



Ministry of Water Resources and Irrigation
Arab Republic of Egypt

The Second National Water Resources Plan 2017 - 2030 - 2037

**ENHANCE
AVAILABILITY
OF FRESHWATER
RESOURCES**

**WATER
SECURITY
FOR ALL**

**IMPROVE
WATER
QUALITY**

**IMPROVE
ENABLING
ENVIRONMENT
FOR IWRM**

**RATIONALIZE
WATER
USE**

2021

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Abbreviations and Terminology

ARE	Arab Republic of Egypt
ASME	Agricultural Sector Model for Egypt
BaU	Business as Usual
BCM	Billion Cubic Meters
BCWUA	Branch Canal Water Users Associations
BLE	Billion Egyptian Pounds
BOD	Biological Oxygen Demand
CMU	Crisis Management Unit
DO	Dissolved Oxygen
DRI	Drainage Research Institute
DWB	District Water Board
EEAA	Egyptian Environmental Affairs Agency
ET	Evapotranspiration
FOREX	Foreign Exchange
FYP	Five Year Plan
GDP	Gross Domestic Product
GoE	Government of Egypt
HAD	High Aswan Dam
HCWW	Holding Company for Water and Wastewater
IAA	Integrated Agro-Aquaculture
ICDS	Information and Decision Support Center
IFI	International Financial Institution
IWRM	Integrated Water Resources Management
LE	Egyptian Pound
MALR	Ministry of Agriculture and Land Reclamation
MCA	Multi-Criteria Analysis
MoEnv	Ministry of Environment
MoF	Ministry of Finance
MoHP	Ministry of Health and Population
MoHUUC	Ministry of Housing, Utilities and Urban Communities
MoLD	Ministry of Local Development
MPED	Ministry of Planning and Economic Development
MoT	Ministry of Tourism
MoTI	Ministry of Trade and Industry
MPWWR	Ministry of Public Works and Water Resources
MWRI	Ministry of Water Resources and Irrigation
NBI	Nile Basin Initiative
No3	Nitrate
MoIC	Ministry of International Cooperation
MoFA	Ministry of Foreign Affairs
NPV	Net Present Value
NWRP	National Water Resources Plan
pH	Power of Hydrogen
PoM	Programme of Measures
SDGs	Sustainable Development Goals
SDS	Sustainable Development Strategy
SNWRP	Support to National Water Resources Plan
TDS	Total Dissolved Solids
UNEP	United Nations Environment Programme
WUA	Water Users Associations
WWTP	Waste Water Treatment Plant
Feddan	Area unit of 0.42. ha
Governorate	Second government level (province)
Marwa	Small on-farm irrigation water conduit
Mesqa	Lowest (tertiary) level of irrigation canals
New lands	Lands reclaimed from the desert
Upper Egypt	Nile Valley upstream of Asyut

Executive Summary



This document comprises the Second National Water Resources Plan 2017 – 2030 – 2037. The Plan itself covers the period 2017 – 2037 into which the intermediate years 2020 and 2030 have been added.

The year 2030 has become an important milestone for several reasons. First, the Government of Egypt (GoE) has published its Sustainable Development Strategy, with the intention of placing the country in the global top 30 with respect to a range of social, economic and environment metrics by 2030.

In 2016, Egypt again faced water shortage due to drought in the upper catchment of the River Nile. In a swift response to the imminent crisis, water for irrigation was rationed strictly and the ceiling on the cultivation of water-thirsty crops was resolutely enforced. Firm action helped avert serious consequences.

Water scarcity in Egypt will increase for several reasons. Climate change may result in less predictable annual inflow into Lake Nasser; reduced rainfall in northern Egypt; and, increased crop water requirements. Projected population growth is an even stronger determinant of increased water scarcity. In 2037, the amount of available freshwater per capita of the population is expected to be less than 35%, of 2017 levels.

A larger population has greater demands for drinking water, while the sustained economic growth intended by Egypt, will increase industrial freshwater demands and return flows of water from domestic and industrial uses will affect its suitability for further use. The agricultural sector will be strongly affected by the growing scarcity of good quality water and will be hard-pressed to continue to contribute 12% to GDP; and to prevent the existing food gap from widening further.

Similar to the one-off water shortage in 2016, the growing water scarcity facing Egypt's society, economy and environment requires urgent action. This Second National Water Resources Plan (NWRP) provides a strategic framework for the firm measures needed to face growing water scarcity.

Scope for Higher Water Security

This Plan foresees a further widening gap between water supply and demand under all future scenarios. Without interventions, Egypt's social, economic and environmental sectors are headed for a situation where growing water scarcity will negatively affect each of them.

As drinking water and industrial water supplies have priority over agriculture, the latter sector's capacity to contribute to the economy and to close the food gap will be further challenged. Augmenting supplies and better management of demands will alleviate this situation but cannot avert the negative impacts of growing scarcity. The need for adaptation to water scarcity is therefore inevitable.

Egypt accordingly, needs to manage its water resources and their use in a more productive fashion, in order both to slow-down this negative trend and to adapt to its outcome:

- Supply-driven interventions have a limited scope - Opportunities to enhance the

freshwater resources should not be ignored, but are not nearly enough to prevent growing water scarcity;

- Demand-management interventions have modest potential
- Water use efficiency (physical and economic) in industry, agriculture, and domestic use can be enhanced so as to reduce waste, while improvements in water quality could increase the volume of water that can be safely re-used;
- Adaptation to water scarcity is urgent – this requires innovation by water users, domestic, industrial, and agricultural, to be facilitated and promoted.

Governmental agencies, the private sector, and civil organizations – as well as individual farmers and users of domestic water - will have to find ways to adapt to increasing scarcity. This NWRP aims to bring coherence and momentum to their efforts by providing a common sense of purpose and urgency among the key stakeholders concerned with water management.

■ The Second National Water Resources Plan 2037 (NWRP 2037)

NWRP 2037 builds primarily on experiences gained and lessons learned from the implementation of the first NWRP (NWRP 2017) in the period between 1997 and 2017. In addition, the new plan is firmly aligned to the vision provided by Egypt's Sustainable Development Strategy.

NWRP 2037 contributes to the Sustainable Development vision by enabling Egypt's society, economy, and environment to share effectively the available water for a robust, balanced, diversified and knowledge-based economy, characterised by justice, social

integration, and participation, and by a balanced and diversified ecosystem.

It also elaborates and provides details for the issues raised in the long-term 2050 water strategy of the Ministry of Water Resources and Irrigation (MWRI) as published in 2017.

NWRP 2037 has explored the 'water future' of Egypt for the milestone years 2020 and 2030 and beyond to 2037. In order to deal with the anticipated water shortages, the Plan compares two strategies: a Business-as-Usual (BaU) or baseline strategy and a NWRP 2037 strategy

EGYPT's Second National Water Resources Plan 2017-2037



with 27 measures in place. As planning involves dealing with an uncertain future, BaU strategy is further explored with an 'optimistic', 'most probable' and a 'pessimistic' scenario, while NWRP strategy is extended with a 'most probable' and 'optimistic' scenarios.

The scenarios are based on socio-economic and other external conditions. In particular, these include: population numbers; Nile water flows; and, the successful implementation of the proposed measures in response to the economic situation and enabling environment. For practicality, the plan presented herein focusses here on the most probable scenario and was prepared in close consultation with relevant stakeholders.

The purpose of this new NWRP; in brief, is referred to as 'Water Security For All'. Water security is defined as ensuring that the intended use of water is supported by sufficient water availability through supply and demand-side improvements; as well as

through adaptation of the intended water use to the resource limitations.

Achievement of this purpose is monitored by using a widely-used international water security index (WSI), which gauges the stage of the national response to water scarcity. For Egypt, the level of water management is targeted to increase from the present index value of 2 ('engaged') to 4 ('effective').

In support to its overall purpose, NWRP 2037 will pursue four objectives:

- Improve water quality;
- Rationalize water use;
- Enhance availability of freshwater resources;
- Improve enabling environment for IWRM, planning and implementation

For each of the objectives, NWRP 2037 has defined indicators together with their targets as follows:

	Plan Element	Targets
Objective 1	Improve Water Quality	- By 2030, the water quality in all surface water sub-systems is maintained or enhanced, according to their current situation, as indicated by the water quality index (WQI) - By 2037, the absolute number of surface water sub-systems with a water quality satisfies the law of Environment increased to 85% of the total number of surface water sub-systems (based on WQI)
Objective 2	Rationalize Water Use	- By 2030, Total water use efficiency reaches 83% and reaches 85% by 2037* - By 2030, Average growth rate of productivity from unit of water is 7.2% and reached 7.9% by 2037 - By 2030, at least 70% of water resources available is allocated for the Agricultural sector
Objective 3	Enhance Availability of Freshwater Resources	- By 2030, 3.97 BCM of freshwater resources are added to the water balance; (Additional: Deep GW, Desalination & Rainfall harvesting) - By 2037, another 1.22 BCM of freshwater resources are added to the water balance; (Deep GW, Desalination & Rainfall harvesting)
Objective 4	Improve Enabling Environment for IWRM (planning and implementation)	- By 2022, a dynamic structure for national strategic coordination of integrated water resources management is in place, supported by key processes for planning, monitoring and evaluation; - By 2022, an updated NWRP Programme of Measures (PoM) for 2023-2025 is made, which reflects full coherence between national objectives, 5-year plans and budgets; and priorities set at Governorate-level - By 2030, important legislation for water quality and water management reflects Egypt's interpretation of Integrated Water Resources management (IWRM) principles (i.e. finite resource; decentralized management, social inclusion and economic assessments)

Under these four objectives, 15 outcomes have been set, and clusters of measures have been defined for each outcome together with their indicators targets for the year 2037.

NWRP 2037 also set targets per outcome, so that the exact mix of, and balance between, measures can be optimised to achieve the target in the most effective and expedient manner.

For each outcome, a specific Ministry will be assigned the responsibility to coordinate implementation (as shown in the following table), which includes defining and refining the measures to be implemented to achieve the outcome target. Most, and sometimes all, measures included in the cluster related to the outcome will be implemented by the same Ministry, but strategic and operational coordination with other entities is required.

* Total of consumption of agricultural, industrial, municipal waters plus evaporation from canals divided by freshwater volume.

For each outcome, NWRP 2037 has defined coordinating public entity as follows:

#	Objective / Outcome	Coordinating Public entity per Outcome
1	Improve Water Quality	
1.1	Reduced domestic pollution loads released into the water system	Ministry of Housing, Utilities, and Urban Communities (MoHUUC) and Ministry of Local Development (MoLD)
1.2	Reduced industrial pollution loads released into the water system	Ministry of Environment (MoEnv)
1.3	Reduced agricultural pollution loads released into the water system	Ministry of Agriculture and Land Reclamation (MALR) and Ministry of Water Resources and Irrigation (MWRI)
1.4	Increased quantity of good quality drainage water suitable for different usages	Ministry of Water Resources and Irrigation (MWRI)
2	Rationalize Water Use	
2.1	Increase Agricultural Water Productivity	Ministry of Agriculture and Land Reclamation (MALR) and Ministry of Water Resources and Irrigation (MWRI)
2.2	Household Water Use Rationalized	Ministry of Housing, Utilities, and Urban Communities (MoHUUC)
2.3	Increase Industrial Water Productivity	Ministry of Trade and Industry (MoTI)
3	Enhance Availability of Freshwater Resources	
3.1	Securing share of Egypt in the Nile water	Ministry of Water Resources and Irrigation (MWRI), Ministry of Foreign Affairs (MoFA) and Ministry of International Cooperation (MoIC)
3.2	Enhanced Volume of Rainwater Captured	Ministry of Water Resources and Irrigation (MWRI)
3.3	Increased volume of desalinated brackish groundwater and seawater	Ministry of Housing, Utilities, and Urban Communities (MoHUUC)
3.4	Rationalized abstracted volume of groundwater	Ministry of Water Resources and Irrigation (MWRI)
4	Improve Enabling Environment for IWRM (planning & implementation)	
4.1	Mechanisms and structures for coordination at decentral and central levels strengthened	
4.2	Regulatory framework revised and updated	
4.3	Public support and awareness for “Water Security for All” generated	
4.4	Enhanced professional capacities for IWRM	

The adopted Program-of-Measures adds up to a total of 27 individual measures. A first screening of these measures based on their apparent cost-effectiveness, public acceptability, and urgency using a simplified multi-criteria analysis (MCA) revealed the following priority measures or projects:

- Expand flash floods water harvesting and protection projects especially in coastal areas;
- Expand desalination of brackish and sea water in remote and coastal areas using renewable energy;
- Increase percentage coverage, operational capacity, efficiency of domestic wastewater treatment services with consideration of integrated sanitation and wastewater management systems;
- Develop an efficient solid waste management system to prevent pollution of waterways;
- Carry out civil works on surface water system infrastructure: Irrigation and Drainage networks, Pump Stations, and Grand Barrages;
- Plan and initiate projects to protect shore lines against sea level rise on North Coast and sea water intrusion in Nile Delta;
- Increase volumes of drainage water recycled for irrigation;
- Expand greenhouse cultivations, including hydroponics;
- Review and modify drinking water intakes from Nile and main canals to cope with possibly lower water levels;
- Reduce / eliminate water leakage losses from municipal pipe networks and the unaccounted for water taken by households and industries;
- Promote cultivation of crops with low water consuming and salt tolerant characteristics.

Several of these measures are also considered as ‘no-regret’ in the sense that they are low cost and are expected to be highly acceptable to the public. Although other measures may result in a larger overall effect on the targeted outcomes, such low cost/high acceptability measures may be considered as ‘no-regret’ measures regardless of the scale of their impact. ‘No-regret’ measures

are suitable for immediate implementation in parallel to the lengthier planning processes that are inevitably required for more costly and higher impact measures.

As agencies review and refine MCA in the early stages of implementation of NWRP, they should identify the ‘no-regret’ measures. Such ‘no-regret’ measures may include, for example, the activation of continuous monitoring for industrial wastewater for improved water quality and the promotion of the use of water efficient appliances and fixtures for the enhanced management of water use.

As already mentioned, water scarcity will hit the agricultural sector the hardest and under the various scenarios screened the expected water availability per unit land is expected to decrease by about 8% of the value of 2017. To maintain this important mainstay of the national economy, the sector needs to adapt itself to a water scarcity situation by means of:

- Innovation towards a lower use of water per unit land and unit of product;
- Growing less water consumptive crops and limit the area cultivated with high water consumptive crops;
- Water users Associations established at branch canals;

while, at the same time MWRI should provide improved services through:

- Upgrading the canal infrastructure;
- Improving the water distribution and the setup of a proper metering system for water deliveries and consumption (“water accounting”).

The pivotal idea here is that when such measures run in tandem, then volumes delivered reliably at branch canal offtakes should be adequate for dealing with increasing water scarcity in the agricultural sector.

The situation can be further alleviated by improving the water quality. Further recycling of

drainage water is limited due to the prevailing water quality, particularly in the Nile Delta where the water shortages are the most pressing. The Ministry of Housing and Utilities and its affiliates have prepared a Rural Sanitation Strategy to address the issue and improve the water quality in the surface drains.

An indicative investment level for all measures taken together is estimated at BLE 724 over the period 2017–2037 (excluding third party investment costs), with an additional amount for operation & maintenance as well as other supporting costs for implementation of about BLE 204 for the same period (i.e. total costs during the period 2017–2037 is BLE 928). The average annual expenditure is estimated at BLE 46.4, Equivalent to approximately 0.7% of the projected GDP for 2017, or up to three times higher than current expenditures.

The present document also includes preliminary projections of expenditures and effects, as well as the risks facing the successful implementation of the measures. The plan is consistent with Government planning cycles. During the interlude, fast-track measures will be implemented; reflecting the priorities given in the fast-track plan prepared under the auspices of H.E. the Prime Minister.

In addition, the period will also be used by the above entities to coordinate the outcomes and clusters of measures to refine the present projections of expenditures and effects, review the measures included and assess their cost-effectiveness, public acceptability, and urgency. This will enable each coordinating entity to optimize its mix of, and balance between, measures and to enter its expenditure projections in the 2020 – 2025 Five Year Plan (FYP). These will be more accurate than the present projections.

Putting NWRP 2037 in Motion now

The need to enhance water security – principally by adapting intended water use to the limited resources – is urgent. BaU means that the

agricultural sector, on which so many Egyptians depend, will have a lesser economic performance.

A higher and more effective level of management needs to be established in order to enable investments that enhance security of water use. Providing such an enabling environment is a priority, as is the augmentation of investments towards enhanced water security.

In view of the urgency, the following Cabinet decisions are proposed:

- Building capacity for the staff of MRWI and focal points in partner ministries;
- NWRP 2037 will be implemented by charging the coordinating entities with the responsibility for specified outcomes and for coordinating the related clusters of measures;
- Water resources plans will be prepared for all Governorates with an estimated budget and priorities for required investments with NWRP.

Further recommendations for Plan implementation

• Monitoring and Evaluation

No far-reaching Plan, which is vital for the national interest, should be executed without having a Monitoring and Evaluation program in place.

The current plan has built a new and consistent framework with indicators and their targets at four different levels (purpose, objectives, outcomes, and measures) and fully formalized this structure into a database. This database needs to be maintained and its data needs to be evaluated and reported periodically to partners and policy makers by MWRI.

• Effects of on-going measures on the water balance and water quality

Although most numerically quantifiable indicators can now be easily scaled up from measure level to objective level, the full effects of

all identified indicators on the water balance and water quality index cannot be gauged in this way.

This can only be done by means of field measurements and/or by the establishment of new national water balances. It is therefore strongly recommended that drafting of the annual State-of-Water reports for policy makers, including its paragraphs addressing water quality and the reports on the various indicators, should continue.

- **Effectively screening the effects of current measures**

Measures with sufficient supporting data were appraised and initially prioritized. However, screening the effects of these measures on the national and regional water balances and water quality parameters has not taken place in a very detailed manner, mostly at the level of «expert judgement».

For promising but complex measures more efforts are needed in order to properly prioritise investments in nature and in timing. This can be done, in part, by separate studies together with (affiliated) research organizations.

- **Cross over effects of current measures**

Not all measures will be mutually reinforcing. Some may show synergy ('win-win'), while many others may lead to diminishing returns once combined. This may potentially lead to misguided investments when involved agencies are unaware of these trade-offs.

For instance, treatment facilities for the use of drainage water in agriculture should be properly aligned with investments in cleaning up any waste loads entering the upstream drainage network. Studies with ensuing policy notes should be undertaken leading to updates in strategic plans and related investments.

- **Assessment of actions needed to promote more crop per drop innovations in agriculture**

The reduced water allocation to agriculture may lead the farming community to identify, suggest and implement innovations that generate more crop per drop. Farmers will need to invest in new technology to realize more crop per drop.

The Government (MALR) can stimulate this by providing Research & Development support and subsidies for innovators and early adopters. Crucial for farmers to invest in new technologies is water security and their trust in water security. If farmers fear water shortages during the growing season they will not invest in more crop per drop but avoid the risks. Accurate and reliable water supply is therefore an absolute pre-requisite for the future.

- **Adding new measures/Deleting old measures**

External conditions may change in such a way that new measures should be considered while others may become obsolete. For the same, or other reasons priorities between measures may also change.

This flexibility should be taken care of in the Plan ('Living Plan') and has, in part, already been addressed by proposing to assign responsibility to partners at the outcome level where packages of measures are combined. New measures will require a new round of screening, monetarising, and prioritising followed by a similar round for the underlying projects.

In addition to this, and considering earlier and recently renewed support from the International Financial Institutions (IFI), it would be highly recommendable to link up to the Joint Integrated Sector Approach for the multi-sector

ranking procedures for subsequent investments.

- **Assessment of measures on ‘food security’**
Egypt allocates over 80% of its available water resources to the agricultural sector. Under increasingly water scarce conditions this sector will be the first to feel the effects in the form of lower water availability per unit area.

Considering the fact that Egypt has a fast growing population with high imports of basic agricultural commodities (in particular wheat), it becomes important to make accurate assessments of the resulting food balance, including agricultural trade (‘virtual water’), foreign exchange aspects, etc.

For various reasons the current plan was not able to look into these issues. The lead for such a study clearly resides with MALR with substantial inputs from MWRI and others.

- **Assessment of measures on their ‘environmental impacts’**
GoE requires that projects are pre-screened with respect to their environmental impacts (EIA). At the levels of measures and higher, Strategic-EIAs are needed so that there exists an ex-ante assessment of potential effects on the environment before projects are actually defined.

The Egyptian Environmental Affairs Agency (EEAA) would be the lead partner but also requires the support of other ministries.

- **Assessment of measures on their ‘socio-economic’ impacts**
Considering the historical context, GoE is very keen to determine ex-ante. the effects of far-reaching measures on the population and the urban and rural poor

in particular. Not all measures defined under NWRP 2037 would classify as having a significant impact on the socio-economic environment, but a number of measures affecting agriculture would certainly reflect on the living conditions of small farmers.

On another track, the new Plan has also defined its purpose as ‘Water Security for All’ which has been linked to WSI. Using international conventions for calculating WSI would require inclusion of socio-economic factors as well.

Finally, GoE is committed to its Social Development Strategy 2030 largely based on UN Sustainable Development Goals, to which the new Water Plan should contribute. The exact manner of this contribution needs to be further defined. This all advocates dedicated support to MWRI, including the partner Ministries, to tackle these issues.



Chapter 1

Introduction

- Why a new NWRP?
- The Underlying Concept : IWRM
- The Need of the Hour : Growing Scarcity Demands a New Management Strategy
- What type of Plan is NWRP 2037
- Environmental and social impacts
- Structure of NWRP 2037

In January 2005, MRWI published Egypt's first NWRP, which aimed to support Egypt's socio-economic development by the sustainable use of its water resources, while protecting and restoring the natural environment.

The plan was in force up to the year 2017. The plan and subsequent developments make abundantly clear that careful management and utilisation of water resources is a dire necessity.

As all trends point to water scarcity and deterioration of water quality, better management of water supply and demand will be needed to secure sustainable future water use.

Better management begins with defining objectives and plans; and recurrent planning, supported by review of achievements and by articulation of a long-term vision, helps continuous adaptation of water resources management to the challenge ahead.

1.1 Why a new NWRP?

The first NWRP covered the period up to 2017, but completion of this period is not the only reason to develop and accept a new plan. The main reasons for Egypt to prepare a new NWRP include:

- The magnitude and urgency of growing water scarcity and its implications for society which have become increasingly evident. Population growth, economic expansion, accelerated upstream development and climate change all combine to reduce the unit volumes and quality of water available to Egypt's society, economy and environment.
- National strategies and policies guiding Egypt's development set a new vision (and a new time frame) to which IWRM should be aligned. Egypt's Sustainable Development Strategy (Abul-Naga, 2009) defines ambitious goals to be achieved by 2030.
- The implementation of the first NWRP provided lessons that can inform future decision maker with respect to water resources. This new Plan (referred to as NWRP 2037) also looked at the (likely) impact of NWRP 2017 and distils lessons on the manner in which NWRP can provide better guidance to help society make its water use sustainable under conditions of growing scarcity.

NWRP 2037 provides a 20-year time horizon, which is a generally accepted practice in water resources planning. Given the importance of the year 2030 as the time horizon for Egypt's Sustainable Development Strategy, NWRP 2037 also defines milestones to be achieved in 2030.

1.2 The Underlying Concept: IWRM

NWRP 2037 is based on the concept of IWRM. It describes principles, opportunities, risks and procedures rather than to chart a rigid course of actions towards the future.

"IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP, 2013).

Application of IWRM perspective is guided by a country-specific interpretation of four principles, which were defined by the 1992 International Conference on Water and the Environment (UN, 1992). These four principles – together with the way they are understood and applied in Egypt – are:

1. Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;
2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels;
3. Women play a central part in the provision, management and safeguarding of water;
4. Water has an economic value in all its competing uses and should be recognised as an economic good.

IWRM is a much broader concept than the water management concepts used in the previous century. IWRM encompasses supply and demand management; but looks beyond sector and sub-sector performance to resolve conflicting interests. By doing so it profoundly changes the way water resources are perceived, used, and safeguarded.

Water management develops from being the outcome of brief transactions between engineers and users to being the outcome of a permanent interactive multi-stakeholder planning process, in which the definition of a plan is a means to an end.

1.3 The Need of the Hour: Growing Scarcity Demands a New Management Strategy (MWRI-APP, 2008)

While the average amount of available water is, ever since the completion of HAD, relatively constant, Egypt's population has continued to grow. The outcome of this is a declining per capita share of water and a growing sense of water scarcity. Pressures associated with population growth, such as urbanisation, waste and wastewater disposal and industrial expansion place a further squeeze on the availability of water of good quality.

IWRM is a suitable concept/framework for addressing the complexities associated with growing scarcity and growing competition between different uses. But the growing urgency

requires IWRM to be applied with a renewed vigour and – more importantly – with a new underlying strategy. Whereas in the past, efforts such as the construction of the Nile barrages and ultimately the construction of the High Aswan Dam (HAD) were aimed at making more water available, this supply-driven strategy is now facing diminishing returns.

A demand-oriented strategy intended to enhance allocation and end-use efficiencies is becoming less viable because the overall efficiency of water use in Egypt's Nile system is already very high. The continued increase of water scarcity requires a shift from supply-driven and demand-oriented strategies to a strategy of adapting to water scarcity.

This is not to say that opportunities to enhance the resource base should be ignored, nor that system loss should be neglected; but it adds that end-use sectors will have to make fundamental changes to the way they use precious water resources.

The new style for dealing with water scarcity is an adaptive strategy, with adaptive water management involving input from social disciplines together with engineers, economists, ecologists and politicians. Adaptive management is characterised by a decentralisation policy where water users are encouraged to find solutions for water management by self-organization.

Self-organization increases the social learning capacity of water users and water user organizations. It is believed that adaptive water management and social learning by water users increases the innovative capacity of society and the different water using sectors.

1.4 What type of Plan is NWRP 2037 NWRP 2037 is an update and actualization of NWRP 2017.

The update is necessary in the light of increasing pressures on water availability; of new policies; and of lessons learned from water

resources planning. NWRP 2037 expands the analyses and updates key figures and sets the time horizon to 2037; with 2030 – the year up to which Egypt’s Sustainable Development Strategy is projected – as an important milestone.

NWRP 2037 is a stakeholders’ plan

NWRP 2037, like its precursor, affects all water usages by society, economy and environment; and it involves public stakeholders from all these domains. NWRP 2037 has been prepared in close consultation with a broad array of public agencies. As NWRP 2037 is a framework plan at national level, consultations have been limited to those agencies that represent the different water use sectors at national level.

NWRP 2037 is an IWRM plan

It establishes conditions to enable concerned ministries and agencies to take decisions on investments and supplementary actions that optimally support national objectives.

Different ministries and agencies have responsibilities towards the outcomes of and measures contained in this plan. NWRP 2037 sets a framework for implementing IWRM.

In line with the four IWRM principles mentioned above, this plan provides: (i) Objectives and targets for sustainable water use; (ii) Mechanisms that enable decision-making at local, regional, sectoral, national and trans-national levels; (iii) Mechanisms that help attune IWRM measures to the aspiration of inclusive development for all people, regions and generations; and (iv) Mechanisms that help include an understanding of the full cost and benefit of IWRM measures in the decision-making process.

NWRP 2037 is a framework plan

It enables implementing ministries and public agencies responsible for investments, and supplementary actions to base their decisions on the principles of IWRM.

It allows them to combine their own objectives with the objectives and targets suggested by NWRP 2037 and to apply their own expertise in allocating resources in ways that serve both their own mandate and address the concern for sustainable water use. It also estimates the financial resources to be allocated to IWRM-related measures; it safeguards how water concerns are incorporated in development planning; and it proposes stronger national coordination for water resources management. NWRP was also a framework style plan, but NWRP 2037 establishes a tighter set of boundary conditions for its implementation.

NWRP 2037 also aligns the incorporation of water management concerns in the plans of concerned Ministries and agencies to the national Sustainable Development Strategy and to the time-scale set by Ministry of Planning and Economic Development (MPED).

The period up to 2020 allows the Ministries and Agencies a further fine-tuning of the measures they need to consider to achieve NWRP 2037 targets. From 2020 onwards, implementation is guided by the renewed cycle of five-year planning set by MPED.

1.5 Environmental and social impacts

NWRP 2037 provides targets and mechanisms for integrated water management in the face of growing water scarcity. It will lead to a more robust and adaptive management of water resources and to the implementation of measures that seek to attain greater water security.

The plan, however, does not include an overarching assessment of its impacts on society, economy and environment. Egyptian law does require social and environmental assessments of the impacts of major programmes and investments, but it does not have a provision for the early determination of the social and environmental scope of national plans and policies. NWRP 2037 therefore does not include a social and environmental scoping note.

1.6 Structure of NWRP 2037

The plan is based on a comparison between an unchanging development strategy BaU and a strategy where NWRP 2037 is implemented. BaU strategy provides the baseline. NWRP 2037 then projects both strategies up to 2037 with stops for 2020 and 2030. To allow for the uncertainty in population numbers, Nile discharges, and economic growth, BaU strategy has been applied to three scenarios: pessimistic, most probable, and optimistic.

But NWRP 2037 itself, only contains a most probable and an optimistic scenario. No pessimistic scenario is included here as its results will be better than for BaU pessimistic. The outcome envelope will hence be defined by BaU pessimistic and NWRP 2037 optimistic scenarios. In this document, NWRP 2037's most probable scenario is the only one that is used for projecting future actions.



Chapter 2

The State of Water

- The State of Water 2016 - 2017
- Trends in Water Use
- Can Water Management Achieve Water Security for All?

The 2015/16 drought in the Horn of Africa also affected the inflow to Egypt's most strategic water resource: Lake Nasser. The dwindling inflow into the lake led MWRP to strictly limit the allocation of water and compelled the Ministries of Agriculture and Land Reclamation and of Water Resources and Irrigation to enforce a ceiling on the cultivation of thirsty crops; including taking the drastic and unpopular measure of burning illegally cultivated standing rice. Over-consumption of water by a few had become detrimental to the water needs of the many, and had to be stopped. The Cabinet backed the decision that no leniency should be shown toward those who violated the rice-planting ban; and a further disincentive to rice cultivation was provided by a Cabinet Decision banning the export of rice.

The 2016 rationalization of the irrigation water distribution, and the accompanying measures to curb illegal cultivation of wetland rice, places water management once again in the national headlines and shows the Government is willing and able to take the decisions that are required for such a situation. Yet, the 2016 water crisis is not unprecedented: low inflows into Lake Nasser during a period of six years compelled MWRI in 1987/1988 to enforce a

strict water distribution regime. What makes the 2016 crisis more worrisome, however, are the indications that the occurrence of such extremes may become more frequent; and that developments in upstream Nile riparian countries may pose additional challenges to Egypt's water resources.

2.1 The State of Water 2016-2017

2.1.1 Water quantity

In order to better understand the present and future state of water, a national water balance has been drafted. The water balance has been developed for the year 2017 and will be used as a basis to predict the outcome of trends up to 2030 & 2037. In doing so, it is assumed that the main storage reservoirs (i.e. Lake Nasser and deep groundwater) are kept at their present capacity, meaning that Egypt does not exhaust its resources. In a water balance, the amount entering a system matches the amounts consumed by that system plus the amounts leaving it. The following Table shows overall and sector-wise water availability and consumption. The annual amount of freshwater available per capita is often used as an indicator of water sufficiency. In Egypt the critical value for water scarcity (i.e. less than 1,000 m³ per capita per year) was reached in around 1997. Due to a rapid increase of population – from 63 million in 2000 to near 95 million in 2017, which is a growth rate exceeding NWRP 2017 high scenario – the per capita amount of renewable freshwater has decreased to 599 m³ per capita per year in 2017. The water stress index clearly indicates that water has become a scarce resource.

Water Balance 2017 - Sector Indicators

Sectorial indicator	Unit	2017
Available renewable freshwater resources (Nile water + Rain)	BCM/year	56.80
Available per capita (Faulkenmark Index)*	m ³ /capita/year	599
Allocation for domestic water supply	BCM/year	10.70
Per capita allocation	l/c/d	309
Per capita consumption**	l/c/d	78
Allocation for industries	BCM/year	5.40
Industrial water consumption**	BCM/year	1.41
Allocation for agriculture***	BCM/year	61.65
Allocation per feddan	m ³ /feddan/year	6752
Agricultural water consumption**	BCM/year	40.69
Consumption per feddan	m ³ /feddan/year	4457

* Faulkenmark Index = Water volume of renewable freshwater divided by population

** Per capita consumption of domestic water, industrial water consumption and agricultural water consumption are estimated.

*** Net agricultural allocation equals available resources minus net outflow minus net consumption by domestic and industrial users

The scarcity is not reflected strongly in the allocation figures for domestic supply and industry. Allocations in 2017 exceed the actual consumptive use in both sectors. Egypt has achieved a very high coverage of drinking water supply. The coverage at present is estimated at 97%, with an objective to achieve full coverage by 2030.

The per capita allocation of water for domestic supply is a multiple of the estimated actual consumption, indicating loss of potable water in the supply system and spillage of potable water in the households. Unaccounted-for-water and system loss from the domestic water supply network are estimated at 30-35% (MoHUUC, 2015). The domestic supply systems also serve (i) cottage industries (which will take a higher share from the system than most individual users); (ii) offices and tourist facilities; and (iii) the watering of parks and other recreational areas.

The use of potable water also results in a return flow of wastewater and a large share of both the treated and untreated wastewater re-enters the freshwater system.

Industries draw process water from a variety of sources, including the water supply network, their own wells and direct pumping from the Nile, Nile branches, and main canal system.

The volume extracted for industrial production, and the volume actually consumed by it differ: Against an annual withdrawal in 2017 of 5.40 BCM; only 1.41 BCM was consumed; while the balance returns to the water system. Power plant cooling water is not included in those figures. Industrial effluents carry a pollution load, depending on the industries and the production processes therein.

In 2017 a total of 61.65 BCM of Egypt's available water resources was allocated to irrigate 9.13 million feddan. This amount of water has been supplied directly to agriculture or, after its initial use, has been supplied as reused drainage water; either by mixing drainage water with canal

water or by direct use from drains. The supplied amount in 2017 is equivalent to an irrigation application of 6752 cubic meters per feddan (1,608 mm). With this amount, farmers grow between one to three crops per year.

2.1.2 Water quality

In Egypt, measurements of physical, chemical, and biological water quality parameters are routinely taken. While the calculation of water quality indices has not been studied previously, a comprehensive benchmarking study for the quality of all waters in Egypt was completed (NWRP, 2017), with the aim of developing Water Quality Indices for different water bodies to allow tracking of water quality changes and to assess the impact of future developments on water resources.

WQI is a convenient dimensionless number to summarize water quality status from measured parameters. It aims at giving a single value to the water quality of a source using a simple expression rather than a great amount of data. In this preliminary study, nine water quality parameters have been analysed, weighted (based on their importance in relation to the different water uses of each source) and transformed into a Common Single Scale.

Yet, the temporal and spatial changes in WQI, provide information that decision makers and water quality managers can understand/use easily. The developed index can be employed to assess the impact of water management practices on surface water health. Most important, the assessment output will describe the current water quality status as benchmarking for future comparison and quantify level of impacts on water resources and quality due to future interventions.

About 71% of the sampling sites along the River Nile were found to have a good quality of water during winter and summer seasons, while the remaining sites indicated a medium quality of water. Going further downstream, the index demonstrated that the water quality along Damiet-

ta branch deteriorates from good to medium. For the Rosetta Branch the same trend occurs, but the quality index plunges to the poorest condition at a site located 120 km downstream of the offtake. This is because the Rosetta Branch receives wastewater from Greater Cairo and inflow from other major drains.

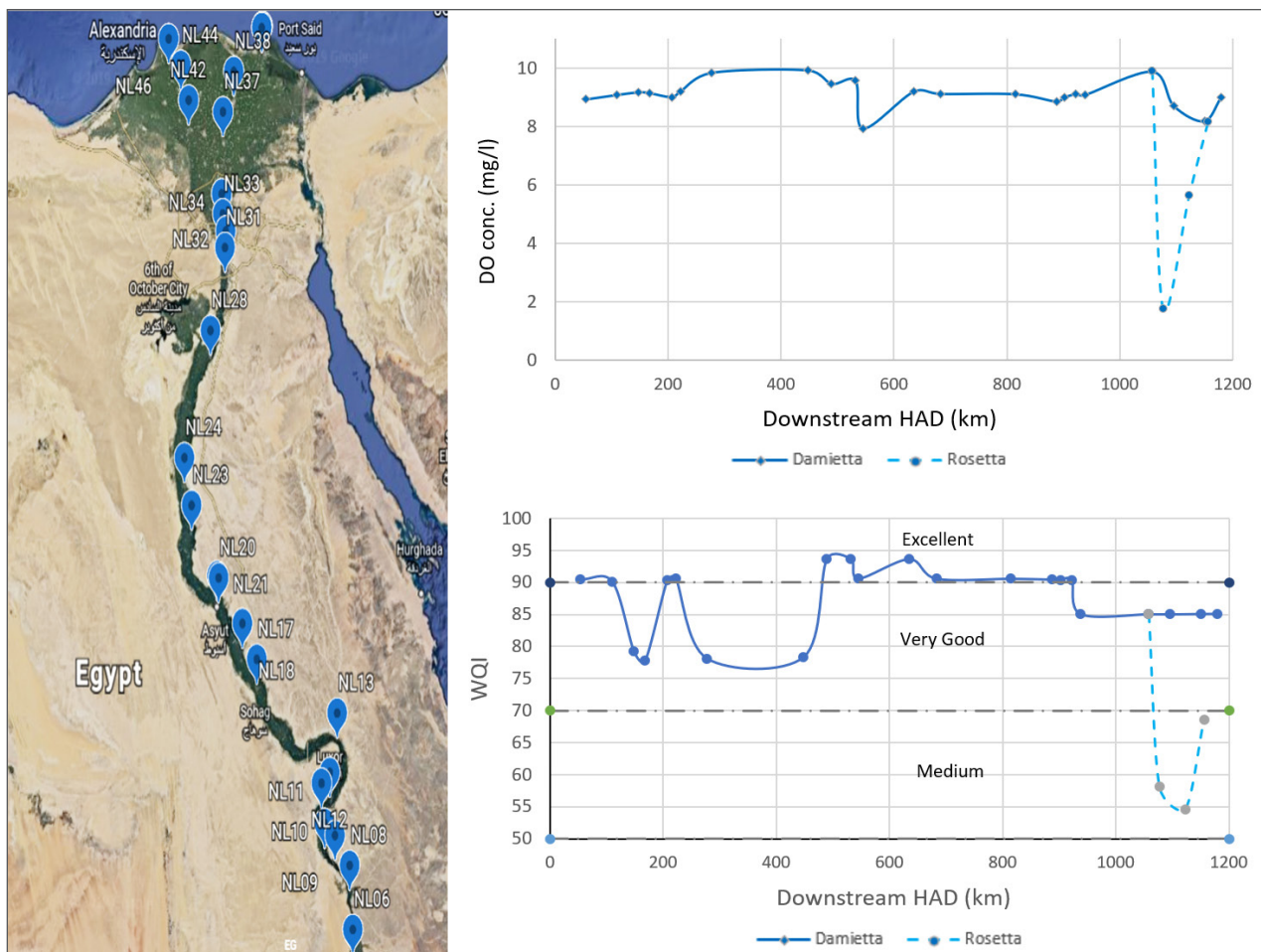
The benchmark study also considered the water quality within Egypt's lakes, assessed through the trophic state of the lakes (total weight of biomass, nitrogen, phosphorus, and other biologically active nutrients). These lakes often have a high biodiversity value and provide many societal functions, including water supply for industrial, agricultural and municipal use as well as recreation.

The distinguishing physical features of the lakes include relatively low 'flow-through' velocities and development of significant

vertical gradients in water quality variables. As a result, the lakes often become sinks for nutrients and toxins. As a result, eutrophication is common, especially in the northern coastal lakes.

The preliminary outcomes of the water quality baseline study for the irrigation network compared well to the outcomes of the one-off assessment of water quality that was made by the Nile Research Institute (NRI) for the summer and winter of 2000. The data were also reported in WQI, combining nine parameters (DO, pH, TSS, BOD, NO₃, Total P, turbidity, faecal coliform and temperature deviation).

In 2020, WQI has been further updated. The updated version is tailored to address Egyptian waters in specific. It primarily compares measured water quality parameters to the thresholds stated in Law no. 48 based on the usage of water. It is im-



* Example for some Results of The Water Quality Tool in 2020

important to state that Law no. 48 has different sets of thresholds for different water bodies. The method accounts for the associated set of thresholds.

The parameter limits stated by the law range from 21 to 42 parameters, according to the water status and usage. A web tool (WQ-Dat) is developed for the surface water bodies based on collected water quality data. The web tool and index are designed to provide a comprehensive vision of the water quality along the Nile, surface and drainage networks. The main objective is to achieve consistency in the reporting at different scales.

Therefore, it is accessible to all sectors to facilitate communication and monitoring, significantly (inside and outside MWRI). Under this web tool, the time spent in processing, preparing, transferring and communicating results is significantly reduced. Results are available as soon as the analysis is done by the central laboratory. It is also the base of an early warning system of WQ. Moreover, its importance is reflected in monitoring WQI both spatially, and temporally.

The trends in water quality are generally difficult to assess as there are large spatial differences in water quality. Water quality is driven strongly by: (i) the release of freshwater (known as the dilution factor), (ii) untreated wastewater as well as effluent from industries, and (iii) the overall capacity and effectiveness of treatment facilities. However, this tool facilitates the spatial and temporal analysis of water quality in Egypt.

Hotspots are expected to endure with time, unless major measures are foreseen. Three main hotspots are observed from various data sets. The first compelling hotspot being around Rosetta Branch, due to fish farms. Another hotspot is around Helwan, due to the high flow of industrial and domestic discharge. Finally, the third hotspot is near Luxor, as a result of the presence of a number of industries.

It seems evident that water quality will continue to be under pressure unless additional measures are taken. The recurrent reuse of water – done in the face of scarcity – is only viable in the long-term if the loads of dissolved salts, contaminants and pathogens in the drainage water are kept within acceptable standards. Addressing pollution at the source is an essential condition for long-term reuse.

2.1.3 State of Water Management – Water Security Index (WSI)

To assess the level of management achieved in Egypt, use is made of WSI, which was established for inter alia Egypt in 2013 (ADB, 2013). The overall water security index reflects five dimensions for which Egypt's overall WSI across the five categories is about 2.0 out of 5.

This reflects the fact that the key public stakeholders in IWRM in Egypt have come to realize their need to act in order to preclude a water crisis, for which the drafting of NWRP 2017 provides a point in case.

2.2 Trends in Water Use

2.2.1 General

Growing scarcity – mainly driven by population growth – will alter the water balance. The state of water in 2020, 2030 and 2037 has been assessed on the assumption that investments in water resources management would continue at the present level and as currently intended, but with population growth projections taken into account.

This forecast provides the base case (autonomous development of BaU against which to evaluate the proposed NWRP 2037).

The following table shows that despite the modest increase in available freshwater resources, the availability of renewable freshwater would drop to 386 m³/capita/year, well below the threshold value for absolute scarcity of 500 m³/capita/year. The driving factor is the population growth.

Sectoral indicators for BaU strategy

Sectoral indicator	Unit	2017	2020*	2030*	2037*
Population	Million capita	94.8	101.79	128.09	147.14
All available freshwater resources	BCM/year	59.60	60.5	61.2	61.67
Per capita share of renewable water resources (Faulkenmarkex)	m ³ /capita/year	599	558	444	386
Allocation for domestic water supply	BCM/year	10.70	11.9	14.1	14.9
Per capita allocation	l/c/d	309	320	301	277
Per capita consumption**	l/c/d	77.9	73	72.4	69.4
Allocation for industries	BCM/year	5.4	5.65	5.9	6.0
Industrial water consumption**	BCM/year	1.41	1.44	1.56	1.59
Allocation for agriculture***	BCM/year	61.65	61.26	60.64	60.14
Irrigated Agric. Area	Million feddan	9.13	9.30	9.65	9.80
Allocation per feddan	m ³ /feddan/year	6752	6587	6284	6137
Agricultural water consumption**	BCM/year	40.69	41.30	41.45	41.86
Consumption per feddan	m ³ /feddan/year	4457	4440	4295	4271

* All future projections pertain to BaU strategy, Most Probable scenario

** Per capita consumption of domestic water, industrial water consumption and agricultural water consumption are estimated.

*** Net agricultural allocation equals available resources minus net outflow minus net consumption by domestic and industrial users Source: NWRP Water balance studies

2.2.2 Domestic and Industrial Water Supply and Use

In BaU strategy, the amount of water allocated to domestic water supply is gradually increasing, in response to the trend in population growth. The increase in the per capita allocation for the years 2020 and 2030 reflect that in this period the planned increase (HCWW, Pers.Comm, 2016) in production of drinking water exceeds the effects of any measures at reducing unaccounted-for-water and water supply system loss. The consumptive use per capita reflects the same trend.

Growth projections for industrial water use are harder to make and historic data hard to obtain, but it seems valid to say that a likely growth in consumption will partially be offset by a higher efficiency of industrial water usage.

2.2.3 Agricultural Water Supply and Use

By 2037, under BaU strategy, the amount of water available for agriculture will fall to 60.14 BCM; as gains in the overall availability of freshwater are more than offset by the increased supplies to domestic and industrial usage. The area irrigated will

remain quite similar to that of 2017: although additional lands have been reclaimed, existing lands will also be lost due to urbanisation, reducing the net increase in agricultural area. (Source: NWRP water balance studies: 2017- 9.13 million feddan; 2037- 9.80 million feddan).

Due to the above, the water allocation per feddan will fall by roughly 8% (from 6752 to 6137 m³/feddan/year), which is equivalent to a water layer of 146 mm. As a consequence, farm households or agricultural enterprises will have to make do with a 9% reduction in the amount of water available to their crops.

This is all the more challenging, as temperature rises due to climate change will result in higher potential crop evapotranspiration. Farmers will have to choose crops or cultivation systems that consume less water, reduce cropping intensity, or accept sub-optimal production.

The Agricultural Simulation Model for Egypt (ASME), which optimises crop choice against water resource availability and market opportunity, predicts that farmers will move to crops that have

a higher return per feddan and per cubic meter. The area under maize, sorghum and wheat will reduce, while crops such as soybean and sunflower will be grown more.

The area of sugarcane (located mainly in Upper Egypt) is predicted to become less, while the cultivation of sugar beet (a viable and salt tolerant crop for the Delta) would increase. In this way, the sector as a whole will grow economically at a rate of 1.6% per year. With this growth percentage, the sector will not be able to continue to contribute 11.6% to GDP, and the shift to high-value crops implies that under BaU strategy the existing food gap will widen further.

ASME assumes that the logical response of the farming community to increasing pressure on water supply is to look for alternative agricultural activities that bring a higher income with less water use. This transition can be stimulated by an incentive system for innovative farmers to develop new farming systems, accompanied by research budgets to help farming communities explore innovations.

2.3 Can Water Management Achieve Water Security for All?

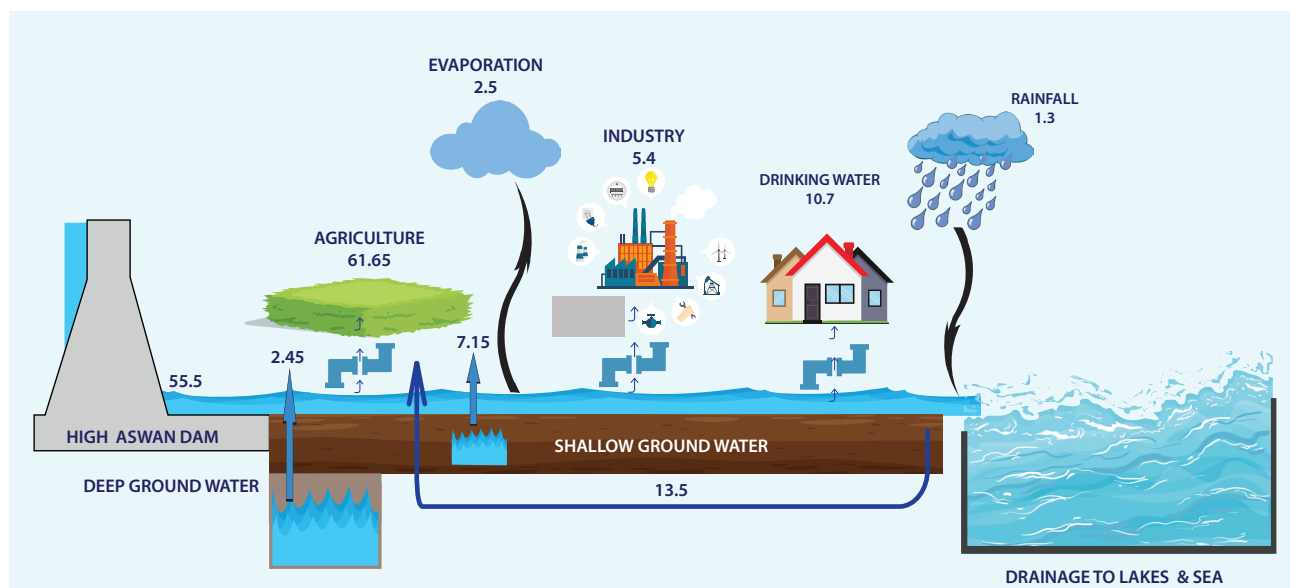
The decrease in water availability for agriculture and the deterioration of water quality are two

closely interlinked phenomena. Their common root cause is that the increase in demand for all water using sectors exceeds supplies.

The problem is that a growing population and economy have growing demands for good quality freshwater; while it is difficult to add new water resources to Egypt's water balance. The challenge is for the present management of water resources to move to a higher level.

The need for adaptation to water scarcity is inevitable as there is limited scope for supply-driven interventions and modest scope for demand-oriented interventions. There is, however, scope to do so by:

- A change in the farming system towards crops and systems that make do with less water;
- Curbing the cultivation of high water consuming crops, such as sugarcane, banana, and rice;
- Closed and circular systems can be introduced, both in farming and industry to reduce per unit water use and to recover water that otherwise would have been lost;
- Treated wastewater can be used for designated purposes, rather than to be returned back to the overall water resources.



Water resources and water allocation to different sectors in 2017 (BCM)

The common thread in adaptation is that innovation is taken forward by the stakeholders on-the-ground. Government agencies, private sector and civil organizations – as well as individual farmers and users of domestic water - will, of course, not let an undesired future take shape. They will find ways to adapt to increasing scarcity.

This NWRP aims to bring coherence and momentum by providing a common sense of purpose among the key stakeholders concerned with water management. NWRP 2037 includes objectives and measures that help Egypt's society, economy and environment adapt to water scarcity.



Chapter 3

Policy Context

- SDS 2030 and NWRP 2037
- Sector Policies and NWRP 2037
- Legislation and NWRP 2037
- International Cooperation

The objective of the recently completed Sustainable Development Strategy for 2030 stated:

“By 2030, the new Egypt will achieve a competitive, balanced, diversified and knowledge-based economy, characterised by justice, social integration and participation, with a balanced and diversified ecosystem, benefiting from its strategic location and human capital to achieve sustainable development for a better life of all Egyptians”.

The strategy is strongly based on the United Nations Sustainable Development Goals (SDGs) and is intended to elevate Egypt to be among the world's top 30 countries in terms of the size of its economy, its market competitiveness, human development, quality of life and anti-corruption.

3.1 SDS 2030 and NWRP 2037

3.1.1 SDS 2030 Water Programmes

The Sustainable Development Strategy (SDS 2030) provides an ambitious vision to be realized on an ambitious time-scale. It hopes to achieve its objectives in less than 15 years. Its vision and ambition form the backdrop for all Government-issued strategies and plans. The strategy is elaborated along three dimensions: an economic dimension, a social dimension and an environmental dimension.

For each dimension, objectives have been defined, which in turn are further specified in key performance indicators (for results, outcomes and inputs) and programmes.

In fact, SDS 2030 recognizes and accepts the fact that water scarcity will continue to intensify, while finding ways to use the limited resources for continued development of Egypt's society, economy and environment.

SDS 2030 is an integrated vision, which means that strategies and plans formulated under its umbrella must reflect all three dimensions of SDS 2030. Within the Vision SDS 2030, key water-related programmes can be found under the economic and environmental dimensions, while key indicators feature in the social and environmental dimension (see the following Table).

Overview of Water-related Indicators and Programmes in SDS 2030

Key Performance Indicators for 2030 from Vision SDS 2030)	Programs identified by Vision 2030
100% of population has access to safe drinking water 100% of population has access to sanitation services 40% of the water usage supplied by non-traditional water resources - The Sanitation comprises 80% of the sewage flow (i.e. as an effect of less wastage of good water.) - The Illegal industrial discharge to the Nile are reduced to zero - The 100% of the sewage into the Nile is treated according to the required standards - The Real losses are less than 15% in water transfer networks - The Less than 10% system loss in wastewater treatment plants	- Rationalization of water usage - Rehabilitation of mega water pumping stations - Addressing climate change, including protection of the coast and buildings thereon - Water resources development - Water quality improvement - Expanding sustainable development program for the Nubian sandstone aquifer - Developing groundwater and preventing its infringement - Developing covered sewage networks - Strengthening the institutional and legislative structure of water resources management system - Expanding infrastructure for supporting a sustainable water system - Adopting of fiscal policy reforms to encourage sustainable consumption patterns of water and natural resources - Raising the awareness to preserve the environment and natural resources, providing incentives for more advanced alternatives and technologies for water conservation and natural resources protection.

3.1.2 Alignment

There are three immediate impacts of the Vision SDS 2030 on the contents of NWRP 2037:

- While maintaining its 20-year perspective, the year 2030 will be adopted as a milestone year in NWRP 2037;
- To further facilitate coherence to Vision SDS 2030, NWRP 2037 will set quantified targets, which are aligned to the key performance indicators of the Vision;
- The ambition of the Vision 2030 has been used to define the ambition of NWRP 2037. The planning of measures will correspond to this level of ambition; and this will in turn be reflected in the financial projections of NWRP 2037.

NWRP 2037 includes a timeline showing how, over the period up to 2020, the sectoral plans will be refined to reflect the objectives and targets of NWRP 2037.

Alignment of NWRP 2037 with SDS 2030 is not only a necessity; it is also an opportunity to make NWRP 2037 a plan that has the public and political support required to make implementation a success. Nonetheless, in aligning NWRP 2037 to SDS 2030 Vision a balance will have to be made between ambitions, targets and financial means.

3.2 Sector Policies and NWRP 2037

This section summarises the key policies and strategies of the three key implementing Ministries (MWRI, MALR, MoHUUC) and MoEnv involved in NWRP 2037 implementation.

The section points out synergies between these strategies and NWRP 2037.

3.2.1 Ministry of Water Resources and Irrigation

MWRI's main mandate is to supply and distribute water resources to the different users. Important policies under development by Ministry are:

- Draft Water Resources Development and Management Strategy for 2050, prepared in 2011 and recently reviewed, updated and issued in 2017. The strategy is highly congruent with NWRP 2037 and it sets a long-term time horizon, but does not provide projections of the 2050 situation in similar detail as NWRP 2037. It does, however, emphasise two strategic concerns:
 - Climate change will affect Egypt principally through higher uncertainty on the upstream water supply through the river Nile; and clear negative pressures on the coastal zone in terms of sea-level rise, storms, erosion, and salt water intrusion, aggravated by continued land subsidence. In addition, more net water will be required to produce the same amount of agricultural commodities because of higher evaporation and lower yields. The 2050 strategy signals the urgency of climate change adaptation. The draft Climate Change Adaptation Strategy (UNESCO-MWRI, 2013) is incorporated in the revised MWRI 2050 strategy;
 - The higher level of management over the water resources that is required to be achieved over the coming decades. – keeping up with water scarcity and other resource pressures – also requires the development of infrastructure that better manages the resource. The 2050 strategy: i) signals, for instance, the vast and sustained effort that is required in modernising the national water infrastructure; and, ii) advocates infrastructure that allows a strong regional management of allocated water resources, taking place at Governorate-level.
- Fast-track measures to tackle Egypt's Future Water Needs. A Committee set-up by Prime Ministerial Decree 1193 of April 2016 has developed fast-track measures to tackle Egypt's future water needs. The ambition of this strategy is to save 10 BCM by

2030 – both through rational use of existing resources and development of new resources – through measures to be implemented between 2017 and 2020. NWRP 2037 has incorporated these measures and reflected their impact and cost.

The strategies and plans of MWRI demonstrate a growing commitment to a broad agenda of far-reaching measures. The proposed measures go beyond the traditional ‘water supply – infrastructure’ preference of water resources engineers and give a comprehensive selection of measures, which coincide with the intervention segments of an integrated water resources plan.

3.2.2 Ministry of Agriculture and Land Reclamation

MALR published its Sustainable Agricultural Development Strategy towards 2030. The strategy has six main objectives: (i) sustainable use of natural resources; (ii) increased productivity of both land and water; (iii) raising security of the strategic food commodities; (iv) increased competitiveness of agricultural products in domestic and international markets; (v) improved climate for agricultural investment; and, (vi) improved living standards of rural inhabitants and reduced poverty rates in rural areas.

The water balance calculations by NWRP 2037 set the limitations for water use, including the water available for the agricultural sector. A key consideration is that the actual adaptation to water scarcity in agriculture will be made by the private sector, comprising both small farmers and agricultural enterprises, with Ministry playing a facilitative role towards local adaptation measures.

3.2.3 Ministry of Housing, Utilities and Urban Communities

MoHUUC has multiple mandates. Apart from its planning, investment, and regula-

tory functions in municipal water supply, wastewater collection, and wastewater treatment, MoHUUC is also responsible for the development of standards and controls for the housing and building industries, and for the planning and development of new urban communities.

MoHUUC and HCWW are currently preparing a Rural Sanitation Strategy up to the year 2030. It is expected that the strategy includes four tranches of investments to achieve full coverage of the sewerage and treatment network in rural areas by 2030.

Major institutional and regulatory reform are included to enable concerned agencies to effectively implement the programmes in keeping with principles of good governance.

3.2.4 Ministry of Environment

The National Environmental Action Plan of Egypt 2002/2017 (MSEA, 2002) seeks to mainstream consideration of the environment in the decision-making cycle for the five-year plans.

It emphasises the need for better information and analysis to understand the water quality challenge and prioritises water quality management in general, and specifically for the lakes and the coastal zone. It places great emphasis on the development of monitoring mechanisms to assess implementation and impacts of such programmes.

3.3 Legislation and NWRP 2037

Water management needs the support of an adequate legal framework that provides water managers with guidelines and instruments for the planning of new developments, for the allocation of water, for the operational management and maintenance of the irrigation and drainage system, for the ma-

nagement of water quality and for financing all these activities (NWRP 2017). The most important laws in this respect are:

- Law 12 (1984), «Concerning the Issue of the Law on Irrigation and Drainage»;
- Law 213 (1994), “Regarding Farmer Participation”;
- Law 48 (1982), «Concerning the Protection of the River Nile and Waterways from Pollution”, implemented by Decree 8/1982 of MPWWR (now MWRI); and
- Law 4 (1994), “Law for the Environment.”
- Law 9 (2009) amendment of Law 4
- The unified irrigation Law; expected to be issued soon, will include several legislation rules contributing to achieve wide range of necessary reforms to enhance water management.

3.4 International Cooperation

3.4.1 The Nile Basin

The Nile River is an international river and is shared by 11 countries: Burundi, Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, South-Sudan, Tanzania and Uganda.

The engagement of Egypt with the upstream riparian countries takes place within the framework of a number of international agreements; and comprises a combination of international diplomacy and international cooperation in technical studies.

The 1959 Nile Waters Agreement stipulates that the entire average annual flow of the Nile should be shared among the Sudan and Egypt at 18.5 and 55.5 BCM, respectively. Egypt also support initiatives to safeguard and increase its share by promoting and participating in upstream developments.

Multi-lateral negotiations and joint technical programmes take place through the Nile Basin Initiative (NBI). The Initiative aimed to culminate in a Cooperative Framework Agreement, which inter alia establishes a permanent Nile River Basin Committee.

Measures that increase Egypt’s share of the Nile water are considered only in the optimistic scenario. Such measures can only be realized with full cooperation of the country where the measure takes place; and measures



would have to be developed taking into account international standards on social and environmental safeguards.

As this means that realising such measures has a long lead time. NWRP 2037 assumes under the 'Most Probable' scenario that Egypt should be able to ensure at least the current share of Nile water (55.5 BCM/year) according to the 1959 agreement.

3.4.2 The Mediterranean

Egypt is a signatory of the Convention for Protection of the Marine Environment and the Coastal Region of the Mediterranean; also known as the Barcelona Convention.

The Barcelona Convention and its protocols, together with the Mediterranean Action Plan, form part of the United Nations Environment Programme (UNEP) Regional Seas Programme. The key goal of the convention is to 'reduce pollution in the Mediterranean Sea and protect and improve the marine environment in the area, thereby contributing to its sustainable development'.



Chapter 4

NWRP 2037 Overview

- Goal
- Purpose
- Objectives
- Structure of NWRP 2037's Programme of Measures

Egypt faces imminent water poverty (also known as absolute water scarcity) and its society, economy and environment are not well-prepared for this. This new NWRP has been developed in order that the country may adapt to this future situation.

It builds on the vision that by 2030, Egypt should rank among the top 30 countries in the world for the size of its economy, its market competitiveness, human development, quality of life and anti-corruption; and it takes into account that so far it has proved very hard to make tangible progress towards a higher degree of water security.

NWRP 2037 establishes how water security can be enhanced in order to support the achievement of Egypt's Sustainable Development Strategy. The term 'water security' is crucial, as it is the guiding concept for making the best use of scarce water resources

4.1 Goal

NWRP 2037 is aligned to SDS 2030 and takes into consideration the Water Resources Development and Management Strategy for 2050 to project measures and impacts up to 2037.

SDS 2030 Goal

	Plan Element	Targets
Goal	By 2030, the new Egypt will achieve a competitive, balanced, diversified and knowledge based economy, characterised by justice, social integration and participation, with a balanced and diversified ecosystem, benefiting from its strategic location and human capital to achieve sustainable development for a better life to all Egyptians.	Top 30 global ratings of Egypt for: • Size of the economy, measured by GDP; • Market competitiveness, measured by global competitiveness index; • Human development, measured by HDI; • Quality of life; index to be decided among int. indices • Anti-corruption, measured by anti-corruption score.

NWRP 2037 contributes to the achievement of this goal and its targets by providing an essential condition to enable society and economy to pursue it. This essential condition is 'water security for all', and comprises – as elaborated in the next section – the purpose of NWRP 2037.

Water security is the availability of acceptable quantities and quality of water to society, economy and environment, coupled with an acceptable level of water-related risks (GWP, 2013). An index measuring water security does not measure volumes per se; but it assesses the degree to which the functions that are supported by water resources and the availability of adequate water resources are in a robust and stable balance.

The 2013 Global Water Partnership's report on assessing water security through appropriate indicators provides an overview of several instruments (indices) for measuring a country's (or region's) water security. The report suggests that the most comprehensive indicator is the Asia Water Development Outlook, or Asian water security index. In the report, WSI is applied to Egypt alongside 12 other selected countries on 4 continents.

To rank in the 'top 30' countries, Egypt would to move, in terms of WSI, from being:

- engaged (index value 2) in dealing with water scarcity, i.e. “Legislation and policy supported by government capacity building programs; institutional arrangements improving; and levels of public investment increasing (although these rates may still be inadequate”),
- effective (index value 4) in dealing with water scarcity, i.e. “Water security initiatives built into key national, urban, basin and rural development master plans; high priority on national development agenda; public investment reaching appropriate levels; effective regulation and public awareness and behavioural change are a government priority.

4.2 Purpose

The purpose of NWRP 2037 is to ensure that Egypt achieves water security for all by effectively securing water resources for a competitive, balanced, diversified and knowledge-based economy, characterised by justice, social integration and participation, and by a balanced and diversified ecosystem.

The crux of this purpose lies in three aspects:

- Effectiveness: meaning that the country has to get a better grip on its water resources and on the way it handles and safeguards these;
- Water resources for water use: Egypt will have to make ends meet, where possible by augmenting supplies and enhancing efficiencies and where needed by adapting water use to the water resources availability;
- The objective reads ‘is securing’ rather than ‘has secured’. This indicates that Egypt (through the stakeholders and water users) will achieve a sufficient level of control, while water scarcity itself remains a fact of life.

4.3 Objectives

The above purpose requires Egypt to get a better grip on the way it secures and handles water resources for its society, economy and environment. This is in essence a better grip on the water balance and on the quality of water resources. NWRP 2037 has 4 objectives with associated targets.

4.4 Structure of NWRP 2037's Programme of Measures

4.4.1 Plan Logic

NWRP 2037's logic follows the structure of the intervention logic of the logical framework approach. The lowest tier of the plan comprises activities and measures and supplementary measures. Sets of activities result in an outcome. Making use of this outcomes, Egypt will be able to attain the plan's purpose to provide water security for all. The purpose, in turn, contributes to the national goal (see also Annex 1).

Outcomes are measurable achievements at the end of the plan period (often via interim targets). The outcomes are further discussed in Section 4.4.2.

NWRP 2037 distinguishes between activities, measures and supplementary measures:

- Activities describe what is to be done under the four objectives (WQI, enhanced management of use, new water resources, and enabling environment)
- Measures are the investments that are included in NWRP 2037. They constitute the major part of the forecasted expenditure of NWRP 2037.
- Supplementary measures are activities that enhance or secure the effectiveness of an investment in a measure.

Measures and supplementary measures together form NWRP 2037 Programme of Measures.

4.4.2 Plan Structure

While the structure of the Logical Framework allows us to discern different levels in the intervention logic (activity-outcome-objective—purpose-goal); it does not link outcomes to institutions.

Measures can be unequivocally attributed to a single implementing partner. But generally, several different measures, complemented by supplementary measures, are needed to achieve the required outcome.

NWRP 2037 Objective 1 'IMPROVE WATER QUALITY'

	Plan Element	Targets and sub-Indices
Objective 1	Improve Water Quality	By 2030, the water quality in all surface water sub-systems is maintained or enhanced, according to their current situation, as indicated by the water quality index;
		By 2037, the absolute number of surface water sub-systems with a water quality satisfies the law of Environment increased to 85% of the total number of surface water sub-systems (based on the water quality index)

NWRP 2037 Objective 2 'RATIONALIZE WATER USE'

Objective 2	Rationalize Water Use	By 2030, Total water use efficiency reaches 83%, and reaches 85% by 2037
		By 2030, Average growth rate of productivity from unit of water is 7.2%, and reached 7.9% by 2037
		By 2030, at least 70% of water resources available is allocated for the Agricultural sector

NWRP 2037 Objective 3 'ENHANCE FRESHWATER AVAILABILITY'

Objective 3	Enhance Availability of Freshwater Resources	By 2030, 3.97 BCM of freshwater resources are added to the water balance; (Additional: Deep GW, Desalination & Rainfall harvesting)
		By 2037 another 1.22 BCM of freshwater resources are added to the water balance; (Deep GW, Desalination & Rainfall harvesting)

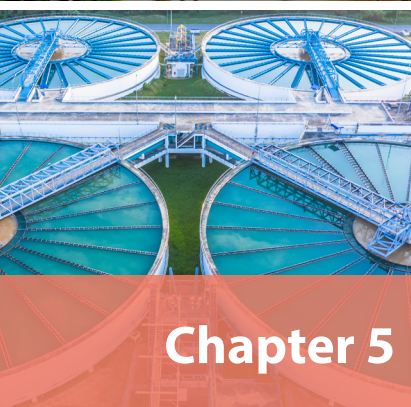
NWRP 2037 Objective 4 'IMPROVE ENABLING ENVIRONMENT'

Objective 4	Improve Enabling Environment for IWRM (planning and implementation)	By 2022, a dynamic structure for national strategic coordination of IWRM is in place, supported by key processes for planning, monitoring and evaluation;
		By 2022, an updated NWRP Programme of Measures for 2023 – 2025 is made, which reflects full coherence between national objectives, 5-year plans and budgets; and priorities set at Governorate-level;
		By 2030, important legislation for water quality and water management reflects Egypt's interpretation of IWRM principles (i.e. finite resource; decentralized management, social inclusion and economic assessments)

As an example: reduced water use by agriculture, requires enforcement of a ceiling on rice, a ban on the export of high water consuming crops, allocation of predefined quantities, possible support mechanisms for investment in farm irrigation infrastructure, promotion of drought resistant crops and research and capacity development to support the spread of new technology.

Where different measures combine in one outcome, two different situations may occur: (i) all or nearly all, measures fall within the mandate of a single implementing agency; (ii) the measures relate to several different implementing agencies.

The implementing partners of NWRP 2037 are Ministries, and it is too simplistic to assume that NWRP 2037 defines all the tasks for them to undertake. Despite having a national plan with a nationally coordinated programme of measures; each implementing agency is and remains responsible for operational planning of investments and supplementary measures in its own domain or jurisdiction. The implementing partners have their own important mandates with respect to society, economy and environment and have important decisions to make with respect to their involvement in NWRP 2037.



Chapter 5

Programme of Measures – General Structure and Overview

- General
- Objective 1 - Improve Water Quality
- Objective 2 - Rationalize Water Use
- Objective 3 - Enhance Availability of Freshwater Resources
- Objective 4 – Improve Enabling Environment for IWRM

This section describes the outcomes and measures that will be pursued and implemented in order to achieve three of NWRP 2037's, which have a direct bearing on water quality, enhanced management of water use, and water availability. Effective implementation assumes that the enabling environment for plan implementation is in place, and that the targets described in this section are assigned to, owned by, and coordinated by or between the concerned ministries. The framework assumes that, within the given targets, the concerned Ministries will, in dialogue with the stakeholders, optimise the set of measures that they will pursue.

5.1 General

An overview of the outcomes, measures, and targets will be given per objective. Further details on the proposed programme of measures, their indicators, and the institutions responsible for their implementation can be found in Annex 2. All targets presented in here refer to the most probable scenario of NWRP 2037 strategy.

5.2 Objective 1 – Improve Water Quality

This objective deals with securing a better quality for all surface waters. Under the most probable scenario of NWRP 2037 strategy it is assumed that these waters will attain at least a medium quality as indicated by WQI.

A recent water quality index is under development which takes into account the compliance with the environmental law no. 48. This will be used routinely to monitor progress in water quality status.



Objective 1 Improve water quality : Overview

	Objective 1	Targets and sub-Indices	
1	Improve Water Quality	- By 2030, the water quality in all surface water sub-systems is maintained or enhanced, according to their current situation, as indicated by WQI; - By 2037, the absolute number of surface water sub-systems with a water quality satisfies the law of Environment increased to 85% of the total number of surface water sub-systems (based on WQI)	
#	Outcome	Targets and Indicators	Responsible Coordinating Entity for Outcome
1.1	Reduced Domestic Pollution Loads Released into the Water System	- By 2030, 100% of all households are served by a wastewater collection system or network. - By 2030, 80% of all households are served by wastewater treatment plants. This service should reach 90% by 2037 . - By 2030, Percentage of solid wastes disposed into water system is 20% of the current situation. By 2037, no solid wastes are expected to be disposed into the water system.	Ministry of Housing, Utilities and Urban Communities Ministry of Local Development
1.2	Reduced Industrial Pollution Loads Released into the Water System	- By 2030, 80% of all industrial wastewater is expected to undergo treatment before release. By 2037, 100% of these wastes is to be treated. - By 2030, organic loads in industrial wastewater disposed into the Nile are reduced by 80%, and fully removed (100%) by 2037. - By 2030, organic loads in industrial wastewater disposed into the Lakes are reduced by 80%, and further reduced to 95% by 2037. - By 2030, organic loads in industrial wastewater disposed into coastal environment are reduced by 60%, and further reduced to 85% by 2037.	Ministry of Environment
1.3	Reduced Agricultural Pollution Loads Released into the Water System	- By 2030, percentage use of agro-chemicals (relative to total usage) from the agricultural sector is reduced to 75%, and further reduced to 70% by 2037; - By 2030; 75% of samples taken from freshwater bodies (Nile & canals) should meet the thresholds indicated by the law. This percentage should reach 85% by 2037 (according to same regulations).	Ministry of Agriculture and Land Reclamation Ministry of Water Resources and Irrigation
1.4	Increased Quantity of Good Quality Drainage Water Suitable for Different Usages	By 2030, 80% of the drainage surface water sub-systems downstream sampling locations report at least medium quality as measured by the water quality index and it will be the same until 2037.	Ministry of Water Resources and Irrigation

Outcome 1.1 – Reduced Domestic Pollution Loads Released into the Water System

Around 72% of the settled rural areas in Egypt are not served by public sanitation networks. Wastewater is discharged (with or without treatment) to agricultural drains, and sometimes to canals, where its use becomes unsafe (MoHUUC, 2016). In addition, in many areas solid household waste is also dumped in open waterways, where it threatens both the water quality and the conveyance capacity of these waterways. Since sanitation networks reduce water quality in the receiving water bodies, wastewater treatment is needed to decrease the domestic pollution in water bodies.

MoHUUC and the Holding Company for Wastewater (HCWW) are required to improve upon this situation. The Rural Sanitation Strategy (MoHUUC, 2016) provides a comprehensive framework to guide the investments in improving the situation. In addition, efforts are needed to address the problem of solid waste.

Outcome 1.2 – Reduced Industrial Pollution Loads Released into the Water System

MoEnv has the lead in reducing the pollution by industries. Measures combine investment in treatment capacity with regulatory measures and enforcement to bring down the industrial pollution. Development of industrial zones could facilitate shared treatment of some industrial wastes.

Outcome 1.3 – Reduced Agricultural Pollution Loads Released Into the Water System

Control of agro-chemicals use (fertilizers, plant protection chemicals and medicines in fish culture) is a challenge facing MALR.

Measures could include promotion of awareness for safe and efficient use; promotion of integrated pest management practices, preferential treatment of organic agriculture and a stricter regulation on the import and sale of agro-chemicals. Innovation in integrated aquaculture and fisheries could be attractive.

Outcome 1.4 – Increased Quantity of Good Quality Drainage Water Suitable for Different Usages

The measures under outcome 1.1, 1.2 and 1.3 will go a long way in improving water quality in drains. Nevertheless, dedicated efforts to address pollution in specific drains with critical water quality are needed simply because one cannot wait in such cases. Measures that could be considered include dredging of contaminated sludge, in-stream treatment of water through wetlands and conventional treatment.

5.3 Objective 2 – Rationalize Water Use

The second objective deals with a better water management in all water services and consuming sectors.

The total water use efficiency is defined as the total consumed water (including evaporation) divided by total available freshwater supplied.

Outcome 2.1 – Increase of Agricultural Water Productivity

How water is used in the individual farm is of course determined by the farmer, but MALR has a lead role in enhancing the production per unit water (more crop per drop; or even: more cash per splash). MALR invests in marwa improvements and laser land levelling, and it uses its extension wing to promulgate rational use of water.

Water security is a key prerequisite for farmers to invest in water saving technology and to switch to high value cash crops that require less water. In this context it is essential that sufficient water buffers are available in the whole system, either in the root zone, in the aquifers, or by setting up fish ponds.

Proposed measures also include increased reuse of drainage water for agriculture. While generally considered not fit for use in irrigating food commodities, sewage effluent can be an important source of freshwater for agricultural production, especially where primary treatment has been completed and sanitary precautions have been taken. MoHUUC, with involvement of MALR and the private sector, is responsible to enhance reuse of sewage effluent of an adequate quality. However,

Objective 2 – Rationalize Water Use: Overview

#	Objective	Targets and sub-Indices	
2	Rationalize Water Use	• By 2030, Total water use efficiency reaches 83%, and reaches 85% by 2037	
		• By 2030, Average fixed growth rate of water productivity from unit of water is 7.2%, and reached 7.90% by 2037	
		• By 2030, at least 70% of water resources available is allocated for the Agricultural sector	
#	Outcome	Targets and Indicators	Responsible Coordinating Entity for Outcome
2.1.	Increase of Agricultural Water Productivity	• By 2030, the average growth rate of local agricultural production reaches 4.5%, and achieves 6% by 2037	Ministry of Agriculture and Land Reclamation
		• By 2030, the percentage of safely used agricultural drains water reaches 49%, of ag. drainage water and reaches 51% by 2037	Ministry of Water Resources and Irrigation
2.2	Household Water Use Rationalized	• By 2030, system loss and unaccounted for water will not exceed 20% of the total volume supplied for domestic water use, and reaches 15% by 2037	Ministry of Housing, Utilities and Urban Communities
		• By 2030, the average total water use per capita will fall to 266 l/c/d, and further fall to 242 l/c/d by 2037	
2.3	Increase of Industrial Water Productivity	• By 2030, the average fixed growth rate of water productivity of industrial water is 6.5%, and reaches 7% by 2037	Ministry of Trade and Industry

this measure will only be possible following improved coverage of domestic wastewater systems through ongoing interventions such as the Rural Sanitation Programme, equivalent programmes in urban areas and measures under outcome 1.1.

Measures under this outcome are focussed on managing water conveyance and distribution as well as water use at field level demand, including the promotion of strategic cropping patterns and low water consuming crops and legislation to ban the export of crops that require high volumes of water,

The measure includes expanded the construction of greenhouses which already started as part of the fast action taken by the government recently in 2016. Initially, it is envisaged that simple greenhouses are be constructed, and that these will become increasingly high-tech as the plan progresses, first included automated fertigation, air conditioning and ultimately water recycling and hydroponics.

Regulatory measures should accompany the technical measures under this outcome, such as legislation to allow fish culture using fresh Nile water when integrated with agriculture, charges for operation and maintenance of water transmission systems, and modification of the HAD operating rules.

Outcome 2.2 – Household Water Use Rationalized

To influence how households use the drinking water they are supplied with, MoHUUC employs a plethora of supplementary measures: awareness campaigns, (staggered) pricing and metering; direct intervention at big spenders; and campaigns to promote use of better equipment (fittings and seals) and water saving devices.

Investments are also needed with respect to the upkeep, modification and possible expansion of supply systems to serve Egypt's growing population.

However, part of this extra capacity will be covered from reduced leakage and wastage of treated drinking water.

Measures include leak detection and remediation; and curbing of usage of drinking water for public green or private parks. MoHUUC is responsible for this outcome.

Outcome 2.3 – Increase of Industrial Water Productivity

MoTI will, in parallel to its efforts to enforce better treatment of polluted return flows from industries, work on programmes to enhance the rational use of water in the industries.

This will include price incentives and awareness campaigns; in-company treatment; use of closed circuits and a shift from water cooling to air cooling.

5.4 Objective 3 – Enhance Availability of Freshwater Resources

The 3rd objective deals with the amount of freshwater which can be made available to the country in a sustainable way.

Outcome 3.1 – Securing Share of Egypt in the Nile Water¹

Set against the challenges posed by climate change and upstream developments, Egypt strives to secure its current annual share of the Nile water (55.50 BCM) or, if possible, enlarge its share in the Nile flows. Continued engagement in water diplomacy with the upstream riparian states is the first step towards this outcome.

Being able to engage with these countries in a constructive manner opens the way for looking for win-win solutions. This allows dialogue on

Objective 3 – Enhance Availability of Freshwater Resources

#	Objective	Targets and sub-Indices	
3	Enhance Availability of Freshwater Resources	• By 2030, 3.97 BCM of freshwater resources are added to the water balance; (Additional: Deep GW, Desalination & Rainfall harvesting)	
		• By 2037 another 1.22 BCM of freshwater resources are added to the water balance; (Deep GW, Desalination & Rainfall harvesting)	
#	Outcome	Targets and Indicators	Responsible Coordinating Entity for Outcome
3.1	Securing Share of Egypt in Nile Water	• Annual water flowing into the HAD secured at of 55.50 BCM	Ministry of Water Resources and Irrigation and both of Ministry of Foreign Affairs and Ministry of International Cooperation
3.2	Enhanced volume of Rainwater Captured	• By 2030, annual average contribution of rainwater & flood harvesting reaches 1.42 BCM, to be stabilized at 1.45 BCM by 2037	Ministry of Water Resources and Irrigation
3.3	Increased volume of Desalinated Brackish Groundwater and Seawater	• By 2030, a total of 2.40 BCM of desalinated water produced annually, and raised to 3.14 BCM by 2037	Ministry of Housing, Utilities and Urban Communities
3.4	Rationalized Abstracted Volume of Groundwater	• By 2030, total extraction of deep groundwater reaches 4.25 BCM per year, and to be stabilized at 4.70 by 2037	Ministry of Water Resources and Irrigation

¹ at least equal to the current rate of 55.50 BCM per year



the operation of upstream reservoirs and on other interventions in the flow of the river Nile; with a view to secure Egypt's share. Measures under this outcome include a portfolio of upstream developments to enhance the inflow into Lake Nasser, however implementation of these developments depends on international diplomacy efforts and it may take some time before these interventions can be started.

Outcome 3.2 – Enhanced Volume of Rainwater Captured

There is some scope to capture a greater part of the limited rainwater through rainwater harvesting, flood interception and recovery of shallow rain-fed groundwater, largely along the Mediterranean coast, Red Sea coast and in Sinai.

The potential for doing so is likely to reduce with climate change, but it is possible to bring the proportion of rainwater captured up.

MWRI is the main player in providing the requisite infrastructure (such as retention dams and reservoirs) and in regulating the reuse of this rain-fed groundwater.

Outcome 3.3 – Increased Volume of Desalinated Brackish Groundwater and Seawater

Desalination of brackish groundwater or seawater is an alternative to bringing Nile Water Resources to remote and coastal areas, especially, the Red Sea coast.

In particular, the tourist facilities on the Red Sea coast could rely on desalinated water, but the same holds for some of the towns in that area, and on the Mediterranean coast - MoHUUC will require that developers invest in desalination through its system of permitting.

MoT plays an important role in pursuing desalination by the coastal resorts. It was agreed that

any additional water demand for the municipal sector in the coastal areas shall be satisfied based on desalination.

Outcome 3.4 – Rationalized, Abstracted Volume of Groundwater

Water continues to be drawn from the Nubian Sandstone Aquifer.

This source of groundwater can be used as long as withdrawals are within the safe yield.

MWRI will lead this development, and will combine licensing withdrawals, with monitoring of the withdrawal, rehabilitation of groundwater pumps, and with further research into the recharge rate.

5.5 Objective 4 – Improve Enabling Environment for IWRM

This section discusses the outcomes and activities of the 4th objective which ‘put the house in order’ for organising the implementation of ‘water security for all’. The outcomes enhance the level of control over water availability, water quality and enhanced management of water use at national, regional and local levels. The outcomes enable key actors in the present and future management of water to assume their

role within an overall structure that ensures adequate national oversight and coordination.

The following two Tables provide an overview of the objective targets and outcomes to be provided towards establishing the ‘enabling environment’ required for the implementation of NWRP 2037. Following the Tables, the outcomes and the associated implications, are briefly discussed.

Objective 4 – Improve Enabling Environment for IWRM : Objective Overview

#	Objective	Targets and sub-Indices
	Improve enabling environment for IWRM, planning and implementation	• By 2022, a dynamic structure for national strategic coordination of IWRM is in place, supported by key processes for planning, monitoring and evaluation; • By 2022, an updated NWRP Programme of Measures for 2023 – 2025 is made, which reflects full coherence between national objectives, 5-year plans and budgets; and priorities set at Governorate-level; • By 2030, important legislation for water quality and water management reflects Egypt’s interpretation of IWRM principles (i.e. finite resource; decentralized management, social inclusion and economic assessments)



Objective 4 - Enabling Environment: Outcomes Overview

#	Outcome	Targets and Indicators
4.1	Mechanisms and structures for coordination at decentral and central levels strengthened	• By 2022, NWRP is approved by charging implementing agencies with the responsibility for specified outcomes. • By 2022, water resources plans for the governorates are prepared, and each governorate has a tentative water budget and a priority plan for NWRP-related investments, based on a consultative approach. • By 2023, the implementing agency's five-year plans reflect own objectives, relevant NWRP outcomes and priorities expressed at national and governorate levels. • By 2023, a baseline with respect to the goal, purpose, objectives and outcomes of NWRP is established, and the routine system for the monitoring & evaluation of the situation with respect to water resources is in operation. Periodic report (every two or three years) on the state of water (until 2037), gauged against NWRP goal, purpose and objectives are published and publicly accessible. • By 2022, a strategy with respect to disaster management and disaster risk reduction is agreed; as well as developing and testing institutional capacities for this purpose.
4.2	Regulatory framework revised and updated	• By 2023, a water balance and water quality assessment will inform all approvals and all decisions with respect to major investments. • By 2030, a comprehensive legal and regulatory framework reflects Egypt's NWRP principles is in place to enable decentral decision-making with respect to water management.
4.3	Public support for 'water security for all' generated	• By 2025, all implementing partners have aligned their external communication to the communication strategy 'water security for all'
4.4	Enhanced Professional capacities for IWRM	• By 2022, a strategy with respect to building IWRM capacities is prepared and agreed;

Outcome 4.1 – Mechanisms and Structures for Coordination at Decentral and Central Levels Strengthened

The firm hand that is required to enhance Egypt's control over its scarce water resources needs to be established urgently. A Cabinet decision is required to mandate a permanent high-level council for oversight and strategic coordination of NWRP.

A key exercise, to be undertaken in the short-term, is to ensure that the work plans and

budgets of the implementing agencies reflect the outcome targets set by NWRP 2037. This requires that the draft Five Year Plans of the implementing agencies take into consideration the priorities expressed at Governorate-level; as well as to assess the effectiveness of the measures undertaken by them.

For practical reasons, coordination between entities, especially for outcomes that involve more implementing partners, needs to take place at the lowest possible level; but procedures for

such coordination needs to develop. MPED and MWRI will help develop additional coordination mechanisms for critical outcomes, ensuring that the concerned implementing partners establish synergy between their respective measures. MPED and MWRI will address this issue in the period up to 2020.

Egypt, in applying its principles for IWRM, hope to focus water resources decision- at the lowest appropriate level. This is also known as the subsidiarity-principle and it is a well-tested governance approach. Decisions are in principle taken at the lowest level, but higher authorities may temporarily step in if an issue or bottleneck is not adequately addressed at the lower level. Subsidiarity allows the Government to issue new policies, while hierarchically lower entities have a fair degree of freedom in deciding how they would apply that policy to their specific circumstance. Only when the lower entity ignores the new policy or is unable to achieve it, will the Government step in directly.

Egypt has in the past decade defined the outline of its decentralised system to govern water resources.

This includes Governorates, as the entity where available water resources are allocated between sectors; the Integrated Water Management District, which regulates water use between sectors and a tiered organization that represents the interest of water users at different levels:

- WUAs at mesqa (tertiary) level, who are fully responsible for water distribution and cost recovery within their command area;
- BCWUAs, which play the same role at the level of the branch canals;
- District Water Boards (DWB), which are the counterpart organization to the IWM-Districts.

In recent years, the roll-out of the above model has come to a standstill, while the formal mandating of the new structure has been lagging behind their establishment on the ground.



A decentralized structure is essential for matching supply and demand; and for addressing water quality concerns; especially those emanating from point sources. MWRI is to renew its efforts at establishing a new institutional framework for water management decisions; with a view to have the system fully up-and-running by the end of the present plan.

A higher degree of control over water availability, water quality and water use strengthen the capability to prepare for and swiftly respond to emergency situations, including exceptional and possibly prolonged drought, pollution incidents and floods. This may be coordinated with the existing Crisis Management Unit (CMU) under the Information and Decision Support Center of the Cabinet.

Outcome 4.2 – Regulatory Framework Revised and Updated

A regulatory framework is needed to ensure that planning of individual investments, whether by government or private entities, takes into account how the investment affects other water users in terms of water availability and water quality.

This would be a further specification to the already existing framework for environmental and social due diligence. It follows then, that the development of this procedure is the responsibility of MoEnv. The required procedure must ensure that new investments do not negatively affect the water availability and water quality for downstream water usage. This may require that mitigation or compensation is included in the planned investment.

In the short-term a strategy defining priorities and methods for implementing IWRM principles in the national legislation and regulatory framework needs to be developed. This defines a trajectory for the revision of key legislation by the concerned implementing agencies and helps to ensure the consistency between the various legislative developments.

Outcome 4.3 – Public Support and Awareness of “Water Security for All” strengthened

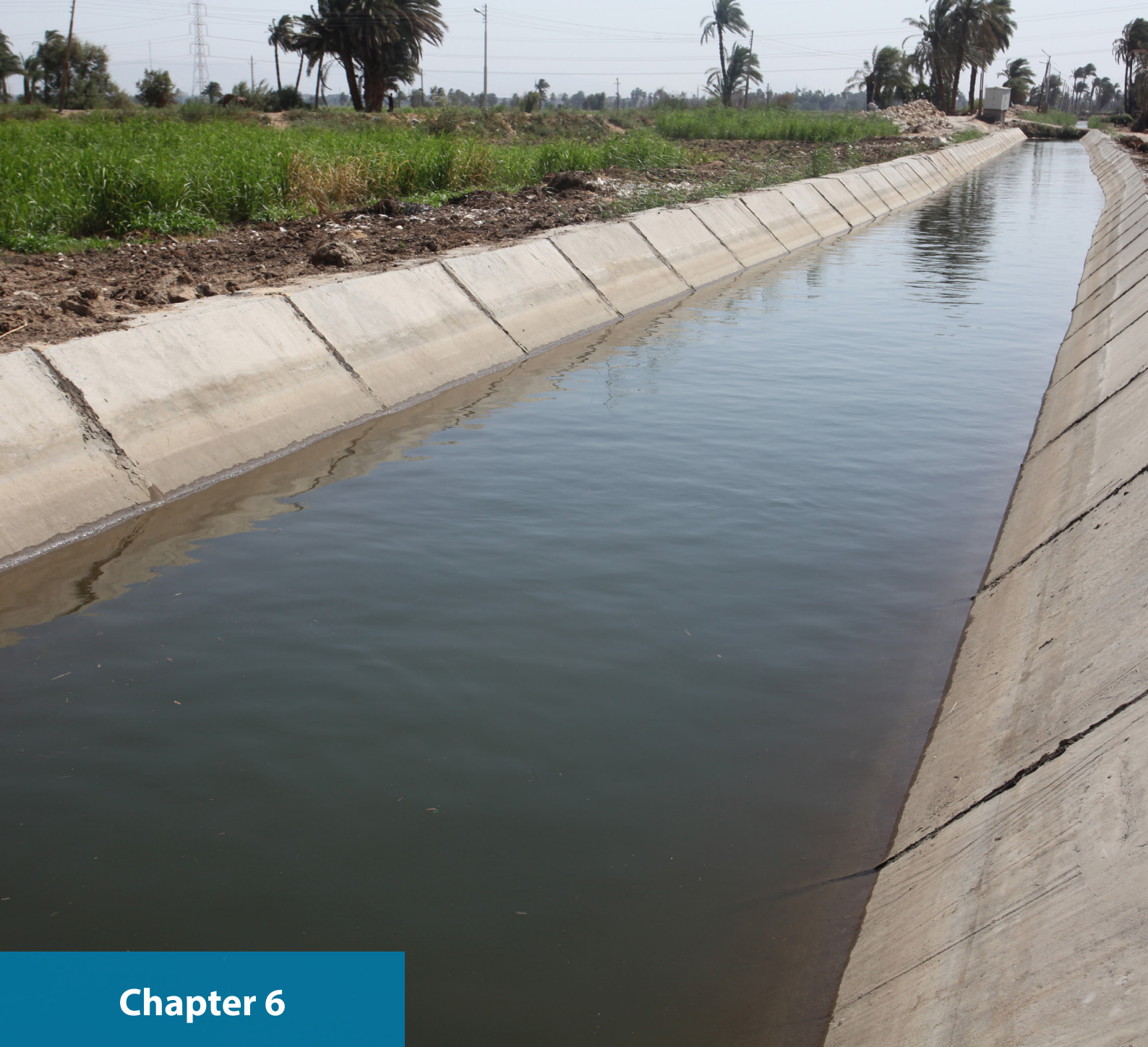
‘Water security for all’ requires public acceptance of costly and sometimes controversial measures. It also requires a culture of wise water use to be embraced by all members of the public. This ambition stands in stark contrast to the present public negligence of water resources. Neither excessive water use nor pollution of the water resources by solid waste are presently frowned upon by the general public..

In the short-term a core message and integrated communication strategy need to be defined, and accepted by the implementing agencies, so that within the next five-year plan, each implementing partner disseminates the same or a similar message on the urgency for the measures it takes. The key audience in the medium-term is the staff of the concerned Ministries, so that decentral offices or specialised services conform to a central message, which includes information on the severity of the problem (‘a forty percent decline in per capita water availability by 2030’) and the solution (‘strong measures to ensure water security for all’).

All information should be presented in periodical State of the Water Reports; and the reports and underlying information should be accessible for the public. Getting a commitment from society to support water security for all; and to accept the difficult measures associated with it, requires full openness about the situation.

Outcome 4.4 – Enhanced Professional Capacities for IWRM

To make sure that an enhanced level of water management is applied to balance demands and supplies, public servants in the water sector need to acquire new capacities, including ‘soft skills’, such as coordination and dealing with the public. While each implementing agency has its own capacity building programmes.



Chapter 6

Implementation

- From National Plan to Implementation
- Impacts
- Cost estimates for investments of the second NWRP
- Funding Potentials and Alternatives
- Risks

NWRP 2037 provides a framework for facing growing pressures on water availability and quality. It does so by: (i) aligning water management to the national vision of sustainable and inclusive development (i.e. the Government's Sustainable Development Vision for 2030); (ii) providing a common goal for all water sector agencies (water security for all, with a measurable index value for 2037); and (iii) defining clear objectives (improve water quality, enhanced management of water use, developing water resources, and improve enabling framework.). In addition, NWRP 2037 suggests outcomes and measures per implementing partner.

This Section describes how measures can be brought to implementation to achieve suggested outcomes. The first section outlines the steps by which NWRP 2037 can be brought to bear on the operational plans of the implementing partners. In support to the operational planning, the subsequent sections provide: (i) a perspective of what can be achieved by full implementation; (ii) a discussion of the likely costs and a basic framework for identifying measures that provide most effect for the least cost; and (iii) a discussion of the main risks that could affect implementation.

6.1 From National Plan to Implementation

Responsibility for implementing NWRP 2037's activities, measures and supplementary measures rests and remains with the implementing partners. A lesson learned from the previous NWRP is that the plan and its coordination mechanisms did not provide sufficient guidance to the decision-making by the implementing partners.

NWRP 2037 intends to provide stronger guidance than NWRP 2017 was able to do. This is primarily done by the establishment and activation of coordination mechanisms at both National and Governorate-levels.

However, it is by no means the intention that decisions are made for, or on behalf of, the implementing partners. Rather, while there is need for a stronger hand in terms of overall coordination, the implementing partners themselves remain primarily responsible for establishing a realistic match between outcome, targets, measures and resources.

For the period 2018–2020, the financial allocations by the implementing agencies will be dictated to a large extent by the fast-track measures listed by the Ministerial Committee established by Prime Ministerial Decree 1193 of April 2016. NWRP 2037 recommends fast-tracking the activities under its first objective (better enabling environment) as well so that by 2020 the implementing agencies are able to reflect NWRP 2037 ambitions in their FYP 2020–2025.

Preparations for the 2020–2025 FYP is to be supported by an exercise further elaborating the programme of measures per outcome. Each outcome sets a quantified target; and individual measures can be assessed on their contribution to this target through indicators (Annex 2). However, it is for the entities responsible for each outcome to refine the measures and indicators, as well as the timeframe for implementation.

6.2 Impacts

Full and successful implementation of NWRP 2037 will alter the water balance and will impact the water allocation to, especially, the agricultural sector.

The water balance indicators below reflect the overall changes to the water balance. Compared to BaU strategy the higher net supply in 2037 brought about by NWRP 2037, results in concomitant increases in net consumptive use, net outflow and reuse. The overall efficiency of the system does not change significantly, as the present overall system efficiency is close to its ceiling.

Overall water balances up to 2037 for the Strategy NWRP 2037 – Most Probable Scenario

Year	Net Supply (BCM)	Net Consumptive Use (including evaporation) (BCM)	Net outflow (drainage to sea and sump) (BCM)	Reuse (BCM)	Net System Efficiency (%)
2017	59.60	47.29	12.31	20.65	79.35
2020*	60.70	48.97	11.73	21.26	80.68
2030*	63.57	53.02	10.55	22.11	83.40
2037*	64.79	55.17	9.62	22.34	85.15

* All future projections pertain to the Strategy NWRP 2037 – Most Probable Scenario
Source: Water balance studies

The next table uses sector indicators to show first that water scarcity – expressed in total freshwater resources per year per head of the population – is only narrowly higher than expected by the business-as-usual strategy; and still remains in the range of absolute scarcity.

The table also shows that, compared to the business-as-usual strategy presented earlier, substantial changes will occur in the allocations

and usage by the sectors. Despite the autonomous effect of a rapidly growing population, from 95 million in 2017 to a probable 147 million in 2037 (50% increase), the allocations to domestic and industrial sectors will grow at a more modest rate; reflecting that the sectors are able to enhance their water use efficiencies and at the same time ensure that allocations continue to cover the actual use.

Sector Indicators for all water balances up to 2037 for the Strategy NWRP 2037 - Most Probable Scenario

Sectorial indicator	Unit	2017	2020*	2030*	2037*
Population	Million capita	94.8	101.79	128.09	147.1
Available freshwater resources	BCM/year	59.60	60.70	63.57	64.79
Available per capita (freshwater)	m ³ /capita/year	629	596	496	440
Allocation for domestic water supply	BCM/year	10.70	11.25	12.45	13.00
Per capita allocation	l/c/d	309	302	266	242
Per capita consumption**	l/c/d	77.9	76.6	69.8	67.8
Allocation for industries	BCM/year	5.40	5.50	6.90	7.30
Industrial water consumption**	BCM/year	1.41	1.46	2.19	2.41
Allocation for agriculture***	BCM/year	61.65	62.71	63.76	64.23
Allocation per feddan	m ³ /year	6752	6532	6015	5735
Agricultural water consumption**	BCM/year	40.69	42.13	45.00	46.52
Consumption per feddan	m ³ /fed/year	4457	4389	4245	4154

* All future projections pertain to the Strategy NWRP 2037 – Most Probable Scenario

** Per capita consumption of domestic water, industrial water consumption and agricultural water consumption are estimated.

*** Net agricultural allocation equals available resources minus net outflow minus net consumption by domestic & industrial users
Source: Water balance studies

As a consequence of the small increase in supply and the restrained growth of allocations to the domestic and industrial sectors; the total allocation to the agricultural sector can actually increase from 61.65 in 2017 to 64.23 BCM in 2037. NWRP 2037 expects that this growth in allocation will allow the agricultural sector to expand its area. The total agricultural area is expected to increase in the 'with-NWRP' strategy to 11.20 million feddan, as opposed to 9.80 million feddan under BaU strategy in 2037. As a consequence, the allocation per feddan will be reduced; which translates into a reduced consumption per feddan as well. While allocating more water to the agricultural sector, the farmers will continue to face a situation of water scarcity.

ASME predicts that without fundamental changes to the farming system, the above would allow farmers to realize a 2.0% annual growth of their sector to the economy. ASME can, however, not reflect fundamental adaptation measures in the agricultural sector very well. Such fundamental innovations could include closed systems (e.g. hydroponics), extensive use of greenhouses and integration of agriculture and aquaculture.

Innovation in the agricultural sector - brought about inter alia by strict volumetric supply, investment support facilities and dedicated research and dissemination efforts - is expected to result in a sustained agricultural growth of 4.5% per annum in 2030, and this can be further raised to 6% by 2037. This is expected to be reflected in a continued trend towards high value crops. Even without factoring in innovation in agriculture,

ASME foresees a drop in cereal self-sufficiency, accompanied by a relative shift from rice to wheat cultivation. The existing food gap is likely to widen, but the ratio of exports to imports is expected to marginally improve. As a consequence, the import of virtual water will - through the import of food - increase, but not as drastically as foreseen in BaU strategy.

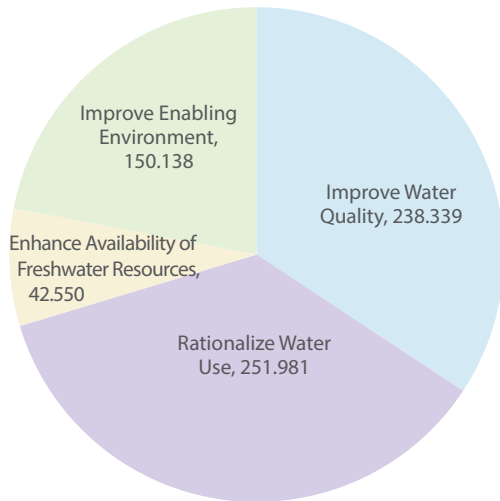
6.3 Costs and Cost-Effectiveness Analysis

The programme table in Annex (1), lists the actions likely to be undertaken by the implementing partners for achieving targeted outcomes with respect to water quality, enhanced management of water use, and water availability.

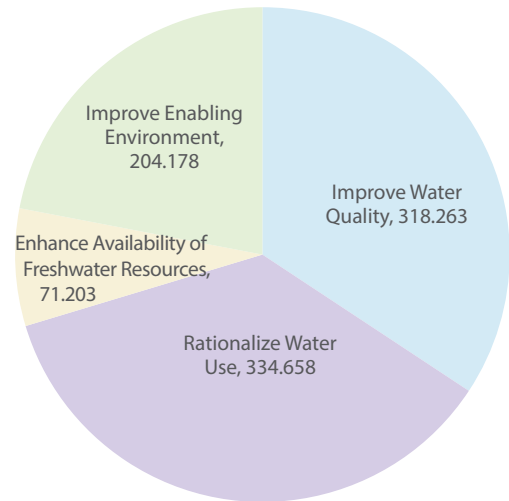
Taken together, these measures (and supplementary measures) are estimated to amount to an investment value of approximately BLE 533 over the period 2017–2030, with an additional amount to be spent on enabling environment activities and total recurrent costs of BLE 150 (i.e. total of BLE 683). For the period 2017–2037 this investment value rises to BLE 724 plus enabling environment activities and total recurrent costs of BLE 204 (i.e. total of BLE 928).

The distribution of these investments over the four NWRP 2037 Objectives and among the various partner Ministries is presented in the following figure:

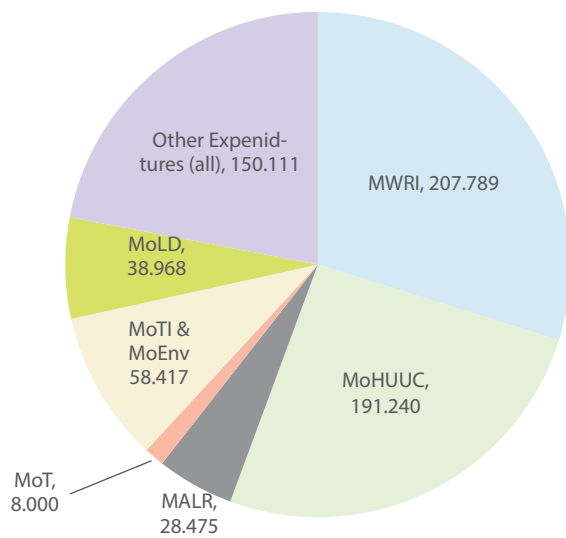
Summary for estimated costs of the investment plan of the second National Water Resources Plan 2037 (BLE)



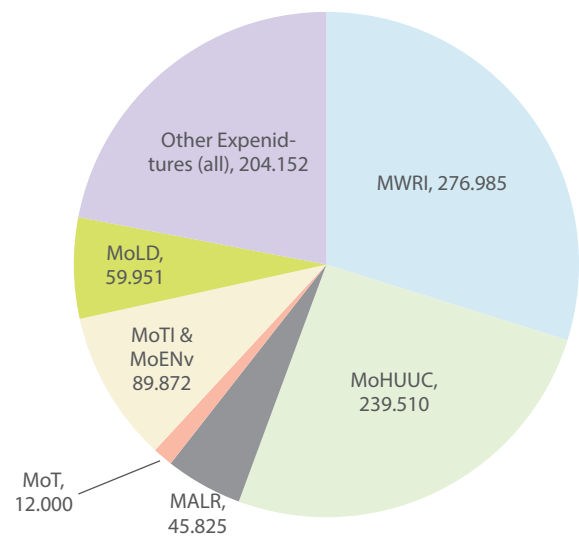
Estimated Investments till 2030: (Total BLE 683)



Estimated Investments till 2037: (Total BLE 928)

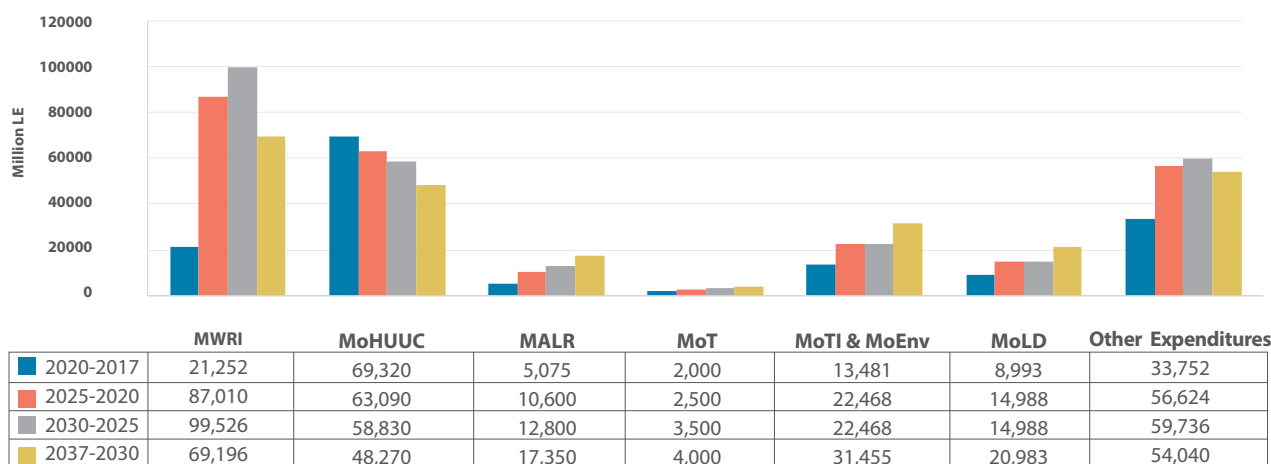


Distribution of estimated investments till 2030 (BLE)



Distribution of estimated investments till 2037 (BLE)

NWRP Estimated Investments for Measures of Different Ministries for the period 2017-2037



These estimates are ‘ballpark’ figures and they provide a rough indication of the investments and recurrent costs to be made. When expressed as an annual expenditure – considering both investment and recurrent costs – the average annual expenditure is estimated at BLE 49.50 till 2037, equivalent to approximately 0.7% of the projected GDP for 2017.

NWRP 2037 is a framework that provides direction and coordination to the national effort to provide water security for society, economy and environment. It does not have its own budget allocation.

Rather it is predicated on the assumption that the budgets of implementing agencies adequately reflect the urgency of enhanced water security. Operational planning, and therefore also budgeting and disbursement, are the responsibility of the implementing agencies.

NWRP 2037 aspires that by 2020, when Egypt re-starts a cyclic five-year planning cycle, the implementing agencies have operational activity plans and budgets that support the achievement of well-defined tangible outcomes with respect to water availability, water quality and enhanced management of water use.

The cost of a measure comprises two elements: (i) the (one-time) investment, and (ii) the re-

current annual expenditure associated with it. The investment is a one-off cost, which does not need to be repeated until the economic life time of the investment ends.

The recurrent cost is an annual expenditure, repeated every year over the life-time of the investment. Taken together, investment and recurrent cost form the life cycle cost. Net Present Values (NPV) for different alternatives are estimated in order to compare the economic performances of alternative approaches.

6.4 Funding Potentials and Alternatives

Infrastructure projects constitute major parts of the investment plan for NWRP 2037. Projects usually include; physical infrastructure projects such as roads, power stations, utility networks, irrigation systems, and drinking water and waste water treatment plants.

Traditionally, state budgets play the key role in financing various infrastructure projects. Some serious questions are raised when considering the investments required to implement all NWRP 2037 measures over the upcoming 20 years.

This is mainly due to aggravated economic pressures on state budgets created by costs of

subsidies and social safety networks, such as education and health services, as well as the recent devaluation of Egyptian Pound against foreign currencies.

This critical situation necessitates employing other funding mechanism and alternatives to enable the implementation of NWRP 2037 projects and activities which requires its implementors to:

- stimulate and enhance participation of the private sector in the construction and operation of infrastructure and public utilities projects. Law 67 / 2010 was ratified to regulate this process on BOT (Build, Operate and Transfer) basis. A special PPP (Public-Private-Partnership) Unit was established and activated within the Ministry of Finance for this purpose;
- Maximize international partnerships, participation and contribution to infrastructure projects via bi-lateral or multi-lateral agreements. This is to help in satisfying increasing demands of foreign currencies required for infrastructure projects;
- Rationalize investment costs by investigating potentials for low cost technologies, especially the adoption of simple, low cost technologies for rural areas. Encouraging scientific research is a vital factor in this respect to develop a demand driven national know-how that is fully adopted to local conditions;
- Make an inclusive inventory of all unutilized/not needed fixed assets of the governmental implementing agencies and to be prepared to sell or rent them off when required to finance infrastructure projects. MWRI already started the process of establishing a dedicated economic/ investing entity to efficiently utilize all existing assets;
- Recover self-financing/cost recovery for investments/capital costs of infrastructure

projects from beneficiaries. This alternative is of increasing importance for irrigation improvement and modernization projects due to the high costs and big benefits gained at later stages.

Irrigation and Drainage Law 12/1984 stipulated that in cases where the government initiated projects to improve irrigation and drainage infrastructure systems, farmers need to pay for the costs. The ongoing update of this law, which is still under discussions, shall give more emphasis to this issue;

- Recover of operational/maintenance costs of infrastructure services rendered to beneficiaries, especially those who are directly benefiting from these services. Consumer or client organizations would undertake this assignment if being delegated by relevant authorities.

6.5 Risks

Implementation of NWRP 2037; the achievement of its outcomes, objectives and purpose; and its contribution to Egypt's overall development goal may be hampered by one or more of several risks among which a number of common examples are identified in this paragraph.

In anticipation of a full-fledged risk analysis, it would also be commendable to set aside a 'Contingency Allocation' of 35% of the full costs, or some 310 BLE in total for the period 2017-2037.

Risk 1:

Low Acceptance of the Common Goal

NWRP 2037 addresses an enormous challenge to society, economy and environment. The issue of water scarcity, and its impacts, goes beyond the mandate of a single Ministry. If the present situation – in which one ministry is more strongly inclined to address the issue than other ministries – continues, then the progress across the plan will be very uneven; and some measures will be ineffective.

Risk 2: **Inadequate Financial Resources**

NWRP 2037 comes with a price tag. This is logical, as a higher degree of control over scarce water resources requires an effort. The effort eventually pays-off, as the value of water for the economy would increase as well. However, before that happens substantial investments need to be made. And with each investment, there will also be a concomitant need to cover the costs of operation and maintenance.

Assuming that the commitment to the implementation of NWRP 2037 remains strong throughout (i.e. risk 1 does not materialise), external economic and geopolitical developments may affect the Government's capacity to finance all measures implied by NWRP 2037.

NWRP 2037 promotes prioritisation of those measures that provide the highest effectiveness for the least combined cost of investment and recurrent activities.

If a shortfall in investment funding would occur, this would largely have the effect of delaying the achievement of the plan. If, however, recurrent costs cannot be met (or are not met), this would render investment less effective.

For example: a well-built wastewater treatment plant will not downstream water quality if the cost of running it is not met. This makes recurrent cost recovery a high priority, especially in a situation of limited resources.

There are also risks associated with unreliable estimates for financial investments stemming from a wide variety of sources, but the most likely to occur are those from inflation, FOREX adjustments, and other changes in local prices for materials and labour. The common strategy to deal with this is to verify and regularly update these sheets.

Risk 3: **Unforeseen Environmental and Social Impacts**

No strategic environmental and social assessment for NWRP 2037 has been done, as doing

so is not a standard procedure under the current regulations in Egypt. Environmental impact assessments would only take place at the planning stage of individual measures; and then only for physical investments.

Although the Environmental Impact Assessment procedure addresses social concerns (such as displacement) these would only be undertaken for infrastructure. The costs of mitigation of social and environmental impacts are, however, not explicitly factored into the estimated investment costs.

In addition to social and environmental impacts of physical investments; supplementary measures, such as removal of illegal settlements from the banks of canals (in order to improve water management), do affect livelihoods of people and – depending on the situation and the legal dimensions – may require a compensation and/or resettlement package.

The above indicates that there are gaps in the due diligence process for social and environmental impacts: costs are as yet not foreseen, and safeguards are applied neither on the supplementary measures nor on the activities to establish a new enabling environment.

Risk 4: **Weak Public Awareness and Support**

The ambitions of NWRP 2037 require that tough choices are made. For example, drinking water use is proposed to be reduced; and doing so may be wrongly construed as an infringement on the individual Egyptian's entitlement to drinking water.

Lack of public awareness on the urgency and necessity of measures, and on the underlying principles of inclusive development and sustainability would make the implementation of NWRP 2037 vulnerable to public opposition.

A number of measures directly depend on the willingness of the public to contribute to the



measures. This holds especially true for all efforts with respect to promoting rational use of water at household, farm and enterprise levels. Stricter allocation of predetermined volumes will stimulate the water users to innovate the way they use the limited resource; but the same strictness may provoke opposition.

NWRP 2037 prioritises development of a communication strategy across all implementing agencies. The core message would include an explanation of the challenge (growing water scarcity) and of the way forward (water security for all).

Risk 5:

Continued Rapid Population Growth

NWRP 2017 high scenario for population growth expected a population of 86.9 million by 2017. In 2017 the population already exceeded 90 million. For NWRP 2037, new projections (optimistic, most probable, and pessimistic) are made, reflecting the current demographic trend.

NWRP 2037 outcomes will be strongly affected by a higher than expected population growth. Population policies may help manage this risk, but these fall outside the scope of the present, and in fact any, water resources plan.

Risk 6:

Unanticipated Upstream Developments

Developments in the upstream Nile riparian states may affect Egypt's share of the Nile waters more strongly than presently assumed and agreed.

Diplomacy and bilateral cooperation are directed at initiating development activities that provide win-win outcomes: both supporting the local development in the upstream country, as well as contributing to ensure, and possibly enhance, Egypt's share from the Nile waters.

Risk 7:

Unforeseen Stronger Effects of Climate Change

NWRP 2037 has included effects of climate change in its analysis of the water balance.

These are, by necessity, average effects, whereas the reality may be that, for example, inflow into Lake Nasser will be affected by a series of extremely dry years.

The actual weather patterns will deviate from the expected average foreseen by climate change studies, and the climate change models themselves may underestimate the actual climate change taking place.

The end result would be that overall available water resources may reduce further, while agricultural productivity and water use are affected by higher temperatures.

NWRP 2037 is based on the assumption that Egypt can address the effects of climate change by a combination of coping and adaptation.

If, however, climate change intensifies faster or more than foreseen, Egypt may be obliged to consider fundamental changes in its overall pattern of water use. NWRP 2037 does not consider such a fundamental transformation of water management.

Risk 8: Occurrence of Large-Scale Calamities

In addition to calamities caused by weather extremes, such as the floods along the Nile in early 2016, other calamities may disrupt the implementation of NWRP 2037, and may cause the Government to divert resources from NWRP 2037 priorities to relief and rehabilitation works.

Within NWRP 2037, actions are included to enhance disaster preparedness. Specific activities will have to be defined and allocated to the concerned implementing partners.

The disaster preparedness strategy would address both preventive measures as well as disaster management, if a calamity actually occurs.

Risk 9: Failure to Include Innovation and Research Outcomes

Both the analysis underpinning NWRP 2037, as well as the suggested measures reflect today's thinking and understanding.

Tapping into pure and adaptive research helps develop and improve policies, approaches and measures to achieve NWRP 2037 targets, while technological innovation is essential in order to find measures that can achieve the same effect at less cost.

Annex 1. NWRP 2037 Logical Framework

EGYPT's Second National Water Resources Plan (2017-2037)

Purpose	WATER SECURITY FOR ALL by 2037				National Water Security Index
Objectives	1 Improve Water Quality	2 Rationalize Water Use	3 Enhance Availability of Freshwater Resources	4 Improve Enabling Environment for IWRM	Objective Targets
Outcomes	1.1 Reduced Domestic Pollution Loads Released into the Water System	2.1 Increase of Agricultural Water Productivity	3.1 Securing Share of Egypt in the Nile Water	4.1 Mechanisms & Structures for Coordination at Decentral and Central Levels Strengthened	Outcome Targets
	1.2 Reduced Industrial Pollution Loads Released into the Water System	2.2 Household Water Use Rationalized	3.2 Enhanced Volume of Rainwater Captured	4.2 Regulatory Framework Revised and Updated	
	1.3 Reduced Agricultural Pollution Loads Released into the Water System	2.3 Increased Industrial Water Productivity	3.3 Increased Volume of Desalinated Brackish Groundwater & Seawater	4.3 Public Support & Awareness for "Water Security for All" Generated	
	1.4 Increased Quantity of Good Quality Drainage Water Suitable for Different Usages		3.4 Rationalized Abstracted Volume of Groundwater	4.4 Enhanced Professional Capacities for IWRM	
Measures	1.1.1 Increase percentage coverage of sanitation services	2.1.1 Raise water conveyance & distribution efficiency for the irrigation & Agricultural purposes	3.1.1 Continue and Support Cooperation with Nile Basin countries	4.1.1 Coordination between monitoring & early warning networks to effectively prevent violations & pollution in water bodies according to Law-48	Measures Indicators
	1.1.2 Raise efficiency of sewage treatment (including an integrated approach for sanitary services)	2.1.2 Raise Water Use Efficiency of the Irrigation & Agriculture	3.2.1 Expand rainfall harvesting and flashflood protection projects especially at coastal regions	4.1.2 Define procedures & guidelines for Bottom-Up planning & management of water resources (taking into account water scarcity & climate change)	
	1.1.3 Develop and initiate an efficient solid waste management system (to avoid disposal in water ways)	2.2.1 Raise Water Conveyance and Distribution Efficiency in the Drinking Water Sector	3.3.1 Expand desalination projects for brackish groundwater & sea water in remote & coastal regions using renewable energy	4.1.3 Prepare & authorize water related emergency plans to face different water crises in different sectors & governorates	
	1.2.1 Improve and raise operational capacity of treating and recycling industrial waste water within industrial units	2.2.2 Raise Water Use Efficiency in the Drinking Water Sector	3.4.1 Activate effective monitoring & control systems to optimize pumping of safe groundwater abstractions (to avoid over pumping)	4.2.1 Revise rules related to re-use of treated waste water according to level of treatment to maximize benefits from suitable water for different usages	
	1.2.2 Support, organize, and help industries for safe disposal and dealing with industrial waste water	2.3.1 Raise Water Use Efficiency in the Industrial Sector		4.2.2 Introduce law to enable recovery of O&M costs from beneficiary companies making use of transported water to their locations	
	1.2.3 Activate and raise efficiency of industrial waste water quality monitoring networks			4.3.1 Developing resources to finance water resources projects	
	1.3.1 Control and Rationing trade & production of agricultural chemicals (fertilizers & pesticides)			4.3.2 Raise awareness to rationalize water use and protection of water quality	
	1.3.2 Reduce and Eliminate fish farming in Water ways			4.4.1 Raise institutional & professional capacity for personnel working in integrated water management disciplines	
	1.4.1 Improve Drain's Water Quality			4.4.2 Improve & coordinate effective scientific research in the field of integrated water management	

Annex 2 : Programme of Measures

Objectives	Results / Outcomes	Proposed Measures		Targets for Outcomes & Indicators for Measures	
(1) IMPROVE WATER QUALITY	1-1 Reduced Domestic Pollution Loads Released into the Water System		Increase percentage coverage of sanitation services	• By 2030, 100% of all households are served by a wastewater collection system or network	
				• By 2030, 80% of all households are served by wastewater treatment plants; and this service reaches 90% by 2037	
				• By 2030, Percentage of solid wastes disposed into water system is 20% of the current situation; & by 2037, no solid wastes are disposed into the water system.	
		1-1-1		1-1-1-1	Percentage of families connected with basic sanitation services in Rural areas
				1-1-1-2	Percentage of families connected with basic sanitation services in Urban areas
		1-1-2	Raise efficiency of sewage treatment (including an integrated approach for sanitary services)	1-1-2-1	Total volume of annually treated sanitary waste water
				1-1-2-2	Percentage of primary treated sewage water
				1-1-2-3	Percentage of secondary treated sewage water
				1-1-2-4	Percentage of tertiary treated sewage water
				1-1-2-5	Total percentage of treated sewage water in a safe way
		1-1-3	Develop and initiate an efficient solid waste management system (to avoid disposal in water ways)	1-1-3-1	Percentage of collected solid wastes being safely disposed (w.r.t. current situation)
				1-1-3-2	Percentage of recycled solid wastes according to environmental regulations (w.r.t. current situation)
	1-2 Reduced Industrial Pollution Loads Released into the Water System			• By 2030, 80% of all industrial wastewater undergoes treatment before release, and reaches 100% treatment of these wastes by 2037	
				• By 2030, organic loads in industrial wastewater disposed into the Nile are reduced by 80%, and fully removed 100% by 2037	
				• By 2030, organic loads in industrial wastewater disposed into the Lakes are reduced by 80%, and further reduced to 95% by 2037	
				• By 2030, organic loads in industrial wastewater disposed into coastal environment are reduced by 60%, and further reduced to 85% by 2037	
		1-2-1	Improve & raise operational capacity of treating & recycling industrial waste water within industrial units	1-2-1-1	Percentage of treated volume of industrial waste water
		1-2-2	Support, organize, and help industries for safe disposal and dealing with industrial waste water	1-2-2-1	No. of corrected actions for industrial waste water relative to registered violations
				1-2-2-2	Percentage of factories where waste water networks disposing into water ways are redirected to the public sewage networks (or other collecting facility for treatment)
		1-2-3	Activate and raise efficiency of industrial waste water quality monitoring networks	1-2-3-1	Number of Industrial units connected to the instantenuous monitoring network of industrial water quality of the Nile
				1-2-3-2	Number of intantenuous monitoring stations of Nile Water quality
				1-2-3-3	Percentage of industrial units discaharging directly or indirectly to the lakes connected to the instantenuous monitoring network fof industrial water quality
	1-3 Reduced Agri-cultural Pollution Loads Released into the Water System			• By 2030, percentage use of agro-chemicals (relative to total usage) from the agricultural sector is reduced to 75%, and further reduced to 70% by 2037	
				• By 2030; 75% of samples taken from freshwater bodies (Nile & canals) should meet the thresholds indicated by the law. This percentage should reach 85% by 2037 (according to same regulations)	
		1-3-1	Control and Rationing trade & production of agricultural chemicals (fertilizers & pesticides)	1-3-1-1	Rate of using organic & biofertilizers and biopesticides
				1-3-1-2	Percentage of area using organic and natural agricultural practices relative to total area
		1-3-2	Reduce and eliminate fish farming in Water ways	1-3-2-1	Percentage of area of fish cages in water ways relative to their current area
	1-4 Increased Quantity of Good Quality Drainage Water Suitable for Different Usages			• By 2030, 80% of the drainage surface water sub-systems downstream sampling locations report at least medium quality as measured by WQI and it will be the same until 2037	
				1-4-1-1	Volume of polluted drains' water being improved

Unit	Base year	2020		2025		2030		2037		Cocerned Agencies
	2017	Actual	Target	Actual	Target	Actual	Target	Actual	Target	
%	56%		70%		85%		100%		100%	
%	40%		45%		60%		80%		90%	
%	55%		40%		35%		20%		0%	
%	28%		42%		75%		100%		100%	MoHUUC
%	91%		97%		98%		100%		100%	
BCM/yr	4.30		5.3		6.50		7.20		8.20	
%	18%		16%		13%		11%		10%	
%	79%		74%		73%		72%		70%	
%	3%		10%		14%		17%		20%	
%	69%		77%		84%		92%		100%	
%	20%		30%		45%		60%		80%	MoLD + MoEnv
%	25%		40%		50%		60%		75%	
%	35%		50%		65%		80%		100%	
%	44%		60%		70%		80%		100%	
%	40%		50%		65%		80%		95%	
%	5%		15%		45%		60%		85%	
%	15%		25%		55%		80%		90%	MoEnv + MoTI
No.	20		128		250		400		500	
%			20%		45%		70%		100%	
No.	9		24		60		83		100	MoEnv
No.	11		16		16		16		16	
%	5%		15%		40%		60%		100%	
%	84%		82%		80%		75%		70%	
%	60%		65%		70%		75%		85%	
%	16%		18%		20%		25%		30%	MALR
%	2.6%		3.4%		4.7%		6.5%		8.5%	
%	100%		70%		30%		0%		0%	MWRI
%	37%		40%		45%		50%		58%	
mil. m ³ /day	0		1		6		10		15	MoHUUC + MWRI + MALR

Annex 2 : Programme of Measures (Continued)

Objectives	Results / Outcomes		Measures		Targets for Outcomes & Indicators for Measures	
(2) RATIONALIZE WATER USE	2-1	Increase of Agricultural Water Productivity	2-1-1	Raise water conveyance and distribution efficiency for the irrigation & Agricultural purposes	• By 2030, the average growth rate of local agricultural production reaches 4.5%, and achieves 6% By 2037	
					• By 2030, the percentage of safely used agricultural drainage water reaches 49%, and reaches 51% by 2037	
					2-1-1-1	Efficiency of Water conveyance and distribution in Irrigation networks
			2-1-2	Raise Water Use Efficiency of the Irrigation & Agriculture	2-1-1-2	Percentage of improved mesqas with single point lifting
					2-1-1-3	Percentage of Investments spent to raise efficiency of water conveyance and distribution systems of irrigation & agriculture
					2-1-2-1	Efficiency of field irrigation water use for agriculture
					2-1-2-2	Annual volume of water allocated to the agricultural sector
	2-2	Household Water Use Rationalized	2-2-1	Raise Water Conveyance and Distribution Efficiency in the Drinking Water Sector	2-1-2-3	Percentage irrigated area uses improved and modernized irrigation methods
					• By 2030, system loss and unaccounted for water will not exceed 20% of the total volume supplied for domestic water use, and reduces 15% by 2037	
					• By 2030, the overall average water use per capita will fall to less than 266 l/c/d, and further fall to 242 l/c/d by 2037 (includes small industries)	
			2-2-2	Raise Water Use Efficiency in the Drinking Water Sector	2-2-1-1	Efficiency of water conveyance and distribution in the drinking water sector
					2-2-1-2	Percentage of Investments spent to raise efficiency of water conveyance in the drinking water sector
					2-2-1-3	Percentage of families connected to basic potable water services (average Rural & Urban)
					2-2-2-1	Per capita actual average usage/share of drinking water (domestic, commercial and mosques)
	2-3	Increased Industrial Water Productivity	2-3-1	Raise Water Use Efficiency in the Industrial Sector	• By 2030, the average growth rate of water productivity of industrial water is 6.5%, and reaches 7% by 2037	
					2-3-1-1	Volume of water allocated for the Industrial sector
					2-3-1-2	Percentage of industrial water being recycled within industrial units

Unit	Base year	2020		2025		2030		2037		Cocerned Agencies
	2017	Actual	Target	Actual	Target	Actual	Target	Actual	Target	
%	3.2%		3.7%		4.5%		4.5%		6.0%	
%	45%		45%		48%		49%		51%	
%	63%		65%		67%		71%		75%	MWRI
%	15%		20%		25%		32%		50%	
%	95%		100%		100%		100%		100%	
%	55%		56%		58%		60%		63%	MALR
BCM/yr	61.65		62.71		64.19		63.76		64.23	MWRI
%	16.5%		20.8%		28.5%		31.7%		36.0%	MALR+MRWI
%	32%		28%		25%		20%		15%	
l/c/d	309		302		283		266		242	
%	68%		72%		75%		80%		82%	MoHUUC
%	100%		100%		100%		100%		100%	
%	97%		99%		100%		100%		100%	
l/c/d	255		250		235		215		190	
%	4.0%						6.5%		7.0%	
BCM/yr	5.4		5.5		6		6.9		7.3	MoTI
%	15%		20%		27%		37%		50%	

Annex 2 : Programme of Measures (Continued)

Objetives	Results / Outcomes		Measures		Targets for Outcomes & Indicators for Measures	
(3) ENHANCE AVAILABILITY OF FRESHWATER RESOURCES	3-1	Securing Share of Egypt in the Nile Water	3-1-1	Continue and Support Cooperation with Nile Basin countries	• Annual water flowing to HAD secured at 55.5 BCM	
					3-1-1-1	Investments values in dual cooperation projects with Nile Basin countries (confidence building and integration)
					3-1-1-2	Investments values in updating studies for reducing water losses and cooperation with Nile Basin countries
					3-1-1-3	All other Investments and trade with Nile Basin countries (rather than upper Nile projects)
	3-2	Enhanced Volume of Rainwater Captured	3-2-1	Expand rainfall harvesting and flashflood protection projects especially at coastal regions	• By 2037 : annual average contribution of rainwater & flood harvesting reaches 1.42 BCM, and to be stabilized at 1.45 BCM per year by 2037	
					3-2-1-1	Capacity of ground reservoirs accomodating harvested rainfall and flash floods
					3-2-1-2	Percentage of investments spent to implement obstruction dams, ground reservoirs, and flash flood protection works
	3-3	Increased Volume of Desalinated Brackish Groundwater and Seawater	3-3-1	Expand desalination projects for brackish groundwater & sea water in remote and coastal regions using renewable energy	• By 2037 : raised to 2.40 BCM of desalinated water produced annually, and to be stabilized at 3.14 BCM per year by 2037	
					3-3-1-1	Capacity of desalination plants belonging to MoHUUC
					3-3-1-2	Capacity of desalination plants belonging to MoT
					3-3-1-3	Percentage of Investments spent in new Desalination plants in all governorates
	3-4	Rationalized Abstracted Volume of Groundwater	3-4-1	Activate effective monitoring and control systems to optimize pumping of safe groundwater abstractions (to avoid over pumping)	• By 2030, total extraction of deep groundwater reaches 4.25 BCM per year, and to be stabilized at 4.70 by 2037	
					3-4-1-1	Number of wells having effective monitoring and pumping control system (relative to total number)

Unit	Base year	2020		2025		2030		2037		Concerned Agencies
	2017	Actual	Target	Actual	Target	Actual	Target	Actual	Target	
BCM/Yr	55.5		55.5		55.5		55.5		55.5	
LE Bil./yr	0.16		0.69		0.95		1.22		1.60	MWRI
LE Bil./yr							0.50		1.00	
LE Bil./yr	1.49		1.86		0.00		0.00		0.00	MoIC
BCM/yr	1.3		1.32		1.34		1.42		1.45	
mil. m ³	30		50		75		100		150	MWRI
%	0%		100%		100%		100%		100%	
BCM/yr	0.35		0.50		1.83		2.40		3.14	
BCM/yr	0.28		0.40		1.50		1.90		2.40	MoHUUC
BCM/yr	0.07		0.10		0.33		0.50		0.74	MoT
%			100%		100%		100%		100%	MoHUUC + MoT
BCM/Yr	2.25		3.40		3.90		4.25		4.70	
No.	1		112		262		362		462	MWRI

Annex 2 : Programme of Measures (Continued)

Objectives	Results / Outcomes		Measures		Targets for Outcomes & Indicators for Measures	
(4) IMPROVE ENABLING ENVIRONMENT FOR IWRM	4-1	Mechanisms and Structures for Coordination at Decentered and Central Levels Strengthened			• By 2022, NWRP is approved by charging implementing agencies with the responsibility for specified outcomes.	
					• By 2022, water resources plans for the governorates are prepared and each governorate has a tentative water budget and a priority plan for NWRP-related investments, based on a consultative approach	
					• By 2023, the implementing agency's five-year plans reflect own objectives, relevant NWRP outcomes & priorities expressed at national & governorate-level	
					• By 2023, a baseline with respect to the goal, purpose, objectives & outcomes of NWRP is established, & the routine system for the monitoring & evaluation of the situation with respect to water resources is in operation. Periodic report (every 2 or 3 years) on the state of water (until 2037), gauged against NWRP goal, purpose & objectives are published and publicly accessible.	
					• By 2022, a strategy with respect to disaster management & disaster risk reduction is agreed; as well as developing & testing institutional capacities for this purpose	
			4-1-1	Coordination between monitoring and early warning networks to effectively prevent violations and pollution in water bodies according to Law-48	4-1-1-1	Number of monitoring networks being connected and coordinated between different agencies
					4-1-1-2	Percentage of coverage of regular water quality sampling from drinking water treatment plants
	4-1-2	Define procedures & guidelines for bottom-up planning and management of water resources (taking into account water scarcity & climate change)	4-1-2-1	Number of governorates updating thier water resources plans taking into account scarcity development and climate change impacts		
	4-1-3	Prepare and authorize water related emergency plans to face different water crises in different sectors and governorates	4-1-3-1	No. of issued and approved/updated water related emergency plans for different ministries		
			4-1-3-2	No. of issued and approved/updated water related emergency plans for different governerates		
	4-2	Regulatory Framework Revised and Updated			• By 2023, a water balance and water quality assessment will inform all approvals and all decisions with respect to major investments	
					• By 2030, a comprehensive legal and regulatory framework reflects Egypt's NWRP principles is in place to enable decentral decision-making with respect to water management	
			4-2-1	Revise rules related to re-use of treated waste water according to level of treatment to maximize benefits from suitable water for different usages	4-2-1-1	Authorization of a modified Re-Use water code
			4-2-2	Introduce law to enable recovery of O&M costs from beneficiary companies making use of transported water to their locations	4-2-2-1	Percentage of O&M cost recovery collected from beneficiary agencies relative to the target
	4-3	Public Support and awareness for 'Water Security for All' Generated			• By 2025, all implementing partners have aligned their external communication to the communication strategy "water security for all"	
					4-3-1	Developing resources to finance water resources projects
			4-3-2	Raise awareness to rationalize water use and protection of water quality	4-3-2-1	No. of Awareness campaigns for the agro-society to spread knowledge about crops using less water and tolerant to salts as well as high production as well as reduce usage of agro-chemicals and protection of water ways
					4-3-2-2	No. of Awareness campaigns for the public rationalize household water usage and industrial water use, as well as promote low cost-modern technologies for water savings
4-4	Enhanced Professional Capacities for IWRM			• By 2022, a strategy with respect to building IWRM capacities is prepared & agreed		
				4-4-1	Raise institutional & professional capacity for personnel working in integrated water management disciplines	4-4-1-1
				4-4-1-2	Percentage of institutions implemented training on IWRM for their personned and activated role of water management units relative to targets	
		4-4-2	Improve and coordinate effective scientific research in the field of integrated water management	4-4-2-1	No. of utilized scientific research projects contributing to enhance integrated water resources management	

	Unit	Base year	2020		2025		2030		2037		Cocerned Agencies
		2017	Actual	Target	Actual	Target	Actual	Target	Actual	Target	
	No	0		1		3		3		3	MoEnv
	%	95%		100%		100%		100%		100%	MoHP
	No.	0		27		27		27		27	MWRI
	No.										
	No.	0		27		27		27		27	
	Y/N			Y							
	Y/N							Y			
	Y/N					Y		Y		Y	MWRI
	%					100%		100%		100%	MWRI + MoF+ Perliment
	Y/N			Y							
	%	0.9%		1.1%		1.7%		2.4%		3.3%	MWRI + MPED + MoF
	No.										MWRI (Awareness & Water Guidance)
	No.										
	Y/N			Y							
	Y/N			Y							MWRI (RCTWS)
	%					50%		75%		100%	
	No.	226		300		462		750		1100	MWRI (NWRC)

Annex 3 : References

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