

WATER AND GREEN GROWTH

EXECUTIVE SUMMARY - Edition 1, March 2012



THEMATIC PUBLICATION



FOREWORD FROM THE WORLD WATER COUNCIL

In their continuing march towards human development, many States are working to put in place the necessary stimulus for significant and sustainable growth. Sustainable growth cannot be guaranteed without security to ensure continuous and enduring development. This new form of security is based on an improved relationship between humans and natural resources. Water is a resource essential to life, becoming rarer in the face of population growth, urbanization and changing climate.

There can be no development without water, but not all water can go towards development. In this context we examine the future of water. Securing water resources and their utilization now has to be considered in terms of time as well as space.

Thus “water security” has several complementary aspects:

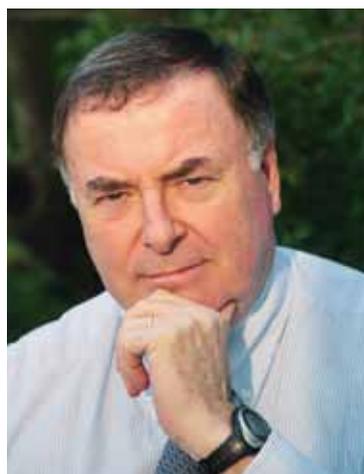
- First, **human security**, to meet basic needs, means having adequate water to nourish the world’s population and keep people healthy.
- Second, **economic security**, to ensure sufficient water to produce goods and services, means making water available in fair and affordable ways.
- Finally, what I call **ecological security**, to give water back to nature, means ensuring the quantity and quality of water needed for protecting biological diversity and the lives of future generations.

To guarantee the future of water for the planet is to accept the idea of the right to water as a basic human right, ensuring dignity for every person on Earth. In order to guarantee these securities and this right, we need to make sure that three basic elements are in place in support of water policy: finance, governance and knowledge. There is no national or local water policy without a clear and strong interaction between these three elements.

At this moment in the long history of water resources, we ask ourselves about the nature of growth in the decades to come. Will it be along the lines of blue economy or perhaps green growth? The problem with growth is not just its colour, but its character, its quality and its durability—and whether it is fair, equitable and shared.

The Government of the Republic of Korea was one of the first to initiate discussions on the important topic of green growth. How can we implement growth that does not exhaust nature? It proposed to the World Water Council to work together on a multiyear programme to examine the place and role that water plays in greening growth.

Now, on behalf of the water community, I wish to express my gratitude to the Korean officials, particularly those in the Ministry of Land, Transport and Maritime Affairs for the remarkable collaboration that has been established. This report on Water and Green Growth is a testament to that effort. The focus on green growth at the 6th World Water Forum reflects that excellent collaboration.



Finally, on behalf of the World Water Council, I express the hope that the solutions from this Forum give new impetus to the preparations for the 7th World Water Forum in 2015, which the Republic of Korea will be organizing.

Loïc Fauchon
President World Water Council
09 March 2012



FOREWORD FROM THE MINISTRY OF LAND, TRANSPORT AND MARITIME AFFAIRS

Over recent decades, countries around the world have been working together to mitigate climate change, which threatens civilizations and mankind more seriously than ever before. In the year 2000, the heads of 191 nations from the United Nations gathered and adopted the Millennium Development Goals, among which are to significantly reduce poverty and to halve the proportion of people without sustainable access to clean drinking water and basic sanitation by 2015. There is an urgent need for countries to respond to climate change in a concerted manner and, at the same time, eradicate poverty and minimize environmental damage by adopting sustainable development practices. That implies improvement in water resources management to ensure better access to water and sanitation and to prepare for more extreme water-related events.

To this end, the Korean Government announced “Green Growth” as its new national agenda in 2008. The Green Growth policy aims to effectively implement climate change adaptation strategies nationally and internationally, and thereby contributing to green growth and climate change adaptation in developing countries. Many international organizations have shown their keen interests in green growth which is a highly effective strategy for pursuing environmental protection and economic growth at the same time.

Since water is the most crucial element among the natural resources we need for green growth, water issues need to be urgently addressed. In this regard, it is very timely for the World Water Council and the Korean Government to jointly conduct a systematic research project under the theme of “Water and Green Growth”.

I am very pleased to introduce the first edition of the “Water and Green Growth” report. This report from our joint project summarizes the concept development on “Water and Green Growth” and analyses relevant case studies collected from all over the world. The synergy of this research suggests a feasible policy framework that highlights the role of water in realizing the green economic growth, while enhancing the quality of life and achieving sustainable development.

The 6th World Water Forum offers a good opportunity for exchanging diverse opinions on this concept and joining forces to emphasize the role and importance of water in achieving green growth. I hope this first edition of the “Water and Green Growth” report sheds new light on the role of water as a growth engine and raises active discussion. We expect that these discussions will continue at the United Nations Conference on Sustainable Development (Rio+20) in June 2012, with the aim of solving some of the many environmental, economic and social problems facing our global society.



Kwon, Do-youp

Kwon, Do-Youp
Minister of Land, Transport and Maritime Affairs
09 March 2012





Geum River Eco Park



EXECUTIVE SUMMARY

I. BACKGROUND

Water is a precious and essential resource, yet people no longer hold it sacred. It is degraded, misused and wasted in almost every part of the world. The serious environmental and water management challenges that face communities everywhere include: deteriorating water quality; inadequate access to clean water and sanitation for health; a decline in biological diversity; flooding, droughts and other natural disasters; and the need for ecosystem restoration, water treatment and wastewater management. To meet these challenges, water managers need to draw on innovative ideas and plans to build appropriate infrastructure in the face of climate change.

This report is the first major output of a project on Water and Green Growth, led by the Government of the Republic of Korea¹ and the World Water Council (WWC)². It is the result of over 12 months of research and analysis by an international group of experts. The purpose of the report is to examine the relationship between water and an emerging economic paradigm called “green growth”. It provides an analysis of 26 case studies that illustrate various aspects of water and green growth, and then uses the analysis to recommend a draft framework for policymakers.

“Green growth” is an idea that emerged out of East Asia in the context of the global economic recession starting in 2008, after which public spending became increasingly restricted. It has evolved in response to the high environmental cost of rapid economic development and urbanization that has taken place there over the past several decades. The concept has been championed by the Republic of Korea, promoted by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and adopted by the Organisation for Economic Cooperation and Development (OECD). What is not yet clear is how water management is being factored into green growth.

The full first edition of the report on Water and Green Growth³ is available on CD-ROM and on the project Web site. The report examines the origins and meaning of green growth, and considers the relationship of water to green growth. That discussion is then applied in the analysis of 26 real world case studies to draw out the key lessons learned from each. Based on the analysis, a draft Policy Framework for Water and Green Growth is drawn up, as shown in section 4 below. This framework will be further developed in 2012 and is aimed at stakeholders looking to adopt water and green growth policies at local, national and regional levels. The project Web site (www.waterandgreen-

1. Ministry of Land, Transport and Maritime Affairs (MLTM), the Presidential Committee on Green Growth (PCGG), and the Korea Water Resources Corporation (K-water).

2. An international membership-led NGO focusing on water and sanitation issues.

3. Co-authored by MLTM, PCGG, K-water and WWC, March 2012, and available at the project Web site: www.waterandgreengrowth.org.

growth.org) will be updated regularly with revised editions of this report and new case studies that become available.

The Government of the Republic of Korea, the World Water Council and their partners are offering this report to concerned policymakers, technical project staff and people on the ground involved in water management. It is hoped that their efforts to

manage water resources will combine economic growth, environmental protection and social development simultaneously. The research and case studies for this report indicate that a serious joint effort that involves all stakeholders in cleaning waterways and protecting ecosystems results not only in economic growth but also an improvement in livelihoods, quality of life and health.

WHAT IS GREEN GROWTH?

By the mid-20th Century people, corporations and their various activities had created such a serious impact on the environment that it was beyond the capacity of nature to absorb, with consequent negative effects on people's livelihoods and health. Thus, the benefits of economic growth had come at the expense of a serious deterioration in the environment. Climate change, including extreme weather events and global warming, has come about mainly because of mankind's unsustainable use of natural resources and ecosystems. Climate change in turn has resulted in droughts and floods, the spread of infectious diseases and rising seawater levels, which threaten national security and the very existence of island countries.

Green growth policies are a response to the traditional unsustainable energy and carbon intensive economic models based on constant growth that have caused climate change and impacted human health and national security. An underpinning assumption of the green growth concept is that, if humans make an effort to change how they pursue economic growth, they can solve the environmental problems they have caused.

The Republic of Korea has pursued a green growth policy since 2008 in an effort to achieve environmentally-sound economic growth using new and renewable energy and green technologies. The policy aims to implement climate change adaptation strategies nationally and internationally, and to contribute to green growth and climate change adaptation in developing countries. In 2009 the Korean Government formulated a Five-Year Action Plan for Green Growth, and in 2010 established the independent Global Green Growth Institute (GGGI, 2011) to share its experience of green growth policies and promote knowledge exchange throughout the world.

The policy begins with the premise that there is a virtuous-cycle relationship, rather than trade-offs, between the environment and economic growth so that synergies may be maximized. Thus, economic growth will enable the improvement of the environment, and the improved environment will be a driving force for sustainable economic growth and an improved quality of life. The policy consists of three strategies focusing on: mitigation of climate change and energy independence; creation of new growth engines; and an improvement in quality of life and enhanced international standing. The three strategies are accompanied by 10 policy directions, as summarized in **Table I**.

Other organizations have drawn on the Korean initiative to promote the green growth concept. Several definitions have been formulated for green growth and the green economy, as listed in **Box I**. A definition of green growth for the purpose of this report has also been included in the box.

While the policies and strategies of the various organizations are somewhat different, all of the concepts advocate a positive shift away from traditional development strategies to green growth strategies as the means to achieve sustainable development.



Table 1: Strategies and goals of the Republic of Korea's green growth policy

Strategies	Policy direction
1. Mitigation of climate change and energy independence	1. Effective mitigation of greenhouse gas emissions
	2. Reduction in the use of fossil fuels and the enhancement of energy independence
	3. Strengthening the capacity to adapt to climate change
2. Creation of new growth engine	4. Development of green technologies
	5. Greening of existing industries and promotion of green industries
	6. Advancement of industrial structure
	7. Engineering a structural basis for the green economy
3. Improvement in quality of life and enhanced international standing	8. Greening the land, water and building the green transportation infrastructure
	9. Bringing green revolution into our daily lives
	10. Becoming a role-model for the international community as a green growth leader

Source: Presidential Committee on Green Growth, 2009.

Box 1: Definitions related to green growth, green economy and water and green growth:

UNESCAP (2012) defines green growth as: “a policy focus for the Asia and Pacific region that emphasises environmentally sustainable economic progress to foster low-carbon, socially inclusive development”.

UNEP (2009) defines green economy as: “one that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities”.

OECD (2011a) defines green growth as: “fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies”. In addition to defining green growth, OECD also proposes detailed indicators to measure green growth (OECD 2011b).

The Water and Green Growth project defines green growth as: a strategy that fosters economic growth and development, protects natural ecosystems and the resources and environmental services they provide, and enhances socially-inclusive development.

Building upon this, water and green growth is defined as: a strategy to invest in water infrastructure and water security, fostering economic growth and development, protecting the environment and the services it provides, and enhancing socially-inclusive development.

HOW DOES WATER RELATE TO GREEN GROWTH?

The concept of water and green growth has been introduced as a strategy for sustainable economic development in tandem with environmental conservation, to meet the challenges arising from climate change and the impact of unrestrained economic growth on water resources.

Most developing countries still need more investment in water infrastructure to achieve water security, including structural measures such as multipurpose dams, as well as non-structural measures such as water reallocation and water tariff reform. One of the most crucial principles in establishing policies related to water and green growth is “integration”, and this relates directly to the integrated water resources management model. With regard to institutional reform, the Korean Government is drafting a new law on water and green growth, based on its experience in enacting the “Basic Act on Low Carbon, Green Growth”.

While the green growth strategy focuses primarily on economic development and environmental protection, it did not adequately extend into the social dimension, which is the third pillar of sustainable development. The addition of water resources development enables green growth to address social development goals more fully.

Figure 1 illustrates a strategic approach to water and green growth that better addresses all three dimensions of sustainable development.

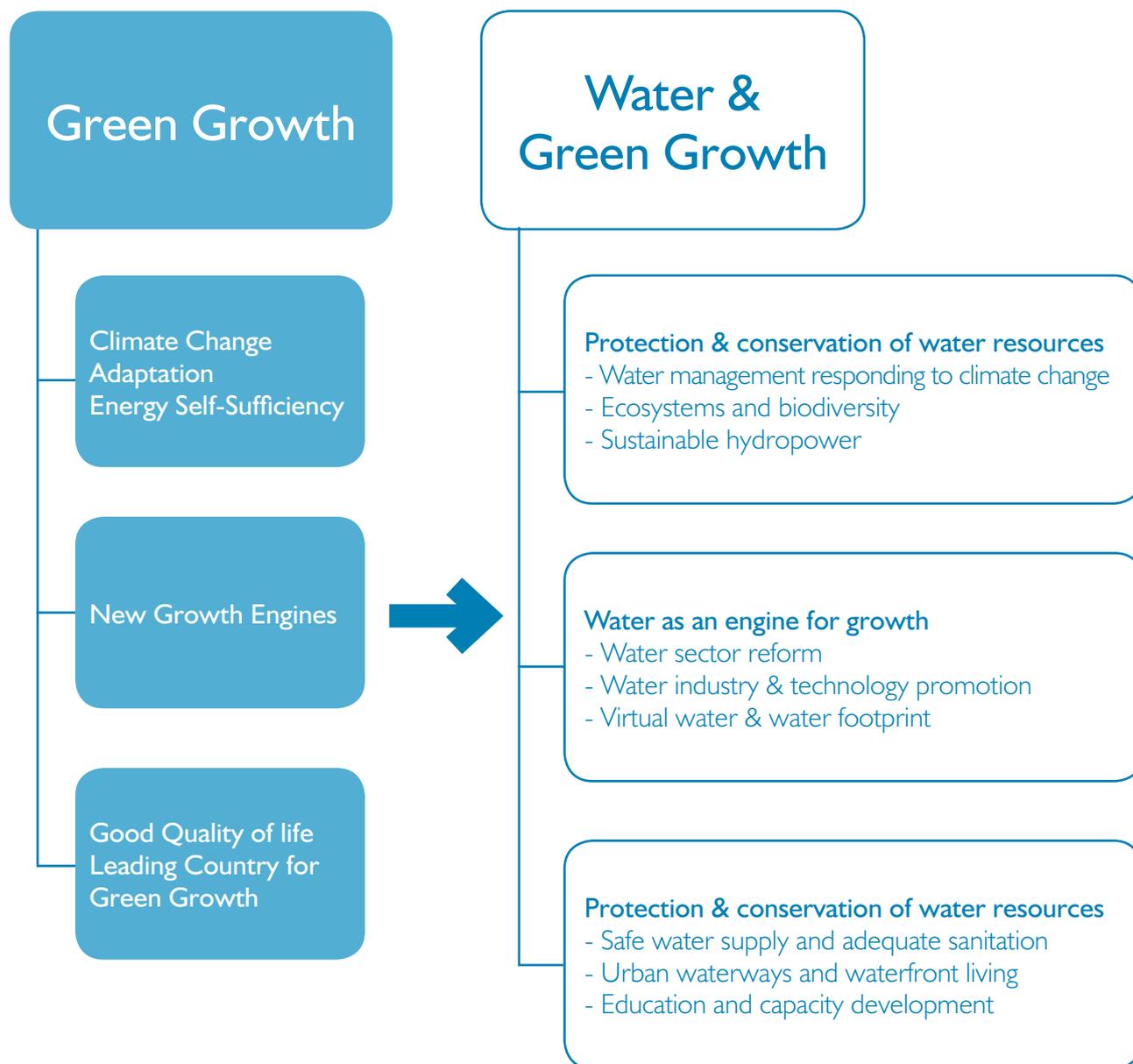
The vision for water and green growth includes many components. Improvements in systems and institutions for water management can enhance green growth and nurture resilience to climate change. Innovative approaches to limiting consumption of water resources, such as water recycling and reuse in domestic as well as industrial sectors, can protect the environment and help maximize the volume of water available for human use. Technological advancements and integrated approaches to water management can also improve efficiency of water use; i.e., rainwater harvesting, use of information technologies for decision making systems, more efficient irrigation systems, recycling in industry, and storm water and aquifer management (Grobicki 2010).

National legislation is imperative in establishing water and green growth policies and programmes in any country. Without a legal foundation, the relevant policies might not be appropriately implemented. There is no “one-size-fits-all” policy framework. The economic and industrial aspects of the strategy should be incorporated into the legal framework together with the means of providing basic water supply and sanitation services and technologies for water saving, irrigation, recycling and reuse. Institutional change may also be necessary in areas such as water pricing reform, pollution-based tax reform, river basin management, and water management that accounts for virtual water and the country’s water footprint. Most importantly, the public sector should provide a sound legal and institutional foundation for the private sector to focus on technology development, contribute efficient operational and management skills, and provide private investment for the water sector with adequate public support. A coordinating body is a prerequisite to setting priorities for the water and green growth agenda in a country. Korea’s experience suggests that the type of institution needed to oversee this policy would be a politically, administratively and financially powerful independent organization for water and green growth.

Climate variability and change have a direct impact on water availability and the frequency and magnitude of water-related natural disasters. In response, sustainable solutions and frameworks for water infrastructure planning and management have become global priorities. These include reengineering existing infrastructure and creating new green water infrastructure, as well as developing new water policies and regulations. Measures for monitoring water and green growth are briefly introduced in **Box 2**.



Figure 1: Water and Green Growth – Strategic Approach



Box 2: Indicators for monitoring water and green growth

A number of environmental and vulnerability indices and indicators have been developed to measure sustainable development, such as the Environmental Sustainability Index (ESI), Environmental Performance Index (EPI) and Environmental Vulnerability Index (EVI). Based on the discussion of these and other sets of indicators, researchers in the Republic of Korea have drawn up a Water and Green Growth Index (WGGI) that includes 14 categories and 45 indicators identified under environmental, economic and social dimensions. The WGGI covers categories such as water quality and water stress (environmental dimension); water quantity and water expenditure (economic dimension); and equity and disaster vulnerability (social dimension). A detailed list of the WGGI indicators is in the full report and on the project Web site. WGGI promises to be useful in evaluating the extent to which a country or community is committed to water and green growth.

INTERNATIONAL COOPERATION

Part of the Republic of Korea's policy on green growth relates to its becoming a leader and role model for green growth, and imparting its experience to developing countries through international cooperation. As a country that has achieved rapid economic growth at the expense of protecting the environment, the Republic of Korea can influence developing countries to approach growth differently. Korea has successfully evolved from an aid recipient to a donor country in only half a century. Annual per capita income increased significantly from less than US\$ 100 in the 1960s to US\$ 20,000 in 2009. Korea's example can encourage developing countries to participate in global efforts to reduce greenhouse gas emissions and promote sustainable development.

In order to move forward on a sustainable development path, developing countries will have to introduce or expand measures to protect the environment and mitigate or adapt to climate change. Developed countries have begun investing in green technologies and industries as part of their efforts to mitigate climate change. They have also started to introduce preferential policies for the purchase of environmentally-friendly products. Accordingly, developing countries would do well to begin manufacture of products in an environmentally-friendly way in their efforts to promote economic growth; otherwise they may be left behind in terms of international competitiveness.

Some developing countries argue that a shift to green growth and a low-carbon society will result in an increasing income gap with developed countries. Therefore, they are calling for the international community to compensate them for the income gap that will result from their adoption of green economic growth. Developed countries can assist by transferring technologies that apply eco-efficient production processes and technologies, using natural resources more efficiently and recycling. Developed countries can also provide official development assistance (ODA) and capacity building assistance to help developing countries narrow the income gap.

Assistance to developing countries in terms of technology transfer and ODA is considered necessary to effectively reduce greenhouse gas emissions to tackle climate change. The Republic of Korea has made an attempt to reclassify current ODA to reflect climate change policies. In line with Korea's strategy, definitions for green growth ODA and water and green growth ODA are briefly introduced in **Box 3**.

The adoption of water and green growth ODA by donor countries would provide an international cooperative mechanism for water and green growth. The approach paves the way for the international community to collaborate on the enhancement of water management for greening development in times of uncertainty.

Box 3: Definitions of Official Development Assistance focused on Green Growth

"Green Growth ODA" is assistance that nurtures the capacity of developing countries to cope with climate change challenges, to create a springboard for constant economic growth with reduced environmental impacts, and to enable green lifestyles (S. J. Kang 2011, 14). Green growth ODA has been adopted by the Republic of Korea and reflects the relevant OECD Creditor Reporting System (CRS) codes related to climate change, environmental factors and economic growth.

"Water and Green Growth ODA" is the official development assistance that focuses on the diverse roles of water in economic growth and environmental protection, together with consideration of the complex uncertainties that characterize development scenarios, one of which is climate change. It includes CSR codes concerned with water transportation, business activities for public-private partnership, energy and mining issues, trading policy, and humanitarian assistance (disaster relief).

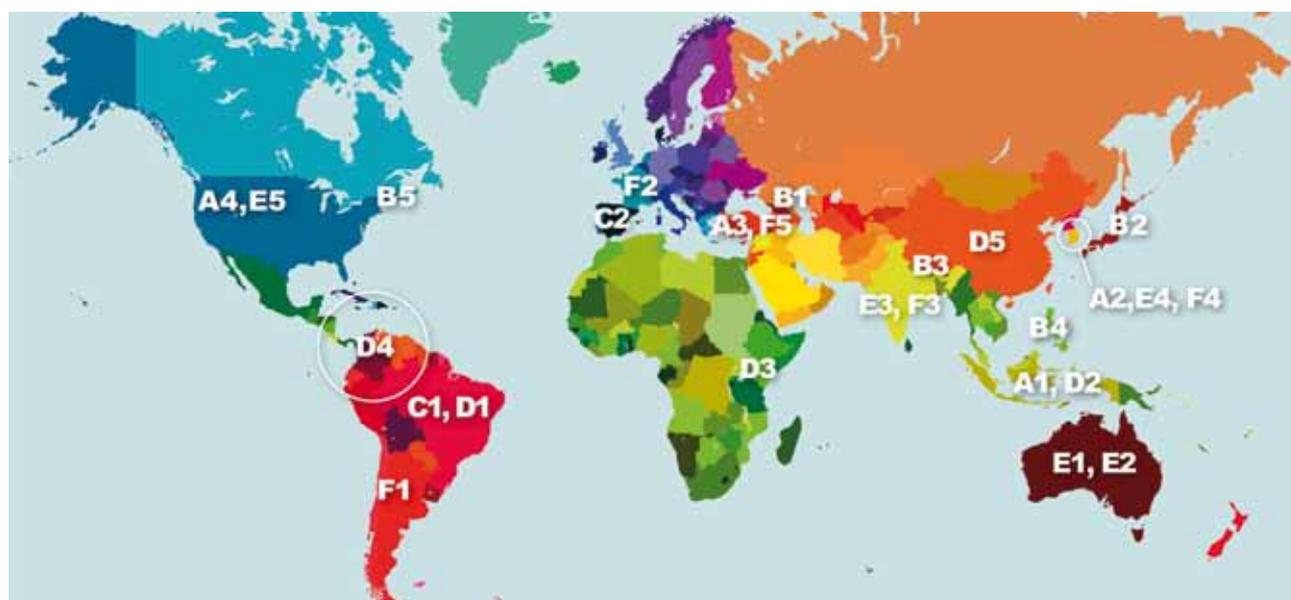
2. MAIN LESSONS FROM THE CASE STUDIES

Building on the theoretical research and policy development related to water and green growth outlined above, the project implementation team gathered real world examples of water being used to promote green growth. From the case studies received and identified for this project, 26 were chosen to be included in the analysis, based on how informative they were for policymakers looking to combine their water and economic policies in an environmentally sound way. The aim was to obtain

a balance of case studies across regions, from developing, emerging and developed economies. The map shows the distribution of the case studies, indicating that the concept has a global reach.

The case studies were divided into six categories as shown below to facilitate the analysis and develop a draft policy framework. In reality, each case study is complex in nature and demonstrates aspects of multiple categories.

WATER & GREEN GROWTH CASE STUDIES



A Ecosystem Recovery & Water Quality Improvement

- A1 Green Growth-Based Integrated Water Management
Indonesia (Citarum River Basin)
- A2 Development of Lake District
Republic of Korea (Lake Sihwa)
- A3 Rehabilitation of Urban Estuary as a Green Growth Project
Turkey (Golden Horn, Istanbul)
- A4 Water Quality Management & Wastewater Services
USA (Tualatin River Watershed, Oregon)

B Watershed Management

- B1 Integrated Natural Resources Management in Watersheds (INRMW) Programme
Georgia
- B2 Regional Development & Canal Project
Japan (Aichi Canal)
- B3 Rural Electrification Project (AHREP)
Nepal (Andhikhola River)
- B4 River System Rehabilitation
The Philippines (Las Piñas-Zapote River)
- B5 Basin-Scale Approach to Balancing Power Generation & Ecosystem Restoration
USA (Penobscot River, Maine)

C Policy, Planning & Governance

- C1 Green Growth & Integrated Water Resources Management
Brazil
- C2 Water Planning Towards a Green Economy
Spain (Ebro River Basin)

D Financing & Public-Private Partnerships

- D1 Public Policy of Payment for Environmental Services: A Financial Instrument to Improve Water Quality
Brazil
- D2 Rewards for Watershed Services
Indonesia (Sumberjaya Watershed)
- D3 Payment for Environmental Services Pilot Project
Kenya (Lake Naivasha Basin)
- D4 Public-Private Fund Mechanism for Watershed Protection: Water Funds
Latin America & the Caribbean (Columbia & Ecuador)
- D5 Eco-Compensation for Watershed Services
People's Republic of China

E Innovation & Technology

- E1 Integrated Urban Water Management: Modelling Human Behaviour
Australia
- E2 Recycled Water Scheme: A Best Practice for Industrial & Potable Supply Augmentation
Australia (Western Corridor)
- E3 Role of Technology in Water Quality Improvements
India (Gujarat State)
- E4 Photovoltaic System Floating on Reservoir
Republic of Korea (Hapcheon Dam)
- E5 Nutrient Recovery and Conversion to Fertilizer
USA (Tigard, Oregon)

F Infrastructure

- F1 Sanitation Plan
Chile (Santiago Water Basin)
- F2 Logistical Hotel: A River Transport Project
France (Quai d'Austerlitz, Paris)
- F3 Urban Water Sector Improvement Project
India (Karnataka State)
- F4 Four Major Rivers Restoration Project
Republic of Korea (Han, Nakdong, Geum & Yeongsan Rivers)
- F5 Participatory Irrigation Management
Turkey

A. ECOSYSTEM RECOVERY AND WATER QUALITY IMPROVEMENT

The restoration of water-related ecosystems and water quality improvement provide long-term benefits in terms of public health, economic growth, aesthetic, recreational and cultural amenities, and improved well-being and livelihoods. Ecosystem restoration efforts require the support of people living in both the watershed area and in downstream municipal areas. In urban areas, restored waterfronts can become lively and popular catalysts for economic growth and urban revitalisation. When people get back in touch with their rivers, lakes, and oceans, they take better care of those ecosystems in line with conservation and sustainable development efforts.

A project from the Lake Sihwa District in the Republic of Korea describes a case of urban renewal based on recovery of the lake basin. This lake was created by the Land Expansion Project which built a dike along the Yellow Sea coast in 1987. As a result of serious eutrophication of the lake, the population in the area protested against the project for 10 years. Finally, in 2004 the Government created the Sihwa District Sustainable Development Council, a consultative group that engages the population living in the

district. The comprehensive long-term development project has now gained more support among the people. The Council has expanded the range of participation of stakeholders, while encouraging active communication with the local community. The components of the project include a high-tech industrial complex, housing and theme parks, as well as the world's largest tidal power plant. The latter is designed to produce over 500 GWh of clean ocean energy per year. The wave energy has improved the water quality of Lake Sihwa through increasing circulation of seawater and reduces greenhouse gases. The Council changed the direction of some of the original plan, by insisting upon environmental measures that would reduce the impact of the development. The Government accepted the Council's suggestions on low density housing and restoration of habitat that had been lost. This case study should be very instructive to any government setting out to do a large-scale development project. Such projects require a lot of time for consultation and social mobilization in order to be successful.

The case study from the Golden Horn estuary that divides the city of Istanbul, Turkey shows how



Revitalization of the lake is a catalyst for the development of Sihwa Multi Techno Valley Project.



Cleaning up a polluted urban waterway became the catalyst for multi-dimensional economic & social development in Istanbul

a polluted urban waterway can be restored and become the centre of vibrant economic activity. The Golden Horn rehabilitation project is a multi-dimensional plan aimed at improving water quality and navigation in the estuary that had become a shallow dead lagoon by 1985. The project, implemented by the Greater Istanbul Municipality from 1995 to 2003, has made significant progress in restoring and revitalizing the historic and cultural features of the Golden Horn and surrounding area. The project had five phases: investigation; dredging; construction of wastewater facilities; landscaping; and repurposing the area as a tourism and cultural destination. Much of the initial work was concentrated in dredging the Golden Horn and preventing sewage from entering it by collecting it and sending it to a treatment facility. Then the landscaping and repurposing of this strategic and

historic waterway became an engine for economic growth. As a result of the project, water quality in the estuary has improved, while the tourism potential and recreational areas have increased.

Similar examples can be found for urban waterfronts ranging from New York City (2012), USA to Shanghai, China (ADB 2010). Restoration of waterways generally requires an agreement with upstream residents to maintain plantings along the river banks and carry out actions to reduce siltation. Such agreements require sustained government commitment and enormous economic resources, but they pay dividends far into the future. As can be seen from the case studies in this category, the value of the restoration affects all aspects of life; it cannot be calculated in monetary terms alone.

B. WATERSHED MANAGEMENT

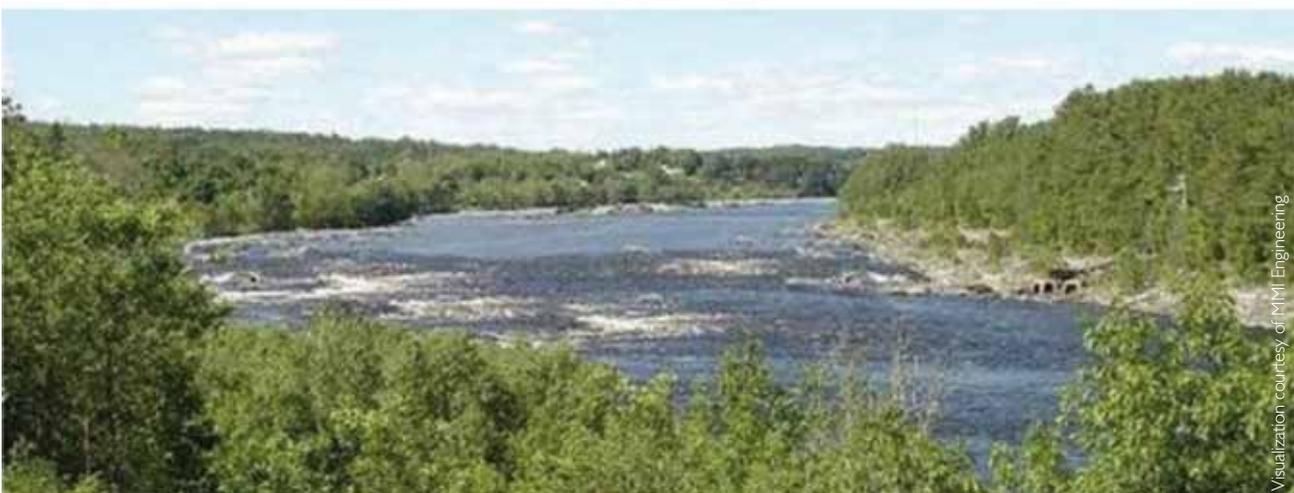
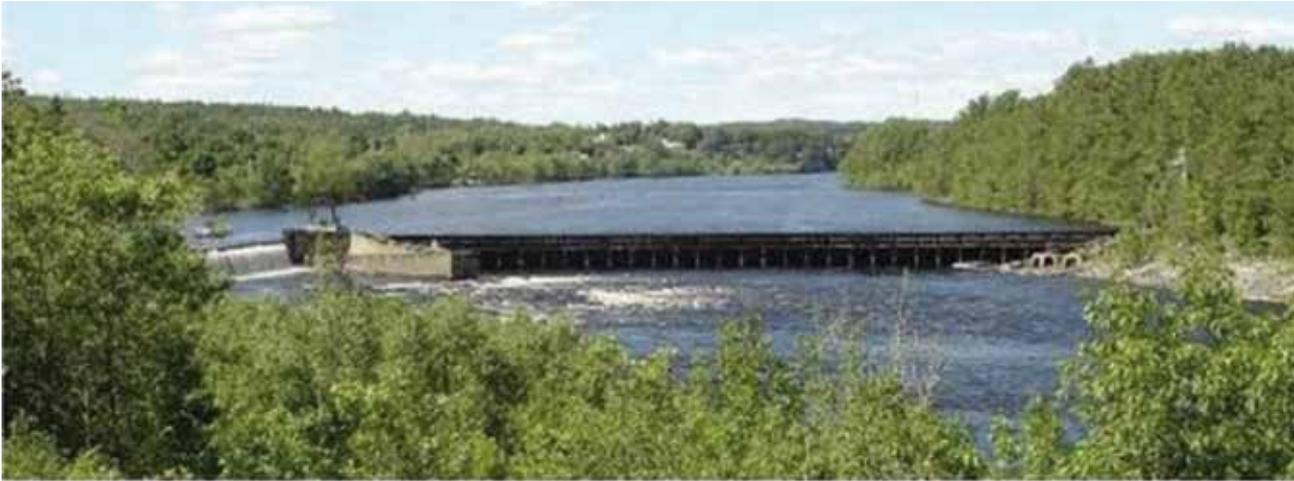
Recent interest in the United States and other countries that have highly regulated river systems has concentrated on the preservation of watersheds to improve water quality for downstream users. Agreements have been forged between the residents of the watershed area, who agree to protect the reservoirs located in the watershed, and municipal areas downstream, which compensate them through taxes or payment for environmental services (PES). The preservation and restoration of natural landscape features (such as forests, floodplains and wetlands) are critical components of green watershed infrastructure. By protecting these ecologically sensitive areas, communities can improve water quality while providing wildlife habitat and opportunities for outdoor recreation.

Most of the world's major rivers, particularly in developed countries, have been fragmented by dams, diversions and canals, resulting in siltation and water quality deterioration. The decline in flow levels of rivers as they move towards the sea threatens human and animal life and whole ecosystems. Coastal zones are among the most productive ecosystems on earth and depend vitally on the inflow of freshwater to their estuaries, deltas and wetlands.

In some parts of the USA, there has been a move to decommission some dams in order to allow rivers to run free and to restore biological diversity. This trend is illustrated by the case of the Penobscot River Restoration Project in Maine, which shows that basin-scale approaches can provide a broad set of solutions for balancing energy needs and ecosystem resources of the river basin. Two mainstream dams were decommissioned on the lower Penobscot River, which has improved fish passage at the dams that remain. The restoration project was negotiated between a hydropower company and a coalition that includes the Penobscot Indian Nation, resource agencies and non-governmental conservation organizations. The project resulted in a new configuration of dams that will provide slightly more energy but will be dramatically better for fish populations. The project illustrates a green growth approach to water management because it achieves system-scale solutions to balancing the benefits of managing water (hydropower) with the benefits from natural river functions (migratory fish) and can be measured in terms of energy generation and fish populations, and their cultural and economic value to people. It shows that a river basin-scale approach can reveal a broad set of potential solutions for balancing benefits than can be achieved when dams are examined project by project.



Small multipurpose hydropower project transforms the community in the Andhikhola River Basin, Nepal.



Dam removals have the potential to help restore ecosystems on the Penobscot River.

The Andhikhola Hydel and Rural Electrification Project in Nepal shows that a small-scale multi-purpose hydropower project can transform a local community and significantly improve its level of prosperity. The project took a decade in preparation before it came into commercial operation in 1991, with technical and financial assistance from the Norwegian Development Agency. The long gestation period provided its owner, the Butwal Power Company Limited, time to develop innovative, sustainable rural electrification approaches and to develop local capacity, all of which has influenced Nepal's hydropower sector. This case study shows how the protection and management of a watershed area by a poor community can be used as the basis for green growth. As a result of a small scale dam for hydropower and irrigation, the quality of life in the community and the levels of prosperity have risen significantly. This has been achieved through

community engagement, capacity development and ownership of the project. Where local geography favours such a scheme, elements of this project could be transferred to other regions.

Protection of the watershed is needed to preserve ecosystem services. It requires a broad framework that incorporates integrated planning and management of land use and water use at the river basin level, within a broader ecosystem context, involving all stakeholders.

C. POLICY, PLANNING AND GOVERNANCE

Balancing economic growth with watershed protection and ecosystem recovery requires a policy and planning framework that looks at the river or water basin in a holistic way. The example of the Ebro Basin outlines Spain's decades-old water management policy based at the river basin level. The Ebro River Basin has been managed since 1926 by the Ebro Water Authority as a partnership of private users and public authorities. The Ebro Water Authority was the first to coordinate water policy in a river basin in Spain, and it played a central role in transforming the formerly semi-arid Ebro Valley into a prosperous economy. The initial objective of water management in the basin was to promote and coordinate the building and operation of water infrastructure, first to support agricultural development and then as an instrument to meet water demands stemming from economic growth. Today, the primary objective of water management

is reconciling economic growth with the protection and improvement of the water resources and the ecosystem. This case study focuses on the last two decades and illustrates innovative water planning processes, leading to a transition towards green water planning in the Ebro River basin. One of the most positive aspects of the case study is that the Authority is setting environmental baseline requirements first before allocating water resources. This would seem to be an excellent first step towards green growth.

In the case of Brazil, which has one of the world's largest endowments of freshwater resources, the country has been divided into 12 hydrographic units, each with its own water management plans, agreements, regulations and water fees. The boundaries of these regions are different from the geopolitical boundaries of the Brazilian States.



cc Confederación Hidrográfica del Ebro

From the first irrigation works carried out by the Ebro River Basin Authority (1927)...

The approach in Brazil provides a good example of integrated river basin management in practice. Brazil holds 12% of the world's fresh water and has one of the most sophisticated water resources management systems. The National Water Resources Management System (SINGREH) has introduced such water management practices as decentralization, the use of economic tools for water management, and public participation in the decision-making process. The National Water Agency (ANA) is the institution responsible for implementing the national policy and coordinating the SINGREH, particularly its technical and institutional instruments. Moreover, ANA is responsible for regulating water uses for rivers under federal jurisdiction by issuing water permits and controlling water uses. At the sub-basin level, the River Basin Committee includes representatives of the government, users and non-governmental organi-

zations. These committees are responsible for approving the River Basin Plan and for proposing the amount to be charged for water use. A Management Contract enables collection of water charges by Federal or State organizations and transfer to the River Basin Water Agency. ANA has introduced the polluter-pays and user pays concepts in Brazil.

The basin authorities in Brazil and the Ebro Basin in Spain ensure that the ecosystem water needs are met, and both use a variety of instruments – economic, regulatory, legal and engineering – to achieve their water management goals. Basin Committees that involve major stakeholders are an essential part of the negotiation process.



cc creativecommons.org — Phil Blackburn

...to today's technologically advanced and water-efficient irrigated agriculture.

D. FINANCING AND PUBLIC-PRIVATE PARTNERSHIPS

The case studies in this category do not address general financing for water resources infrastructure, but rather examine payments for environmental services (PES) that support protection of the ecosystem as a basis for green growth. The PES schemes reward municipalities, communities or individuals for protecting water resources essential for upstream and downstream economic activities.

The case of Lake Naivasha in the Great Rift Valley of Kenya demonstrates how economic incentives for both ecosystem service buyers and sellers can be used to achieve significant land- and water-management improvements. Contractual agreements are negotiated between the ecosystem stewards and ecosystem beneficiaries, making PES a benefit-sharing mechanism. Implementation of the pilot project began in 2008 and is currently being scaled up. The payments are made by the Lake Naivasha Water Resource Users Association and the Lake Naivasha Growers Group to small-scale

landowners and farmers in the upper watershed area represented by Water User Associations, who forego some potential income from land use to provide good quality water to downstream users. The structures introduced in the farms have reduced soil erosion and surface water run-off. Soil fertility and tree cover have been enhanced by on-farm planting of appropriate trees. The project area covers two major tributaries of the Malewa River sub-catchment, which contributes 80% of the water that flows into Lake Naivasha. The success of the project depended on strong stakeholder partnerships as well as the availability of baseline hydrological data and a strong business case. The overall approach is one that can serve as a model for developing countries in Africa and elsewhere, where conservation of soil, water and biodiversity must be seen to be delivering tangible benefits.

In the cases from Latin America and the Caribbean, Water Funds set up by The Nature Conservancy



Photo by Njoroge Maina, provided courtesy of CARE-Kenya

Buyers and sellers of ecosystem services verify soil and water conservation goals before payments are made in Lake Naivasha.



Photo courtesy of The Nature Conservancy

Green growth supports people in the watershed who can help protect the water and forests; school children work in a vegetable garden supported by water funds in Ecuador.

(TNC) are endowments to support watershed protection and promote green growth, rather than direct payments to individuals. The Funds require involvement of stakeholders upstream and downstream and spread both benefits and costs among industries, municipalities, communities, utilities and the ecosystem. Financing comes from the users, the government (including a percentage of the water company's revenues) and international development banks and other donors. Although it is difficult to initiate them, these funds can serve as models for municipalities that are searching for ways to reduce costs of treatment and distribution. In the case of Quito, Ecuador, about 80% of the water for the city comes from three protected areas and their buffer zones. The Quito Water Conservation Fund (Fondo para la Conservación del Agua – FONAG), created with the help of The Nature Conservancy about 10 years ago, receives money from government, public utilities, electric companies, private companies and non-government organizations. An independent financial manager invests the money, and the interest is used to fund activities for watershed protection. These include: control

and monitoring of protected areas, restoration of natural vegetation, environmental education, training in watershed management, and a hydrological monitoring programme. Local communities that live close to the water sources receive support from FONAG for environmental education and community-based projects. Initial funding for the Quito Water Fund included TNC and USAID grants. The Fund amounted to US\$ 5.4 million at the end of 2008 and is now almost US\$ 10 million.

The other case studies in this category show a wide variety of PES and similar schemes that provide monetary and non-monetary (including provisional land tenure) incentives to residents of the watershed to be stewards of the forest and water resources. Water Stewardship has now become an important model for restoration and protection of watershed resources and has spread internationally into the Alliance for Water Stewardship, spearheaded by the Nature Conservancy.

E. INNOVATION AND TECHNOLOGY

Technological innovations can increase water availability from water savings and pollution control. These are considered green growth solutions, as they improve the environment and reduce costs to users. Some of them include: recycling and reuse of water, low water using appliances, efficient irrigation systems, decentralized sewerage systems, rainwater catchments and reclamation of nutrients. With such green growth innovations, energy costs are also reduced, with savings on fossil fuel consumption, greenhouse gas emissions and climate change impacts. Other technological tools that contribute to green growth include information and communications technologies that will assist water managers to encourage conservation and manage demand.

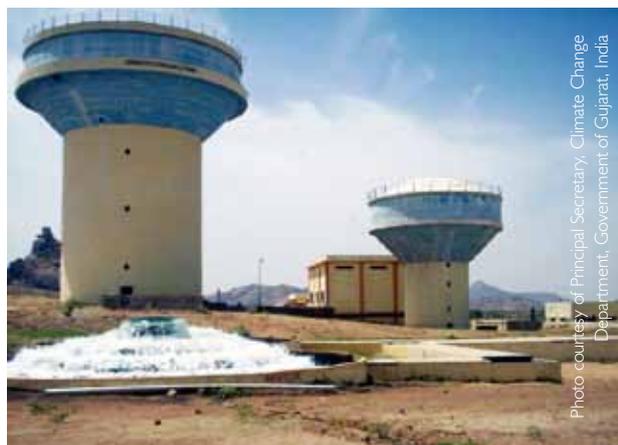


Photo courtesy of Principal Secretary, Climate Change Department, Government of Gujarat, India

Investments in major water infrastructure combine with small-scale innovations to serve millions of people in Gujarat.

A case study from Australia describes an information technology model that measures the impact of changes in human behaviour and adoption of green technologies on urban water use. A software product developed by eWater Cooperative Research Centre⁴ models this information as an input to Integrated Urban Water Management (IUWM). Modellers can explore design scenarios which substitute tank water or grey water instead of tap for household water uses such as toilet, shower, washing machine or outdoor water use. The latest software tool incorporates all three urban water cycle services – potable, wastewater and storm water – within a single framework. It can simulate demand and supply interactions at sub-daily time scales, and can deal with catchment rainfall-runoff

responses at a range of scales. This software solution from Australia should be replicable in other countries as a support to urban water managers implementing demand management and conservation approaches to reduce consumption. It supports water and sanitation authorities that are introducing alternative options to building new supply systems, which could include use of non-potable water and re-use of grey water for outside purposes, flushing and fire fighting. As all nations will have to begin to use water more wisely, this water management tool could be useful in emerging economies. The next step would be to work with customers to see how they can participate in water-saving decisions.

The case study from Gujarat (India) chronicles a combination of huge investments in water infrastructure and modifications in water and energy policies that have affected millions of people throughout the State. One of the important lessons learned from the case study is that technological initiatives to improve water supply for domestic consumption and irrigation have to be complemented by grassroots people's participation in management and distribution of water. The community managed water supply programme in Gujarat has proved to be a model for the entire country. Small innovations, such as micro-water harvesting, can make a large impact on agricultural production. For example, the Sardar Patel Participatory Conservation Project (SPPWCP) involves construction of check dams and village tanks or ponds by a designated beneficiary group, with



Photo courtesy of Principal Secretary, Climate Change Department, Government of Gujarat, India

Scarcity of drinking water caused mass scale migration and transportation of water by train or trucks before innovations to the water grid in Gujarat.



Narmada river at Baruch, Gujarat.

technical and financial assistance from the district office. More than 350,000 check dams and village tanks or ponds were created in the last eight years, providing direct benefit to over 13 million people in rural Gujarat. Gujarat has also created the Gujarat Green Revolution Company Ltd. to popularize the adoption of drip irrigation among farmers. GGRC offers highly subsidized loans to farmers and has simplified the administrative procedures.

Other innovative solutions result in direct economic benefits; for example, one case study from Oregon (USA) shows that the nutrients removed from water and wastewater treatment can be sold as commercial fertilizer. Nutrient recovery contributes to a change in thinking through which wastewater treatment plants become resource recovery plants.

F. INFRASTRUCTURE

Extensive networks of 'grey' infrastructure have been built over the years that provide drinking water, wastewater and storm water services to the public. Dams, weirs and diversions generate electricity and supply irrigation water to farmers. Much of that infrastructure is now getting old, and is in need of repair or replacement. In the process of repairing and constructing infrastructure, new concepts are being introduced to reduce their negative environmental impact. At the basin level, a combination of grey and green infrastructure can include the preservation and restoration of natural landscape features, such as forests, floodplains and wetlands. Communities can participate in improving water quality while providing wildlife habitat and opportunities for outdoor recreation. The case studies below address construction of grey infrastructure, as well as green infrastructure in restoration of waterways.

The 'Sanitation Plan' case study from Santiago, Chile focuses on wastewater treatment, for the Santiago water basin. The project is led by Aguas Andinas, the main water and sewerage utility in Santiago, which is partly owned by Agbar, an international water company with a presence in nine countries. Chile essentially privatized its water and sanitation services from 1998 to 2005, and this project was carried out by private sector companies in collaboration with the Government of Chile. The case study shows how the city of Santiago has cleaned the rivers in its watershed, reduced pollution and improved wastewater treatment. Residents of Santiago pay for the wastewater treatment and sewerage services they receive through tariffs. The project is financed by bonds issued by Aguas Andinas that will be repaid by tariffs over time. The case is important as it shows that a large urban metropolis can succeed in cleaning up its waterways, and that improvements in water quality can be a factor in green growth. While this project entailed a huge investment in treatment infrastructure, it has had many positive impacts on health, the economy and the environment.

The Republic of Korea's Four Major Rivers Restoration Project, a massive infrastructure project, is a priority under the Government's green investment programme. The Government is allocating 2% of its GDP per year over the 2009-13 period (approximately US\$ 86 billion)

on green investment. Approximately 20% of the green budget is to be invested in the water sector through the Four Major Rivers Restoration Project. The project is designed to address the significant environmental challenges faced by the Han, Nakdong, Geum and Yeongsan Rivers. The organization in charge of project execution and coordination among various government agencies is the Office of National River Restoration in the Ministry of Land, Transport and Maritime Affairs. The Office itself has a high level of expertise, and it coordinates the work of five ministries and 78 local governments. The goals of the project are to: secure water supply (1.3 billion m³); manage floods and droughts; restore water ecosystems and improve water quality; develop river banks to ensure space for recreation; and develop the waterfront areas along the rivers. This has entailed extensive dredging of sediments, constructing new small-sized multipurpose dams and reservoirs, and removing pollutants, including in farming areas. More than 1,000 km of major streams have been restored, and another 10,000 km of minor streams are being restored. The government expects the project to generate approximately US\$ 32.8 billion in positive economic benefits, and create 340,000 jobs in a time frame of 6-10 years.

While these case studies describe large infrastructure projects that seem to be implemented from the top, they have had positive environmental, economic and social impacts on the communities living in the project area. Experience indicates that it may be better to start small and scale up, so that large infrastructure solutions are tested and accepted by the communities where they are implemented.





© Korea Water Resources Corporation (K-Water), 2011

Residents enjoy this riverfront amphitheatre on the Geum River, “that flows with culture.”



Photo courtesy of Aguas Andinas

Treatment of wastewater at Planta Mapocho supports future green growth in the Santiago Water Basin.

3. CORE ELEMENTS OF WATER AND GREEN GROWTH PROJECTS

In analysing the 26 case studies, certain factors for success came up time and time again. These factors crossed category boundaries, geographical regions and levels of development. Some factors that seem to be critical for success in water and green growth projects are outlined below.

FACTORS FOR SUCCESS

Cross-cutting factors

1. Strong political leadership: political commitment from the top and from local government levels;
2. Plan or project backed by government policy, legislation and water management institutions;
3. Use of the river or lake basin as the primary planning unit; planning in a holistic way; stakeholder engagement in planning process;
4. Use of a variety of economic and regulatory instruments to achieve water management goals;
5. Good baseline information gathering, decision support systems, and monitoring systems;
6. Management decisions based on enhanced information and data systems;
7. A solid expert organization to support local water managers;
8. Multidisciplinary and multidimensional approach.

Environmental Factors

1. Protection of the ecosystem as a main objective of the basin management plan;
2. Integration of land-use and water-use planning;
3. Benefits and costs balanced among competing uses in the river basin;
4. Commitments from suppliers and users of ecosystems services;
5. Green infrastructure management approaches aimed at restoring natural hydrological functions;
6. Adaptation to respond to unintended consequences;
7. Flexible systems focused on desired outcomes;
8. Green infrastructure such as reforestation, terraces and planting native species.

Economic Factors

1. Collaboration among a wide variety of interests, public and private interests & partnerships;
2. Economic opportunities for industry, small-scale enterprises, commerce and agriculture;
3. Demand management and improved efficiency as means to water and energy savings;
4. Better utilization of existing waterways, revitalization of urban waterfronts, mixed-use waterfront development;
5. Large-scale infrastructure balanced with small-scale innovations;
6. Increased water availability from recycling and pollution control & wastewater treatment;
7. Costs and benefits shared by upstream stewards and downstream beneficiaries;
8. Financing from multiple sources, including public and private investors.

Social Factors:

1. Active public participation in water stewardship and ecosystem restoration;
2. Grassroots people's participation in distribution of water for domestic use and irrigation;
3. Access to clean water and sanitation as a government priority;
4. Local community involvement in collecting solid baseline data and monitoring;
5. Clean public spaces created for meetings, recreation and tourism;
6. Improved livelihoods from job creation and small enterprises;
7. Empowerment through social mobilization of stakeholders;
8. Training and education provided to men and women on river rehabilitation and protection.



BENEFITS COMMON TO MANY OF THE WATER AND GREEN GROWTH PROJECTS

Environmental benefits from water and green growth projects include the following:

- **Improvement in Water Quality:** improved health of ecosystems, reduction in siltation and erosion;
- **Decontamination of surface and groundwater bodies:** lower levels of biological, agricultural and industrial contaminants; drastic reduction in water pollution;
- **Restoration of natural river functions:** maintenance of minimum flows; flood protection and drought reduction;
- **Restoration of fish and wildlife habitat:** higher level of biological diversity
- **Improved vegetation cover:** reforestation; recovery of degraded soils; planting along river banks
- **Recharge of reservoirs and aquifers;**
- **Reductions in CO₂ emissions.**

Economic benefits that have been identified in the water and green growth case studies include:

- **Engines of growth:** waterfront developments in cities; light industry and high tech development along waterfronts; sales of recycled products; growth in agricultural production;
- **Industrial expansion:** growth in industrial production, small-scale enterprises and handicrafts;
- **Increased efficiency:** more efficient irrigation systems and wastewater treatment systems; reduced wastage from distribution of water supply and from collection of sewage; recycling and reuse of water and wastewater;
- **Employment opportunities:** job creation from waterfront developments, small and medium-scale industries, ecosystem restoration, handicrafts with local products; sales of waste products;
- **Improved hydropower capacity;**
- **Fairer allocation of water among water-using sectors;**
- **Shared costs and benefits:** ecosystem service buyers and sellers;
- **Affordable green alternatives:** avoidance of investment for large-scale infrastructure;
- **Reductions in public expenditures:** savings on water treatment costs in municipal areas; reduction in public health expenditures and improved human productivity;
- **Mobilization of funds:** public and private sources, NGOs, multilateral and bilateral donors.

Social benefits that have been identified as a result of water and green growth projects include:

- **Access to clean water and sanitation:** reduction in time spent fetching water, decrease in the cost of drinking water; improvements in quality of life;
- **Health improvements:** reduction in water-borne diseases, higher productivity, higher school attendance;
- **Rehabilitation of clean public spaces:** improvements in landscapes; facilities for recreation, sports, tourism, education;
- **Improved livelihoods:** job creation; social entrepreneurship; agricultural production;
- **Training and education:** programmes available for men and women;
- **Empowerment to influence change:** participation in watershed management and decisions on water allocation; consultations; fairer water distribution;
- **Greater security:** water security for people in watershed areas, social inclusion;
- **Monetary and non-monetary compensation:** farmers and communities in the watershed receive payments or other compensation to protect the watershed and forest.

REPLICATION

Many of the lessons learned from the case studies have the possibility to be scaled up, particularly to the national level. This is certainly the case with examples of technologies and of water fund schemes, many of which started with small pilot studies. When the scheme is set up successfully and begins to provide the anticipated benefits, it can encourage others to participate. It is also possible for international organizations or NGOs to spread the word about successful technologies or approaches to neighbouring regions or countries. This has happened with the Water Funds in Latin America and the Caribbean and the expansion of the Alliance for Water Stewardship.

On the other hand, some of the large-scale infrastructure projects may be too ambitious to implement all at once without a considerable commitment and coordination of public resources. It may make sense in some countries to either scale down or break up these huge top-down projects to more manageable size. Considering the large investment involved and the importance of engaging stakeholders and mobilizing communities, it might be worthwhile to 'start small and scale up.' The programme can be gradually expanded after the

benefits and the costs are measured. Such projects might be reconsidered as a step-by-step process where the results are measured according to agreed benchmarks before expanding up to the wider river basin level, and ultimately to other river basins. The evidence shows that watershed management is a delicate balance of economic, social and environmental concerns, and will not be successful if simply imposed from the top.

Each water and green growth initiative is specific to the area and country where it is implemented. The case studies that were analysed provide some direction through the factors for success that have been identified in each category. Each one depends on political commitment, stakeholder engagement and enabling conditions based on well-crafted government policy and regulation. In particular, government policy should be flexible enough to encourage a variety of innovative solutions that can come from public institutions, NGOs, the private sector or individuals for implementation at local, national or international levels. One thing that has been demonstrated clearly from the case studies is that partnerships at all levels are crucial for success.



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4. DRAFT POLICY FRAMEWORK ON WATER AND GREEN GROWTH

Drawing on the common factors for success identified in the case study analysis, the Water and Green Growth project has drawn up a Draft Policy Framework for Water and Green Growth outlined in the matrix in **Table 2** on the next page. It should be stressed that the case studies reinforce the idea that economic growth and environmental stewardship can be complementary strategies, and do not require zero-sum trade-offs between these two objectives. In considering policies that can advance green growth, it is also important to note that the synergies between economic growth and conservation of the environment emerge best when there is not only a holistic approach that takes into account social factors, but also a long-term timeframe. This harks back to the original definition of sustainable development: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Water management from the green growth perspective must be undertaken in a holistic way and must consider future generations when defining available resources.

The Draft Policy Framework is based on the above principles and draws on the Korean experience in implementing a Green Growth Strategy. Suggested actions under each policy direction are being elaborated. Although a number of common elements for success have been identified, the case studies demonstrate that each country or region needs to select the appropriate policies for its own situation. As a background to economic growth, however, healthy ecosystems, sufficient water and biological diversity play a critical role as infrastructure not only in rural areas but also in urban areas where the population and the economy are growing the fastest. The maintenance or restoration of ecosystems should be considered as a priority for both public and private investments.

Under the first strategy ‘protection and conservation of water resources’, river or water basin planning is recognized as the foundation for designing water policy that reconciles economic growth, the protection of freshwater ecosystems and the

creation of jobs linked to the green economy. In consultation with major stakeholders, basin planners examine economic opportunities and address environmental and development challenges simultaneously. The protection of the source of water is the first step in a green growth programme. Payments for ecosystem services (PES) schemes have been identified as a tool used by many sectors, notably agriculture and forestry, to support rural livelihoods and restore damaged ecosystems. When successfully implemented they can help communities adapt to climate change and to preserve aquatic ecosystems. PES has also been used for income generation in rural areas and, thus, can be a means to green growth.

Under the strategy, ‘Water as an engine for growth’, the transition to green growth will involve: investments in green and grey infrastructure and better use of existing waterways; promotion of technology transfer and innovative green technologies; adoption of economic instruments to increase water availability and reduce wastage; and capacity building, information and enforcement mechanisms. It will also require increasing efficiencies in the production and consumption of water and energy to better use limited financial resources. Governments need to facilitate innovation and adoption of greener water and energy technologies, contributing to structural transformation towards green growth. Barriers to adoption of innovative tools and technologies, such as lack of access to finance, knowledge and patents, must be addressed. There are opportunities for developing countries to ‘leapfrog’ past traditional unsustainable patterns using information technology. Public-private partnerships will be essential to successful green growth strategies.

Under the strategy ‘water for an improved quality of life’, the desire to improve human well-being and social equity is at the heart of the approach to green growth. This implies investments in human and social capital in addition to investments in ecosystem protection and green infrastructure. A green growth approach must enhance access to clean drinking water and sanitation for the poor,

especially women, and encourage communities to participate in the management and protection of their own water resources. A common thread running through many of the case studies is that social mobilization is essential to the success of any green growth programme. By involving the stakeholders, better solutions can be reached on the fair allocation of resources and responsibilities. Green growth programmes will improve livelihoods and encourage social cohesion.

When considering a framework on water and green growth, it is important to take into account water governance issues and the predominant role of government in water management. At the same time, successful water and green growth projects have demonstrated a policy shift towards a more participatory approach, including multi-stakeholder platforms from the local level to the river basin level. In this way, the State is able to accommodate

more flexible and adaptive systems in its decision-making approaches in the water sector. River basin authorities or committees have also been able to provide a forum for education, knowledge sharing and awareness raising programmes.

Good policy, planning and governance take time to evolve through a process of trial and error, but the case studies in this report provide informative examples from one region that may be useful for policymakers in other regions. Good governance for a river basin requires an authority that can coordinate between stakeholders with competing demands and allocate water equitably among the competing uses of the basin, including agriculture, energy, urban water supply and industry. Of course in river basins that cross international boundaries, this may also require high levels of international negotiation and cooperation under transboundary basin authorities.

Table 2: Draft Policy Framework for Water and Green Growth

Strategies	Policy direction
1. Protection and conservation of water resources	1. Adopt river basin management plans using integrated water resources management (IWRM) principles
	2. Value ecosystem services to ensure their conservation (e.g. Payment for Ecosystem Services)
	3. Strengthen the capacity to adapt to climate change
	4. Ensure environmental integrity of the ecosystem and protect biodiversity
2. Water as an engine for growth	5. Promote technology transfer and invest in innovative tools to improve water and energy efficiency
	6. Revitalize and better use urban waterways and waterfront areas
	7. Adopt a package of economic instruments, including demand management and incentives for recycling and reuse of water
	8. Balance green and grey infrastructure among the competing uses – e.g., energy, industry, municipal, domestic, agriculture
3. Water for an improved quality of life	9. Empower people, especially women, to better manage their own water resources
	10. Promote access to clean drinking water and sanitation as a key to poverty alleviation, public health and quality of life
	11. Facilitate adoption of water and green growth through education and capacity development policies
	12. Build resilience among watershed communities to cope with water-related disasters

5. NEXT STEPS

The policy framework will be further developed by the project implementation team, led by its Steering Committee and advised by a High Level Panel of Experts (HLP). It is proposed that the outputs from the 6th World Water Forum, held in Marseille France in March 2012, including the policy framework, shall be taken forward with the support of the HLP.

The Water and Green Growth project will require the collaboration of a wide variety of key stakeholders, many of whom are already working in the area of water and green growth. These include UN-Water, UNEP, the United Nations Regional Economic Commissions such as UNESCAP, OECD, GGGI and national governments at all levels of economic development. As nations everywhere are looking to continue growing and developing their economies, the lessons learned by past mistakes in managing environmental resources can offer both cost savings and encourage more stable economies in the future. This means catalysing innovation and investment which will underpin sustained growth and give rise to new economic opportunities.

By the end of 2012, a revised report on Water and Green Growth will be issued taking into account the outputs from the 6th World Water Forum and other international events related to water being held in 2012, as well as feedback from the Steering Committee and HLP. The revised report will present a refined version

of the policy framework. This will then be promoted with the aim of getting several national policymaking bodies to adopt and test the framework.

The water and green growth approach will pave the way for the international community to collaborate on the enhancement of water management for greening development in times of uncertainty. The challenge over the next three years is to identify more case studies in areas and regions that were not covered so far, such as in water-scarce regions and in Sub-Saharan Africa. The transferability of the lessons from the case studies and policy framework should be tested in countries that are under water stress and would like to adopt water and green growth strategies.

The 6th World Water Forum in Marseille is only the beginning of a global effort to bring water and green growth to the attention of governments and other stakeholders. The joint Water and Green Growth project between the Korean Government (MLTM, PCGG, K-water) and the WWC is scheduled to continue until the 7th World Water Forum in 2015. Between the 6th and 7th Forums, the project will continue to identify case studies on water and green growth and will also monitor on-going projects already identified in the project report, and will feed into the 7th World Water Forum to be held in Daegu-Gyeongbuk, Republic of Korea in 2015.

References

- Asian Development Bank (ADB). 2010. Suzhou Creek Rehabilitation Project. Project information document 32121. Available at: www.adb.org/projects/project.asp?id=32121; accessed on 12/02/12.
- Global Green Growth Institute (GGGI), 2011. Green Growth in Motion: Sharing Korea's Experience. Available at www.gggi.org; accessed on 27/02/12.
- Grobicki, A. 2010. Managing water for green growth: Supporting climate adaptation and building climate resilience. COP 16 Publication, Global Water Partnership. 118–121.
- Kang, S. J. 2011. Green growth official development assistance (ODA) and sustainable development. Draft policy paper, not pub. Seoul.
- New York City, Department of Environmental Protection. 2012. The Staten Island Bluebelt: A natural solution to storm water management. Available at http://home2.nyc.gov/html/dep/html/dep_projects/bluebelt.shtml; accessed on 12/02/12.
- Organisation for Economic Co-operation and Development (OECD). 2011a. Towards Green Growth. Available at: www.oecd.org/dataoecd/37/34/48224539.pdf; accessed 12/02/12.
- . 2011b. OECD secretariat: Inputs to the Rio+20 compilation document. Available at: www.oecd.org/dataoecd/57/52/49030776.pdf; accessed 12/02/12.
- Presidential Committee on Green Growth (PCGG). 2009. 5-Year Green Growth Plan (2009-2013).
- United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 2009. Green Growth. Available at: www.greengrowth.org; accessed on 22/02/12.
- United Nations Environment Programme (UNEP). 2009. Overview of the Republic of Korea's Green Growth National Vision. Geneva.

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