, floating in the sky and carrying the earth, reaching everywhere and nourishing all things”. Changes in rivers’ ecological environment directly impact the rise and fall of civilizations. The ancient civilizations of Egypt, Babylon, India, and China all originated in regions with rivers boasting abundant water resources. The decline of river ecosystems, especially river desiccation and desertification, led to the fall of ancient Egypt and Babylon. For China, the Yangtze and Yellow Rivers are the cradle of the nation, nurturing the splendid Chinese civilization. Throughout five thousand years of the Chinese history, the wheels of regional prosperity and decline were oftentimes driven by water disasters. To ensure the prosperity of the country and the well-being of its people, it is essential to perfect water governance, address water security issues, and protect rivers and lakes well.

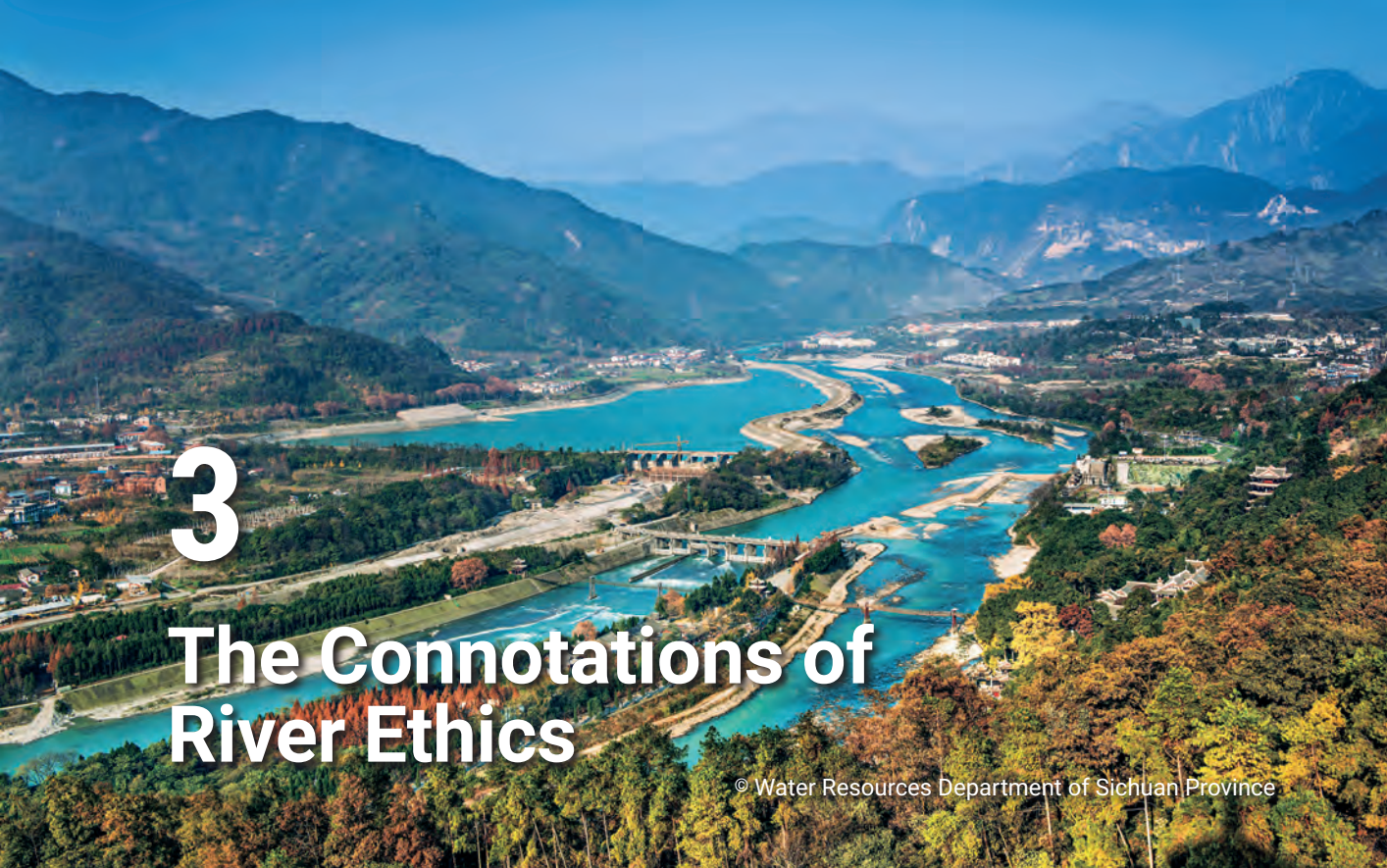
2.4 Green development is a thinking revolution on development and points to the right direction of river ethics

Green development involves discarding development models that do harms to the ecological environment and abandoning shortsighted practices that sacrifice the environment for temporary development gains. Economies, energy mix, and industrial structures need to be upgraded so that a sound and healthy eco-environment can buttress global sustainable socio-economic development. Green development demands that economic activities and human behavior be confined within the limits that natural resources and

ecosystem can sustain, and thus effectively prevents the excessive exploitation of nature beyond its recovering capacity.

Nature is the basic condition for the survival and development of human beings. Respecting, conforming to and protecting nature is an inherent requirement for the overall development of a modern country. It is necessary to establish and practice the philosophy that “green is gold”, and to plan for development in the context of harmony between humanity and nature.

The core of green development is to maintain harmony between humanity and nature. Specifically, in terms of river protection and governance, this means treating rivers as living entities. While pursuing development for human society, people have to respect rivers, conform to their laws, correct the reckless exploitation of rivers, and ultimately live in harmony with them. Therefore, green development is a profound revolution in human development philosophy and the guiding direction for developing river ethics.

An aerial photograph of a wide river flowing through a valley. A large dam is visible in the middle of the river. The surrounding landscape is lush with green and yellow trees, and mountains are visible in the background under a clear blue sky.

3

The Connotations of River Ethics

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River ethics encompasses the values, moral principles, and behavioral norms that govern and regulate the relationship between humans and rivers.

3.1 Major issues in river ethics

For humans water represents a dual-edged sword, serving both as an indispensable resource and a cause of natural disasters such as floods and droughts. Effective water governance necessitates optimizing the benefits derived from water while minimizing its harm. This requirement establishes the human-river relationship as a dialectical unity characterized by both interdependence and conflict. The escalating river crisis, highlighted by increased conflicts and compromised mutual reliance, is rooted in a fundamental issue related to the value orientation of the human-river relationship. At the value level, questions about how rivers are perceived—whether they should be recognized as living entities and granted the status of moral entity—and how human activities within the human-river inter-linkage should be ethically governed with due recognition and respect for the rights of rivers, etc., have become major issues river ethics needs to address.

3.1.1 The concept of river life and its moral status

This issue focuses on the perception of rivers, which is the primary question that needs to be addressed in the development of river ethics.

Rivers possess the traits of living entities. Although rivers are not living organisms in the biological sense, they function as a life support systems crucial for human survival and development. On the macro scale of an ecosystem, rivers embody the changes, coordination, and unity of matter, energy, and information that pervade the metabolism process of living entities. In many aspects, rivers exhibit characteristics of living entities, such as the abilities of self-adjustment, self-purification, and self-recovery. Rivers are not only physical and chemical entities in objective existence but also entities of value in biological and ecological terms. Therefore, they can be regarded as living entities. Even though rivers do not “speak” like humans, they do express themselves through various signals (just as humans communicate through body and facial expressions beyond language), especially through negative expressions such as water quality deterioration, river cutoffs and shrinkage, extinction of aquatic life, decline in biodiversity, and ultimately, the disappearance of rivers. These signals often imply that the interests of the human-nature community of life have been compromised. Hence, we need to view natural rivers as living entities, respect their rights to survival and health, and attentively “listen” and respond to the signals they send. Only in this way could humans systematically understand and then follow the objective laws governing river ecosystem evolution. This approach embodies the proper moral connotations of river ethics.

Rivers enjoy the status of a moral entity. Within the framework of eco-civilization, humanity and nature are viewed as a unified community of life. The symbiotic relationship between humans and nature arise from their inherent and inseparable connections. From the standpoint of safeguarding the common interests of man and nature, the respect of their interdependence should target both the community itself and its individual members. Specifically, in the case of humans and rivers, they form an

organically intertwined community of life which should be seen as one moral entity. Members of this community should both be beneficiaries of morality, and moral attentiveness should extend to rivers as well. Caring for rivers is tantamount to caring for humanity; respecting rivers equates to valuing life; and loving rivers is an expression of love for humanity itself. This represents the underlying rationale for assigning rivers the status of moral entities within the scope of river ethics.

3.1.2 The value of river life

The intrinsic value of natural ecosystems is widely recognized. Rivers, as pivotal components of these ecosystems and as organic and systemic living entities, have their intrinsic value as well. This value is understood not only in natural terms but also through a socio-economic lens, emphasizing the importance of harmony between humanity and nature.

Rivers possess a natural value that is rooted in the overall integrity or interconnectivity inherent within the natural world. This value is not confined to individual entities but is intrinsic to nature as a whole. Rivers, as subsystems of the natural ecosystem, interact with and contribute to the broader system, and form with it a cohesive organic entity. Through processes of erosion, transport, and deposition, rivers shape the environment. In their ceaseless flow day and night, they serve as vital conduits for the flow of matter, energy, information, and organisms, thereby facilitating the creation, nourishment, and sustenance of diverse life forms. This, in turn, enhances the biodiversity of the biosphere. Recognizing the natural value of rivers challenges the traditional anthropocentric approach to river management, which is often driven by instrumental rationality. It encourages a shift towards acknowledging, respecting, and ultimately safeguarding the value of rivers and their life systems.

Rivers hold socio-economic value. Lucid waters and lush mountains are invaluable assets. A thriving ecosystem boasts immense socio-economic value. The regulatory and support functions provided by ecosystems, many of

which remain unparalleled by technological advancements, are fundamental to human civilization. The socio-economic value of rivers refers to their vast resource-based, environmental, and cultural contribution to people. Rivers have been indispensable to human societies throughout history, regardless of the evolution in production methods. The steady flow of benefits from rivers have always been critical to human existence. Furthermore, the fate of civilizations has been intricately linked to the health and vitality of river ecosystems.

The concept of the value of river life underscores the scientific integration of the natural and socio-economic significance of rivers. Centered on the relationship between humans and rivers, this concept advocates for a harmonious coexistence, recognizing that each is the foundation for the existence and development of the other. It emphasizes the importance of viewing the interests of the human-river community from a holistic and systemic perspective, with the aim of maximizing the benefits for this community of life. The vision of creating “rivers for the common well-being” embodies the idea of rivers that can sustain their own health and life while supporting the high-quality economic and social development of their basins and regions. Such rivers achieve harmony with humans, providing a high sense of security, gain, and satisfaction to the people. Therefore, as the value of river life implies, protecting rivers means safeguarding their natural value and enhancing their natural capital, and respecting rivers is tantamount to respecting the interests of sustainable economic and social development.

3.1.3 Rivers’ rights to survival and health

The concept of river life and its associated value system dictate that rivers inherently possess the right to exist in accordance with the laws of ecology and to receive respect from humans. This entitlement is articulated through five primary aspects:

The first is rivers’ right to integrity. A river, characterized by its continuity and inter-connectivity, constitutes a holistic and organic entity. It comprises river corridors that facilitate the water cycle and various functional units with

distinct geomorphic features. Its broad spatial and temporal distribution underpins the convergence, regulation, and transport of water flows. Hence, maintaining the physical integrity of a river is fundamental, serving as the paramount right that is essential for its sustenance.

The second aspect centers on the right to continuity. The continuity of rivers encompasses the longitudinal flow from upper to lower reaches, the vertical connection between surface and groundwater, and the lateral integration between water bodies and adjacent land areas. Ensuring the continuity of rivers across these three dimensions is critical for the development of a cohesive and organic ecosystem throughout the river basin.

The third aspect pertains to the right to cleanliness. While rivers possess an inherent capacity for self-purification, this ability is not limitless. Exceeding a river's capacity to absorb pollutants can lead to a decline in water quality, which, in turn, compromises the health of the river ecosystem and diminishes the river's overall value. Therefore, preventing pollution and maintaining the cleanliness of rivers are imperative for their well-being.

The fourth aspect concerns the right to ecological flow. The vitality of a river is fundamentally linked to its flow, which is essential for the preservation of the river ecosystem's structure and function. Ensuring the ecological flow—regarding both the volume and level of water—is indispensable for the survival and health of rivers. Rivers are entitled to maintain an adequate water flow as an ecological imperative to remain vibrant and healthy.

The fifth aspect addresses the right to foster life. Rivers, as custodians of basin ecosystems, provide critical conditions necessary for the survival, growth, and reproduction of a myriad of aquatic and terrestrial species. They act as fundamental support systems, nurturing diverse biotic communities and generating remarkable biodiversity. These inherent rights of rivers to biodiversity and life creation are not only vital indicators of their health but also essential foundations for the sustenance of river basin vitality.

3.1.4 The ethical relationship between humans and rivers

Achieving harmony between humans and rivers is the fundamental requirement for establishing an ethical human-river relationship. The holistic approach of thinking behind the concept of one community of life, or shared life, reveals the unity and symbiosis between humans and rivers, and emphasizes the need to establish an ethical relationship between the two. Humans and rivers are organically intertwined in one life. Such intrinsic connection has facilitated the realization of river values, thereby forming the value relationship between humans and rivers. The basic goal of all value relationships, including that between humans and rivers, is to maintain human survival and development. Safeguarding this interdependent community of life following the principle of harmonious coexistence is an essential prerequisite for human survival and development, and also the vital requirement for setting up an ethical relationship between man and river.

Viewing rivers as living entities and acknowledging their status as moral entities should not be interpreted as a means to impede development activities related to rivers. Rather, the aim of implementing protective measures for rivers is to ensure their survival and health, which ultimately supports sustainable human development. In the context of human-river interactions, actions that purportedly “care for rivers” yet harm the broader interests of humans lack moral justification. The acknowledgment and respect for rivers’ moral rights serve to confine human activities within ethical boundaries established by objective, law-based river ethics, and to set a clear bottom line, hence bringing about a dialectical unity of honoring objective laws and attaining development goals.

Therefore, river ethics, founded on the holistic concept of the life community, is centered on the human-river relationship, and takes harmony between humans and rivers and sustainable human development as its fundamental demand and ultimate goal respectively. It has transcended the ethical views of absolute anthropocentrism and non-anthropocentrism and overcome their respective theoretical deficiencies and practical dilemmas.

3.2 Moral principles of river ethics

3.2.1 Respectful stewardship of rivers

Embracing the concept that humanity and nature form a unified community of life, individuals are called upon to protect rivers with the same diligence as they would protect their own sight and to value them as deeply as they value their lives. This approach necessitates the establishment of a value system that acknowledges the intrinsic life value of rivers as living entities, affirms their fundamental rights to survival and health, and promotes the adoption of an ethos of harmonious coexistence between humans and rivers.

3.2.2 Sustainable utilization of rivers

Individuals are tasked with recognizing that green is gold and are urged to champion sustainable practices in the utilization of rivers. Development planning should prioritize the maintenance of harmony between humans and rivers. This includes respecting the natural carrying capacity of rivers as the foundational premise for their utilization, ensuring that all economic activities and human actions remain within these ecological limits. Such an approach should aim to integrate river utilization with the protection of the river basin ecosystems by transitioning towards a model of green development.

3.2.3 Integrated governance of rivers

Humans need to fully respect and accommodate nature, adhere to nature-based solutions that leverage rivers' intrinsic abilities for self-adjustment, self-purification, and self-restoration. With self-sustenance as the mainstay and the enhancement of river ecosystem quality and stability as the core, the governance of rivers has to solve the problems at the source in a systematic and comprehensive way and adopt a holistic approach for the management of the upper and lower reaches, the left and right banks, the mainstream and tributaries, and both surface and ground water. Policies and measures also need to be cohesive and tailored to the specific ecological and socio-economic contexts, aiming to foster the conservation and rehabilitation of river ecosystems, thereby ensuring their health and life.

3.2.4 Lasting enjoyment of rivers

Embracing the notion that “a good eco-environment is a basic public good and offers most inclusive wellbeing”, governments need to fully factor in people’s yearning for a better life, their desire for rivers benefiting the common wellbeing, and their obligation to future generations, and manage to provide ecological dividends that serve and benefit them. It is also imperative to work towards both intra- and inter-generational river-centric justice, provide more high-quality ecological products, and enhance people’s sense of gain, joy, and security.

3.3 Responsibilities of human society

3.3.1 Respecting rivers’ rights to survival and health

The first imperative is to cultivate a value system that promotes harmony between humans and rivers and champion a water culture deeply rooted in river ethics. This involves encouraging a societal recognition that humans and nature constitute a unified community of life. It is essential to instill values that foster harmony between humans and rivers, prompting individuals to safeguard rivers with the same care and reverence they would afford to their own sight and to life itself. Achieving this goal necessitates widespread consensus-building, engaging the public extensively, and actively promoting a water culture that places river ethics at its core.

Furthermore, it is crucial to defend the health and life of rivers and to embrace the responsibility of being their advocates. This includes acknowledging the inherent rights of rivers to survive and thrive, establishing non-negotiable bottom line for their survival and red line for their health, monitoring their condition, developing robust, long-term mechanisms for monitoring and early warning related to the carrying capacities of resources and the environment, conducting regular evaluations of river health, implementing precautionary approaches, and vigorously championing the rights of rivers. Only through such dedicated efforts can rivers maintain their vitality and continue to flourish.

Moreover, the principles of river ethics have to be upheld, and high ethical standards are needed from entities engaged in river conservation and governance. It is imperative for society to enhance the capacities of these entities, encouraging the development of moral virtues among the general populace as well as within social institutions, groups, and organizations dedicated to creating thriving river ecosystems for the benefit of all. Furthermore, these entities should be motivated to establish systems of moral oversight internally, facilitating the internalization of river ethics principles into individual moral frameworks. This approach will foster a culture of self-supervision and self-regulation.

3.3.2 Developing and utilizing rivers in a rational and efficient way

Governments must prioritize the well-being of their citizens by establishing comprehensive flood management and disaster reduction frameworks for river basins. This entails a commitment to safeguarding human life and property above all else, adopting a holistic approach to river basin management, optimizing the configuration of flood control and disaster reduction infrastructures to enable the safe management of rivers, and bolstering resilience against floods. Such measures aim to significantly reduce the risk posed by extreme flood events, with the ultimate objective of maximizing the protection of human life and minimizing flood-incurred losses.

Water conservation has to be prioritized, necessitating the implementation of a rigid restraint policy framework. It is crucial for people to recognize the finite and irreplaceable nature of freshwater resources, tailor development plans to water availability, establish a rigid restraint system, promote the efficient, intensive and safe use of water resources, adjust the scale of water resources development and utilization to rational levels, and pursue economic activities and human behaviors within the limits that river ecosystems can sustain.

It is essential to establish a robust system for water resources optimal allocation to achieve a balanced spatial distribution. Actions have to be taken to maintain a balance among ecological, production, and living spaces, thereby ensuring adequate ecological space for harmony between humans and rivers. The system of water resources allocation needs to be refined further on the foundation of a rigid restraint regime and holistically balanced spatial distribution. Specific measures are requested to ensure proper water distribution, rational and optimal water use, and differentiated water supply strategies. These measures aim to enhance the overall capability for water resources allocation and improve the level of water supply security and resilience in water-stressed areas.

Governments have to embrace innovation-driven development and promote the digital twinning of river basins to empower river protection and governance. The construction of digital twin river basins involves using physical river basins as units, spatial-temporal data as the foundation, mathematical models as the core, and hydrological knowledge as the driving force. This approach entails the digital mapping, intelligent simulation, and proactive rehearsal of all elements of the physical river basin and the entire process of water management and governance, achieving synchronized simulation operations with the physical river basin, interactive virtual and real integration, and iterative optimization. By developing digital twin river basins equipped with forecasting, early warning, rehearsal, and contingency planning capabilities, it could provide forward-looking, scientific, precise, and security support for the unified planning, governance, scheduling, and management of river basins.

It is crucial to apply the strictest regulations and laws to river protection and governance and to form a sound basin-based governance system. Guided by the understanding that humanity and nature have one shared life, legislation on river protection should uphold the principles of river ethics to propel the establishment of a “pro-good” river protection system on this basis. A systematic approach needs to be adopted to practice holistic water

governance, with efforts taken to achieve coordinated planning, governance, regulation, and management on the river basin level. Moreover, it is essential to observe the rule of law and further refine and strictly enforce laws and regulations on river protection and governance, and through rigorous oversight, robust enforcement, and law-based accountability pursuit, to safeguard the health and vitality of rivers.

3.3.3 Enhancing the quality and stability of river ecosystems

It is imperative to pursue systematic governance for the protection and governance from mountain summits to ocean depths. A comprehensive and integrated approach is essential for the conservation and enhancement of mountains, waters, forests, farmland, grasslands, and deserts. It is critical to consider the integrity of river ecosystems across the entire basin, recognizing the unique characteristics of the upper and lower reaches, the left and right banks, the ground and surface water, and spaces inside and outside the river courses. This approach should guide the implementation of holistic protection, systematic restoration, and comprehensive management efforts. Such measures are vital for augmenting the diversity and stability of river ecosystems and for the restoration of rivers to a state of purity and beauty.

Addressing water ecological and environmental issues is imperative for preserving livelihoods, hence urgently needed to resolve river ecosystem challenges on full steam. Efforts are needed to establish and enhance the system for water pollution prevention and control, with a central focus on improving the water quality in river basins. This includes expediting the shift towards sustainable development practices, mitigating pollutant emissions at their sources, and augmenting the capabilities and standards of water pollution management within these basins. Attention is directed towards rectifying significant river environmental concerns, fortifying the binding forces of the ecological red line, and regulating the oversight of critical ecological conservation zones. The initiative involves stringent spatial regulation of water bodies and their shorelines, ensuring the pristine condition of rivers. Furthermore, the establishment of a comprehensive,

tiered ecological and environmental risk prevention framework is mandated. This framework aims to rigorously mitigate water pollution risks, enhance the safeguarding of water sources, and ensure the provision of safe drinking water for all.

Nature has to be revered, respected, and complied with in the implementation of river ecosystem protection and restoration. Emphasizing a priority on protection and primarily relying on natural regeneration, the approach adheres to the natural laws of river ecosystems. It ensures rivers are afforded ample time and space for recuperation, avoiding excessive human intervention in river ecosystems, and fully harnesses nature's self-healing capabilities. By relying on the intrinsic forces of nature, the aim is to restore the diversity, stability, and sustainability of river ecosystems. Respecting and conforming to nature involves a comprehensive application of both natural restoration and artificial intervention as necessary, adapting strategies to local conditions and temporal circumstances, and implementing region-specific and categorized measures in a non-stop manner.

3.3.4 Providing more ecological products to the benefit of the people

Collaborative efforts from multiple parties are necessary to enable comprehensive protection and collaborative governance. This includes the perfection of river basin protection and governance systems, the strengthening of coordination mechanisms at basin scale, and the formation of a river and lake protection and governance mechanism characterized by clear responsibilities, orderly coordination, strict supervision, and strong protection, ensuring effective management of every river. By adhering to a multidimensional collaboration, the initiative aims to strengthen the alignment of goals, departments, regions, and policies in river protection and governance. It seeks to gather strengths from all sectors, facilitate the participation of diverse entities, fully leverage their unique characteristics and advantages, and achieve an organic integration of responsibilities, rights, and benefits in river protection and governance.

A synergistic approach that promotes beneficial interactions between government and market is promoted. It aims to enhance overall coordination and develop a sustainable framework for river protection and governance led by governmental agencies, in collaboration with businesses and the public, and grounded in market operations. This approach employs taxation and pricing strategies to regulate water demand, and integrates water rights, pollution discharge rights, and other environmental factors into a cohesive market-based allocation system. It facilitates market transactions, including sales, transfers, mortgages, and equity investments, while also establishing a robust risk management framework. It further supports innovation in diverse investment and financing models, leveraging market tools and financial instruments to create a varied, multi-tiered, and multi-channel investment and financing structure for river protection and governance. Moreover, it seeks to implement comprehensive mechanisms for ecological compensation and cashing in on ecological products, thereby ensuring reasonable reward for efforts directed towards the protection and restoration of river ecosystems.

An aerial photograph of a city, likely Chongqing, China, featuring a wide river (Jialing River) and a prominent cable-stayed bridge with orange and white structural elements. The city skyline is dense with high-rise buildings, and mountains are visible in the background under a clear sky. The number '4' is overlaid on the left side of the image.

4

Behavioral Norms in River Ethics

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The key to practicing river ethics lies in shifting our mindset from changing and conquering nature to adjusting human behavior and correcting mistakes. This requires extensive consensus building across society, lodging the concept of river ethics firmly in place, and forming a joint force to care for, cherish, and protect rivers at different levels.

4.1 The public

The public is not only a major participant in river protection and governance but also a direct beneficiary of healthy waters. A deep understanding, heightened awareness, and active practice of river protection notions are the foundation for developing river ethics.

4.1.1 Recognizing the life properties of rivers

The public needs to recognize the inextricable relation between humans and rivers, acquire knowledge and skills in areas such as water resources conservation and efficient utilization, water ecosystem protection, and climate change response, understand policies, regulations and other related

information, establish a value system that respects the rights of rivers, as living entities, to survival and health, and form an ethical consciousness of “protecting and treating rivers as we do our own lives”.

4.1.2 Adopting a green lifestyle

The public needs to follow the goal of maintaining the health and life of rivers, adhere to a lifestyle and production methods that are simple and moderate, green and low-carbon, civilized and healthy, practice green consumption, refuse waste of water, reduce water pollution, minimize negative impacts on rivers, lead river protection by setting an example, and contribute in one's own capacity to the harmonious coexistence between humans and rivers.

4.1.3 Active participation in river protection practices

The public needs to be actively involved in the promotion of ecological civilization, does volunteer work related to river protection, sets an example from small, routine activities in life and encourages more people to take part. The public should uphold related laws and regulations, fulfill their lawful obligations, and act as citizen custodians and supervisors. In addition, the public can be spokespersons for the importance and urgency of river protection and whistle blowers for any detrimental actions against the rivers.

4.2 Watershed managers

As the guardians and advocates of river health and life, watershed managers bear the primary responsibility for recognizing and disseminating river ethics. They need to be prepared to deal with worst-case scenarios and maintain inter-departmental collaboration in order to create and maintain healthy and stable river ecosystems.

4.2.1 Maintaining the bottom line of river ecological security

Watershed managers should be able to navigate the dialectical relationship between human beings and rivers in harmonious coexistence, protect the basic rights of rivers to survival and health, and implement them in all

aspects and processes of water governance, effectively fulfill the duties of “river advocates”, and guard the bottom line of ecological security of rivers.

4.2.2 Building a comprehensive framework of protection and governance from mountain summits to ocean depths

Watershed managers should adhere to a holistic and systematic approach to conserving and improving mountains, waters, forests, farmlands, grasslands, and deserts, and make efforts to enhance the quality and stability of river ecosystems. Proceeding from the integrity of river ecosystems and the systemic nature of watersheds, and taking into full consideration of the characteristics and differences between the upper, middle and lower reaches of the watersheds, watershed managers should implement comprehensive protection, systematic restoration and integrated management, and build a protection and management system from mountain summits to ocean depths. Moreover, they should adopt a forward thinking, formulate long-term management strategies and cooperate with all stakeholders to strengthen unified planning, governance, scheduling and management of the river basins to ensure the ecological security and sustainable use of rivers.

4.2.3 Adjusting and correcting wrong actions

Watershed managers should use various means such as laws, policies, and cultural norms to advance rule of law in river protection, improve policy guidance, cultivate and promote river ethics, and shape river ethics culture; improve the supervision and control mechanisms for activities involving rivers, strengthen law enforcement, stop and correct illegal and harmful behaviors such as excessive development, reckless utilization, illegal occupation, water pollution, and ecological damages. They should adopt a zero-tolerance approach to wrongdoings that disrespect or even violate the laws of nature of rivers; establish a risk prevention and control mechanism for wrongdoings, strengthen the prediction and prevention of ethical risks related to rivers, so the health and life of rivers can be safeguarded and the harmonious coexistence between humans and rivers can be realized.

4.3 Policymakers

Policymakers should pursue the promotion and realization of sustainable development for the whole society, incorporate the normative requirements of river ethics into the whole process of formulating and implementing laws, strategies, plans, standards and policies, and coordinate economic development and the health and life of rivers.

4.3.1 Promoting green development

Green is gold, and green development is a necessary condition for sustainability. Given the irreplaceable nature of river ecosystems, protecting river ecosystems is protecting productive forces and improving them is improving productivity. Watershed managers should adopt a holistic, long-term, and overall approach to implementing river protection and governance. Besides, they should adhere to the principle of balancing population and economy with resources and environment, plan urban development, human activities and production in line with local water resources carrying capacities, optimize the spatial development and protection pattern of the national territory, promote the scientific and rational distribution of population and cities, build a modern industrial system compatible with the carrying capacity of water resources, water environment and water ecology, and accelerate the formation of spatial structure, industrial structure, mode of production, and way of life to the conservation of water resources and the protection of rivers, so as to ensure harmony between economic growth, social progress and the health of river ecosystems.

4.3.2 Establishing stringent institutional and legal systems to ensure river protection

Policymakers should develop and improve the legal system for river protection and governance, prioritize the maintenance of the health and life of rivers, and establish the legal status and regulatory framework for river protection; they should establish a multi-level water governance system at the national, basin and local levels, strengthen cross-regional and inter-departmental

coordination and cooperation, and form a unified and efficient integrated river basin management system. Besides, they should maintain policy consistency and ensure that policies related to the development and utilization of water resources, ecological and environmental protection, and urban and rural planning are consistent with the principles of river ethics.

4.3.3 Building a better homeland by all and for all

Policymakers should stand at the height of harmonious coexistence between human beings and rivers, implement water plans and actions related to the United Nations Agenda for Sustainable Development, carry out in-depth technical exchanges and cooperation in the field of river protection and governance, promote the sharing of knowledge and achievements, deepen cultural exchanges and mutual understanding, and make concerted efforts to seek solutions to the protection and sustainable development of rivers globally by jointly responding to the river crisis and building an ecologically sound homeland.

4.4 Improving monitoring and enforcement mechanisms

Policymakers shall establish and improve the supervision and restraining mechanism for various subjects' behavioral norms, further strengthen the moral consciousness and clarify the behavioral responsibility of actors in the whole society, and promote the effective implementation of the ethical code of conduct for rivers.

4.4.1 Establishing a comprehensive inspection and evaluation mechanism

Through scientific methods and technical means, key indicators such as quantity of river flows, water quality and biodiversity are monitored, and the ecological conditions of rivers, progress in protection and governance, and human activities in relation to rivers should be regularly evaluated. A system of publicizing information on river protection and governance should be established, and the results of inspections and assessments shall be made available to the public. In this context, social supervision will be introduced and transparency increased.

4.4.2 Strengthening supervision, evaluation and accountability

In accordance with the laws and regulations on river protection and river ethics behavioral norms, clear indicators and standards for supervision and evaluation should be formulated to ensure that the behavior of governments at all levels, managers of relevant industries and the public conforms to the ethical requirements related to rivers. For behaviors that violate river ethics requirements, necessary measures such as public admonishment, administrative penalties or legal enforcement can be taken.

4.4.3 Promoting capacity building and behavioral improvement

Education and training on river ethics for policymakers, watershed managers and the public should be in place to raise the awareness and enhance river ethical and cultural literacy. Besides, scientific and technological innovation and the application of new technologies to improve the effectiveness of protection and management should be taken and international exchanges and cooperation in a global context be encouraged.



5

Practices and Achievements of China

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China is one of the countries with the most rivers globally, with many long-standing major rivers. There are 2,221 rivers with a catchment area exceeding 1,000 km²; among them are the seven biggest rivers—the Yangtze, Yellow, Huaihe, Haihe, Pearl, Songhua, and Liaohe, draining over 4.3 million km². For thousands of years, the surging Yellow River and the Yangtze have nourished the Chinese nation and fostered its civilization.

China's unique natural, geographical, and climatic conditions make river management complex and challenging. Historically, managing water resources has been an essential aspect of governance and national stability. China's development history is, in a sense, a history of water governance. Throughout millennia, a brilliant culture of water conservancy is created in the course of developing water engineering. Particularly since the founding of the People's Republic of China in 1949, large-scale and systemic efforts to build water conservancy projects take place, which delivered the most extensive water infrastructure system in the world. Water conservancy has made fundamental changes in the country. The historic twin catastrophe of "great

floods leading to grave disasters, severe droughts causing great famines” is broken down, and chronic water inaccessibility that many farmers had faced for generations is addressed.

However, with rapid economic and social development, urbanization, and the deepening impacts of global climate change, problems such as frequent water disasters have not been completely solved. New issues such as water scarcity, water environmental pollution, and water ecological damage have emerged. The intertwining of old and new water issues presents new challenges for modern water governance in supporting sustainable economic and social development and protecting the ecological environment.

Over the past decade, the scientific understanding of the relations between humans and water, water and ecosystems, and water and the economy and society has made great leaps forward. In pursuit of development sustainability of the Chinese nation, a new water governance approach has been proposed, focusing on “prioritizing water conservation, pursuing spatially balanced development, conducting systematic governance and harnessing the synergy of government and market”. The concept and practices of river protection and management has also evolved.

5.1 Transforming river protection and management approaches to promote harmonious coexistence between humans and rivers

The interests of humans and rivers are congruent with, not opposite to, each other. To achieve harmonious coexistence between humans and rivers, it is necessary to transform the approach to river protection and management. In this regard, the water governance philosophy of “prioritizing water conservation, pursuing spatially balanced development, conducting systematic governance and harnessing the synergy of government and market” provides guidance.

By prioritizing water conservation, it emphasizes that the key to water

management is water conservation. Water conservation is prioritized in concept, awareness, and measures. China has implemented a national water-saving strategy, carrying out water-saving societal construction across the country for over twenty years. In 2019, the National Water-Saving Action was introduced. Sectorial approaches, including improving agricultural water use efficiency, reducing wastewater discharge in industries, and reducing leakage and losses in urban water supplies, are implemented. This has led to a fundamental shift from extensive to economical and efficient water use, ensuring continuous and stable economic and social growth without increasing total water use.

Pursuing spatially balanced development emphasizes the principle of balancing population and economy with resources and environmental capacities. These water-related natural capacities are treated as rigid restraints when planning the land use for production, for human expansion, and for nature. To be more specific, in a bid to promote green and low-carbon socio-economic development, the water resources carrying capacity are used to delineate the upper limits of agriculture, industry, city expansion and population growth.

Conducting systematic governance emphasizes a systemic view on water issues, coordinating integrated protection and systematic governance of mountains, waters, forests, farmlands, grasslands and deserts. China focuses on the overall integrity of the river ecosystem, starting from the systemic nature of the river basin, tracing the root causes of problems in the health of rivers for a holistic treatment, and preventing a fragmented approach to governance. This has led to a significant shift from focusing on post-event rectifications to systematic governance.

Harnessing the synergy of government and market emphasizes the coordinated efforts of government and market forces. River protection and management are primarily responsibilities of the government. Through reform and innovation, China has formed a relatively comprehensive water



Figure 5-1 Chun'an County, Hangzhou City, Zhejiang Province: Xiajiang Village nestled in the Fenglinggang watershed and lush mountains, presenting a living example of harmony between humans and nature

law system and a water management system combining unified management with specialized management, basin management with administrative regional management, and central management with local management.

Meanwhile, China is exploring market mechanisms for river protection and management, implementing paid use of water resources, ecological protection compensation, and water rights reform. This incentivizes stakeholders to comply with river ethics standards, obtaining reasonable returns for protecting and restoring the river ecological environment and paying corresponding costs for actions damaging river health. This has formed a river protection and management pattern where government and market roles are organically integrated and mutually reinforcing.

5.2 Incorporating ecological civilization into the constitution and enacting river protection legislation to solidify the legal foundation for river governance

Law is a crucial instrument for national governance, whose effectiveness relies on sound laws. Over the past decade, amid the national drive toward developing eco-civilization, China has prioritized ecological protection and green development, and advanced national river protection legislation. This provides legal support for the protection, management, and high-quality development of river basins.



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Figure 5-2 Fozhang (Buddha's palm-shaped) Dune at the Yarlung Zangbo River: A perfect blend of mountains, waters, green lands, and sands

Ecological civilization is incorporated into the Constitution. In March 2018, the 13th National People's Congress approved the Amendment to the Constitution of the People's Republic of China. The amendment revised a phrase in the preamble's seventh paragraph to read: "Promote the coordinated development of material, political, spiritual, social, and ecological civilizations, to build our country into a strong, democratic, civilized, harmonious, and beautiful modern socialist country, and achieve the great rejuvenation of the Chinese nation." The addition of "ecological civilization" establishes its legal status in China's fundamental law, reflecting a new historical understanding of ecological civilization construction and environmental protection. This underscores China's commitment to ecological protection in planning national development goals, ensuring sustainable development of the Chinese nation, and securing a good life for the people.

Legislation on river protection is improved. As the overarching framework for national governance, China's emphasis on ecological civilization in the Constitution lays the legislative foundation for river protection and governance. The Yangtze River Protection Law, effective from March 1, 2021, adheres to ecological priority and green development, advocates for comprehensive protection instead of large-scale development, and establishes specific chapters on planning and control, resource protection, water pollution prevention, ecological environment restoration, and green development. The Yellow River Protection Law, effective from April 1, 2023, includes specific provisions on ecological protection and restoration, water resources conservation, water and sediment regulation and flood safety, pollution prevention, and the promotion and preservation of Yellow River culture. The enactment of these two national river protection laws provides legal safeguards for the protection and management of Mother Rivers, coordinating the relationship between river protection and development, protection and utilization, and short-term and long-term interests, and embedding river ethics through legislation.

The implementation of the Yangtze and Yellow River protection laws has enhanced the society-wide awareness and actions of respecting and protecting rivers for green development. Law-based river protection and restoration has proved effective. In the Yangtze River Basin, water quality is picking up, shoreline ecosystems are turning for the better, and the ten-year fishing ban initiated in 2020 allows the aquatic biodiversity to recover. In the Yellow River Basin, ecosystem integrity in the upstream water source areas is maintained, soil erosion area and intensity in the upper and middle reaches are dropping, and the Loess Plateau has historically shifted from yellow to green covered. The biodiversity in the delta has increased, so has the ecological corridor function of the entire basin.

5.3 Launching the river/lake chief system to ensure every river is managed and protected

The river/lake chief system is a major national institutional and policy innovation that dates back to 2016. Major advancements of this system can be seen in the meeting of Central Leading Group for Comprehensively Deepening Reforms in 2016, in the President's New Year address in 2017, and in the 14th Five-Year Plan rolled out in 2020, and in the outcome paper of the Sixth Plenary Session of the 19th CPC Central Committee in 2021.

The essence of the river/lake chief system is accountability. Its full implementation is primarily aimed at protecting water resources, safeguarding shorelines, preventing and controlling water pollution, improving the water environment, and restoring aquatic ecosystems. It is characterized by clear responsibilities, orderly coordination, strict supervision, and effective protection, providing institutional safeguards for maintaining the health of rivers and lakes and ensuring their sustainable use. It is made clear that river and lake management are territorial-based responsibilities. Therefore, the local governments from provincial to township need to establish their own river/lake chief responsibilities and the primary official at each administrative level serves as the river/lake chief. The chief is responsible for leading the management and protection of the rivers and lakes within the administrative territory, and



Figure 5-3 Nanxun, Huzhou City, Zhejiang Province: River chief system has brought about high livability with clear waters, lush greens, and charming views

overseeing the resolution of major issues such as illegal encroachments, reclamation of lakes, excessive pollution discharge, illegal sand mining, damage to navigable channels, and fishing by electrification, poisoning or blasting, and ensuring coordinated governance at basin scale. The system also implements mandatory performance review at each administrative level with both positive and negative incentive measures.

The river/lake chief system contributes to progresses in the following aspects.

First, the river governance management system is improved. At the national level, an inter-ministerial joint consultation system is established. At the

basin level, in major river basins like the Yangtze, Yellow, Huaihe, Haihe, Pearl, Songhua-Liaohe, and Taihu Lake, inter-provincial joint consultation is established. The river/lake chief office is stationed in each river basin management organization, aiming at enhancing overall coordination across the entire river basin. At the regional level, a coordinated mechanism among relevant departments within their jurisdictions is put in place, pooling strong collaborative efforts for river and lake protection and management.

Second, a forceful responsibility system is established. The primary officials of provincial-level governments serve as river/lake chiefs, with over 300,000 chiefs appointed at the provincial, city, county, and township levels, and over 900,000 village-level chiefs (including river patrollers) assigned. The implementation of the river/lake chief system has enhanced the sense of responsibility among river managers and stakeholders. Public awareness of river/lake respect and care is also rising as a result.

Third, rivers and lakes are regaining their health. The institutional advantages of the river/lake chief system are proven useful in addressing outstanding issues related to floods and droughts, resources availability, ecosystem restoration, and environment protection. With carefully deliberated and forceful measures dosed out, more and more rivers are regaining their health and life.

5.4 Strengthening administrative performance evaluation to ensure effective policy implementation

Good planning requires even better implementation. Concerns with river protection arise not just from the absence of strategies, but more importantly, from failing to implement good strategies. To ensure the effectiveness of various river protection systems, the Chinese government has implemented related assessments. In January 2013, the General Office of the State Council issued the “Measures for the Assessment of the Implementation of the Strictest Water Resources Management System” to ensure that the primary goals of water resources development, utilization, conservation, and protection are achieved. And in recent years, assessments related to river protection have

been incorporated into the implementation of the strictest water resources management system, with timely optimization of assessment content and focal areas. The assessments are conducted by the Ministry of Water Resources (MWR) in conjunction with the National Development and Reform Commission (NDRC), the Ministry of Industry and Information Technology (MIIT), the Ministry of Finance (MOF), the Ministry of Natural Resources (MNR), the Ministry of Ecology and Environment (MEE), the Ministry of Housing and Urban-Rural Development (MOHURD), the Ministry of Agriculture and Rural Affairs (MARA), and the National Bureau of Statistics (NBS). The assessments are conducted in two parts: achievement of targets and implementation of key tasks and measures.



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Figure 5-4 The Dongjiang Lake, Chenzhou City, Hunan Province: Man in nature

Assessment on performance against the three red lines is conducted. The targets for water resources management include examining the annual control of total water consumption, water use efficiency, and pollution limit management in water functional zones. Specifically, this includes the accomplishment of regional total water consumption control targets, cross-provincial river water allocation indicators, key river and lake ecological flow guarantee targets, key water intake management targets, and minimum utilization targets for unconventional water sources. Water use efficiency control targets include the reduction in water consumption per unit of GDP, decrease in water consumption per unit of industrial added value, and the compliance of the effective utilization coefficient of farmland irrigation water. Water functional zone pollution limit management targets involve implementing water quality compliance rates for important rivers and lakes as approved by the State Council.

Assessment of the implementation of key tasks and measures is conducted. It focuses on tasks such as water-saving management, water intake management, water resources protection, and river and lake management. River and lake management includes evaluating the effectiveness of management and protection and the progress in implementing the river/lake chief system. Water resources protection encompasses ecological and environment recovery, groundwater management, source water protection, and ecological flow supervision of small hydropower stations.

The assessment results are factored in government appraisal. The assessment results are announced to the public after being approved by the State Council and serve as an important basis for the evaluation of the principal officials and leadership teams of provincial-level governments. For major issues identified in the annual assessment, clear feedback with clear instructions for rectification is provided to the relevant governments. Supervision and assessment of river protection have driven and guided governments at all levels, industry managers, and the public to act in compliance with river ethics standards.

5.5 Guaranteeing ecological flows to return water to rivers

Having sufficient ecological flows in the channel is crucial to river health. Under the combined impacts of natural conditions, intense development and utilization, and global climate change, guaranteeing ecological flows becomes a major challenge. This is particularly outstanding in secondary and tertiary tributaries in China's northern regions and river reaches that has heavy hydropower development in the south. In recent years, efforts



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Figure 5-5 Yellow River Delta National Nature Reserve, Dongying City, Shandong Province: Measures to guarantee ecological flows have revived the estuarine ecosystem, attracting tens of thousands of migratory birds

to resume and sustain ecological flows expand from individual projects to entire rivers: Damaged river ecosystems are being repaired and a long-term mechanism to maintain river health and ensure ecological flows is formed.

Comprehensive ecological flow standards are established. They include Specification for Ecological Flow Calculation for Rivers and Lakes, Code for Ecological Flow Discharge of Reservoirs, and Specifications on Ecological Flow Calculation and Discharge Design for Water Conservancy and Hydropower Projects. A standard system covering project planning, construction, and management with regard to guaranteeing ecological flows is in place.

Ecological flow discharge management by water projects is strengthened. Technical requirements for the determination, discharge conditions, and facility construction or modification of reservoir ecological flows have been clarified. The management of ecological flow discharge in existing and new reservoirs is regulated. China issued the "Work Plan for the Pioneering and Piloting of the Ecological Discharge Review of Existing Water and Hydropower Projects" and included 168 typical rivers and lakes and 343 projects in the pilot scope.

Supervision is reinforced. Based on national river and lake water resources conditions, development and utilization status, and ecological protection and restoration needs, rivers with a catchment area larger than 1,000 km² and lakes with a perennial water area over 10 km² are included in the national key river and lake ecological flows guarantee targets. Nationwide, 171 inter-provincial key rivers and lakes and 415 provincial rivers and lakes have been established as ecological flows guarantee targets, covering major rivers and lakes, with ecological flows monitoring and warning systems in place for ecological flows monitoring, analysis and evaluation of the control sections of key rivers and lakes.

Eco-oriented water replenishment to rivers and lakes are conducted, particularly in North China. In 2022, the replenishment covered 48 rivers and lakes in seven water systems of the Haihe River Basin, with a total replenishment of about 7 billion m³. The ecological flow (level) on-target rate of the Baiyangdian Lake reached 100%, and most rivers achieved flowing and clean water. The “Mother River Revival Action” for 88 rivers was launched, with tailored plans for each river and lake. The efforts are aimed at optimizing water resources allocation, restoring river and lake connectivity, and repairing damaged river ecosystems. Since the unified water quantity-based regulation was implemented in the Yellow River in 1999, water flow in the main channel has never been interrupted.

5.6 Rectifying small hydropower to restore river connectivity

Small hydropower is a clean and renewable energy source. In China's vast rural areas, small hydropower has contributed to providing electricity and alleviating poverty, improving the local energy structure and helping local economies to grow. Unfortunately, ill-planned and reckless development in some areas has made the river ecosystems suffer badly. A forceful campaign to decommission or upgrade small hydropower was started in 2008, with the aim of restoring the right of rivers to continuity and safeguarding their health and life.

Small hydropower are categorized by different rectification approaches. The core aim is to mitigate or eliminate the most outstanding ecological impacts of small hydropower stations, which are categorized by retiring, rectification and kept as original decisions. For those located in the core zone or buffer zone of nature reserves and those that caused serious ecological damages which rectification measures cannot eliminate, they were retired with all or part of their facilities dismantled to restore the stream connectivity. For those that failed to meet regulations and requirements on releasing, monitoring, and guaranteeing sufficient ecological flows, that caused drying-up in sections between the powerhouses and the dams, and that failed to meet the requirements for aquatic life protection, they were renovated. Measures



Figure 5-6 Chongqing City: A small hydropower in the aftermath of a flash flood event; Green small hydropower can ensure ecological flows of rivers and bring vitality to economic development

include installing additional ecological flows release and monitoring facilities in line with design standards and specifications, installing necessary fish passage facilities, increasing release to facilitate fish spawning or carrying out eco-oriented flow scheduling. By the end of 2023, more than 41,000 small hydropower stations nationwide resumed required ecological flows, 24 provinces with needs of releasing water for ecological flows had built provincial monitoring platforms, more than 4,000 small hydropower stations were retired, 21,000 stations (renovated or kept as original) met ecological flow requirements and returned flowing water to 90,000 km of river sections.

Green small hydropower is promoted in a standardized manner. In the revised Green Small Hydropower Evaluation Criteria, a basic requirement for green small hydropower is that “the hydropower station and its area of influence do not involve rare and endangered species, national key protected species or their habitats, or in cases of involving the above mentioned matters, stations have taken protective measures by major engineering or management approaches according to their design”. In evaluating hydrological regime, the calculation method is changed to “using indicators for guaranteeing ecological water demands” and monitoring ecological flows is required. A supportive environment for green small hydropower to develop is put in place, with the list of small hydropower stations being reviewed, added or ousted. By the end of 2023, there are 1,067 green small hydropower demonstration stations in the country and 67 stations are withdrawn from the list for failing to meet new requirements. Green small hydropower provides a promising solution to balancing ecological health and economic growth.

5.7 Scientific water and sand regulation to maintain the health and life of the Yellow River

From mid-1980s onwards, the lower reaches of the Yellow River experienced continuously low inflow, which intensified the sediment problems in the river. Serious siltation in the river channel significantly compromised the flow conveyance capacity. By 2002, the minimum bankfull discharge in the lower mainstream had dropped to 1,800 m³/s. The floodplains and the dykes flanking the “Hanging River” further downstream were at risk; in case of a major flood, the Huang-Huai-Hai Plain would be threatened. Increasing the flood discharge capacity in the lower mainstream and alleviating the grave flood risks became the most urgent call at that time. Ever since the Xiaolangdi Reservoir was completed in December 2001, it had been used to regulate the water and sediment dynamics and alleviate the flood risks downstream. Since 2002, the Yellow River Conservancy Commission has organized three tests and 23 operations on regulating water and sand. The benefits have played out in both social and ecological dimensions.

The theory and practices of water and sand regulation in the Yellow River have developed. The Xiaolangdi and other reservoirs are regulated in a systemic, cluster-based approach to regulate the water and sand dynamics. The measures include artificial flood peak generation, detaining the flood to regulate sediment, impounding clear water while flushing out the sand, detaining coarse-grained sand while flushing out the fine-grained, and regulating sand in high-concentration. Three tests were conducted from 2002 to 2024. These tests involved reservoirs on the middle reaches, including



Figure 5-7 Luoyang City, Henan Province: Muddy water gushes out from the sand discharge tunnel during a water and sand regulation operation at the Xiaolangdi Reservoir on the Yellow River

Xiaolangdi, Sanmenxia, Wanjiashai, Luhun, and Guxian, and covered nearly 2,000 km of river channel from Wanjiashai Reservoir down to the river mouth. Involving over 45,000 person-times, the tests produced tens of millions of data sets. For the first time, the theory of regulating a river's water and sand dynamics was translated into successful actions on the Yellow river, and three basic regulation modes—regulation mainly by Xiaolangdi, regulation on a larger spatial scale, and reservoir cluster-based regulation—were created. A bunch of technologies that enabled conditioning the water and sediment processes, forming density flows, controlling test procedures and multi-year regulation covering both reservoirs and river channels were developed. In 2010, the first prize of National Award for Science and Technology Progress was awarded to this theory and its related practices. In the same year, the Yellow River Conservancy Commission was awarded the “Lee Kuan Yew Water Prize” at the Singapore International Water Week. In the past decade, water and sand regulation operation has been extended to key reservoirs in the upper and middle reaches of the river, such as Qingtongxia, Haibowan, and Wanjiashai. At the highest legal level, the “Yellow River Protection Law” demands that “measures shall be taken to minimize the impact on aquatic species and their habitat during water and sand regulation”. Therefore, in the operation before the 2023 flood season, the regulation approaches taken by Xiaolangdi Reservoir were further refined. With new controlling projects like Guxian and Heishanxia in the pipeline, water and sand regulation in the Yellow River will further be improved.

Policies and technical standards are in place. Since 2002, technical regulations on hydrological and sediment observation in reservoirs, the regulations on water and sand regulation in the Yellow River, the list of projects included in water and sand regulation and the list of floodplain areas, among other regulations and standards, are published.

Water and sand regulation operations have yielded intended results. Since such operations began, the Xiaolangdi has flushed downstream 2.73 billion tons of sand. The reservoir's capacity to discharge sediment has been

sustained for much longer time because of the inhibited siltation process. Cumulatively 2.96 billion tons of sediment were scoured down the channel downstream, and the minimum flow conveyance capacity in the main channel rose from 1,800 m³/s to about 5,000 m³/s. As a result, the flood conveyance capacity in the downstream channel has been restored and the flooding risks to the lower floodplains dropped to once-in-five-year flood. Also, the elevation of the downstream main channel has been cut down by an average of 3.1 m. It means that instead of being jacked up due to siltation, the riverbed from Xiaolangdi till the river mouth has been consistently scoured, for the first time in history. In an effort to improve the estuarine ecosystems, 1.25 billion m³ of water has been supplied to the delta wetlands since 2008. The reed swamps and wetlands in the Yellow River Delta already recover their area in the 1980s, standing at 17,300 hm² currently, and the number of bird species rises from 187 in 1992 to 380. Operations before the flood season in 2023 reduced the sediment load in the main stream by 11% to 15% and hence enhanced the natural shelters for fish.

Water and sand regulation in the Yellow River integrates new theories and technologies with the ancient water governance wisdom regarding the Yellow River. It starts from and pursues restoring and maintaining a healthy river system. In this process, human understanding of the natural laws and rhythms of this river has deepened, which proves to be instrumental in making sure that the ancient Yellow River can deliver benefits to the ecosystems and the people in a sustainable manner.

5.8 Strengthening joint scheduling of water projects in the Yangtze River Basin to maximize water-related benefits

There are more than 300 large reservoirs in the Yangtze River Basin. Their total regulating capacity is over 150 billion m³ and the flood control capacity reaches 80 billion m³. Forty-six national flood detention areas are planned for this basin and upon completion, they can detain around 59 billion m³ of floodwater. In addition, this region is also home to some massive inter-basin water diversion projects, such as the Middle Route (phase-I) and the Eastern



Figure 5-8 Yichang City, Hubei Province: The Three Gorges Reservoir discharging floodwaters; joint scheduling of water conservancy projects keeps the "Mother River" Yangtze healthy and charming

Route (phase-I) of the South-to-North Water Diversion Project (SNWDP), as well as a large number of controlling sluice works and pump stations. The Changjiang Water Resources Commission, coordinates with administrative authorities in relevant provincial governments and other stakeholders to implement joint scheduling of the controlling water projects in the basin. A multi-objective scheduling approach is taken to balance the interests and needs in different river reaches, on both river banks, in both mainstream and tributaries, and by one single project vs multiple projects in a cluster. The ultimate objective is an ecologically safe and sustainably utilized river system in the basin.

A sound institutional framework is in place to support joint water scheduling. At the highest level, joint scheduling is written into the Yangtze River Protection Law. Trial administrative measures issued by Ministry of Water

Resources stipulates that the controlling water complexes in the basin must guarantee sound ecological flows (levels) in rivers and lakes in both routine and emergency operations. To guarantee effective implementation, the Changjiang Water Resources Commission follows by establishing a working mechanism that issues ecological flow alerts daily and addresses and reports on the risks on a weekly, monthly and yearly basis.

The joint water scheduling is getting strengthened more and more. Joint scheduling expands from 10 reservoirs in 2012 to 125 water projects in 2023. The objective shifts from flood control only to multiple purposes aside from flood control, including water supply, power generation, ecosystem conservation, navigation and emergency response. Such enhanced operations proved instrumental in coping with the big basin-wide flood in 2020, regional floods in 2012, 2016, 2017, 2021 and 2023, and the severe drought spell in the basin in 2022. For example, in fighting the five numbered floods in 2020, controlling reservoirs were operated to hold back about 50 billion m³ of floodwater and significant flood-induced losses were avoided as a result. When the river inflow was bitterly lower than normal in 2023, the controlling reservoirs managed to store, for the first time, over 100 billion m³ of water at the end of the flood season. Even during impoundment, the Three Gorges Reservoir released water at 14,800 m³/s in average. Water supplies, ecological flows, among other water demands in the middle and lower reaches, were fulfilled as a result of such joint operations.

Ecosystem-oriented flow regulation tests are conducted. The Changjiang Water Resources Commission has conducted ecosystem-oriented flow regulation tests for 13 years in a row with the objectives like facilitating fish reproduction, reducing hysteresis in temperature variation in released flows, and suppressing algal bloom, etc. In 2023 alone, 12 such tests were carried out in the Three Gorges, Baihetan, Xiluodu, Danjiangkou reservoir areas. In the flow regulation test period, sampling at Yidu and Shashi cross-sections reveals record-breaking fish spawning volumes of 31 billion and 46.1 billion eggs, respectively. Rare species such as *Ochetobius elongatus* Kner were

found spawning. Some monitoring results show that the stock of the four major domesticated Chinese carp in the middle reaches of the Yangtze River are almost on par with that in the 1980s, which can be attributed to ecological flow regulation operations and the 10-year fishing ban in the key waters of the Yangtze.

5.9 Replenishing flows in the Yongding River to bring back uninterrupted flow all the year round

Yongding River is one of the seven major water systems in the Haihe River Basin. It flows through five provinces/municipality: Nei Mongol, Shanxi, Hebei, Beijing, and Tianjin. It joins the Beiyun River to become the Yongding New River, before emptying into the Bohai Sea. This river used to have abundant water and flood the surrounding regions quite heavily. To tame the swelling waters, Guanting Reservoir, the first among other water engineering projects and channel treatment works, began to be constructed since the 1950s. The flood control standard for the river now stands against a once-in-100-year flood and the plains downstream are almost free from the threat of floods. However, from the 1960s and onwards, due to reduced instream flow and rising water withdrawal to support growing population and production in the upstream, compounded by worsening ecological conditions in the downstream, river reaches in the lower plains began to have persistent flow cut-off. In 1996, the river had no flow for the whole year; the channel was dried up, the riverbed was exposed, and the groundwater level in the surrounding areas continued to fall.

Flows in the basin are replenished to sustain water-dependent ecosystems. Since 2021, MWR initiates forceful water quantity-based joint scheduling in the basin. Various water sources including the local water, water diverted from the Yellow River and from the Yangtze, and reclaimed water are used; five reservoirs—Guanting, Cetian, Youyi, Dongyulin, and Yanghe—are coordinated. Following the natural hydrological regime of the river, operations include multi-source flow enhancement in spring, storing and utilizing floodwater in summer, water release to prepare for ice formation in autumn,



Figure 5-9 Shijingshan District, Beijing City: The lush banks of the Yongding River have become a popular recreational spot for nearby residents

and water retention by ice in winter. What is worth special mentioning is the 500 m³/s high-flow pulse discharge experiment in the spring of 2022. The operations effectively prevented the river channel from further shrinking and cleared the flow passage. Nowadays the Yongding River is vibrant with life and meets with the Grand Canal, which also resumed uninterrupted flow only recently, for the first time in a century.

The watershed has regained its vitality and vigor. Since the eco-oriented flow replenishment operations begin, on more and more days the river has water in

the channel or continuous flows. Then in 2021, decades since its full flow cut-off in 1969, the river saw water flowing throughout its 865 km-long channel again. During the spring and autumn in 2022, the river flowed uninterruptedly once in each season, bringing the cumulative days with flow to 123 days in the year and the days of water (ice) in the whole channel to 195 days; Then in 2023, the river had water flowing or ice formed in the entire route through the entire year and the cumulative days of flow reached 228 days. The ecological flows in all the major control sections have increased significantly, and the ecological base flows in three reaches upstream of Guanting Reservoir–Sanggan, Yanghe, and Shanxia section of the Yongding River–have been kept. In addition, the groundwater level nearby is picking up: the average groundwater level within 5 km around the Yongding River at the end of 2023 rose by 4.81 m over that in 2018 in the same period. The river is also regaining its functions as a green ecological corridor, with water quality in all the river reaches rising to Grade III and above and the biodiversity increasing gradually. The revitalized Yongding River delivers tremendous happiness and benefits to the locals.

5.10 Replenishing flows in the Grand Canal to resume full-line flow

The Beijing-Hangzhou Grand Canal spans six provinces/municipalities, namely Beijing, Tianjin, Hebei, Shandong, Jiangsu and Zhejiang. It runs through the North China Plain and connects the five major water systems of the Haihe River, the Yellow River, the Huaihe River, the Yangtze River, and the Qiantang River. Ever since the Yellow River burst at Tongwagang, Lankao, in 1855, the flow connectivity of the Grand Canal was cut off; from 1901 onwards, the Grand Canal ceased to be used for Caoyun (centralized grain transport via waterways). The Grand Canal was inscribed on the World Heritage List in 2014. In 2019, China issued the Planning Outline for the Protection, Inheritance and Utilization of the Grand Canal Culture. In 2020, the Ministry of Water Resources, the Ministry of Transport, and the National Development and Reform Commission jointly issued a special plan for the management and protection of the Grand Canal's watercourses.

Focuses are laid on resuming the Canal's flow, enhancing flood safety, building environmental beauty, and delivering benefits to the people with the help of digital smart technologies.

Flow replenishment is conducted in a systematic way. For the two years of 2022-2023, the Ministry of Water Resources coordination with Beijing, Tianjin, Hebei and Shandong provincial governments, replenish flows to the Canal and in particular the 707 km-long section north of the Yellow River. In order to resume the full-line flow connectivity, channels are cleaned up and 137



Figure 5-10 The Grand Canal, Tongzhou section in Beijing: The Grand Canal, which had dried up at multiple sections for over a century, has water flowing throughout its course again since 2022

obstructive facilities in the middle of watercourses are removed. Cumulatively 840 million m^3 of water is sent into the channels of Grand Canal. The water sources are varied: diverted water from the Eastern Route of SNWDP and from the Yellow river, reservoirs, reclaimed water, and retained rain and flood water. Another 340 million m^3 diverted water is used to irrigate 52,000 hm^2 of farmland that used to pump groundwater along the route. Reinforced pollution control measures, like strictly prohibiting illegal wastewater discharge, enhancing water quality monitoring, are taken to ensure safe water supplies.

Water replenishment has been remarkably effective. The Grand Canal resumes its full-line flow after staying disconnected for a century. Groundwater is recharged with effective infiltration, with the watertable rising in average by 1.44 m within 2 km and 1.33 m within 5 km from the Canal. Deep pressurized groundwater in areas that used to be pumped for irrigation is also rising. In terms of the ecosystems, another 163.4 km of watercourses are no longer dried up, another 16.6 km^2 surface water area was created, the number of phytoplankton species rose, the diversity index increased, and 64% of the monitored sections improved in their water quality grading while the others kept stable.

5.11 Revitalizing the inland rivers in the deserts

China's inland rivers, such as the Heihe River and the Tarim River, have regained their life. The ecosystem health in the basins has continued to improve, and the *populus euphratica* forest, an indicator species, is expanding again.

The East Juyanhai, a lake formed at the lower end of the Heihe River, has water all year round. The Heihe River is the second largest inland river in China. It flows through Qinghai, Gansu and Nei Mongol, with a total length of 948 km and a watershed area of 44,400 km^2 . The Zhangye region, located in the middle reaches, is a major commercial grain producer in the country; and

the lower reaches traverses mostly the Gobi deserts, except for Ejina oasis. Since the 1960s, instream flow in the lower reaches has been declining, rivers are drying up more and more frequently, the downstream lakes are dwindling, the watertable is dropping and sandstorms become frequent. In 1992, the East Juyanhai dried up, marking the height of ecological degradation and outstanding water stresses in the basin.

A water quantity-based allocation plan for Heihe was approved by the State Council in 1997. Three years later, systemic river basin management and unified water resources allocation began to take effect. Water intake shutdown, special release in a concentrated period, and restricted water withdrawal, among others, are taken to allow the East Juyanhai flow with water again. Particularly in the past decade, the water resources scheduling and allocation plan is increasingly refined, water allocation is extended to cover winter and thawing periods, and more water is secured for the ecologically fragile regions and oasis marginal areas. In the upper reaches, engineering measures to store and allocate water are taken, including constructing the Huangzangsi Dam; in the middle reaches, the major grain producing cities like Zhangye are innovating on drip irrigation under mulch and high-standard low-pressurized pipe irrigation to be more efficient in water use. As a result, the East Juyanhai began to recover its water surface in 2004 and remain with water for the whole year in 2005. Since then, the lake surface area has been consistently above 30 km², providing habitat for 123 species of wetland birds and more than 100,000 migratory birds. The *populus euphratica* forest has grown from 26,000 hm² in 1999 to 30,000 hm² in 2023, and nearly 200,000 hm² of *amarix chinensis* on the verge of dying are rescued to life. Zhangye city has become China's largest corn seed production base and at the meantime, the city's total water consumption dropped from 2.34 billion m³ in 2012 to 1.99 billion m³ in 2021.

The Tarim River has regained its vitality. The Tarim River is China's largest inland river. Located in the Tarim Basin in southern Xinjiang, it drains from 144 rivers from 9 major water systems in the basin. If counted from its longest



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Figure 5-11 Ejina Banner, Alxa League, Nei Mongol: Migratory birds enjoying a stop at the sapphire-blue Juyanhai Lake

stretch of headwater—the Yarkant River—the Tarim is 2,486 km long and its drainage reaches 1,020,000 km². Its mainstream winds eastward through the northern edge of the Taklamakan Desert and flows into Lake Taitema. Both sides of the river are home to the largest forest of wild populus euphratica in China, totaling 1.13 million hm² and accounting for more than 90% of the national total wild stock.

In the 1970s, affected by climate change and human activities, nearly 400 km of the Tarim mainstream at the downstream part became dry, and so did the Lake Taitema. The Taklamakan Desert and the Kuruktag Desert expanded toward each other and the green corridor functions and services were nearing

total destruction. Recuperative efforts began in 2001. Eco-oriented water replenishment to the lower Tarim River was conducted for 24 times and for 18 times, the water head was large enough to allow water to reach Lake Taitema. Nowadays this lake has water all the year round and its area has been kept stable. The watertable within 1 km from the lower reaches rose from 8-12 m to 2-4 m, and groundwater mineralization intensity dropped from 4-5g/L to 1-2g/L. The natural vegetation is recovering in both coverage and diversity, with the number of vegetation species rising from 17 to 46; the area of sandy area has been reduced by 700 km², and the area of restored or improved vegetation reaches 2,285 km². The expansive tendency of Taklamakan and Kuruktag deserts is curbed.



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Figure 5-12 Taklamakan Desert, Bayingolin Mongol Autonomous Prefecture, Xinjiang Uyghur Autonomous Region: The once withered Taitema Lake is replenished with water year-round, effectively curbing the merging trend of the Taklamakan and Kuruktag deserts



6

Conclusion

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Rivers have played an extremely important role in the course of human civilization and have always been an indispensable foundation supporting sustainable human development. At present, the global river crisis is spreading, the life of rivers is being jeopardized to varying degrees, and a large number of rivers are in a sub-healthy or even unhealthy state. Today, more than halfway through the implementation of the United Nations 2030 Agenda for Sustainable Development, progress on the water-related goals has fallen short of expectations, sustainable development is in trouble, and the river crisis has evolved into a crisis challenging the survival of mankind.

Addressing river crises requires technological innovation and institutional reform. More importantly, it requires systematic thinking that probes into the underlying logic of how such crises arise and deep contemplation on human-river relations from the ethical perspective. It is under this background that when attending the 2023 United Nations Water Conference, the Chinese delegation headed by Mr. Li Guoying, Minister of Water Resources, called for “developing river ethics” in response to the crisis and challenges facing rivers

of the world. This call was showered with recognition from the participants. This report, titled “River Ethics and China’s Practices”, takes stock of China’s practices and experiences in river governance. Readers may find useful references to addressing the crisis of rivers in which global sustainable development is at stakes. With joint efforts, let’s resolve this ultimate crisis of humanity and achieve harmony between humans and rivers.

This report is rooted in the thoughts on eco-civilization and sets its eyes on the sustainable development of humanity. Rivers are imparted with life values and their basic rights to life are recognized and respected. Behavioral norms based on ethical consideration are proposed for handling human-river relations: respectful stewardship, sustainable utilization, integrated governance, and lasting enjoyment. Such is the theoretical and practical framework of river ethics that find inspiration from water governance innovations in China.

We live on one land and breathe under one sky. As humanity’s fate is one and only, joining hands to build a clean, beautiful, and sustainable world for all should be and already have become a wide consensus. In face of the river crisis that threatens the sustainable development, we need to build up the global consensus on respecting, sustaining, and protecting the life of our rivers and mainstream it into our cultures, values, and actions.

Only when all countries follow the path of harmony and win-win cooperation, can prosperity be sustained for the world. Now is high time that we, as one, committed our collective strength to advancing the water-related goals of the UN 2030 Agenda for Sustainable Development and marching ever closer to a community with a shared future for mankind.

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