WATER USE EFFICIENCY FOR RESILIENT ECONOMIES AND SOCIETIES ROADMAP

June 2017

High Level Panel on Water

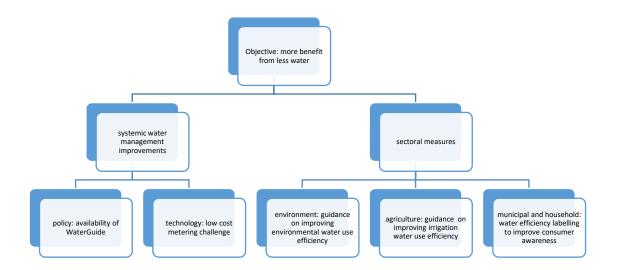
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A: Executive Summary

- 1. In adopting Sustainable Development Goal 6, member states of the United Nations have committed to "ensure availability and sustainable management of water and sanitation for all by 2030". Sustainable water management is also a key precursor to achieving many of the other Sustainable Development Goals.
- 2. The High Level Panel on Water (HLPW) was convened in 2016 by the United Nations Secretary General and World Bank President to mobilise effective action to accelerate the implementation of SDG6 and its related targets. In their Action Plan released on 21 September 2016, the High Level Panel "identified the impacts of water scarcity on economies and societies will rise if current trends in climate change continue..." (Annex 1). The Action Plan identified a set of possible actions to improve water use efficiency for resilient economies by encouraging and including new technologies and policy reforms. The Action Plan also contains several directly linked actions, such as on Valuing Water.
- 3. This Roadmap includes a set of practical measures to assist those governments and other entities seeking to improve their water use efficiency, with the objective of obtaining more benefit for their society from less water.
- 4. Under this Roadmap, a guide to improving water resource management and use under scarcity, will be made available to all countries seeking to improve their water use efficiency. This sets out policy measures that can result in enhanced system efficiency.
- 5. Under this Roadmap, a challenge will be launched to develop very low cost water meters that are reliable, robust, tamper proof, and could be suitable for use by small-holder farmers and city dwellers in locations where it is important to know water use at the enterprise or household scale.
- 6. Because agriculture is the largest water user, efficient and sustainable irrigation is necessary to achieve global food security goals. Under this Roadmap, practical guidance material will be available on how to improve water use efficiency in irrigation districts.
- 7. To assist those entities that are controlling water releases to the environment and are seeking to maximise environmental outcomes from every drop of water, or to use the least amount of water to achieve environmental targets, guidance material will be prepared on how to use water for the environment as efficiently as possible.
- 8. To attain improved water use efficiency at the household level, an ISO standard will be promoted which would require water efficiency labelling of appliances such as taps, toilets, showerheads, washing machines, and dishwashers so consumers of these products could make informed choices and industry to manufacture to recognised performance standards.
- 9. This Roadmap sets out proposed objectives, strategies, projects, timelines and responsibilities for assisting states and organisations to focus on measures to improve water use efficiency over the remaining period of the Panel's mandate until March 2018. The Roadmap sets out what needs to be done, why, how, when and by whom. Figure 1 provides a schematic representation of this Roadmap.

Figure 1. Elements of this water use efficiency roadmap.



B: Objectives

- 10. This Roadmap aims to assist governments and other decision-making entities seeking to enhance the resilience of their economies and societies, by maximising the benefits arising from effective management of their available water resources. Efficient use of water is most necessary in locations facing current or prospective water scarcity, where demand for water resources exceeds supply.
- 11. In this Roadmap, water use efficiency means getting the most amount of outcome from the least amount of water. Maximising the social benefits from the use of a limited quantity of water will also minimise the quantity of water used for a given social objective. For example if a social objective is to achieve a particular level of food production, then improved water use efficiency will allow that outcome to be achieved with the least possible amount of water, freeing up water for other purposes (which may be additional production) or to be not used at all if that is the society's preference. To be worthwhile, the benefits of the efficiency gain need to exceed the costs incurred in achieving it. However each society needs to work out what are its optimum efficiency outcomes, based on how the society 'values' the various potential uses of the water under its control. How these judgements can be made is the subject of the closely associated 'valuing water' actions of the High Level Panel on Water.

C: Approach

- 12. Measures under this Roadmap will support countries, sub-national bodies, enterprises and households that wish to improve their water use efficiency with practical tools for doing so while acknowledging each country has its own unique set of physical, social, economic, political, and environmental circumstances that will determine its optimum water use efficiency objectives and how it prefers to achieve this outcome. Preparation of this suite of tools is consistent with a key call from the Budapest Water Summit 2016 to "reduce water-related risks and strengthen resilience and increase the preparedness of societies necessary to adapt to climate change by raising public awareness and information through disseminating lessons learned and best practices."
- 13. Policy settings will generally create incentives for water users to improve their own water use efficiency of their own accord, or requiring water use efficiency improvements by regulatory measures. Such policies will generally work if water users also have information about how much water they are using, price signals, and access to new technologies appropriate to the circumstances of the water user.
- 14. The measures in this Roadmap will complement programmes that encourage states, the private sector and other water users to adopt a water stewardship approach to improve water use efficiency in human, agricultural, industrial and environmental uses, and regulatory policies which implement 'user pays' and 'polluter pays' principles. In the urban context, these measures will complement water use efficiency benefits from the adoption of Integrated Water Cycle Management (IWCM) representing a vision for contemporary water servicing based on principles of flexibility, diversity and integration. Further information about these and other related initiatives contributing to water use efficiency outcomes may be found at Annex 2 (Supporting Information).
- 15. Guidance material prepared under this Roadmap will be tested with multi-stakeholder dialogues, and with experts. Opportunities for this will be sought at any relevant international conferences.

16.Members of the HLPW will be invited to trial the guidance documents prepared under this Roadmap.

D: Systemic water management improvements through policy: availability of WaterGuide

- 17.To achieve improved water use efficiency requires a framework that assists water policy makers to develop a strategy for improvement over time. *WaterGuide* is offered by Australia as providing the elements of an organising framework for decision makers to:
 - diagnose strengths and weaknesses in current water planning, allocation and use arrangements;
 - design a practically focused action plan for improved water management driven by short-, medium- and long-term priorities;
 - identify the portfolio of policy and/or infrastructure investments that are most likely to deliver the desired outcomes and need to be developed and/or implemented; and
 - understand and communicate the benefits from, and interdependencies between, these investments.
- 18. Water Guide draws on, and combines, theory and practice drawing on the Australian experience of reforming water policy and management over the past three decades. In the course of its development, Water Guide was introduced to key stakeholders in the international water policy and management community including at the 2016 World Water Congress and 2016 Budapest Water Summit. Its development and objectives were discussed with senior experts at the International Union for Conservation of Nature, International Water Association, International Water Management Institute, Netherlands Ministry of Infrastructure and the Environment, Organisation for Economic Co-operation and Development, United Nations Department of Economic and Social Affairs, University of Oxford and World Bank. Feedback from these conference presentations, workshops and other independent reviewers was actively incorporated in the development of WaterGuide.
- 19. WaterGuide will be offered to at least two countries facing water scarcity for trialling as an Australian-funded Lighthouse Initiative. It is hoped that WaterGuide will provide a starting point for in-country dialogue about improved water use efficiency. Associated training materials will be tailored to the needs of the locations where WaterGuide is being used.

E: Systemic water management improvements through technology: reducing metering costs

- 20. Water use efficiency cannot be monitored at all without some form of measurement. Conventional water meters can be too costly for smallholder farmers and urban residents to acquire, install and maintain. Understanding the volume of water used, for example, in irrigation applications is critical to understanding whether crop water needs have not been adequately met (productivity is reduced) or exceeded (water has been wasted). In urban systems, metering enables supply system efficiency to be determined and informs planning for necessary maintenance and refurbishment.
- 21.Relevant sources of challenge funds for innovation in water technology and in metrology will be approached about contributing to the launch of a a challenge that would reward the invention or development of lower cost water meters or other devices for measuring the volume of water use to be more affordable for smallholder farmers and poor municipal households or their service providers to buy, install and operate. An objective may be to halve the current lowest costs. Experts and stakeholders will be consulted on the definition of the challenge, including whether

to prioritise on- and off-farm use, surface or groundwater, irrigation or rain-fed systems or municipal use, and the degree of measurement accuracy that should be required.

F: Sectoral measures for agriculture: improving irrigation water use efficiency

- 22. Agriculture commonly uses 70-90% of freshwater resources in most countries. Where water scarcity exists, more than 90 per cent of water consumption on average goes to irrigated agriculture. Actively improving water use efficiency in irrigated agriculture is critical because agriculture will need to produce 60% more food globally by 2050, and 100% more in developing countries, using diminishing water resources.
- 23. Policies to promote improved efficiency of agricultural water use almost invariably leads to improvements in the economic productivity of water, with consequent improvements to local and regional economic performance.
- 24.A feature of agricultural water use is that a large share of allocations for agriculture can be lost to food production or other beneficial uses through evaporation and non-productive seepage. There are considerable opportunities to reduce these losses from improving the design and management of channels and other distributions systems which deliver water to the farm, and by improving on farm systems delivering water to crops, while not eroding beneficial return flows. There are policy, funding and technical challenges in meeting these multiple objectives.
- 25.A starting point for improved water use efficiency in agriculture is an understanding of current and predicted future groundwater and surface water supply and demand. A systematic, reliable and transparent method for assessing water supply and demand and establishing a water balance in a river or a region is an important starting point, along with managing the link between crop water demands and water supply at any point in the farm production cycle. There are current agreed systems and processes for this purpose which are further promoted under the World Water Data Initiative of the High Level Panel on Water. This kind of assessment can then inform the need for further investment in measures to augment supply (including from recycling and reuse) and the use of economic instruments and other measures to influence demand.
- 26. Guidance material will be prepared aimed at providing practical advice to governments and to irrigation district operators on how to identify non-productive losses from seepage and evaporation, and means for reducing these losses at the lowest possible cost. This will be informed by experience in different Australia where basin accounting and widespread modernisation of irrigation has occurred in the past ten years, with costs and benefits shared between the Government and users. In the example of the Trangie-Nevertire Irrigation District in the Murray-Darling Basin given in the attachment, benefits included improved delivery efficiency (from the river offtake to the farm gate) from 65% to 93%, resulting in local economic gains while also increasing beneficial flows to the local and regional environment from agricultural-use water that was no longer needed for crop production.

G: Sectoral measures for the environment: improving environmental water use efficiency

27.In places where water is supplied for environmental assets such as wetlands can be controlled, there are considerable potential efficiency opportunities from improved water management techniques. The benefits may manifest in gaining improved environmental outcomes from a given volume of water or if environment targets are predetermined, then attaining those targets with less water, freeing up surplus water for other uses.

28.Guidance material will be prepared to assist water managers to get the best possible environmental value from managed water flows. This will be informed by experience in Australia where the Commonwealth Environmental Water Holder works with State Government water managers to achieve this result in the most water efficient way.

H: Sectoral measures for municipal and household users: water efficiency labelling

- 29. There is considerable potential to improve water use efficiency by households if straightforward technological changes are made to domestic fixtures and fittings. The replacement of inefficient taps, toilets, showerheads, washing machines, and dishwashers with more efficient models can have significant effects on water consumption in the home, reducing per capita consumption significantly. Australia, China, Ireland, Israel, New Zealand, Singapore and USA now have water efficiency labelling requirements which empower consumers to make choices favouring more water efficient appliances. Water efficiency benchmarking and labelling is leading to market transformation, as industry better understands the costs and benefits associated with efficiency savings. This is driving innovation and resulting in a steady improvement in the efficiency of technology across a range of industry sectors. Labelling also offers businesses a platform to communicate their commitment to corporate social responsibility especially in industries that traditionally have high water-use.
- 30. Australia's Water Efficiency Labelling and Standards (WELS) scheme has been found to be highly effective in meeting its objectives of conserving water supplies, providing consumers with water efficiency information and promoting the adoption of water saving technologies. Recent research found that 87 per cent of Australian consumers recognised the WELS label, and estimated that by 2030 the scheme will have permanently reduced domestic potable water use by at least 200 GL per annum (more than 8 per cent of total household water consumption), also reducing household water and energy costs.
- 31. Australia's WELS scheme is underpinned by a national standard that specifies requirements for the rating and labelling of products for water efficiency. This standard is proposed to be used as a starting point for an international standard through the International Organization for Standardization (ISO). Enough countries have now agreed to pursue the standard for a standardised water efficiency labelling scheme to authorise its development through the ISO. An international standard would make it easier for countries to implement their own urban water efficiency programs, providing a basis for the rating and labelling of water-using products which can be used to inform consumers or to set minimum national standards. Establishing a single international standard would also provide greater incentives for manufacturers to provide more water efficient products, knowing their efficiency claims would be recognised world-wide.

I: Work Plan

32.July-August 2017:

- Australia to disseminate WaterGuide globally and to consult with all HLPW members on trialling of WaterGuide
- Australia to consult with ISO on best mechanism to progress the WELS ISO
- Australia to prepare workplan for the Irrigation Water Use Efficiency Guide
- Australia to prepare workplan for the Environment Water Use Efficiency Guide
- Deliverables:
 - Water Use Efficiency Roadmap submitted to Sherpas for endorsement as being consistent with the HLPW Action Plan
 - WaterGuide disseminated globally

- o Agreement with two HLPW members on WaterGuide trials.
- Workplan finalised for preparing Irrigation Water Use Efficiency Guide
- o Workplan finalised for preparing Environment Water Use Efficiency Guide
- o Agreement with ISO on way forward with WELS ISO.

33. August-September 2017:

- Australia to settle work plans for implementation of WaterGuide trials with the trialling countries
- Australia to commence preparation of Irrigation Water Use Efficiency Guide
- Australia to commence preparation of Environment Water Use Efficiency Guide
- ISO next steps (to be advised)
- Deliverables:
 - o Work plan for the implementation of Water Guide trials
 - ISO next steps (to be advised)

34.September-October 2017:

- Trialling countries commence WaterGuide trials
- Australia convenes stakeholder workshop on irrigation water use efficiency guide
- ISO next steps (to be advised).

35.October-November 2017:

- Australia finalises Irrigation Water Use Efficiency Guide and consults all HLPW countries on trials.
- Australia finalises Environment Water Use Efficiency Guide and consults all HLPW countries on trials.
- ISO next steps (to be advised)
 - o Deliverable: Draft training material for guidance on water use efficiency.

36. November-December 2017

- Australia convenes stakeholder workshop on environment water use efficiency guide.
- Commence trialling of Irrigation Water Use Efficiency Guide.

37. November 2017-March 2018

- Commence trialling of Environment Water Use Efficiency Guide.
- Preparation of Report on Water Use Efficiency for the HLPW, drawing on trials to date.

J: Responsibilities and exposure opportunities

38. Responsibilities:

- Lead HLPW member: Australia
- HLPW partners: Netherlands, Tajikistan.
- Australian project lead agencies:
 - WaterGuide: Australian Water Partnership
 - o Meter challenge: Department of Foreign Affairs and Trade
 - Irrigation Water Use Efficiency Guide: Department of Agriculture and Water Resources
 - Environment Water Use Efficiency Guide: Commonwealth Environmental Water Holder
 - Water Efficiency Labelling International Standard: Department of Agriculture and Water Resources.

39.Exposure opportunities

- Regional Water Conference Dhaka 28+29 July 2017 (possible launch)
- World Water Week Stockholm 27 August- 1 September 2017 (possible launch, stakeholder and expert engagement)
- UNGA 17 New York 12-25 September 2017 (possible launch, feature in any HLPW Communique)
- Asia International Water Week, Gyeongju, Korea, 20-23 September 2017
- International Commission for Irrigation and Drainage Conference, 8-14 October Mexico City
- Asia-Pacific Water Summit, Myanmar, November 2017 (broader take up to be sought)
- World Water Forum Brazil March 2018 (report on progress and outcomes)

Annex 1: HLPW Action Plan extract **Annex 2:** Supporting information

High Level Panel on Water: Action Plan: Extract

Resilient Economies, Societies, and Disaster Risk Reduction

CHALLENGES

A growing economy is a thirsty economy

Water is central to sustainable development and achieving the broader development goals on poverty reduction, food, energy, cities, and health. Policy and decision makers face tough political choices and trade-offs in allocating water resources across competing demands, as well as in maintaining the quality of water for today and future generations.

The impacts of water scarcity on economies and societies will rise

If current trends observed in climate change continue, water scarcity will worsen in many countries where it is already a significant problem, and will extend to new areas. There will be more frequent / severe droughts, accompanied by worsening economic and societal shocks, unless planned for and mitigated well in advance. Changes in human populations and settlements, as well as increasing demand for agriculture purposes will exacerbate scarcity problems, as will poor decisions on water allocation and use. 45% of total GDP is projected to be at risk due to water stress by 2050. Water scarcity can also be a key factor in migration, contributing to people leaving a place, but scarcity can also be caused by or exacerbated by the arrival of migrants. Unequal access to water and sanitation for women and girls increases morbidity and undermines productivity.

Water is life but also a threat to life

During the past decade, water-related disasters have not only struck more frequently but have also been more severe, hampering sustainable development by causing political, social, and economic upheaval in many countries. Global economic losses from natural disasters are now estimated at between US\$ 250 billion and US\$ 300 billion each year. Sea-level rise can multiply the impacts of storms by creating devastating tidal surges, often aggravated by land subsidence caused by urban construction, groundwater extraction, and the alteration of sedimentation dynamics.

There is a need for new approaches to economic development and infrastructure planning

In many countries and regions, options to build new water supply infrastructure, will be necessary but also constrained because systems are approaching hydrological and ecological limits and/or are becoming less reliable under climate change. Building resilience to scarcity and drought will need to be seen as an integral component of water security planning for economic growth, with innovative allocation and demand-side policies complementing the traditional approach of building additional, or more reliable, water supply infrastructure. New design development and investment strategies will need to be identified, to build resilient infrastructure that will help "future proof" nations' economic interests — and in today's inter-connected world our global supply chains.

Reducing the impact of water-related disasters is critical to achieve sustainable development

Water-related disasters can disrupt the lives of citizens, wipe away many years of development gains and cause political unrest. Water-related disaster risk reduction requires preventive investments and effective emergency response measures weaved into long-term planning. Solutions, policies and tools to address water-related disasters need to be considered in and integrated into sustainable development strategies.

Addressing SDGs 6.4, 9.1 & 11.5

POSSIBLE PRIORITY ACTIONS

- 1. Initiate an analysis of (i) water crises risks (scarcity, water quality and excess water) from climate change and extreme weather events in areas identified as most vulnerable (ii) good practices on managing mega floods and droughts, including validation of investment for water-related DRR.
- 2. Encourage the UN to create a platform where states can share and exchange lessons and good practices for addressing water-related disasters and translate them into solutions that can be promoted globally.
- 3. Encourage states and organizations to focus on measures to improve water use efficiency for resilient economies (agriculture, energy, industry), climate action and human settlement, by encouraging and including new technologies and policy reforms. Initiate/ launch a Challenge inviting the international community to present innovative solutions to improve the efficiency of water use.
- 4. Encourage the academic community to maximize the use of existing knowledge and create knowledge base and tools for better understanding the impacts of water-related disasters and facilitate decision making for prevention and mitigation of risks.

. Call for implementation of projects to strengthen water security and the economic resilience of negatively marginalized communities, with a focus on impact for women, girls and people with disability within those communities.

Supporting Information

Water-use efficiency and the Sustainable Development Goals

- 1. Water is central to sustainable development and achieving the Sustainable Development Goals. Policy and decision makers can face tough political choices and trade-offs in allocating water resources between competing demands, as well as in maintaining the quality of water for today and future generations. Often overlooked in water management debates, maintaining water quality so that it is always 'fit for purpose' is an integral part of improving water use efficiency.
- 2. Climate change and rising competition for water is increasing water scarcity in many regions and increasing the vulnerability of rural communities. Globally, agriculture is by far the largest consumer of water and the demand for water is increasing due to the rising demand for food and animal feed. Accessible and high quality freshwater is a limited and highly variable resource. OECD (2012) projections show the number of people living in water stressed river basins is expected to increase sharply, from 1.6 billion in 2000 to 3.9 billion by 2050, or more than 40% of the world's population. Over-abstraction and contamination of aquifers worldwide will pose significant challenges to food security, the health of ecosystems and safe drinking water supply, and increase the risk of subsidence, among other consequences. In 2000, at least 1.1 billion people 18 per cent of the world's population lacked access to safe water. If present water consumption trends continue, the number will have more than doubled by 2050. (OECD 2006).
- 3. Many countries, states/provinces and municipalities must urgently address the challenge to protect and improve the management of water resources and increase water use efficiency. The World Bank notes that 45% of total GDP is projected to be at risk due to water stress by 2050 and that a component of this water stress is that physically available water in some locations is unusable due to it being polluted. It also calculates that the negative effects of water scarcity on the economies of East, South and Central Asia in 2050 could be reversed through the adoption of efficient water policy regimes that incentivise more efficient allocation and use of water. (World Bank 2016).
- 4. Sustainable Development Goal 6 includes the target to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity as well as improving water quality and implementing integrated water-resource management. The HLPW has noted, "the impacts of water scarcity on economies and societies will rise if current trends in climate change continue". The HLPW Action Plan presents a set of possible actions to improve water use efficiency for resilient economies (agriculture, energy, industry) climate action and human settlement, by encouraging and including new technologies and policy reforms".
- 5. Achieving resilient economies and societies, made more difficult by climate change, growing populations, increasing food demand, and growing awareness of the need to allocate water for environmental and cultural use, means balancing competing demands, managing scarcity over time, and making best use of available supplies. This requires a continual focus on encouraging and facilitating improvements to water use efficiency, informed by awareness of the real value of water.

The case for improving water use efficiency

- 6. Implementing policies for improving water-use efficiency and achieving water productivity gains are core business for government but can also be extremely valuable for the private sector. Benefits can range from more secure food production in the face of variable water supply, better land-use planning; better use of information for improving business efficiencies (such as medium-term weather forecasts); improved irrigation or industrial process scheduling to account for rainfall variability; more reliable operation of sanitation and environmental infrastructure assets; and conjunctive management of various sources of water to improve supply reliability, including water of poorer quality where appropriate.
- 7. However, government policies and incentives to promote water-use efficiency do require interventions that can be significant, including shifting the status quo for access to water to the disadvantage of some users. This is particularly the case where using pricing policies to promote economic productivity of water is perceived as reducing equity of access to water, including for public good purposes. However pricing policies alone are rarely sufficient to promote water use efficiency and productivity whilst also ensuring adequate public good access to water. The key policy initiative is to place a transparent value on water use and supply and to then be able to estimate the costs of providing water if an existing source were to become unavailable. The costs and benefits of investments in improving water use efficiency compared to providing a new source of water at similar volume, quality and reliability can then be assessed.
- 8. For improved economic resilience, water managers may implement a range of interventions appropriate for the circumstances, particularly those initiatives that incentivise productivity growth arising from improvements to water supply volume, reliability and quality, at an affordable price to water users. The investment in water infrastructure and water management capacity building usually required by governments to achieve this, whilst often large, is almost always within reach of most nations and has been demonstrated to contribute significantly to increased production and productivity within a wide range of economic sectors (SIWI 20041). Importantly, policies to improve water-use efficiency and productivity do not necessarily have to preference larger commercial interests. These policies can be designed to benefit the poor, the small and the vulnerable.
- 9. Balancing competing demands (agriculture, industry, cities, energy, and environment), making the best use of available water resources and managing the changes in supply and demand over time require attention to three types of efficiencies. Action is required to ensure optimal allocation between different users (allocative efficiency), the least amount of water is used per unit of output (productive efficiency) and water allocation and use is sustained and improved over time (dynamic efficiency). Underpinning these actions is a requirement for sound knowledge of the water supply sources, including re-use, desalination, and the hydrology of relevant catchments, their yield variability, and scale/direction of consumptive use.

Water use efficiency and water governance

10. A water crisis is often a governance crisis. A central focus of water governance is water use efficiency in all sectors (requisite for sustainable management especially in a context of climate change and uncertainty) and in relation to water institutions and procedures which should normally support the achievement of water outcomes with efficient use of all resources.

¹ http://www.siwi.org/wp-content/uploads/2015/09/waterandmacroecon.pdf

- 11. The OECD Principles on Water Governance, for example, contribute to tangible and outcomeoriented public policies, based on three mutually reinforcing and complementary dimensions of water governance:
 - **Effectiveness** relates to the contribution of governance to define clear sustainable water policy goals and targets at all levels of government, to implement those policy goals, and to meet expected targets.
 - **Efficiency** relates to the contribution of governance to maximise the benefits of sustainable water management and welfare at the least cost to society.
 - Trust and Engagement relate to the contribution of governance to building public confidence and ensuring inclusiveness of stakeholders through democratic legitimacy and fairness for society at large.
- 12. According to the OECD, an effective governance system is ultimately one that helps manage "too much" "too little" and "too dirty" water in a sustainable, integrated and inclusive way, at an acceptable cost, and in a reasonable timeframe. Implementing the OECD Principles requires a systemic and inclusive approach and need to be reflected in overarching water policy cycle and regulations. Effective, efficient and inclusive water governance is a shared responsibility across all levels of government and in co-operation with all relevant stakeholders to meet current and future water challenges.

Water-use efficiency in Agriculture

13. G20 Agricultural Ministers have agreed:

"Water is an essential production resource for agriculture and is therefore critical for feeding the growing world population. We highlight that agriculture, comprising crop production, livestock and aquaculture, accounts for about 70 percent of global freshwater withdrawals. Agricultural water-use efficiency will need to improve if water availability is not to limit capacity for increased global food production."....

We underscore that farmers need **sustainable supplies of water** and need to manage agriculture's impact on water supplies to ensure sufficient quantity and quality of water across the watershed. Given the growing competition for water supply between agriculture and other actors, we therefore aim at **coordinated action** and **policy coherence** for **improving water governance** across sectors, in particular with regard to extraction, distribution, recovery and application systems. We aim to improve **water-use efficiency** in agriculture through improved policies with due regard to regional and local conditions. (G20 Agricultural Ministers' Declaration 2017)

14. The Budapest Water Summit 2016 conclusions included:

"Efficiency gains leading to water savings are possible in all agriculture sectors including crop production, livestock, fisheries, aquaculture and forestry; across the value chain; in domestic and industrial uses; and in capture, production, storage, and distribution systems, including a reduction in food waste".

(Policy Recommendations B1)

15. Women contribute significantly to agriculture worldwide, and they comprise on average 43% of the agricultural labour force. (FAO 2011) The number of women responsible for farming and food production for the family is increasing as men from agricultural-based economies move to cities to find employment. This "feminisation" of agriculture results in additional farming

- responsibilities being placed upon women, who are already typically managing their families and caring for children.
- 16. Yet, the laws and/or customary practices of many countries still deny women an equal right to access land. This is compounded at the point of inheritance. As a consequence, women's economic opportunities overall are hindered, as well as their ability to use and manage water resources for small-scale farming and other agricultural activities. Processes need to be put in place to empower women to participate in water allocation policies/schemes so that existing inequalities and discrimination are not perpetuated by water allocation, trading, or pricing policies.
- 17. Because water is a critical input for agriculture, there is a need for that access to be defined, enabled, secure and enforced. Secure, legally enforceable access to water provides farmers with certainty and confidence in relation to their ability to access water and invest in their farm enterprise. Knowing that water will be available in specific volumes depending on prevailing conditions enables farmers to buy new varieties of seed or invest in equipment and all users to assess the potential benefits of improvements to the efficiency with which they use water. The three main instruments for ensuring access to water is defined, enabled, secure and enforced are: water licences or entitlements; water supply infrastructure; and reliable water use metering.
- 18. The creation of an enforceable system of water licences or entitlements, within a designated cap on total water abstractions, both limits and underwrites access to water for individual users. At least 37 countries have a rights-based allocation regime in place (Richter, 2016). Although these rights-based allocation regimes may be supported by data of highly variable quality and enforced with varying degrees of stringency, they nevertheless offer a degree of economic benefit and certainty that will likely improve over time as governments and water users increasingly understand the benefits.
- 19. Securing access to water for water rights-holders depends on the availability of affordable storage, bore and distribution infrastructure. It is also important that investments in infrastructure are targeted and take into account the water supply variability and particular local conditions prevailing in a given region and the impacts of such infrastructure on other parties. For regions where large numbers of individual irrigator smallholders tap into a single complex canal network, investments in smart gate technology that enables rapid adaptation to changing circumstances may be justified. Whatever the chosen infrastructural approach to water management, it is imperative that physical structures facilitate rather than frustrate the relationship between the system manager and the individual water user. Whatever the physical infrastructure of water supply and control facilitates, it is important that it secures expected access to water for all users in that system.
- 20. Appropriate water use metering is essential to monitoring water use and enforcing abstraction limits established by water entitlements or licences. A risk-based approach to metering and enforcement is likely to deliver the highest value for water managers with the least expenditure of time and resources. There is also scope to improve water meters, make them more reliable, robust, and tamper proof as well as inexpensive.

An example of Irrigation system modernisation

Commencing in 2008, the Australian government began to invest in upgrading the water use efficiency of major irrigation systems with a focus on the Murray Darling basin. In one medium sized scheme (The 'Trangie-Nevertire irrigation scheme' on the Macquarie River, New South Wales), the economic benefits of the investment have been closely assessed and modelled. In return for the Australian Government investment in improving water use efficiency at district level, farmers transferred 40% of the scheme's water entitlements to the government to improve environmental health of the local river system, reduced the scheme's irrigation network area by one third, installed water efficient irrigation systems on 20 farms, lined supply system channels to reduce leaks and seeps, installed remote control operation of the network, reduced total supply channel length by one third, and installed a 229 km stock and domestic pipeline servicing 85 properties so that large irrigation supply channels were not having to provide domestic supply.

The modelled outcomes (based on real data over 14 years to 2013 but not yet independently verified) of the impact of modernisation of the Trangie-Nevertire irrigation network are:

- Reducing seepage and evaporation by improving delivery efficiency from the river offtake to the farm gate from 65% to 93%;
- While the farm water entitlement volume was decreased by 40% the total water delivery to the farms in the network was reduced by only 23% due to the improvement in delivery efficiency;
- Increased total water delivery volumes to the farm gate on average per irrigator, particularly
 in low allocation years, and additional years of water delivery post-project where no
 delivery was possible in dry conditions before the project;
- Increased physical water at the crop root zone for irrigators including an increase in water delivery per irrigator of 37% (there is less water overall in the network but also less farmers irrigating which results in an increase in available water per remaining irrigator);
- Large farms with on-farm works were modelled to irrigate two additional cotton crops and produce an additional 46 ha of cotton per year;
- Small farms without on-farm works are modelled to irrigate two additional cotton crops and produce an additional 19 ha of cotton per year;
- Small farms with on-farm works are modelled to irrigate two additional cotton crops and produce an additional 10 ha of cotton per year;
- Strong improvements in overall farm revenues, with good potential for ongoing economic benefits for the broader irrigation community. The Trangie scheme was modelled to have a pre-project average annual loss of around \$61 million but a post-project profit of around \$68 million across 14 years a \$129 million difference.
- The water entitlement transferred to government for the environment has been used every year for achieving benefits in regional wetlands and other in-stream environmental assets including water for stimulating fish and bird breeding.

Water Use Efficiency in Cities

- 21. Cities and towns are melting pots of a complex mix of infrastructure and sectoral administrative and governance systems. Key sectors include energy, water and transport and efficiencies in each of these sectors are complex and have dynamic inter-relationships associated with the broader efficiency use of resource, infrastructure investment and service delivery. Therefore, in terms of water use efficiency in cities, it is not a simply a matter of efficient water consumption but should also include consideration efficiencies in (i) sourcing and production of water that is fit-for-purpose; (ii) capital and operational expenditures in water services delivery; and (iii) balancing the nexus between water and energy.
- 22. There has been a major improvement in water use efficiency in many cities. Strategies for water use efficiency in cities stem from a combination of supply and demand initiatives, including diversity of water sources (such as effluent and stormwater re-use, and desalination) in concert with fit-for-purpose water production, industrial ecology and the concept of urban metabolism on resources (water-energy-food nexus) all applied at a range of scales.
- 23. A fundamental premise is that cities and towns are water supply catchments, that is, meaning that cities have inherent a diverse sources of water which should be harnessed. The diversity of water sources of water found within cities include pre-dominantly rainwater, stormwater, recycled wastewater, and desalinated water). Diversity of infrastructure (i.e. centralised and decentralised systems) will be necessary to support a fit-for-purpose framework for matching water usage to water quality. Rethinking approaches to city water supply around such a framework may hold the key towards ensuring greater resilience of cities to greater climate uncertainties in the occurrences and severity of future drought conditions. A combination of emerging technologies and reform of conventional regulatory framework for water supply will be required to support this endeavour.
- 24. Demand management is the other side of the ledger in building a more resilient water supply system for cities. Community education to raise water literacy is fundamental as is community inclusiveness in formulating appropriate supply-demand strategies for water supply resilience in cities. Smart metering, big data analysis and public communication are useful tools for building the social capacity for water demand management and appropriate, safe fit-for-purpose water uses. Recent efforts in overcoming water shortages in any cities in Australia included water restrictions and community engagement in water conservation behaviours. Water restrictions is an instrument of last resort and a recent estimate of the impact of water restrictions in Australian cities shows a cost of \$1 billion annually (2008 estimate). However, the social capital built when applied in conjunction with extensive community engagement has meant that many inhabitants in cities have subsequently become a lot more water wise in their behaviour, even when drought conditions have ceased. Melbourne, for example, is now using about 35-40% less water per head than in the 1990s. This is an important achievement which has relied on a mix of regulation, incentives and behaviour change techniques.

Achieving Water Savings in Cities: The Experience of Sydney in the Millennium Drought

Demand Management

- Residential water efficiency 3 star shower heads, tap flow regulators, Do it-yourself kits, toilet replacement, washing machine rebates
- Every Drop Counts Business Program industrial, commercial and government water efficiency – water audits, Best Practice Guidelines, management diagnostics, target large and small users, Benchmarks.
- Loss reduction Leakage management, pressure management
 Regulatory
- Water efficient labeling and standards scheme (WELS)
- Water efficiency management plans 20% reduction target for large business users > 50 ML/y
- Urban planning regulation The Building Sustainability Index (BASIX)
- Water restrictions

Pricing

Alternative Supply sources – recycling and dam transfers

Community outreach – industry, government, business and financial intermediaries

Source: Mohan Seneviratne, Climate Business Group, IFC

Water for the environment

- 25. Ecosystems across the world, particularly wetlands, are in decline in terms of the sustainability services they provide. Improving water use efficiency needs to include consideration of the environment and what it can provide, including avoidance of costs in generating clean water. The environment is a legitimate user of water and environmental water requirements need to be determined. Maintaining water flows for the environment is not only essential to ensure the survival of the ecosystem on which life depends but also to protect freshwater supplies from salinization or pollution due to poor water management.
- 26. Participation of all stakeholders including rural women, who commonly act as grassroots ecosystem mangers, is essential to integrate knowledge, including indigenous knowledge, to protect the ecosystem and access to water for all. The water stewardship approach provides one mechanism that involved stakeholders, including industry in a catchment or river basin to manage their water resources and protect their environment. A participatory approach backed with good legislation and regulations can help achieve water sue efficiency that include the environment.
- 27. Improved management and treatment of wastewater is also essential to maintain water quality. Poor water quality through pollution contributes to water scarcity and higher costs including social costs which are most often born by poor people. Water use efficiency includes reducing or eliminating pollution, proper treatment of wastewater and protection of river catchments and wetlands as they are important to maintaining water quality.

Water use efficiency in the energy sector

40. The energy sector is a significant water consumer especially for power plant cooling. In recent years at the height of hot dry summers, thermal power plants in Europe, North America and India

have been forced to reduce production or to shut-down owing to scarcity of cooling water. The World Bank (2016) has noted that water withdrawals for energy production are expected to increase by 20 percent by 2035. This reflects the predicted increase in global energy demand by one third by 2035, with demand for electricity to grow by 70 percent over the same period. (IEA 2013) Hydropower on the other hand is generally non-consumptive but can require large reserves of water reservoirs, which may or may not be available for other uses at certain times. In these cases, allocative efficiency could ensure supply to thermal power stations. Hydropower dams also can have substantial implications for river ecosystems and can impact of fish and other food production. A shift to solar photovoltaics and wind power will help reduce water demand and are the most sustainable forms of power generation.

- 41. Growing populations and changing food consumption patterns are also increasing demand on water for food and for energy. Energy is the costliest ingredient required to supply safe drinking water and restore water to sufficient quality to enable it to be directed back into ecosystems. Similarly, irrigation and all agricultural processes are highly energy intensive. (ADB 2016).
- 42.Improving water use efficiency in energy production and in food production is critical to sustainable development. Improving water use efficiency can also reduce input costs for energy and agricultural production, as well as delivering cost effective water and sanitation services to cities. Improved water use efficiency will depend on achieving allocative efficiencies as well improved recycling and reuse of water resources, especially in power production. A nexus approach to energy-food-water acknowledges the interlinkages and dependencies and recognises the trade-offs between sectors. Trade-offs can be ameliorated through informed water allocation, improving water use efficiency and prudent stewardship of the resources, as well as promoting new technologies, such as Climate Smart Agriculture, and infrastructure that can ease supply constraints, protect assets and facilitate improved water management. (World Bank 2016)

Water use efficiency by industry

- 43. There is growing interest and commitment in industry, both primary and secondary, to a water stewardship approach, a method to benchmark and create globally recognised standards and certification process in sustainable water use. The international Alliance for Water Stewardship (AWS) states its aim as "to lead a global network that promotes responsible use of freshwater that is socially and economically beneficial and environmentally sustainable achieved through a stakeholder inclusive process that involves site and catchment based actions". AWS is working to achieve this through a global water stewardship system that connects and motivates leading organizations, and an internationally endorsed standard that drives, recognizes and rewards good water stewardship performance.
- 44. When the UN adopted the SDGs it was made very clear that the private sector had a critical role in their achievement. The SDGs call for a fundamental shift in our relationship to water and, as the largest water user, the private sector should be front and centre in this effort. The AWS Standard has a significant role to play in engaging the private sector in the SDG agenda, most notably the eight targets in SDG 6. The ubiquitous nature of water means that the AWS Standard also touches each of the other 16 SDGs. The AWS Standard provides a clear and independently verifiable route for businesses looking to ensure that their actions on water are aligned with the ambitions of the global development community.
- 45.AWS is currently developing a case study on the applications of the water stewardship approach in an industrial park in China to reduce waste discharge and increase water recycling and water

use efficiency. The project will be considered as a possible Lighthouse initiative on the application of Water Stewardship.

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