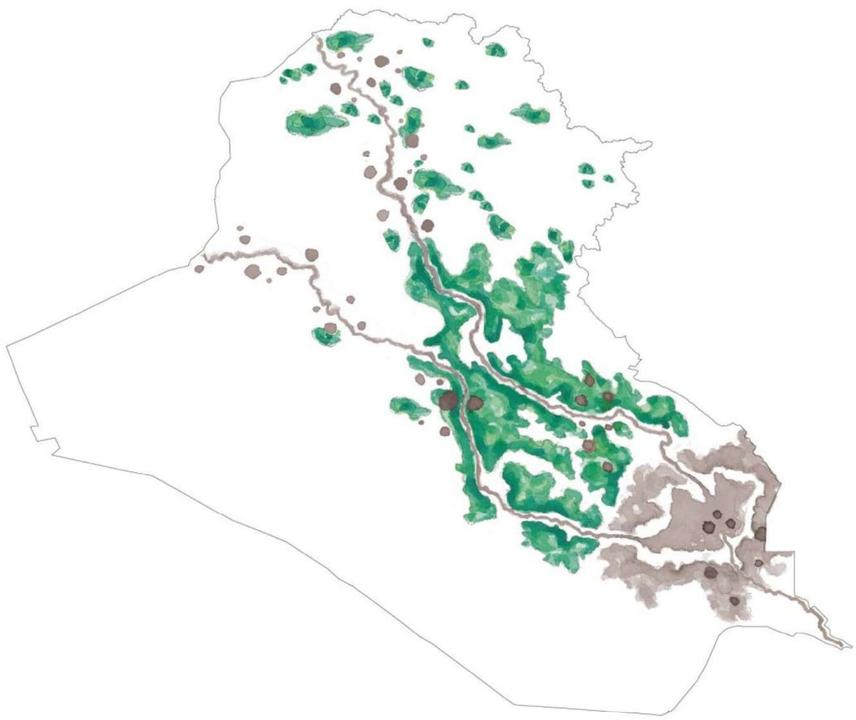
## 1.1food security

Iraq's vision is to achieve food security.[56]Stable food security for the nation is achieved through the cultivation of fertile lands, the use of skilled workers and appropriate equipment, and sound farm management. Increasing financial and technical efficiency in agriculture is essential, as is improving animal productivity. Despite efforts to enhance biodiversity in cropping systems, wheat and barley remain staple crops essential for food self-sufficiency. Whenever water scarcity is a limiting factor in agricultural activities, water consumption and the total irrigated area are reduced, and the necessary food is imported. Iraq's food needs call for greater activity from farmers to contribute to investment costs and conserve natural resources.



56 There are several definitions of food security. The one adopted by SWLRI is the one made by the Tunis Declaration on Arab Food Security in 1996, where food security was defined as:

It is "making food available and provided in the quantity and quality necessary for the health and continuous activity of every Arab citizen, relying primarily on local production, in accordance with the relative experience of each country."

"Arab countries to produce food commodities and make them available to Arab citizens at prices that are consistent with their incomes and financial capabilities."

3.5.1Agricultural development and productivity

### *1.4.2.2 Facts and needs*

The importance of agriculture is not limited to providing food for the population. Agriculture, like the food it produces, is the cornerstone of many key aspects of life, such as culture, health, livelihoods, and prosperity. In Iraq, agriculture is the second largest contributor to GDP (after, of course, oil production) and employs about 41% of the population. Although the sector's contribution to the economy declined from about 0.4% in 1994 to 4.1% in 2011,[57]However, it remains a major source of livelihood for the poor and is the largest source of employment in rural areas.

In addition to feeding and employing people and contributing to GDP, well-managed cultivated land helps prevent desertification, sand and dust storms, and land degradation. However, to achieve the desired goals of the agricultural sector—including reducing food imports, increasing productivity, and building the technical capacity of farmers—coherent and coordinated efforts are required to improve policies, re-prioritize investment projects, and support the rehabilitation of services.

**Providing food for the population and reducing dependence on imports**

The most basic role of food is to feed people. According to the World Food Programme (WFP) for 2014, Iraq's food needs require a minimum dietary energy requirement (MDER) of 0.4 kcal per day per person. In 2011, approximately 0.2% of Iraq's population lived below this minimum, which is relatively better than the rest of the Middle East, which is 0.5%. It is also an improvement compared to 2011, when 0.5% of Iraq's population lived below the MDER. People living below the MDER are considered at risk of malnutrition.

The negative impact on Iraqi health due to food deprivation is significant. Malnutrition, especially among children, increases the frequency and severity of infectious diseases, impacts their intellectual and physical development, and increases mortality rates. Approximately 8.2% of Iraqi children under the age of five are underweight, and one in four suffers from stunted physical and intellectual growth due to chronic malnutrition.

Iraq relies heavily on food imports to meet its food needs. Average national wheat production for the period 1941-1942, including the estimated wheat production for 1944, was 4.4 and 4.0 million tons, respectively. Wheat imports for 1944 are estimated at 4.2 million tons.

57 Source: Central Agency for Statistics and Information Technology

Rice production in the agricultural season from 2014 to 2014, in addition to imported rice in 2014, is estimated at 1.0 and 0.2 million tons, respectively.[58].

Therefore, in 2014 the import dependency ratio (IDR) for wheat and rice was estimated at 14.2% and 4.0%, respectively.[59]Comparing the import dependency ratio for 2012 to 2007, wheat imports remained roughly equal, but rice imports increased by seven percent. This means that during the five-year period from 2007 to 2012, there was no Any improvement in Iraq's wheat production rates, or even an increase in the country's dependence on imported rice. [60'61].

The self-sufficiency ratio (SSR), which expresses the volume of agricultural production relative to household consumption, was 37.5% and 1.4% for wheat and rice, respectively in 2014.[62]These figures indicate a heavy reliance on global food sources..

**Farmer Employment and Poverty Reduction**

Most agriculture in Iraq today is practiced on small farms that operate with relatively low inputs and therefore low outputs. This means limited technology is used on farms, resulting in low crop yields and low economic gains. The use of available, low-quality chemicals, along with the misuse and scarcity of organic fertilizers, results in relatively low crop yields by comparative standards. Furthermore, the obsolescence of agricultural machinery and the lack of technical skills among most farmers contribute to weak and reduced productivity.

Crop production is the primary source of income for 2% of farmers in Iraq, while the remainder depend on livestock production. Cereals, primarily wheat and barley, are the main crops in the north and rain-fed areas. In central and southern Iraq, agriculture is mainly irrigated by the Tigris and Euphrates rivers, and mixed farming systems prevail. Dates are also a valuable food crop, as are vegetables, especially tomatoes and potatoes. Animal husbandry is widely practiced, and fish ponds and poultry are a valuable source of protein and income for rural populations.

Poverty rates in rural areas reach (39)%, which is much higher than in urban areas, which reach (01%), with about 15% of the rural population earning less than 0

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58 Food Outlook, Semi-Annual Report on World Food Markets, Food and Agriculture Organization 2013

59 Food Balance Sheet. Booklet, 2008. FAO.

60 This ratio, rounded to 122, represents that portion of the domestic food supply that was produced in the country itself.

61 Agricultural Overview in Iraq, 2009, FAO

62 See footnote 15.

$1 per person per day, compared to 4.6% in urban areas.[63]Poverty rates vary widely between governorates, ranging from 49% in Muthanna Governorate to 4% in Sulaymaniyah Governorate. In rural areas, poverty rates are particularly high in Muthanna Governorate (75%), Babil Governorate (61%), and Wasit Governorate (11%).[64].

**Preventing desertification and reducing vulnerability**

The agricultural sector is vulnerable to environmental changes, including declining water availability, land degradation and desertification, extreme climate events, and changes in weather patterns. Poor agricultural practices can contribute to this vulnerability. Degraded lands are also susceptible to erosion, meaning that agricultural lands contribute significantly to the formation of sand and dust in the air during strong winds, leading to the loss of fertile soil. It is likely that the number of dust storms will increase significantly within the next ten years, highlighting the urgent need for improved land management by farmers and decision-makers.

The agricultural sector consumes 2% of the total water resources in Iraq. As a result, when drought occurs[65]Agriculture is the most affected. For example, in 2018 and 2011, drought affected nearly 41% of Iraq's agricultural land, with Nineveh and Erbil experiencing damage that affected more than 21% of their agricultural land. Compiling drought threats, irrigated wheat land alone expanded by 44% between 2011 and 2010. Finally, although most of Iraq's agricultural land is irrigated, low rainfall ensures production losses for rain-fed crops. Floods can cause similar damage to the agricultural sector. In May 2014, for example, nearly 600 families were displaced by severe flooding, and approximately 41,111 hectares of crops were damaged or destroyed by floodwaters in Maysan, Qadisiyah, and Wasit governorates.[66].

In addition, according to the Iraqi government, 4% of Iraq's total area is at risk of desertification.[67] Land degradation is a process by which land is degraded in arid and semi-arid climates due to human-made activities, drought, or climate change. Proper management of agricultural land can help stop or reverse this process. Each year, due to poor land management, approximately 11,011 hectares of agricultural land are lost to land degradation.[68]This means

63 National Strategy for Poverty Reduction, Republic of Iraq, 2009

64 The same reference.

65 Drought is a condition in which the available water is not sufficient to meet the demand for water. 66

Mapping of flooded areas in the southern governorates of Iraq 2013 Central Organization for

67 Statistics and Information Technology, Environmental Statistical Report Iraq, 2009, APU.

68 International Astronomical Union Climate Change in Iraq, June 4104

Agricultural land decreased from 44% of the total area of Iraq in 1940 to 19% in 1910.[69].

### 2.4.0.4 Needs

As Iraq's population grows in the coming decades, and to maintain average food supply levels (estimated in 1940 at 1,021 kg of wheat per year per person[70]Iraq will need approximately 1.4 million tons of wheat by 2035 and more than 8 million tons by 2035. Almost 40% of Iraq's daily food consumption is made up of wheat flour and its derivatives. If measures are not taken to improve wheat production in Iraq, average wheat yields are expected to decline by 2.4% by 2045. Therefore, wheat import dependence could exceed 1%, a worrying trend for food security in Iraq.

**table 14/42-3: Expected wheat needs for the next 21 years for each governorate**

**WHEAT NEEDS BY GOVERNORATE BY YEAR [in Tons/Year]**

| 2035 | 2030 | 2025 | 2020 | 2015 | Governorate | ID Gov. |
|---|---|---|---|---|---|---|
| 306,868 | 277,707 | 248,589 | 220,131 | 192,859 | DOHUK | 1 |
| 851,953 | 772,163 | 692,306 | 614,113 | 539,052 | NINAWA | 2 |
| 435,796 | 392,493 | 349,413 | 307,504 | 267,559 | ERBIL | 3 |
| 525,050 | 473,258 | 421,722 | 371,558 | 323,701 | SULAYMANIYAH | 4 |
| 417,837 | 377,063 | 336,399 | 296,755 | 258,891 | KIRKUK | 5 |
| 336,351 | 307,564 | 278,511 | 249,778 | 221,880 | SALAH AD DIN | 6 |
| 443,861 | 403,689 | 363,394 | 323,805 | 285,633 | ANBAR | 7 |
| 366,164 | 334,152 | 301,903 | 270,086 | 239,277 | DIYALA | 8 |
| 2,020,294 | 1,809,514 | 1,600,509 | 1,398,136 | 1,206,388 | BAGHDAD | 9 |
| 302,918 | 274,991 | 247,005 | 219,559 | 193,159 | WASIT | 10 |
| 439,440 | 400,384 | 361,098 | 322,407 | 285,021 | BABIL | 11 |
| 274,538 | 248,220 | 221,942 | 196,277 | 171,711 | KARBALA | 12 |
| 254,677 | 229,769 | 204,941 | 180,745 | 157,640 | MISSAN | 13 |
| 290,057 | 263,388 | 236,651 | 210,418 | 185,178 | Diwaniyah | 14 |
| 345,245 | 311,469 | 277,798 | 244,982 | 213,649 | NAJAF | 15 |
| 483,678 | 439,029 | 394,301 | 350,442 | 308,263 | THI-QAR | 16 |
| 167,226 | 152,286 | 137,261 | 122,471 | 108,190 | MUTHANNA | 17 |
| 683,812 | 616,413 | 549,312 | 483,982 | 421,653 | BASRAH | 18 |
| **8,945,766** | **8,083,550** | **7,223,055** | **6,383,148** | **5,579,704** | **IRAQ** | |

69 World Bank Indicators,www.worldbank.org

70 Food Outlook 2014, FAO

### *2.4.0.2 Opportunities and Strategies*

Rehabilitating and developing Iraqi agriculture is a medium- to long-term goal and can only be achieved through coordinated and coherent efforts based on improved policies and project investments, including the rehabilitation of subsidy services and capacity building. Ultimately, there must be a fundamental transformation in the nature and capacity of Iraqi farmers: they need to be more efficient, more productive, and more responsible in the use of their water and the operation and maintenance of distribution systems. To achieve these gains, farmers need assistance. The government needs to establish clear policies and procedures, relinquish some control to local water user associations, provide access to funding for technology development, and give farmers the support they need to adapt to changing conditions. Furthermore, there is a need for a gradual but determined transition to a market-based system for the food sector, with less reliance on government subsidies.

This strategy envisions that agriculture in Iraq should not be developed at any cost: production activities should be promoted only where good-quality water is available and soil conditions are suitable. In accordance with the National Development Strategy (NWDS) of the Iraqi Ministry of Planning and the United Nations Millennium Development Goals, SWLRI gives top priority to developing a food strategy that improves public health and eradicates poverty. Consequently, the strategy aims to reduce migration by improving economic opportunities in rural areas.

Great importance has also been given to selecting crops that use less water. Consequently, traditional rice cultivation accounts for a much smaller proportion of the total crop mix. Other staple foods, such as wheat and barley, are given high priority and, within a sound crop rotation, will represent significant proportions of Iraq's agricultural system. Priority has also been given to better use of available technologies in irrigated agriculture, and aquaculture will not be widely developed. Some of the key recommendations of this strategy relate to extension services and institutional changes, as outlined below:

Agricultural patterns

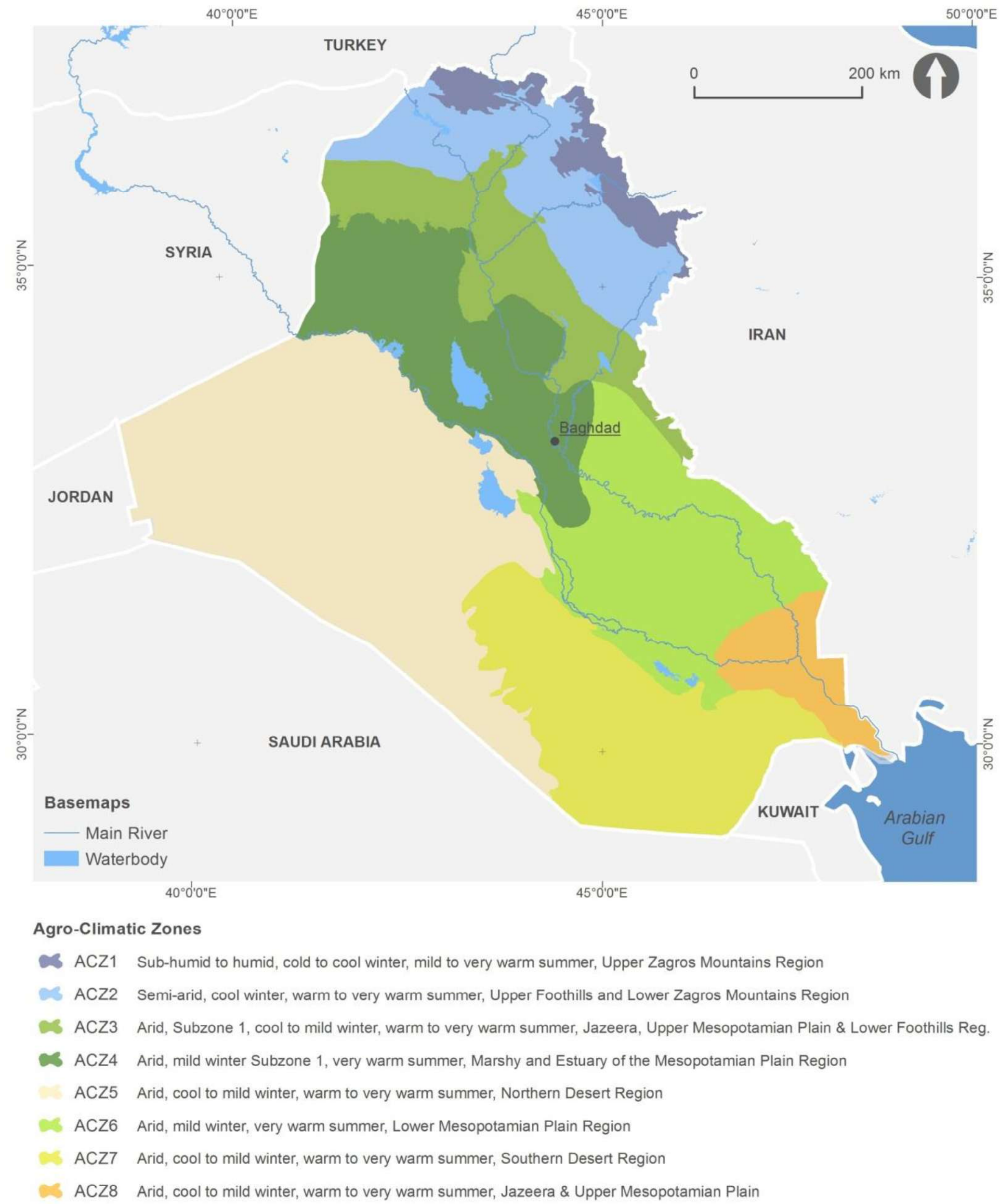


**Illustration51/ Figure 3-32: The eight agro-climatic zones in Iraq**[71]

A water-scarce future requires selecting crops and crop rotations that follow the principles of efficiency and productivity, seeking to maximize the amount of food and jobs per unit of water. It is unlikely that Iraq will be able to achieve food self-sufficiency. Therefore, the challenge is

[71]This figure is also available in a larger size in the map attached to the main report (see the map titled “Food Security – 21”). In addition to other detailed maps of the agro-ecological area (see a series of maps entitled “Food Security –20"

In determining the right crop mix and the most appropriate and sustainable technical approach to maximize plant and animal productivity, both quantitatively and qualitatively, for both local and international markets, the proportion of staple crops and high-value cash crops must be carefully scrutinized and diversified across the country's agroecological zones to achieve national self-sufficiency and ensure acceptable returns for farmers.

In response to these challenges and needs, this strategy identified eight agro-climatic zones (ACZs), whose climatic and agricultural conditions are similar and common strategies can be adopted. For each of the eight agro-climatic zones, a specific crop mix was selected as the most suitable for specific land conditions. The proposed cropping patterns were chosen to be flexible and adaptable to the various regions of Iraq. Furthermore, the proposed cropping patterns meet human nutrition needs and animal feed production to prevent overgrazing of pastures, thus mitigating desertification and the occurrence of dust storms.

Options for intensifying crop production in Iraq were studied based on a very wide and diverse range of crops, most of which were previously widely cultivated in Iraq. The crops were selected in agreement with the Ministry of Agriculture and the Ministry of Water Resources. They belong to diverse groups, such as:

- Market: Food and cash crops.
- Time: Crop rotation (summer, winter and perennial crops)
- Use: Staple food, vegetables, fruit trees, fodder, etc.

In particular, given the length of the crop cycle, there are 42 annual crops, two perennial crops, and six perennial crops. According to their uses, there are two staple grains, three legumes, ten vegetables, three industrial crops, four oil crops, five fodder crops, and six fruit tree crops. Tomatoes, cucumbers, sweet peppers, and eggplants are proposed for both outdoor and greenhouse cultivation, reflecting the growing interest in these agricultural methods, which allow farmers to save water and bring in better market prices, as such greenhouses produce crops during the winter.

**table*15*/43-3: Strategic crops of Iraq**

**LIST OF STRATEGIC CROPS**

| Scientific name | Common Name | N |
|---|---|---|
| *Triticum durum; T. aestivum* | Wheat | 1 |
| *Hordeum vulgare* | Barley | 2 |
| *Vicia faba (maior)* | Broad bean | 3 |
| *Oryza sativa* | Rice | 4 |
| *Zea mays* | Maize (grain) | 5 |
| *Sorghum vulgare* | Sorghum (grain) | 6 |
| *Allium sativum; A. cepa* | Onion | 7 |
| *Phaseolus vulgaris* | Kidney beans | 8 |
| *radiant vein* | Green gram | 9 |
| *Arachis hypogaea* | Groundnut | 10 |

**LIST OF STRATEGIC CROPS**

| Scientific name | Common Name | N |
|---|---|---|
| *Gossypium spp.* | Cotton | 11 |
| *Nicotiana tabacum* | Tobacco | 12 |
| *Helianthus annuus* | Sunflower | 13 |
| *Sesamum indicum* | Sesame | 14 |
| *Brassica oleracea* | Cauliflower | 15 |
| *Brassica oleracea* | Cabbage | 16 |
| *Solanum tuberosum* | Potato | 17 |
| *Cucumis sativus* | Cucumber | 18 |
| *Lycopersicon esculentum* | Tomato | 19 |
| *Solanum melongena* | Egg plant | 20 |
| *Capsicum annuum* | Sweet pepper | 21 |
| *Abelmoschus esculentum* | Okra | 22 |
| *Citrullus lanatus* | Water melon | 23 |
| *Saccharum officinarum* | Sugarcane | 24 |
| *Trifolium alexandrinum* | Persian clover | 25 |
| *Medicago sativa* | Alfalfa | 26 |
| *Glycine max* | Soyabean | 27 |
| *Olea europea* | Olive | 28 |
| *Punica granatum* | Pomegranate | 29 |
| *Vitis vinifera* | Grape | 30 |
| *Phoenix dactylifera* | Date palm | 31 |
| *Prunus armeniaca; Prunus persica* | Stone fruit trees | 32 |
| *Citrus spp.* | Citrus | 33 |

**sustainable intensification**

To benefit from the selection of new crop rotations, a new approach, "sustainable intensification," developed by the Food and Agriculture Organization of the United Nations (FAO), is proposed for adoption in this strategy. The SWLRI coalition recommends this approach for developing agriculture in Iraq because it emphasizes the preservation of Iraq's "natural capital," which is the quality of soil and water. Sustainable crop intensification farming systems provide social, economic, and environmental benefits to producers and society as a whole, including: high and stable production and profit, adaptation to and reduction of vulnerability to climate change, and enhanced ecosystem functioning and services. The strategy recommends that sustainable intensification be implemented gradually by farmers, with strong support from the Iraqi government, through financial incentives, technical assistance, and targeted educational programs.

Sustainable intensification is based on three basic principles:

- Simultaneous achievement of increased agricultural productivity and improved capital
- and ecosystem services. High rates of efficiency in the use of key inputs, including water, nutrients, pesticides, energy, land, and labor;
- Using successful and natural biodiversity to build a resilient system that is able to cope with abiotic, biotic and economic stresses.

Specific agricultural practices for implementing these principles will vary according to local conditions and needs. However, in all cases, implementation will entail reducing mechanical tillage to reduce soil compaction; enhancing and protecting the soil surface through the use of cover crops; and treating or crop residues; and diversify the range of plant species grown to enhance crop nutrition and improve system resilience.

To achieve the sustainable intensification necessary to increase food production, these principles need to be supported by the use of appropriate, high-yielding crop varieties. The nutritional value of crops depends on good soil, crop rotations, the optimal use of organic and inorganic fertilizers, integrated pest, disease, and weed management, and the optimal use of low-risk pesticides when needed; and efficient water management to obtain "more crop from fewer drops" while maintaining soil health.

Knowledge-based, sound irrigation that provides efficient and flexible water use, along with irrigation deficits and wastewater reuse, is a key foundation for sustainable intensification. This type of efficient water management helps reduce the environmental impact of irrigation by preventing soil salinization and potential contamination of groundwater aquifers.

To seamlessly integrate sustainable intensification principles into the strategy, four cropping types (i.e., FT2, FT1, FT0, and FT3) have been defined to represent different farming practices suited to different levels of production and technology. They range from FT0, representing current low-input, low-yield crops, to FT3, representing advanced technology and high-yield crops. The four cropping types are proposed for implementation over time so that the Iraqi government can take an intensive approach to agricultural sector development. The list of crops associated with each cropping type was agreed upon between the Ministry of Agriculture and the Ministry of Water Resources, and cropping combinations were selected under the supervision of the Ministry of Agriculture in Baghdad and the Ministry of Agriculture and Water Resources in Erbil. Each cropping type was designed to achieve a certain degree of biodiversity within the farming system, incorporating soil-impoverishing crop rotations and soil-enhancing crop species.

The crops are arranged into eight groups, and the groups are arranged within a winter-summer crop rotation as shown in the figure below. Perennial species are not part of the crop rotation, although they contribute to the cropping intensity. Full details of the cropping compositions for each cropping pattern and for each agro-climatic zone under different cropping densities (i.e., 82%, 100%, 115%, and 1040%) are given in Appendix H of this strategy.

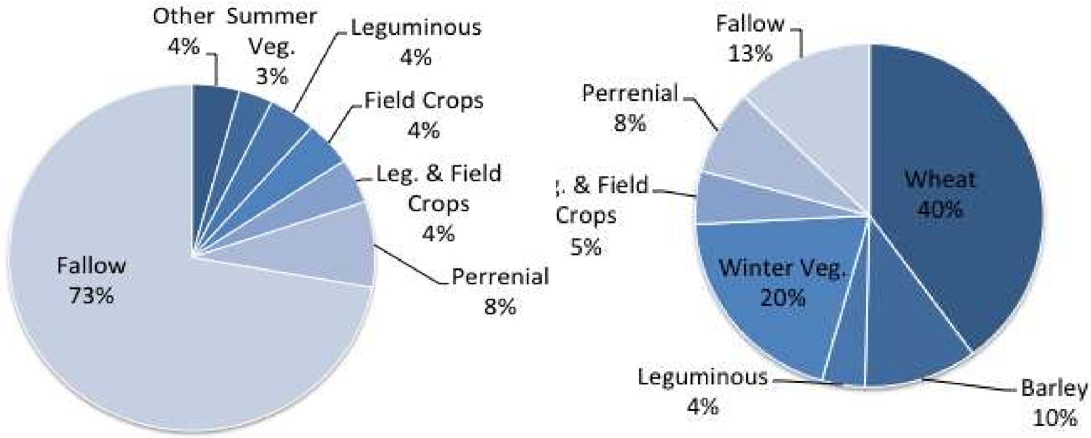


**Illustration54/Figure 3-37: Example of proposed crop rotations for the agro-climatic zone***ACZ 3***For the proposed agricultural pattern***F2*
**Assuming that the agricultural density will reach445% during the winter (left) and summer (right) seasons.**

By 2042, the strategic road plans should achieve FT2 with an agricultural density of 0.02%. FT1 and FT3 have also been analyzed to measure varying levels of impact on water availability and agricultural production.

Under this strategy, Iraq is expected to transition between FT0 and FT2 over a two-year period following the completion of irrigation rehabilitation and reclamation works. Meanwhile, FT1 is expected to represent the best agricultural conditions and performance for newly reclaimed and rehabilitated lands. Furthermore, because the type of cultivation primarily determines the field conditions for each irrigation project, it is also expected that after ensuring suitable conditions, farmers can aim for FT3 in the future.

**market-based agriculture**

The existing framework governing the agricultural sector in Iraq today is not conducive to private sector investment in agriculture. Problems include security, unclear requirements for business registration and closure, licensing requirements, limited communications infrastructure, difficulty accessing financing, and an uncompetitive business environment that lacks transparent and clear legal frameworks based on market competition rules.

Due to the lack of private sector investment, food and agribusiness companies have been unable to take advantage of international markets, modern production technologies, and global trading standards. There are few incentives for investment in agro-processing industries or value chains due to a complex administrative and regulatory system, significant shortcomings of public agencies responsible for advisory and technical services, volatile pricing policies, inefficient and outdated marketing networks, limited market information, and complex and lengthy export/import procedures.

New agricultural sector policies will be implemented through a combination of incentives and cost-recovery strategies to move towards a more market-oriented food sector. Particular attention should be paid to reforming the massive subsidies granted to strategic crops (which support crop and input prices), which are responsible for market volatility, unsustainable water and soil use, and low prevailing values and low product returns. Instead, the new governance system should aim to promote policies that lead to more efficient allocation of public resources and private investment to those agricultural products that demonstrate high social returns and comparative advantages, while simultaneously providing security requirements for the most vulnerable households and farmers.

The Iraqi government will play a key role in making market-based agriculture successful by investing in infrastructure, market information systems, and other measures that reduce transaction costs, promote competition, and narrow the gap between consumer and producer prices, eliminating the role of middlemen and benefiting farmers. In addition, special incentives will be maintained for farmers who adopt a cropping pattern appropriate to a given region's crops with a combination of sustainable agricultural practices, including, among other things, water-saving irrigation methods and efficient water scheduling. At the same time, appropriate fiscal policy will prevent water misuse and inappropriate agricultural practices (e.g., monoculture). Furthermore, the Iraqi government will promote a cost-recovery system through which farmers contribute to the costs of water infrastructure investment.

**Increase productivity**

There are several components of the SWLRI strategy that will help Iraq sustainably increase agricultural productivity. These include:

- Improvement and enhancement of agricultural
- machinery. Availability of organic and mineral fertilizers;
- The spread of modern irrigation methods, along with fertilization, and the
- introduction of post-harvest processes and cold storage facilities.
- Ensuring food safety by producing and manufacturing appropriate protocols, supported by state-of-the-art analytical tools and information technology systems;
- Providing the latest technologies in food processing.
- Developing nutritional value based on sound technology and logistics. Establishing an efficient
- national transportation system to move goods within the country and facilitate exports.

The Iraqi government will create incentives to replicate best practices in this sector and will work to disseminate knowledge from successful examples. In addition, the capacity of the Ministry of Agriculture's extension centers to use modern technologies and equipment and market new knowledge will be enhanced, which is a

Essential to unlocking Iraq's agricultural development potential, capacity building initiatives should ultimately strengthen commodity-specific innovation systems.

In addition, the Iraqi government will distribute grants for science and technology to enhance the efficiency of agricultural practices, and will establish a special fund to provide one-time grants, rather than loans, to farmers who implement technology in farm management. Relevant university departments may also be empowered to promote innovation systems to enforce farm efficiency.

Implementing these measures will help Iraq reduce its dependence on food imports. Table 4-04 and the following chart show that, based on the proposed agricultural strategy, Iraq will be able to reverse the current trend in importing food and supplies and reduce its import dependency ratio (IDR).

**table *16*/42-3: The government's annual wheat imports (the number in red represents net imports)**

**WHEAT IMPORT NEEDS BY GOVERNORATE BY YEAR [in Tons/Year]**

| 2035 | 2030 | 2025 | 2020 | 2015 | Governorate | ID Gov. |
|---|---|---|---|---|---|---|
| 248,591 | 225,359 | 202,170 | 183,605 | 167,786 | DOHUK | 1 |
| 522,689 | 445,125 | 484,170 | 482,203 | 467,797 | NINAWA | 2 |
| 370,442 | 328,303 | 286,538 | 249,298 | 225,753 | ERBIL | 3 |
| 465,078 | 415,721 | 366,857 | 324,907 | 281,893 | SULAYMANIYAH | 4 |
| 192,092 | 151,661 | 111,202 | 77,493 | 76,838 | KIRKUK | 5 |
| 65,663- | 80,493- | 96,402- | 122,144- | 44,051- | SALAH AD DIN | 6 |
| 266,281 | 226,188 | 194,654 | 167,872 | 176,517 | ANBAR | 7 |
| 67,392- | 110,675- | 180,645- | 199,327- | 152,762- | DIYALA | 8 |
| 1,680,337 | 1,464,232 | 1,278,764 | 1,106,364 | 1,041,099 | BAGHDAD | 9 |
| 226,122- | 253,052- | 268,139- | 213,915- | 171,841- | WASIT | 10 |
| 12,630- | 48,992- | 41,757- | 6,451 | 41,193 | BABIL | 11 |
| 204,810 | 178,492 | 152,213 | 130,947 | 137,019 | KARBALA | 12 |
| 26,382 | 39,340 | 68,087 | 123,434 | 120,685 | MISSAN | 13 |
| 129,366- | 151,855- | 68,246- | 25,242- | 19,520- | Diwaniyah | 14 |
| 271,013 | 237,238 | 205,020 | 199,543 | 171,916 | NAJAF | 15 |
| 263,194 | 249,113 | 279,611 | 239,172 | 230,287 | THI-QAR | 16 |
| 48,467 | 29,808 | 20,336 | 17,486 | 15,347 | MUTHANNA | 17 |
| 653,818 | 587,857 | 520,756 | 454,367 | 404,459 | BASRAH | 18 |
| **4,712,022** | **3,933,371** | **3,515,191** | **3,202,514** | **3,170,414** | **IRAQ** | |

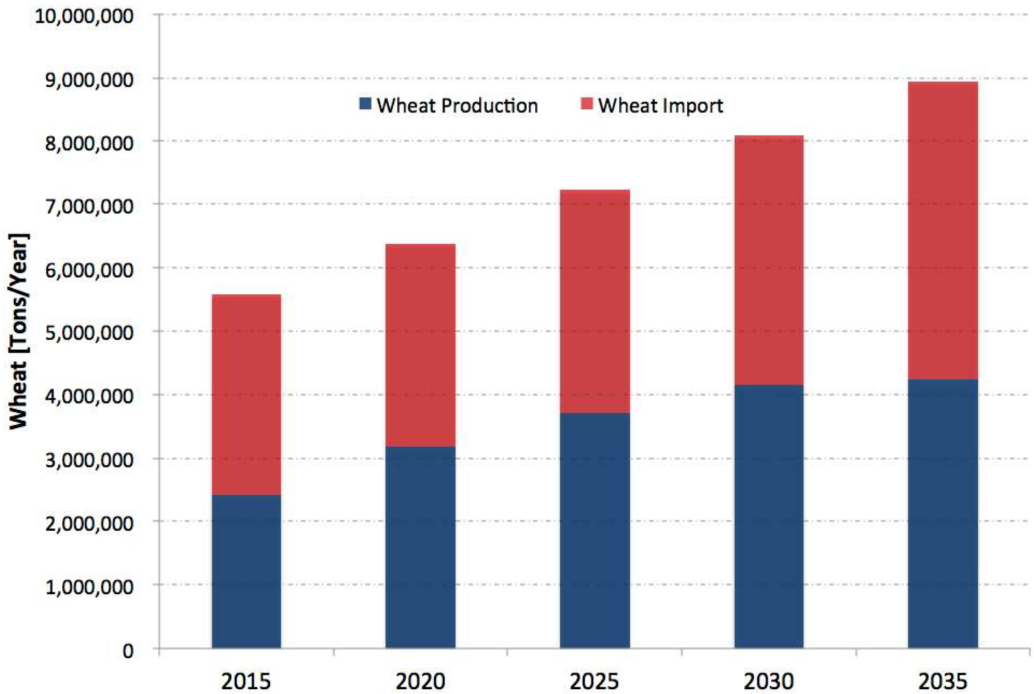


**Illustration52/ Figure 3-33: Wheat requirements over time to maintain average dietary energy requirements for the year 2144**

**table 17/45-3: Iraq's total annual wheat requirement (tons/year)72**

**TOTAL WHEAT NEEDS FOR IRAQ BY YEAR [in Tons/Year] 3.2.1.3.1**

| 2035 | 2015202020252030 | | | | Wheat |
|---|---|---|---|---|---|
| 8,945,766 | 8,083,550 | 7,223,055 | 6,383,148 | 5,579,704 | **Wheat Needs** |
| 4,233,744 | 4,150,180 | 3,707,864 | 3,180,634 | 2,409,290 | **Wheat Production** |
| 4,712,022 | 3,933,371 | 3,515,191 | 3,202,514 | 3,170,414 | **Wheat Import** |
| **53%** | **49%** | **49%** | **50%** | **57%** | **Import Dependency Ration [IDR]** |

### Institutional and legal reform

There is a huge challenge in addressing the issue of fragmented agriculture. Shared farming, in the form of associations, cooperatives, and groups of farmers, can help address this situation. Organized farmer groups may also give life to water user associations, which would help in collective water management in some areas.

72More details on productivity under FT2 type of agriculture for the year 2031 are available in the attached large map "Food Security 22". With the main report.

In order to reduce land fragmentation, a decision must be made regarding land tenure in Iraq. The nature of ownership is one of the main constraints to agricultural development and a major obstacle to increased production, as well as a contributing factor to instability in Iraq. The current land tenure system is a mixture of owner-operator, lessor, and partner farmer. The size of land tenure depends on the type of land. According to the 1990 Agrarian Reform Law, the maximum tenure size is 2.0 hectares in the rain-fed area. State land (i.e., Amiri land) is divided into two types: (i) unused state land; and (ii) land exploited by owners or cooperatives with formal land ownership registration. In 2010, 1.1% of land was state land, and approximately 44% of land was privately owned. State land was leased or distributed by the Ministry of Agriculture to private companies. At that time, 44.0 cooperatives were spread across Iraq, with collective memberships totaling 222,000.

Current land tenure legislation is inadequate. Agrarian reform efforts dating from 1928 to the present, which confiscated land, have largely failed to redistribute land to working smallholders, resulting in fragmented systems and rental arrangements between producers, the Iraqi government, and the Ministry of Agriculture. Reliable information on land tenure in the following decades is scarce, due to mobility, fragmented land policies, internal conflict, and the destruction of public records. Ownership is difficult to determine. The judiciary lacks the capacity to respond to illegal evictions and the rights of landless, impoverished populations. Lack of equipment and disruption of public services by the bureaucracy have exacerbated this problem.

## land use planning

In order to achieve the SWLRI agricultural strategy and realize the benefits it envisions, Iraq must better control land use, particularly urban expansion. Poorly planned urban expansion risks encroaching on fertile land and makes agricultural activities very expensive due to logistical constraints. To prevent this, this strategy carefully defined current and future plans for agriculture and urban expansion so that they could be taken into account in current and future development. In addition, each ministry, with its share of land use-related issues, properly contributed to defining current and future plans for the development of individual industrial sectors. Quarries and mines were identified, pipelines and industrial complexes were identified, and airports and urban areas were identified.

### *2.4.0.2 Conclusions*

The food security strategy includes the division of eight agro-climatic zones into which specific crop mixes and crop rotations were developed to achieve the best balance in terms of crop suitability, water conservation and adaptability to climate variability, improving soil fertility, and preserving Iraq's essential agriculture. In addition, three types of cropping were proposed as an expression of three different potential strategies for food and agriculture in Iraq. The F2 cropping pattern, with a gross irrigation efficiency of 11% and a cropping intensity of 0.02%, was ultimately chosen as the so-called 'central planning scenario', or

The plan that this strategy believes Iraq can realistically achieve within the next two decades.

A complex set of assumptions and analytical tools helped define the types of crops and crop mixes that represent a significant achievement of this strategy and a cornerstone for any future planning. With these tools and the proposed strategy, Iraq can achieve greater food security despite declining water quantity and quality and a growing population. However, this success requires reconsidering the link between food security, agricultural productivity, national and international market forces, and the ongoing management of the agricultural environment and the problem of climate change.

The various strategy concepts described in the previous sections have been adopted and assigned to each of the 44 irrigation projects included in this strategy. Specific recommendations are detailed in Appendix D and summarized in Appendix H.

### 3.5.5 Irrigation and related infrastructure

#### *1.4.4.2 Facts and needs*

**Current situation**

Sixteen percent of Iraq's land, or 70 million hectares, is arable land, and 82.2 million hectares of that land are currently being cultivated either using irrigation or rainwater.

**table *18*/42-3: Summary of the current situation of irrigation in Iraq**

**PRESENT STATE OF AGRICULTURE**

| % | Million Donums | Million Hectars | |
|---|---|---|---|
| 100.0% | 174,800 | 43,700 | Total Area of Iraq |
| 16.0% | 28,000 | 7,000 | Total Area Suitable for Agriculture |
| | | | |
| **100.0%** | **23,938** | **5.985** | **Total area ready for cultivation by 2015** |
| **63.7%** | **15,238** | **3,810** | Irrigated |
| 42.3% | 10,135 | 2.534 | By surface water INSIDE official Irrigation Projects |
| 14.2% | 3,400 | 0.850 | By surface water OUTSIDE official Irrigation Projects |
| 0.1% | 0.029 | 0.007 | By springs INSIDE officials Irrigation Projects |
| 0.3% | 0.081 | 0.020 | By ground water INSIDE officials Irrigation Projects |
| 6.7% | 1.593 | 0.398 | By ground water OUTSIDE officials Irrigation Projects |
| **36.3%** | **8,700** | **2.175** | Rain fed |
| | | | |
| **100.0%** | **15,238** | **3,810** | **Presently Irrigated Areas** |
| **35.9%** | **5.474** | **1.369** | Developed or Partially Developed Irrigation Projects |
| **64.1%** | **9.764** | **2,441** | Undeveloped Land Currently Cultivated |

| | | | |
|---|---|---|---|
| 54.6% | 8.325 | 2,081 | Areas receiving water through gravity irrigation |
| 31.3% | 4.773 | 1.193 | Areas receiving water through pumping |
| 11.2% | 1.703 | 0.350 | Areas receiving water from Ground Water |

| | |
|---|---|
| **49,919** | **Total Amount of Water for Irrigation [BCM]** |
| 46,420 | From Surface Water [BCM] |
| 0.099 | From springs [BCM] |
| 3,400 | From the Ground Water [BCM] |

| | |
|---|---|
| **35%** | **Overall Irrigation Efficiency** |
| **85%** | **Overall Cropping Intensity in the Irrigated Land** |

Agricultural production in central and southern Iraq is entirely dependent on irrigation, while the northern parts of the country are the most heavily rain-fed. Approximately 14% of Iraq's total cultivated area is irrigated. Of the current irrigated land, an estimated 4.484 million hectares are irrigated by surface water and 1.441 million hectares by groundwater. Another estimate is that 4.02 million hectares, or 8.7 million dunums, are rain-fed land.

The area planted with irrigation during the year 4100 was approximately 4.11 million hectares.[73], with an average cropping density of 70%. For planning purposes, this strategy estimated the current average cropping density at 82%, because the estimated average cropping density of 1.0% for the year 1940 was severely affected by drought, which in turn reduced available water by 41% below average.

The vast majority of Iraq's arable land is divided into 44 "projects." These projects include land currently under cultivation and new land suitable for cultivation but not yet formally reclaimed for use. The total potential area of these 44 irrigation projects is 4.404 million hectares.

At present, out of the total inventory of 044 irrigation projects, 41 irrigation projects are fully developed, and 29 are partially developed.[74], and 84 are under development. As of April 2014, the total developed area amounts to 0.4 million hectares. This represents 42% of the total area covered by the 404 irrigation projects, which were identified based on detailed site surveys conducted by the SWLRI consortium over a three-year period between 2010 and 2014. During the same period, the average cropping intensity in these developed areas was 69%, meaning 1.88 million hectares were under irrigation (including summer, winter, and perennial crops).

73 Calculates winter crops + summer + double perennial crops

74 The word "developed" is used here to identify those irrigation projects that are operated and maintained by the Iraqi Ministry of Water Resources.

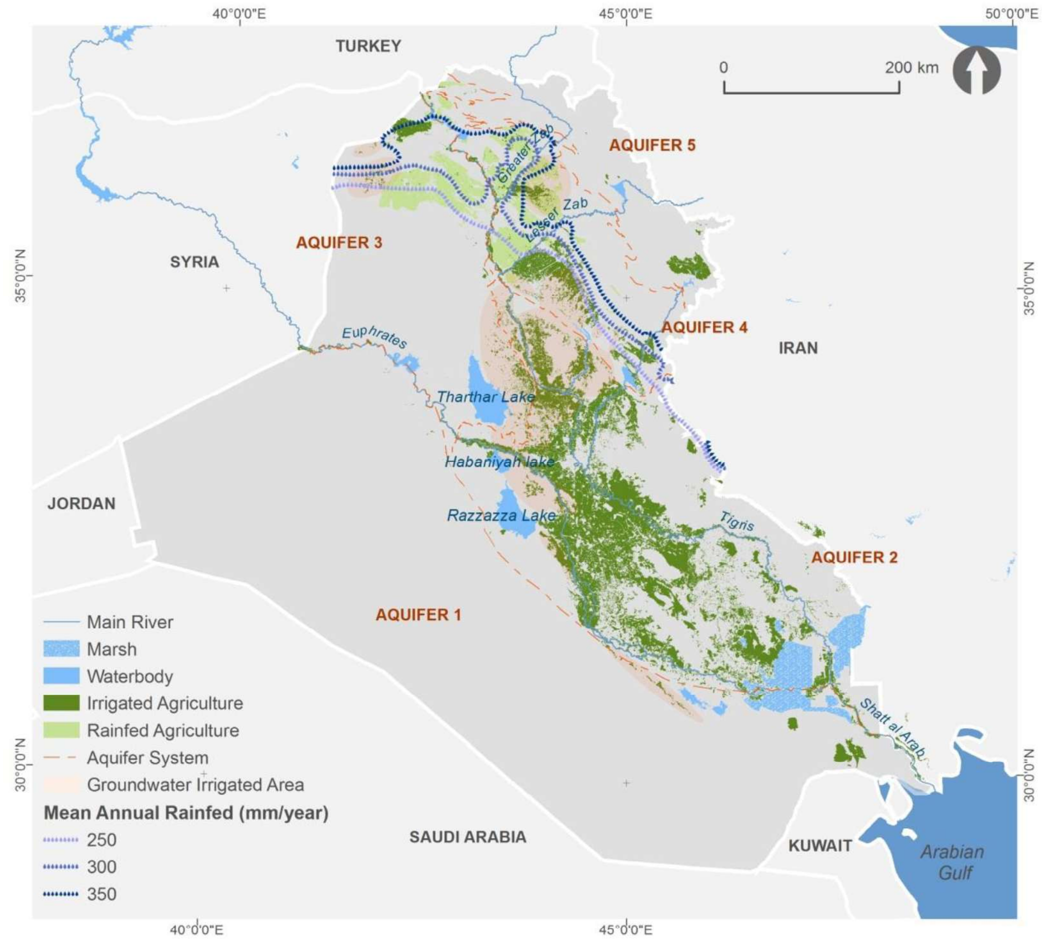


**Illustration53/ Figure 3-32: Current agricultural conditions**[75]

During the year 1940, the total volume of water consumed for irrigation was 41.2 billion cubic meters. Of this figure, 39.1 billion cubic meters were taken from surface water sources and 2.1 billion cubic meters annually were withdrawn from groundwater.

A drought occurred in 1910, resulting in a 41% reduction in water availability below average. A more useful projection of current water demand for irrigation purposes estimates that 0.4 billion cubic meters (BCM) are required annually for irrigation, with 41.4 BCM supplied by surface water and 4.4 BCM by groundwater. This means that, at present, agricultural water requirements consume 67% of total freshwater and represent 2.0% of total water consumption by sector.

[75]This figure is also available in a larger size in the map attached to the main report (see the map titled “Food Security – 23”). Other information about water sources for irrigation under current conditions is shown in the map attached to this report entitled “Food Security - 20".

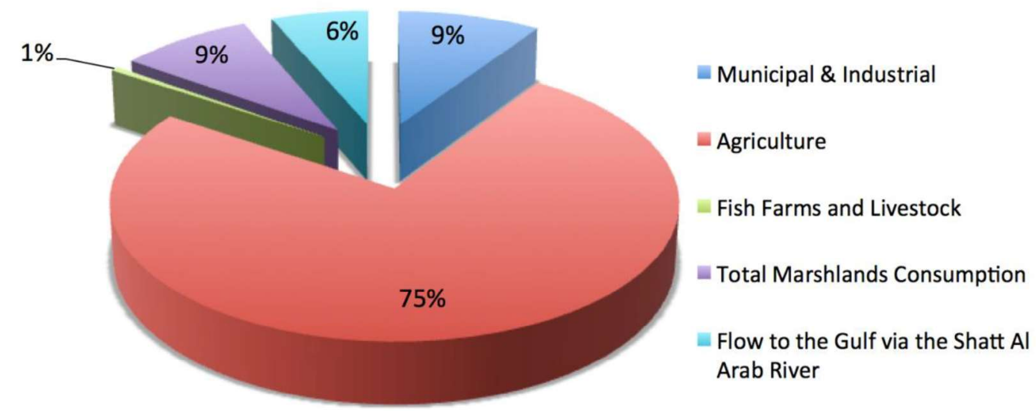


**Illustration52/ Figure 3-21: Water needs for each sector in 2145**

**Challenges**

Current water consumption in the agricultural sector is very high, and current overall irrigation efficiency is very low.[76]Therefore, immediate water conservation measures must be implemented in the agricultural sector to ensure sufficient water quantities are available to support all water users in Iraq.

Poor irrigation practices combined with neglect of on-farm irrigation mean that the overall irrigation efficiency ranges from 41% to 41%, which is roughly the same as today's 0.81. The low water productivity observed in most irrigated agriculture in Iraq is due to four main sources of inefficiency: (a) socio-cultural problems such as low farm skills, low motivation for on-farm investment in irrigation management and improvement activities, and low incentive for joint ventures; (b) constraints from the farmers themselves such as control and authority, for example, over irrigation intervals and rationing, and lack of agricultural inputs; (c) technical and infrastructure constraints and problems; (d) land management problems affecting irrigation, for example, flow obstructions, irrigation methods and land preparation, poor use of water withdrawal facilities, and other factors that can be easily overcome without major investments.

Direct examples of the causes of low water productivity include the lack of guaranteed access to agricultural land due to poorly maintained canal networks, poor on-farm water distribution and management, inadequate field leveling, and the practice of flood irrigation. All of these factors mean that water is treated as a free commodity in Iraq, leading to inefficient use. No system exists anywhere in Iraq that charges users a reasonable price for the benefits derived from irrigation water.

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76 The total efficiency represents the transmission losses in the networks + operating losses + losses within the farms (field efficiency). In the reclaimed irrigation systems in Iraq, the two components

The first two types of losses, i.e. transportation losses and operational losses, are addressed by engineering works, i.e. lining policy and providing adequate monitoring facilities. The largest part of the losses occurs

At the farm level, which are not properly addressed due to current management practices.

## 1.4.4.4 Future needs

Preserving Iraq's existing agricultural land and expanding cultivated land depends on adopting new water-use efficiencies in the agricultural sector. Despite the existence of water policies, strategies, laws, and regulations, effective water resource development has not yet been achieved. Consequently, water management, control, and use must be addressed simultaneously. Water allocation targets, crop rotations, and environmental issues have been assessed for three scenarios in Iraq. Reforms are needed to create a framework for developing relationships between key governance actors, NGOs, civil society, the private sector, and farmers to determine the most effective uses of resources and management practices.

Institutional restructuring and reform are needed across sub-sectors, including both the Ministry of Agriculture and the Ministry of Water Resources. To date, the focus of irrigation water sector development has been primarily on restoring irrigation pumping stations and drainage, with less attention paid to capacity building, accountability of water service providers, and capacity building for the ongoing maintenance of irrigation infrastructure. The operation and maintenance of irrigation systems leaves much to be desired. Water user fees imposed by the Ministry of Water Resources cover only about 1% of the cost of infrastructure and services provided, and water user associations are virtually non-existent.[77].

### 1.4.4.1 Strategies and Opportunities

**Water consumption and cultivated land**

The SWLRI strategic study proposes that by 2042, most of the currently cultivated land will be retained for large-scale development. This means that by 2042, 4.44 million hectares of land will be irrigated from surface and groundwater sources, representing 84.8% of the total currently cultivated land. Cultivating this land will require 44.21 billion cubic meters of freshwater per year (of which 44.18 billion cubic meters per year will be withdrawn from surface water sources and 0.884 billion cubic meters per year from groundwater sources). Under this plan, the region will be irrigated with 41.8% less water than currently used for irrigation. Because agricultural intensity will increase from 82% to 0.02%, the actual cultivated area will increase from the 4.448 million hectares cultivated today to more than 4.04 million hectares cultivated by 2042, representing an increase of 0.00%. Below is a summary of the key facts regarding the proposed state of agriculture for 2014.

77 Water service fees were set by Law 112 of 1955, which aimed to create more responsibility for operation and maintenance on the farmer. Fees are imposed at a rate of constant750 Iraqi dinars per dunum of "reclaimed" land (i.e. containing drains), and 500 Iraqi dinars per dunum of non-reclaimed land. The total is

To less than$2/hectare, which is not even a tenth of the amount the Ministry of Water Resources spends annually on operation and maintenance. On a volume basis, this fee is equivalent to $1 US penny for each12 cubic meters consumed, and water service fees are among the lowest in the world. Source: World Bank Water Resources Assistance Strategy table19/47-3: The State of Agriculture in the Future

**FUTURE STATE OF AGRICULTURE**

| % | Million Donums | Million Hectare | |
|---|---|---|---|
| 100.0% | 174,800 | 43,700 | Total Area of Iraq |
| 16.0% | 28,000 | 7,000 | Total Area Suitable for Agriculture |
| **100.0%** | **21,586** | **5,397** | **Total area ready for cultivation by 2035** |
| **62.9%** | **13,586** | **3,397** | **Irrigated (if 100% of the area were to be developed)** |
| 59.1% | 12,748 | 3,191 | By surface water INSIDE official Irrigation Projects |
| 0.0% | 0.000 | 0.000 | By surface water OUTSIDE official Irrigation Projects |
| 0.2% | 0.045 | 0.011 | By springs INSIDE officials Irrigation Projects |
| 0.6% | 0.127 | 0.032 | By ground water INSIDE officials Irrigation Projects |
| 3.1% | 0.666 | 0.167 | By ground water OUTSIDE officials Irrigation Projects |
| **37.0%** | **8,000** | **2,000** | **Rain fed** |
| **94.6%** | **12,920** | **3,230** | **This Strategy y for Irrigation b d Areas proposed** |
| 42.4% | 5.474 | 1.369 | tedaTo be rehabilit |
| 57.6% | 7,446 | 1.862 | able to water (based on availability) dTo be reclaimed |
| 98.7% | 12,748 | 3,187 | ravity irrigation water through g Receiving Areas |
| 1.3% | 0.172 | 0.043 | and Water Uwater from Gro Receiving Areas |

| | |
|---|---|
| **34,560** | **Total Amount of Water for Irrigation [BCM/Y]** |
| 32,678 | Surface Water [BCM/Y] |
| 0.103 | Springs INSIDE official Irrigation Projects [BCM/Y] |
| 0.300 | Ground Water INSIDE official Irrigation Projects [BCM/Y] |
| 1.479 | Ground Water OUTSIDE official Irrigation Projects [BCM/Y] |

| | |
|---|---|
| **60%** | **Overall Irrigation Efficiency** |
| **115%** | **Overall Cropping Intensity in the Irrigated Land** |

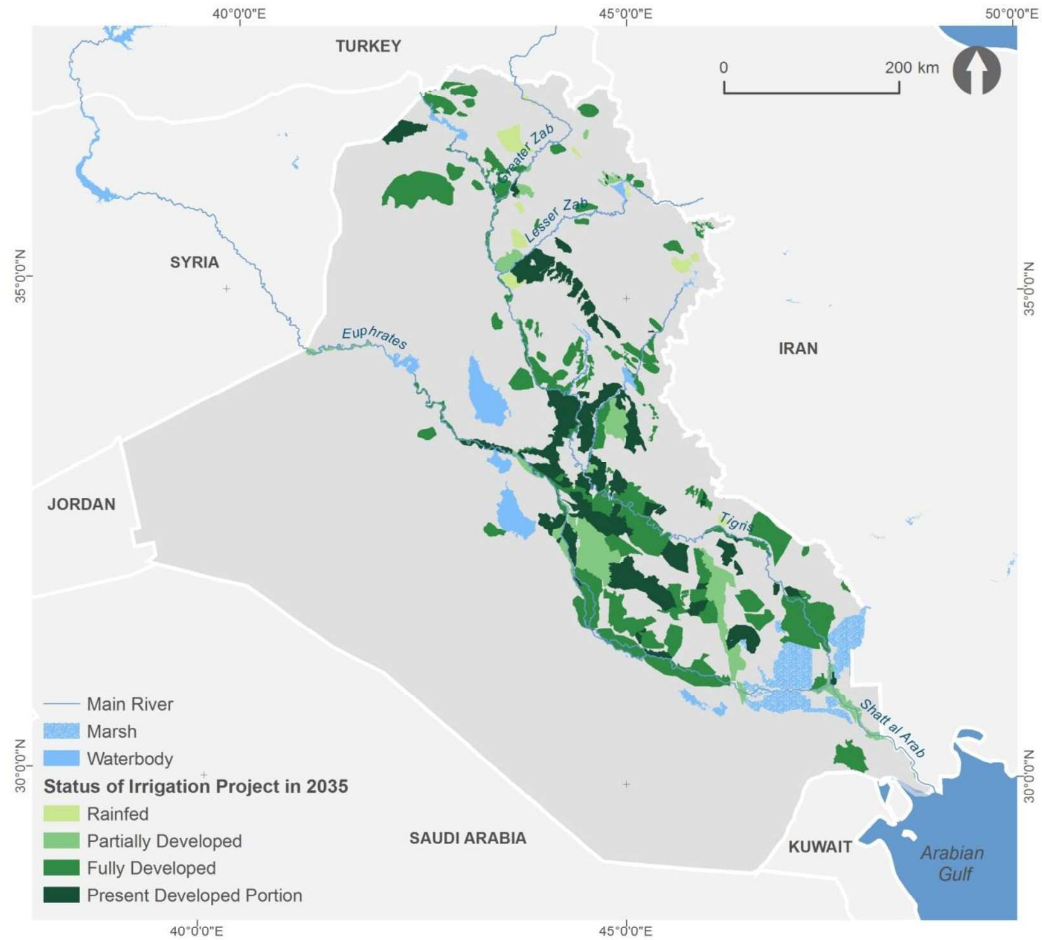



**Illustration55/ Table 3-24: Agricultural situation in 2135[78]**

Water use for irrigation will continue to be provided by multiple sources in the future. The following map (see Figure 4-44) shows the location of each irrigation project and its water source. Rainfed areas are located in the northern part of the country. Surface water irrigated projects are largely located in the central part of the country between the Tigris and Euphrates rivers. Groundwater irrigated projects are located primarily in the north, although some projects are located in the Western Desert and one in the south. The figure above shows the water sources for each irrigation project.

The irrigation strategy assumes that water for irrigation purposes is guaranteed for 8 out of 10 years on average with no significant decrease (i.e. 81% of the time there is no decrease in irrigation water). In the remaining 41% of cases, the decrease in irrigation can reach 42% during drought periods with a probability of occurrence equal to or less than 0% (i.e. drought).

[78]This figure is also available in a larger size in the map attached to the main report (see the map titled "Food Security – 21"). Other information about water productivity for each agricultural project is shown in the map attached to this report, entitled "Food Security."
- . 2".

(which can occur on average once every 100 years). Over time, the demand for fresh water in the agricultural sector will decrease as a result of the implementation of efficient and improved water use methods for FT0 to FT2 farming patterns. As shown in the graph below (Figure 4-44), the decrease in water demand in the agricultural sector will occur throughout the country.

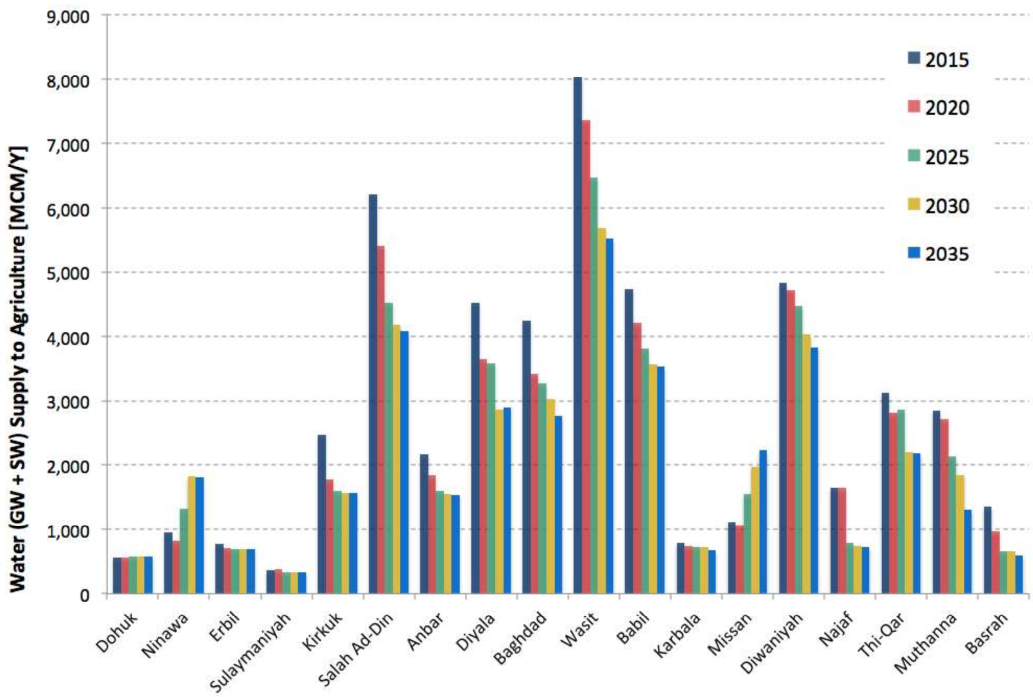



**Illustration52/ Figure 3-22: The volume of fresh water allocated for irrigation for each governorate over the next two decades**

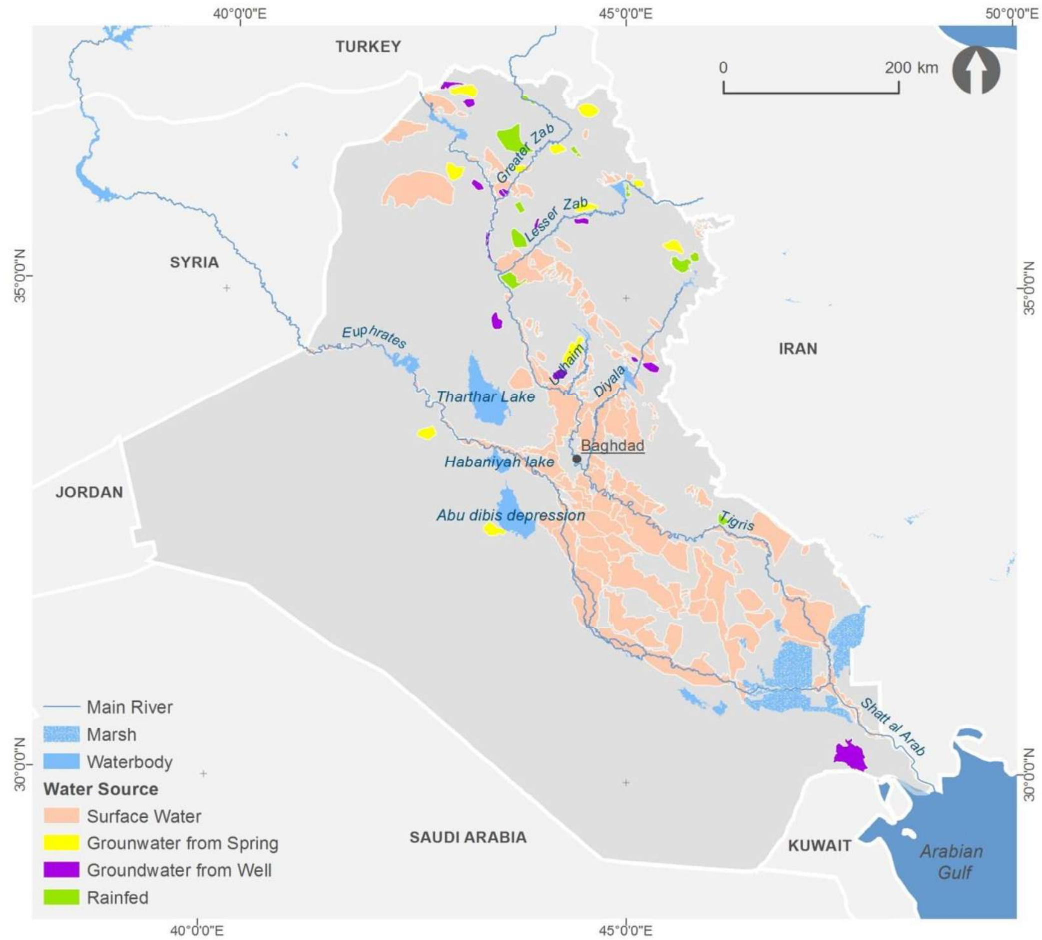



**Illustration57/ Figure 3-23: Irrigation water sources under the conditions of the year 2135**[79]

**Improving irrigation efficiency**

During the development of this strategy, three different irrigation and water conservation alternatives were proposed and incorporated into the three cropping types mentioned above. FT1 assumes an overall irrigation efficiency of 44% and a cropping intensity of 11%. FT2 (which is the cropping pattern the strategy believes can realistically be achieved by 2014) assumes an overall irrigation efficiency of 11% and a cropping intensity of 20%.[80]FT3 is practiced with a total irrigation efficiency of up to ..% and a crop density of up to 0.41%.

[79]This figure is also available in a larger size in the map attached to the main report (see the map titled “Food Security – 20”).

[80]The actual agricultural density upon which each irrigation project will be designed will be determined in the detailed design phase and can be To range between %122 and 132%. In addition, when choosing a different planting density than the target density of 111% (SWLRI), the designer must take into account that the amount of water allocated to each project cannot be changed.

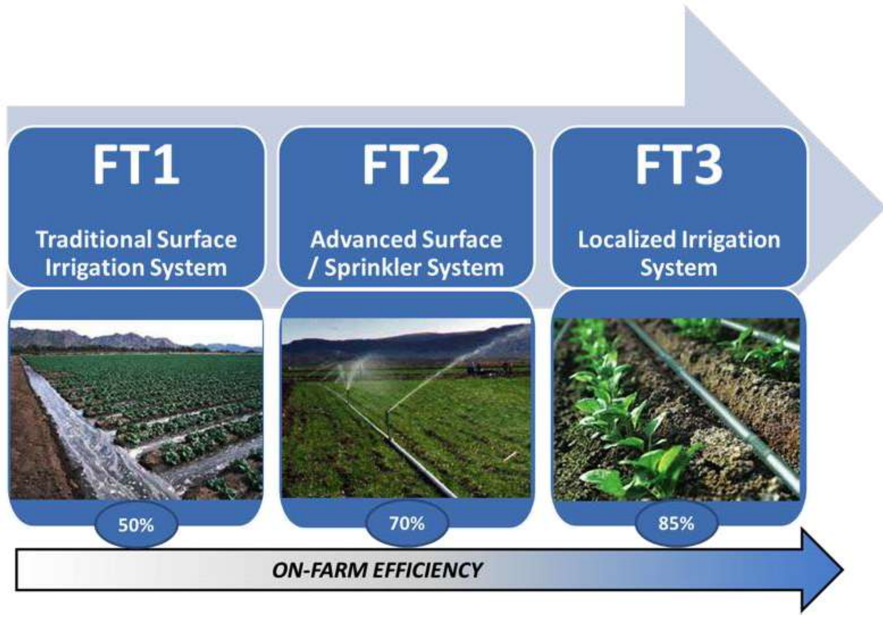



**Illustration53/ Figure 3-22: Transition of agriculture from *FT1* to *FT2* to *FT3* Leads to increased efficiency at the farm level**

The following graph shows an indication of the impact on water demand and land development, depending on which agricultural strategy Iraq adopts. The water calculated in this example refers only to freshwater resources, and the land expected for development is only the area irrigated by surface water.

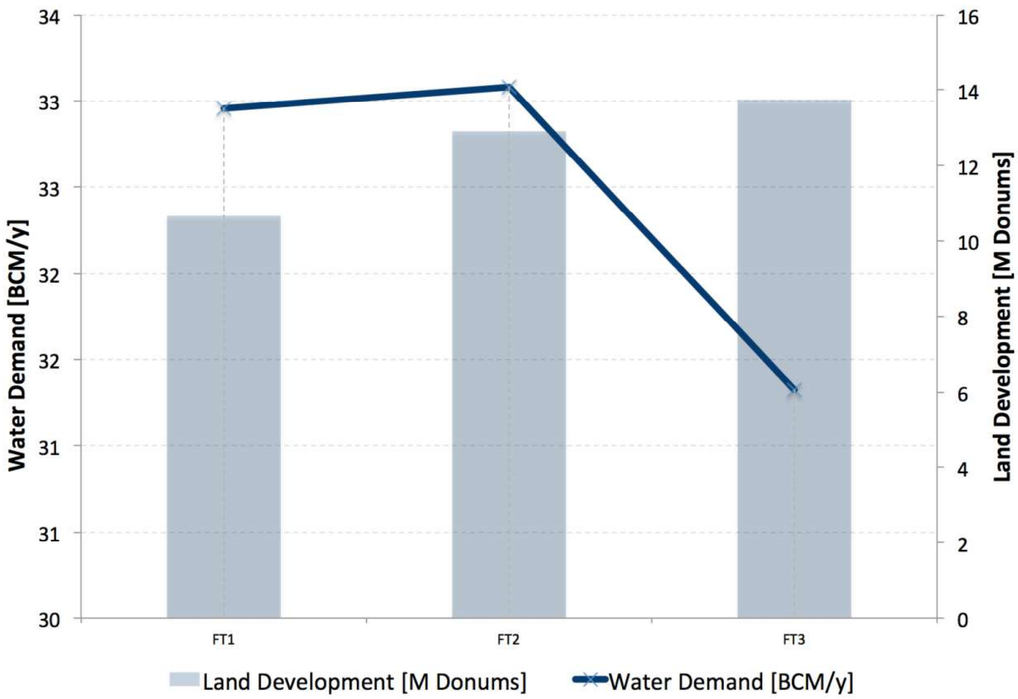



**Illustration52/ Figure 3-25: Comparison of water requirements (billion m3) for irrigation and land development (million dunums) under agricultural strategies different**

If Iraq successfully implements FT3 irrigation, it will be able to develop 0.11% of all irrigation projects in the country, saving 0.80 billion cubic meters of fresh water annually compared to FT2 irrigation. On the other hand, if Iraq is able to implement FT1 irrigation, assuming water volume remains the same, then Iraq will be able to develop 0.8% of the proposed irrigation expansion.

In the three types of farming methods, the basic assumption is that off-field irrigation is entirely by pipe (pressure) irrigation, excluding the main canals. This single requirement will impose high costs, including initial and operating costs. The cost will be 2 to 4 times higher than conventional irrigation methods if both the existing and new irrigation networks are entirely pressurized. Currently, our survey shows that 8.0% of developed land is served by spate irrigation, so approximately all currently developed irrigation systems will need to be retrofitted and upgraded to newer systems. Operating costs will also increase significantly due to rising energy costs. However, the benefits will be significant because the efficiency of the pipes will initially reach 2.0%.

**Prioritizing investments in agriculture**

This strategy assumes that priority should be given to investments in irrigation system rehabilitation. Appropriate rehabilitation is a prerequisite for enhancing credibility regarding the timing and quantity of

Water allocations for irrigation projects. Rehabilitation of water conveyance systems serving lands without salinity problems is expected to be more responsive in terms of productivity and increased production (and at lower investment costs).

**Use appropriate irrigation maps**

This strategy provides specific recommendations for each of the 44 irrigation projects (see Appendix 1.D and the full assessment reports for each proposed irrigation project). The agro-ecological zoning tool was used to develop detailed irrigation maps that guided the selection of the most beneficial irrigation method (see Appendix 6.B for a full description of the agro-ecological zoning tool). These tools are the building blocks for achieving efficiency and productivity, but they must be properly utilized and continually updated.

**Improvements in irrigation networks**

All implemented projects will benefit from improvements to their irrigation networks. Lining canals, controlling aquatic weeds, and improving and maintaining sluice gates will increase the water flow to irrigation projects, thereby improving crop yields. All water-saving methods should be adopted, such as lined earthen canals, careful land leveling, the use of long ditches, night irrigation, modern irrigation systems, changing planting and harvesting dates, changing seeding methods (dry seed or planting), and changing management systems (supply versus demand, advance versus deferred, rationing versus continuous flow, etc.).

**Adoption of in-field water management**

Field-level water management has traditionally been neglected in many irrigation practices currently adopted in Iraq. While the Ministry of Water Resources strives to control water at the field gate and assists the Ministry of Agriculture in enhancing water efficiency through agricultural practices, farmers are responsible for field-level water management. Therefore, some specific strategic recommendations are presented to address water productivity issues in saline areas (more typical of central-southern Iraq) and within the rain-fed areas in the north.

The high number of institutional bodies involved in irrigation and drainage management in Iraq leads to overlapping mandates and insufficient coordination of activities within and between ministries. With regard to irrigation and drainage, the Ministry of Water Resources has the primary role, and as a result, the interests of other ministries are not adequately represented. Meanwhile, the Ministry of Agriculture deals with agricultural aspects such as seeds, fertilizers, and agricultural machinery. These off-farm interventions leave on-farm irrigation and drainage systems solely to farmers, who often

They lack the knowledge and capacity to operate the systems efficiently. This problem has been recognized as one of the priorities for agricultural development in Iraq.

Establishing irrigation consultancy services)Strengthening water users' associations can play a role (IAS). They can be instrumental in resolving some of the above issues and can help improve the administrative structure of irrigation and drainage for future work. They can also facilitate better coordination within and between ministries, particularly between the Ministry of Water Resources and the Ministry of Agriculture.

Irrigation advisory services should comprise multidisciplinary experts from both the Ministry of Water Resources (Irrigation and Drainage Units) and the Ministry of Agriculture (Water, Soil, Investment Units, and Extension Services), to develop an integrated approach to water management and implement irrigation modernization projects for livestock and more profitable crop production. Considering the skills of extension service staff in disseminating innovation among farmers, an active role for the Ministry of Agriculture in irrigation advisory services should be encouraged..IAS

Irrigation advisory services also help link the hydraulic aspects of irrigation with the agronomic aspects, strictly aligning them with the physiological requirements of plants/crops. For this reason, irrigation advisory services should include agricultural engineers capable of calculating crop water requirements for a given site. In addition, one to two experts should have procurement experience to help coordinate the implementation of relevant investments by both the Ministry of Water Resources and the Ministry of Agriculture. Irrigation advisory services could also include international experts representing major donor organizations active in irrigation, drainage, and agriculture in Iraq. Irrigation advisory services experts could be permanent (from 2-1 persons) and temporary (called for specific tasks based on current needs), and coordination By the Irrigation Advisory Services Secretariat consisting of a Secretary/Chief and one or two administrative support staff to handle logistics, finance and communications.

**In-field agricultural strategies to improve water productivity**

Traditional and local irrigation methods need to be replaced with appropriate basin/section methods. The use of high-efficiency, pressurized irrigation systems such as sprinklers, micro-sprinklers, center pivots, moving hose reels, and drip irrigation are all excellent ways to increase water-use efficiency on agricultural land and eliminate most pipe losses. Other irrigation methods can be used to suit local conditions as long as they achieve the primary goal of increasing irrigation efficiency. Once such equipment is available in Iraq, the Ministry of Agriculture can proactively engage with farmers to provide guidance on new technologies, including training and mechanisms to support their use (e.g., financing). Loan programs can

Small-scale irrigation significantly improves farmers' ability to afford equipment. Additionally, low-cost, fixed water intake facilities for agricultural canals must be constructed.

Rural extension services must be strengthened to implement improved management guidelines at the farm level and create favorable conditions for the allocation of water meters to each farmer. Furthermore, farmers should be trained and supervised by irrigation experts to guide them and enhance irrigation management practices.

**In-field strategies for improving water productivity in rainfed areas**

This strategy proposes the implementation of advanced management (AM), including the use of improved varieties, mechanization, appropriate fertilizer management, and weed and disease control. Single irrigation and early planting are effective methods for enhancing productivity, as is a combination of supplementary irrigation with improved management and varieties. If supplementary irrigation is adopted, it should be applied in spring (twice, adding 0.2 mm each time) or in autumn (once, adding 100 mm). To this extent, agro-ecological management can divide the areas to facilitate future planning and prepare iso-potential supplementary irrigation maps for rainfed areas.

The use of newly introduced legume and cereal varieties can help regenerate soils in crop rotations with wheat, barley, and other cereals. Cereals and legumes are also drought- and salinity-tolerant. The implementation of these practices was recently demonstrated as part of the Agriculture Reconstruction and Development in Iraq (ARDI) project.

**Institutional policies and measures**

To support and improve water productivity in the field, the strategy proposes the establishment of an Agricultural Water Management Unit (AWMU) to be jointly managed by the Ministry of Agriculture and the Ministry of Water Resources, headquartered at the Ministry of Water Resources. The AWMU is responsible for addressing issues of drainage, salinity, and land leveling, improving agricultural production at the irrigation project and field levels, and establishing and supporting water user associations.

An expanded and organized cadre should be established within the two departments in the two ministries by adding at least one irrigation engineer to each department. The cadre members should be permanent, well-trained, and constitute the core of the departments. Such training can be achieved through workshops held in the country or abroad. It is recommended that field visits be arranged during the workshops to visit relevant centers of excellence for agricultural practice.

A higher committee comprising representatives from both ministries is required to organize and coordinate the work carried out by the two departments related to the agricultural sector. The Ministry of Water Resources team should be responsible for the designs and supervision of the construction of the systems, and the Ministry of Agriculture team should be responsible for the design and supervision of the construction of the systems.

Responsible for the operation, evaluation, and maintenance of the systems. The committee is also responsible for establishing a database on on-farm irrigation systems and updating data obtained from farms and evaluations. Both departments will be responsible for organizing periodic awareness workshops and providing advice to users and farmers.

In the next phase, the two departments will establish pilot stations in selected locations across the country to conduct field experiments and user demonstrations, and will collaborate with relevant university departments to transfer field experience to students or conduct research for graduate students.

### 3.5.3 Pastures and forage resources

### *1.4.1.2 Facts and needs*

**Pastures and fodder**

more than12% of the land in Iraq is desert with a large portion of permanent pastures. They are subject to erosion due to their low vegetation cover. In addition, large areas of agricultural land are losing productivity due to poor agricultural practices, overexploitation, and soil salinity. Semi-desert areas, in particular, have suffered severe loss of vegetation cover due to overgrazing, off-road vehicle traffic, and construction.

Most agriculture in Iraq involves planting and harvesting one crop per year. In rain-fed areas, winter crops, particularly cereals, are planted in the fall and harvested in the spring. In the irrigated areas of central and southern Iraq, summer crops predominate. A few multiple crops, usually vegetables, are grown where irrigation water is available over more than one season. In rain-fed areas, land is left fallow so that moisture can accumulate.

The largest portion of agricultural land in Iraq is cultivated with field crops. Wheat and barley are currently the most important crops and occupy the majority of the area in rain-fed areas. However, compared to wheat and barley, the areas cultivated with forage crops are very small. The most important of these forage crops is alfalfa (Hijazi).*(Medicago sativa*and yellow corn*Zea mays L.*(and corn White (sorghum)*vulgar*), and the vetch plant (vetch) (*Vicia sativa*( .

Most forage crops are grown under irrigation, especially alfalfa. Straw and surplus alfalfa are transported and sold throughout the country for fertilization during periods of feed scarcity. Yields from all forage crops are extremely low due to traditional production and management practices and the unavailability of improved seed varieties. There is scope for increasing forage yields through the use of improved seeds, appropriate barrier materials, and drought and salt-tolerant varieties.

## Livestock

Livestock is an integral part of agricultural systems. Traditionally, farmers keep livestock to supplement their income and meet basic nutritional needs for milk, meat, and dairy products. For centuries, millions of sheep have roamed the natural pastures of Iraq's deserts, foothills, and mountainous regions. In the past, a large portion of the rural population was nomadic, moving animals between seasonal grazing areas. Livestock contributed about a third of the income of Iraqi rural households before 1979.

15.2. However, the proportion of sheep decreased when parts of the desert lands were converted into Farms (as in the Gezira Scheme) and pastures have gradually become less productive as a result of uncontrolled grazing. Sheep farms have also become fewer due to severe drought in recent years.

Iraq's rich and distinctive livestock population is largely the result of the ancestral legacy of several thousand years of agriculture in the region. The conditions for the production and feeding of these animals are limited, however, by the current potential of pastures and land. At the same time, although the ancient traditions of rural communities heavily involved in animal husbandry still exist and maintain a diversity of cattle, sheep, goats, and buffalo, these practices have often been significantly modified, particularly after the massive importation and spread of imported livestock and the widespread hybridization with local breeds.

Sheep, goats and cows are among the most important livestock resources, providing meat, wool, milk, hides and hair. In the year1522, the government began to emphasize livestock and fish production in An attempt to add protein to the national diet. Although the numbers of cattle and sheep have actually declined from1522 - 0222, the production per head and the total production of meat And the dairy increased. In the year0222, the number of sheep was about 6.9 million and the number of goats was about 143 million, which were owned primarily by nomadic and semi-nomadic groups. According to FAO statistics, by the year0225 There were 1.6 million cows and7.8 million sheep, 1.55 million goats, 275,000 buffaloes, and 48,000 horses. camels58000.

Milk and meat production nearly collapsed in 2007.0223 because of the Gulf War. Although in The period between the years0223 and 0225 Both meat and milk production improved but the numbers failed to reach To previous production levels. The main factors limiting livestock and poultry production include severe shortages of feed/feed and veterinary services, shortages of medicines, and lack of machinery, equipment and spare parts.

An increasingly important obstacle is the gradual shift in land use from pasture to cereal production.1552, poultry consumption in Iraq was high due to the increase in per capita income. This, coupled with the increase in imported poultry, has created a need for a transportation and storage system for perishable products. For these reasons, the Iraqi government has initiated a plan to establish and develop large-scale poultry projects.

To supply the country with sufficient poultry and its products. During the 1980s, there was8353 small projects and01 large poultry project, which provided about 1688 million eggs and 12 million hatching egg, and250,000 tons of chicken meat annually (FAO statistics). However, Many of these projects are either closed or operating at a fraction of their full capacity.

Animals in Iraq graze primarily on crop residues and natural pastures supplemented by imported grains and proteins. Therefore, improving feed production is hardly a priority for farmers. The quality and quantity of feed depend heavily on water availability, soil fertility, the use of improved production techniques, the inclusion of forage legumes in the current agricultural system, and the combination of forage legumes with cereals, all of which have declined in Iraq over the years. The lack of sufficient, quality feed is one of the major factors limiting livestock production.

#### *1.4.1.4 Strategies and opportunities for improving rangeland resources*

Proper rangeland management requires long-term investment in the maintenance and development of essential natural resources such as natural vegetation, water, soil, biodiversity, and wildlife. For effective implementation, rangeland management requires short-, medium-, and long-term planning.

### short-term plans

A number of important but short-term measures can be taken to effectively manage desert rangelands, including:

- Establishing new oases in desert pastures, as well as rehabilitating degraded ones that were previously privatized or leased, can not only provide services such as water for sheep farmers, but also serve as a source of plant genetic resources. Their preservation can also improve plant distribution and restore vegetation cover.
- Control/monitor livestock grazing and implement it according to a well-prepared plan formulated by the relevant authorities. The plan should aim to maintain optimal vegetation cover after grazing animals have used the site and ensure the continuation of palatable species.
- Confirming the strict ban on cultivating land in areas with less than one-third of rainfall. 012 mm/ Annually and strictly monitored. The same rule should apply to sloping lands in mountainous areas. Cultivating these lands is uneconomical in most years, and the resulting returns do not even cover production costs. Cultivation also leads to soil erosion, which is subsequently washed away by surface runoff into valleys and rivers. Dust storms can also blow soil far into urban centers and other establishments.

- It is prohibited to cut and uproot bushes for fuel, charcoal production, and to provide alternative energy sources and feed for livestock.

### Medium-term plans

- Construct roads to connect the mountain stations and oases of the island, as well as the northern and southern desert. The use of roads can help avoid the destruction of vegetation caused by off-road vehicles. Unfortunately, large areas that once supported important forage shrubs have already been destroyed.
- Establish plant genetic resources in desert and mountainous areas to preserve the genetic resources of important species and highly palatable fodder. In addition, a nursery for fodder species should be established, and national activities related to pasture species should be expanded to include information on ecology, palatability, and location.
- Ensure the availability of concentrates to relieve the current pressure on pastures so that they can restore vegetation cover and normal conditions.
- Establish national parks, protected areas/nature reserves in different ecological zones to protect ecosystems and facilitate the work of a group of ecologists to collect data that can be used in rangeland improvement and development.
- Avoid overgrazing and deterioration of vegetation cover due to the concentration of livestock in certain areas, and dig wells in the island, the northern and southern desert, as well as in the eastern region to ensure the proper distribution of grazing animals.
- Employ appropriate water harvesting techniques to collect water and enhance infiltration to increase soil moisture for plant growth.
- Providing advisory services through a range of local media outlets and organizing meetings for governorates and regions adjacent to the desert and the island.
- Constructing small dams across valleys and in other suitable locations to store water that can be used for domestic purposes, as well as to replenish groundwater.

### long-term plans

Long-term plans will include research and studies in the following areas:

- Preparing detailed topographic maps and vegetation cover maps to identify pastures. Degraded and prepared inventories of fodder resources in different grazing areas.
- Mapping and identifying degraded pastures using available maps, aerial photographs and ground verification, and rehabilitating degraded sites through replanting.
- Conducting studies and research on the role of wildlife in Iraqi pastures and determining its impact on the vegetation cover.

- Introduce, collect, identify, and evaluate suitable plants adapted to desert environments.
- Evaluate appropriate water conservation methods to improve vegetation cover in desert areas.
- Select pilot sites in the Jazirah and the northern and southern Badia to improve the scope of participation. Successful approaches such as pilot site interventions can be replicated in other parts of the country.
- Ongoing on-farm establishment of a program for introducing, identifying, collecting, evaluating and selecting salt- and drought-tolerant forage plants adapted to different ecological zones.

## 3.5.4 Fish wealth

### *1.4.2.2 Facts and needs*

Since the 1970s, the Iraqi government has emphasized fish production in an attempt to add protein to the national diet. Many fish, the most common of which is carp (production of which is about1,000 kg/acre/year), raised in fish ponds. Statistics show that National Fish Ponds14,486 dunums located within legal farms (i.e. farms that have been Approved by the Ministry of Agriculture) while it is located11,805 dunums within the so-called non-farms Legality. The land cover analysis developed within the framework of this strategy shows higher values of fishpond lands, which is likely due to the greater prevalence of illegal fishponds. According to the land cover analysis, the total area occupied by fishponds in Iraq is43,704 dunums. There are currently 586 registered farms and the Ministry of Agriculture authorizes 150 farms. Additional: The cost of fish farming is heavily subsidized by the Ministry of Agriculture, which provides larvae (fingers) at a price of15 Iraqi dinars/one (while the market price is about 01 dinar) Iraqi/one).

Usually, the fish ponds operate between June and February when the area is flooded with water by about141-1401 meters. After February, the fish ponds are dried and the soil is fertilized. The water demand for fish ponds is estimated at0322 $m^3$/dunum/season. Water is generally taken from rivers, but in many cases it is also taken from illegal drains and wells. Fishpond water is either legally discharged into appropriate drains or illegally discharged into existing wetlands.

There is another, more efficient method of fish farming in Iraq, which is through cages. At present, the productivity of this method is21 fish/$m^3$(1 fish = 1 kg) and it does not require more From one worker on the farm. In the fish cage, the carp can grow to1 kg During one season (which lasts6 months). The market average for carp is between 0.5 and 1 kg in weight and sold for1222-0222 Iraqi dinars/kg (while the market price of fish Traditionally grown up to four times.

The Ministry of Agriculture's requirements for fish farming in cages provide for a cage of approximately0×3m high and 141m deep with at least 1m of free space left under The bottom of the cage. It is preferable to place the fish cage along rivers where the water current is sufficient. Fish farms should not extend more than212 AD0The place must be far enough away Less than0 km from the mouth of another fish farm.

In order to promote the development of fish cage farming, the Ministry of Agriculture is currently providing complete equipment to farmers. This includes a standard cage with fish feed and feed pellets at a cost of approximately141 million Iraqi dinars / each, applied for a two-year interest-free loan.

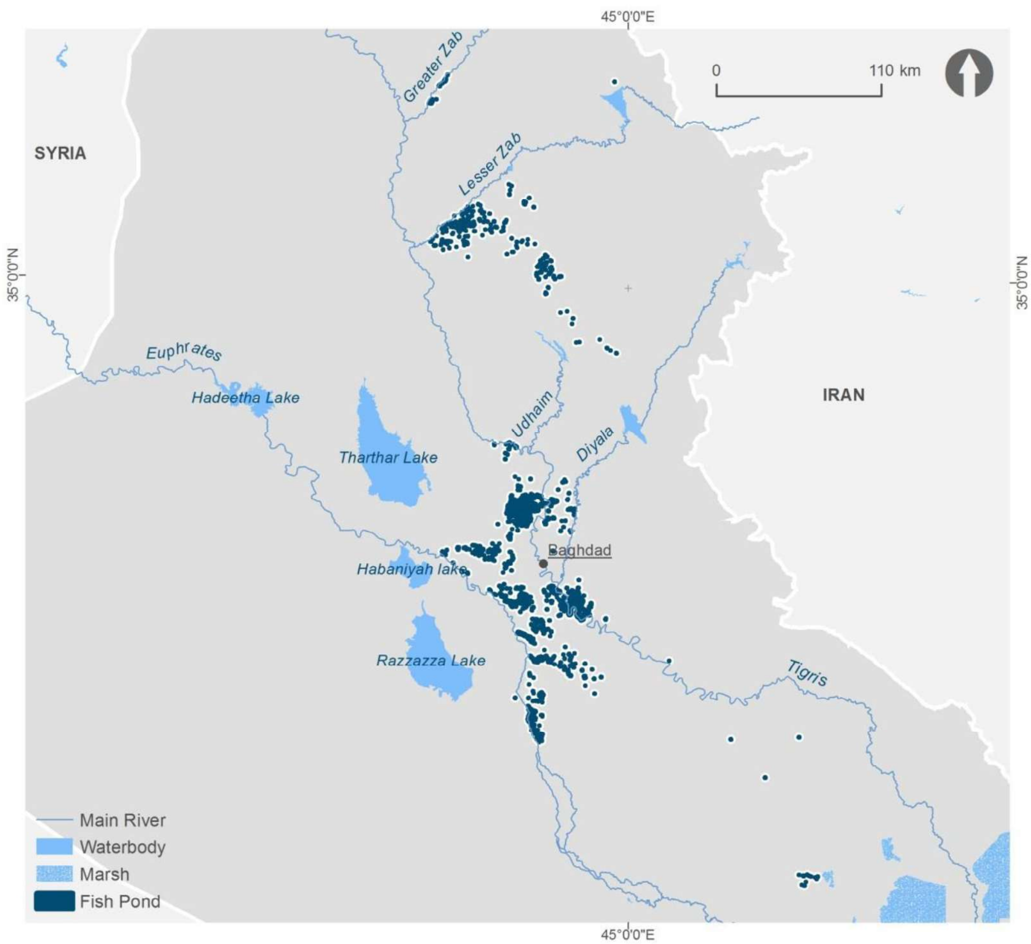



**Illustration21/ Figure 3-22: Fish farm locations in Iraq[81]**

[81]This figure is also available in a larger size in the map attached to the main report (see the map titled "Food Security – 11").

#### *1.4.2.4 Opportunities and Strategies*

In line with the Ministry of Agriculture's recommendations, this strategy assumes that the majority of future fish farming will take place in cages located along rivers. To achieve this, strict policies must be put in place and enforced to reduce illegal fish farms. Furthermore, fish production must be increased to achieve the 2 kg/capita target (currently, only a third of domestic demand is met). In doing so, Iraq must strive to restore and conserve traditional fish species.

## 3.5.2 Reuse of drainage water

### *1.4.3.2 Facts and needs*

**Current situation**

While irrigation is essential for agricultural production in most of Iraq, poor drainage can create significant problems for the fertility of agricultural soils. In addition to providing water for agriculture, systems must be in place to remove excess rainwater or irrigation water and allow salts to be washed out of the soil. Inadequate drainage leads to elevated soil salinity levels, eventually making the soil too salty to produce crops. An estimated 21% of the region's agricultural land is affected by high salinity, much of which has been abandoned by farmers who previously relied on agricultural production for food and income.

Under current conditions, it is estimated that approximately 21 billion cubic meters of water is used for irrigation in Iraq. Due to the low overall irrigation efficiency, a significant proportion of this water is returned to rivers, and some is collected and disposed of through the Tigris-Euphrates common estuary. This estuary, which is now fully constructed and operational, is called the Third River. It extends 218 km from a point northwest of Baghdad to Basra, where it flows into the Shatt al-Basra. Designed to carry over 1 billion cubic meters of drainage water annually, it actually carries no more than 4.8 billion cubic meters annually under current and future planned conditions.

### *2.4.2.4 Future needs*

This strategy assumes that by 2042, if fully implemented, irrigation projects in Iraq will release an average of 2.0 billion cubic meters annually.[82]From drainage water, which, if not collected properly, will affect the quality of river water and cause severe damage to the environment and society as a whole.

[82]See Table 5-3, page 52 of Appendix 1.1.H for this strategy.

The following image illustrates what could happen to river water quality if a proper drainage water collection system is not in place. The map shows the actual dimensions of the rivers to illustrate the projected decrease in freshwater supplies by 2042 if neighboring countries fully implement their plans and Iraqi agriculture follows current irrigation practices.

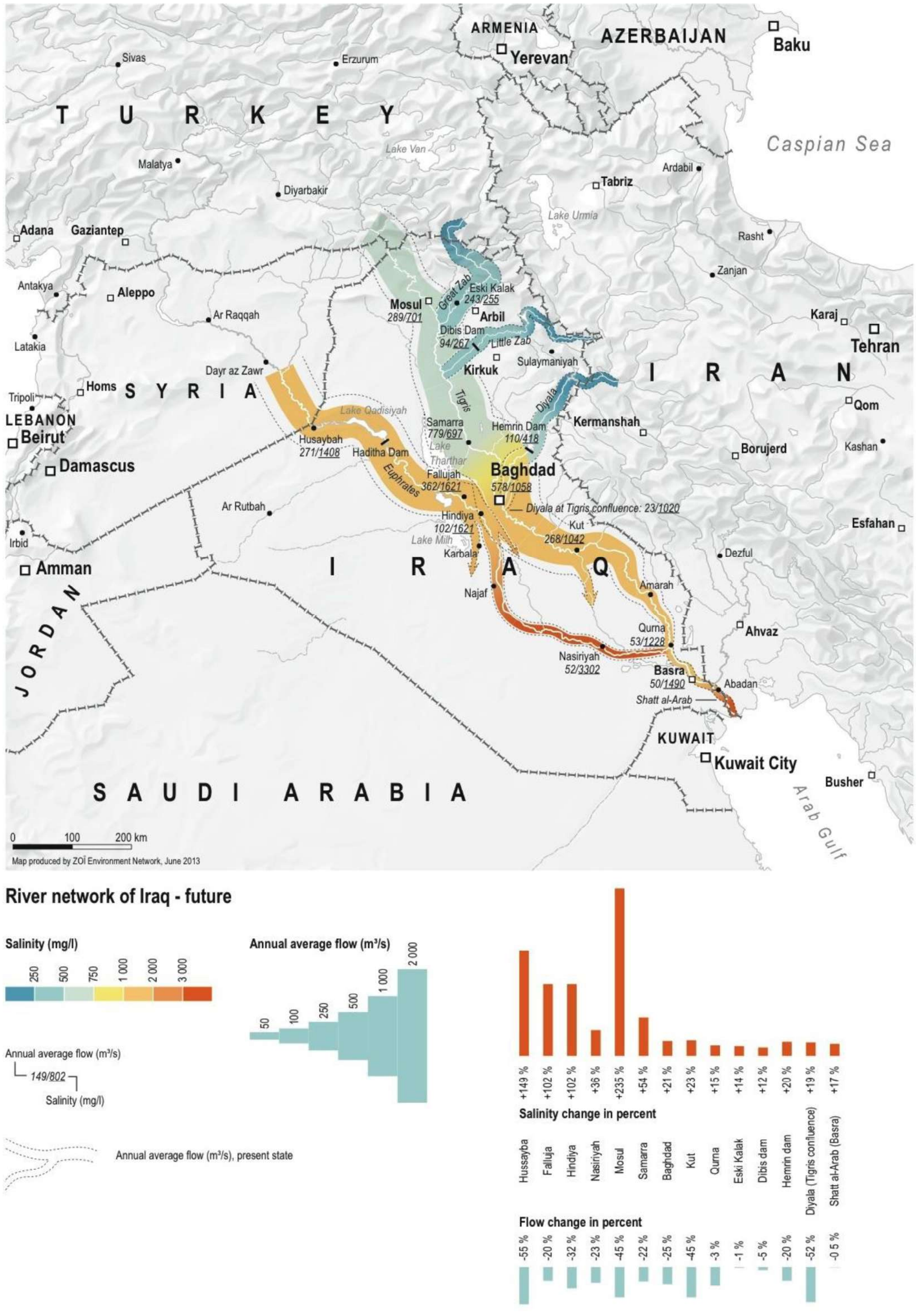



**Illustration61/ shape27-3: Expected changes in water quality and quantity if irrigation and drainage systems are not modernized**

If water quality along the rivers is not improved, crop production will be affected and fall below the expectations that Iraq would achieve if this strategy were fully implemented.

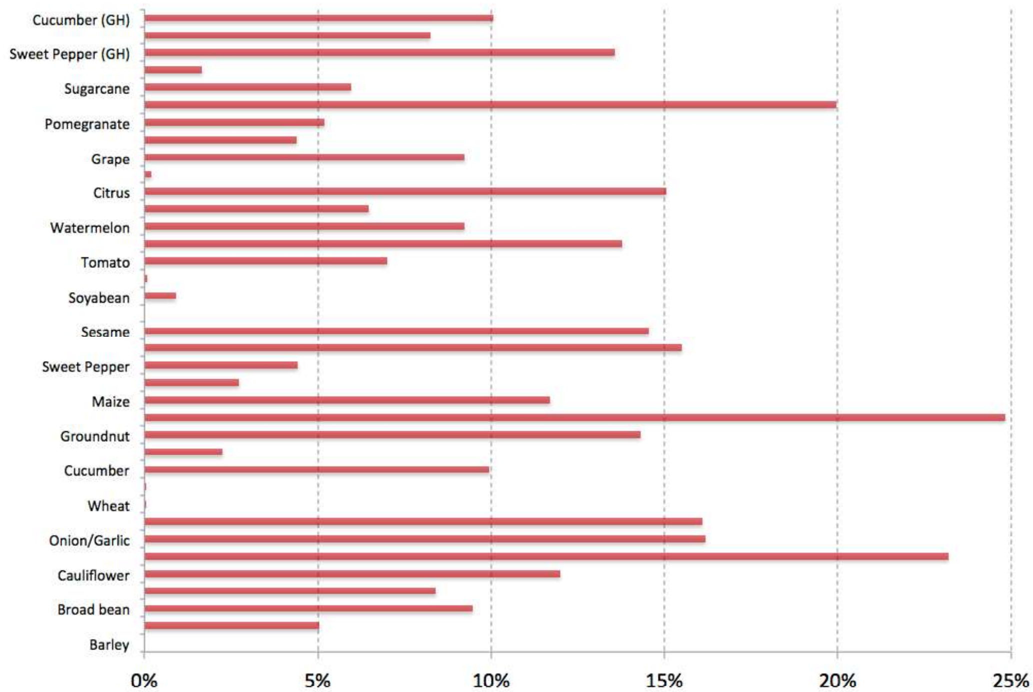



**Illustration22/ Figure 3-23: The impact of deteriorating water quality on crop productivity. This graph shows the decline in productivity as a percentage of Expected productivity by the strategy for the year2135 If all recommendations are adopted**

If a proper drainage system is implemented, water salinity will be between 0.111 and 0.411 mg/L of the annual average for projects located in the northeastern part of the country and will reach 0.811 mg/L for the Suq Al-Shuyukh irrigation project in Dhi Qar Governorate. The average salinity for Iraq is 4.111 mg/L.

Given these high salinity limits, drainage water may need to be treated before reuse. Furthermore, water quantities along the main outfalls are not guaranteed year-round, as they depend largely on the irrigation scheduling applied to each project.

#### *1.4.3.1 Opportunities and Strategies*

**Infrastructure construction**

This strategy assumes that by 2014, Iraq will fully develop the East Tigris Drainage System (ETD) and the Razzaza Evaporator. A diagram of the drainage system is shown below.


**Illustration*63*/ shape22-3: General Outfall System and Planned East Tigris Drain**

The general outfall system and the East Tigris Drainage System will collect a significant portion of the total 4.0 billion cubic meters of drainage water per year that Iraq is required to dispose of through drains by 2014. A total of 4.221 billion cubic meters per year will be collected and made available for reuse (from the general outfall, the East Tigris-Middle Drainage System, and the East Tigris-South Drainage System, as shown in Table 4-08 below). The following table summarizes the annual quantities that the main collection systems could collect when the strategy is fully implemented.

**table*20*/ Table43-3: Annual flow of drainage water (billion m3) after full implementation of the system**

| 2035 | 2030 | 2025 | 2020 | 2015 | |
|---|---|---|---|---|---|
| 3.474 | 3,700 | 3.951 | 3.686 | 3,781 | MOD |
| 0.673 | 0.689 | 0.687 | 0.620 | | ETD Center |
| 0.408 | 0.278 | 0.178 | 0.116 | | ETD South |
| 0.668 | 0.637 | 0.722 | 1.276 | 2,290 | Drainage Water Discharged into Evaporation Ponds |
| 4,076 | 4,193 | 4,568 | 5,359 | 6,507 | Return Flow to the Rivers |
| **9,300** | **9.497** | **10.107** | **11,057** | **12,578** | **Total Drainage Water** |
| **4,556** | **4.667** | **4,817** | **4.423** | **3,781** | **Total Drainage Water potentially available for re -** |

| 2035 | 2030 | 2025 | 2020 | 2015 |
|---|---|---|---|---|

use

The strategy analyzed three options for reusing agricultural drainage water in central and southern Iraq:

0- Providing water for reinjection into oil fields in southern Iraq. 4-
Providing water for developing green belts around cities.
4- Increasing the flow of water to the Hammar Marshes and Shatt al-Arab (through the use of East Drainage Water) Tigris.

**Providing water for oil field re-injection**

Due to Iraq's future water scarcity, there is no justification for using freshwater to support oil production. Instead, the country will need to rely heavily on the reuse of treated wastewater to support the energy and industrial sectors. This strategy assumes that 4.1%, or 0.44 billion cubic meters per year, of the oil industry's water needs will be met by alternative water sources. The cumulative demand for the oil sector is 4.0 billion cubic meters per year (or 4.42% of the total available freshwater—excluding groundwater—which Iraq is expected to have by 2014).

Future water injection plans in southern Iraq include the construction of a Common Seawater Supply Facility (CSSF), which will treat seawater from the Gulf and pump it over 11,000 kilometers locally for use in oil-producing areas. This solution is highly desirable over other water source alternatives: it provides a secure water supply independent of future water availability; it reduces pressure on freshwater resources, freeing up water for other uses; and it achieves economies of scale, by building and operating a single facility to meet the bulk of water needs south of the oil fields.

The projected capacity of the Combined Seawater Supply Facility (CSSF) is 181 million cubic meters per year (MCM/yr), to be constructed in phases. Although there is currently no official start date for the facility's operation, the projected start date for the first phase of the CSSF is likely to be 1.410 MCM/yr. Although this is much later than originally envisioned, given the importance of the CSSF, we anticipate relatively rapid progress with this project. This strategy assumes that by late 2014, the CSSF will be operating at full capacity, delivering 181 MCM/yr. The following chart presents the net water requirements.[83] For oil fields in southern Iraq.

[83] Water coming into the oil well from external sources, for example, excluding produced water from reinjection.

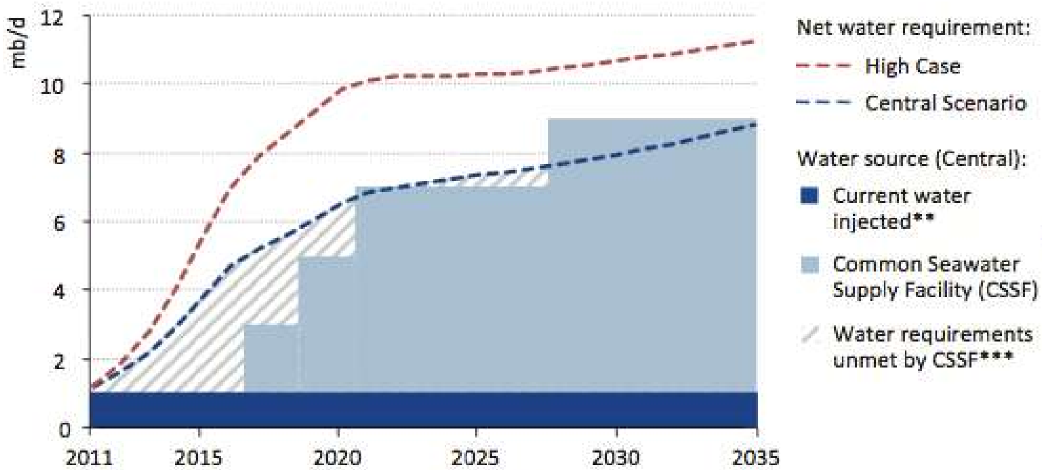



**Illustration*64*/ shape51-3: Expected need for fresh water for oil well re-injection.**

**Source: Iraq Energy Forecast2142**

* * The Karmat Ali facility is the current primary source of water supply. The facility produces 1 million barrels/day (21 million cubic meters/year) from the Shatt al-Arab conveyor and there are plans to increase its capacity to 4.4 million barrels/day (140 million cubic meters/year) in 2014. Sources may include confined aquifers or surface water.

Water not supplied by the CSSF will need to be supplied from groundwater and surface water (potentially provided by expanding existing water treatment facilities, such as the Karmat Ali facility in the south). Delays in planning and implementing the CSSF, beyond what was anticipated here, would rapidly place additional demands on alternative water sources in Iraq. Because the completion date of the CSSF remains unknown, the SWLRI strategy proposes using a portion of the general outfall, as well as water from other major outfalls, for oilfield reinjection, totaling 1.221 billion cubic meters per year by 2022.

Over the next two decades, the Iraqi government will implement the recommendations of the Strategic Water and Land Resources Study (SWLRI). The quantity and quality of downstream water will change significantly. To understand the water availability for oil field reinjection, only the minimum guaranteed flow should be used throughout the year, and oil fields must be supplied with guaranteed flows. The following figure, Figure 4-20, presents the projected monthly water volume at the end of the downstream arm of the SWLRI, assuming the recommendations of the Strategic Water and Land Resources Study (SWLRI) are implemented by 2014. The following graph shows that a total of 4.4 billion cubic meters (BCM) of drainage water per year will flow into the southern section of the downstream arm, and that a minimum drainage volume of approximately 81 MCM per month, or approximately 1.1 BCM per year, can be guaranteed throughout the year, which, combined with the CSSF, will serve 11% of our proposed strategy.

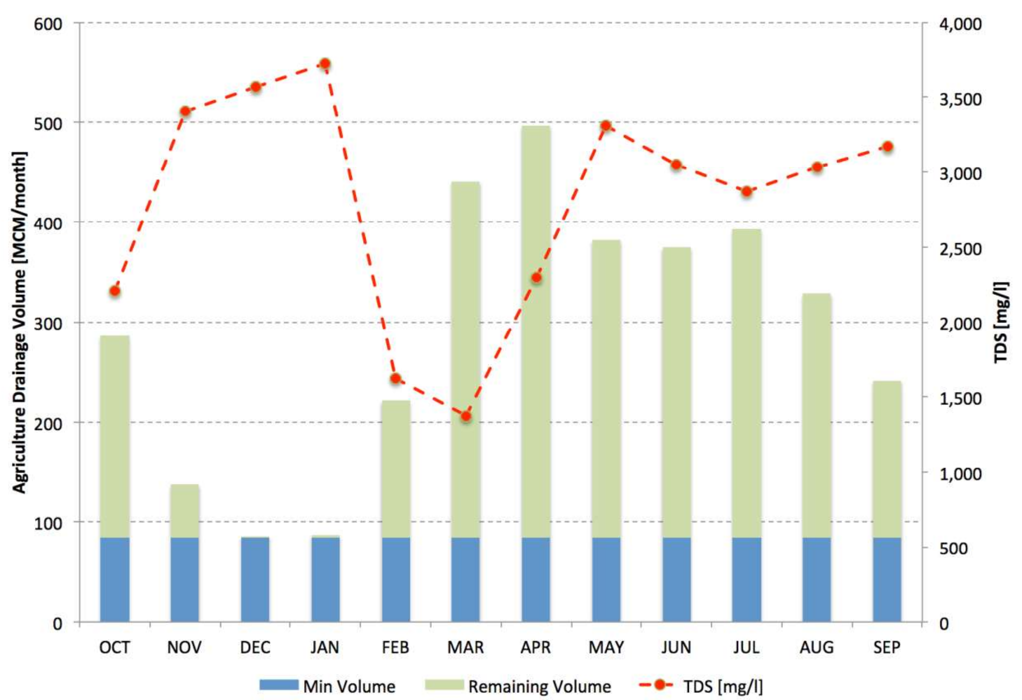



**Illustration25/ Figure 3-54: Quantity and quality of drainage water expected to be available at the end of the general drain in the year 2135 if the entire project is implemented.**

**Strategy recommendations**

**Providing green belts around major cities in Iraq with treated sewage water.**

Green belts have been proposed for development around cities to mitigate the effects of wind erosion, thus preventing desertification and reducing other negative effects of dust. Furthermore, green belts serve multiple purposes by providing shelter and habitat for wildlife, supporting biodiversity, and creating space that can be used as parks for recreation.


**Illustration22/ Figure 3-52: Typical selection of the proposed green belt**

Due to limited water availability, a large number of green belts in Iraq should be irrigated with a portion of the drainage water collected in the general drain. Green belts are proposed for implementation around the perimeter of governorates and major urban districts. Smaller-scale projects could also be undertaken.

Consideration will be given to the future, based on water availability. The green belt development strategy is explained in more detail in Appendix 1.1.H.

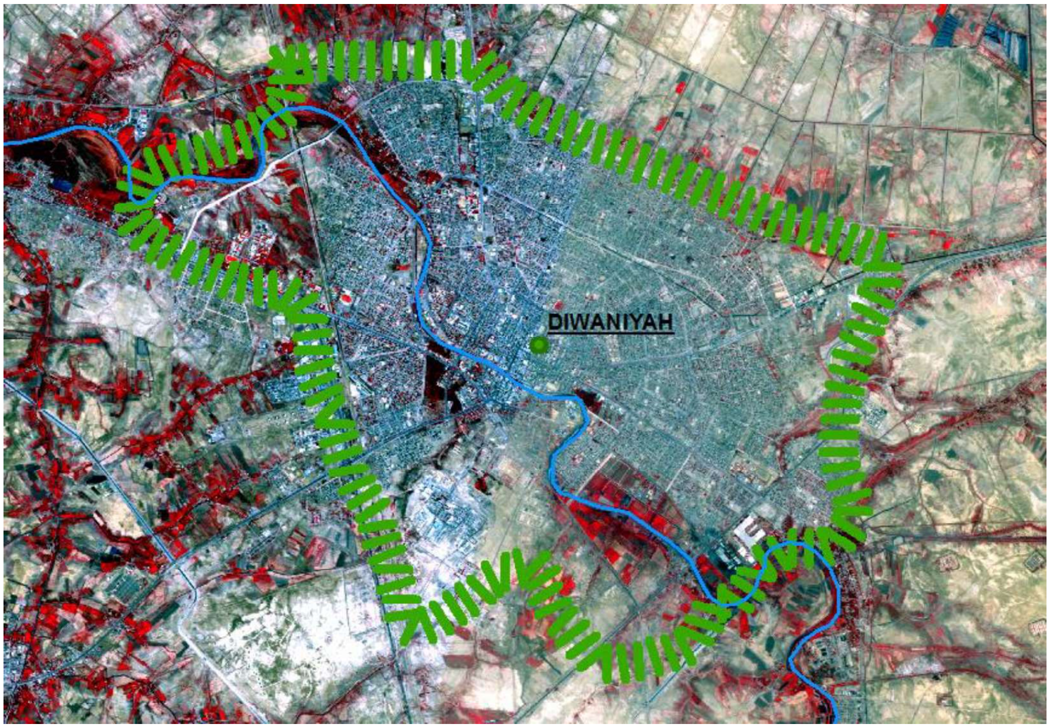



**Illustration27/ Figure 3-53: The green belt of the Diwaniyah area is shown as a green line over a false-color aerial photograph.**

The trees will be irrigated using drip irrigation with an irrigation efficiency of 81%, while shrubs will not be irrigated, but will benefit from existing soil moisture from the irrigation of other trees. The water will be filtered to contain minimal salinity to avoid harming the growth of the belts. Since the primary purpose of the green belt is to act as a windbreak, once the trees are planted, non-fruit trees will be irrigated with less water than the full water requirements of the crops. Because fruit trees can provide a source of income, irrigation of olive and palm trees will match the water requirements of the crops. In total, more than 48,111 hectares have been proposed for urban green belts in Iraq, requiring approximately 1.404 billion cubic meters of water annually for irrigation.

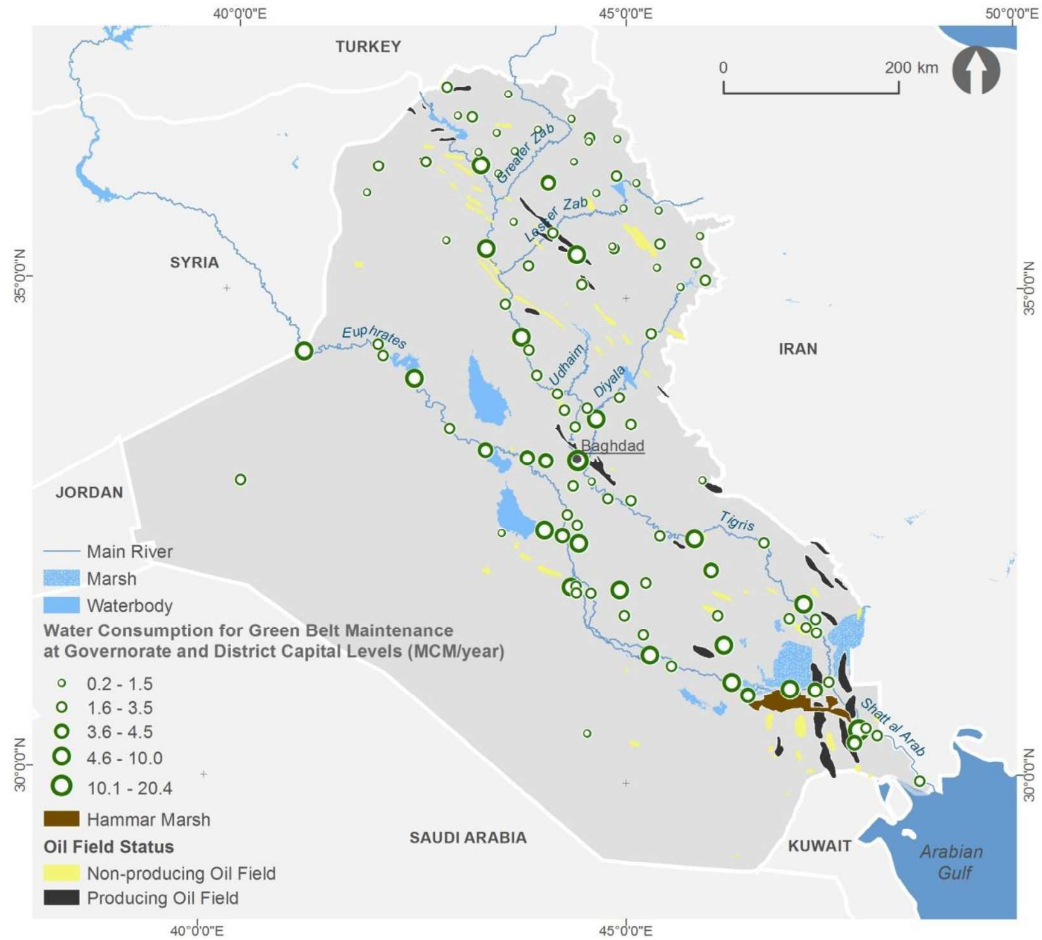



**Illustration23/ Figure 3-52: Locations and projections of water demand for green belts**

The water quantities required to support the greenbelts are significantly lower than the anticipated amounts to be provided by drainage water. Locally, 4.4 billion cubic meters of return flow is expected from drainage systems after the strategy's completion in 2014 (of which 4.221 billion cubic meters/year will be collected from major outfalls), compared to the 1.404 billion cubic meters required for the greenbelts. Planners will need to delve into the details, taking into account topographical, environmental, and infrastructure considerations that could allow each of these cities to reuse drainage water released from nearby irrigation projects.

The strategic study does not go into the details of the precise selection of green belt locations. The precise location and specifications of each green belt must be determined in a future detailed study dedicated to each green belt.

**Providing drainage water for environmental purposes**

The net reuse of water for oil field re-injection is 1.221 billion cubic meters (BCM) per year, and for the proposed Greenbelt Program (1.404 BCM), the main outfall still provides an additional 4.100 BCM per year of runoff from irrigation projects. It is proposed that this water be diverted to the Hammar Marsh to aid the recent expansion of the largest of the three marshes in southern Iraq. This additional water could be channeled to the marshes via a recently excavated canal located in the southwestern section near Karmashah. The excess water could then be channeled back to the main outfall via a newly constructed canal located near the Aramco causeway in the central section.

Further information on options for revitalizing the Hammar Marshes is provided in the environmental section of this strategy document.


**Illustration69/ shape55-3: Location of the main infrastructure for the revitalization of the marshes, including the diversion channel to and from the main estuary.**

This strategy also proposes the reuse of drainage water along the Shatt al-Arab River. The proposed East Tigris Drain will drain water from the proposed Amarah and Shatt al-Arab irrigation projects. The existing water control facility on the Suwaib River provides a means of diverting water from the Hawizeh Marshes to the new drain at a constant rate of 41 m/h.4/ second. A sewer at full capacity will carry over 81 m4/ second, it will be discharged into the Shatt al-Arab River near Abu Flus on the Iraqi-Iranian border. The salinity of the drain will range between 0.411 mg/L and 8.211 mg/L, with an average of 4.211 mg/L (see chart below).

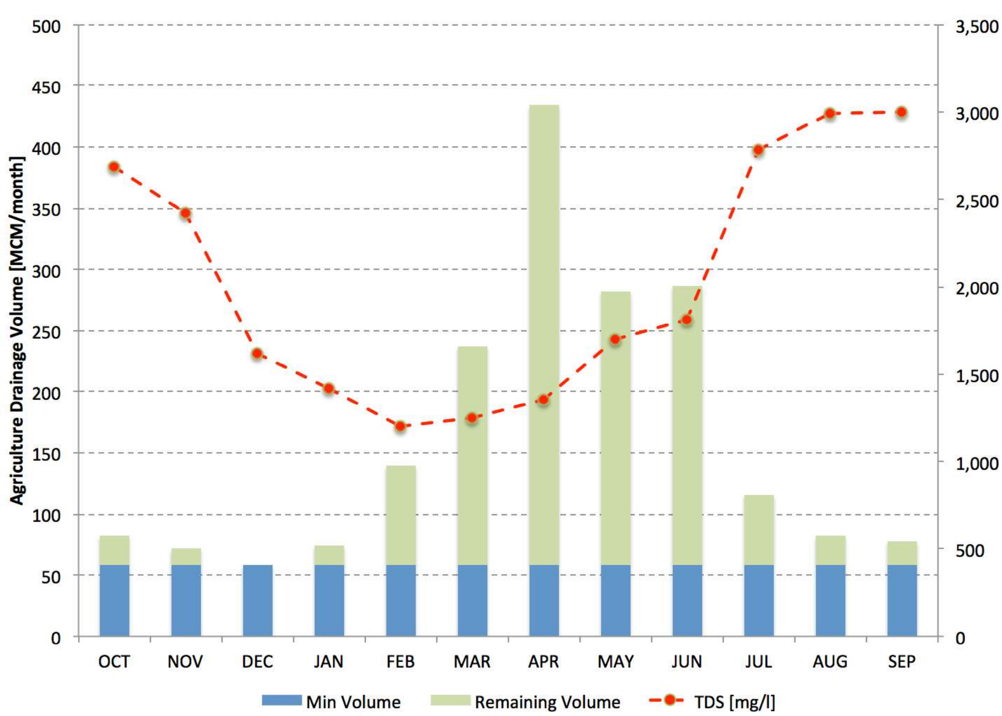



Illustration71/ Figure 3-52: Quantity and quality of sewage water collected in the middle section of the East Tigris Drain

The Shatt al-Arab River needs 21 m4/ second of fresh water from the Tigris River is required at a minimum to prevent the seawater salinity front from reaching Basra. If carefully monitored and controlled, discharge from the eastern Tigris drain can help control this.

### *1.4.3.2 Conclusions*

Modernizing the irrigation sector relies on the harvesting of runoff water. We therefore propose extensive reclamation work within this strategy, as all irrigated lands in central and southern Iraq include covered field drainage. Drainage water should be directed to the main drain and the East Tigris Drain whenever possible, as a strategy to reduce salinity and improve the water quality of the Tigris and Euphrates rivers.

At the same time, the projected decline in available water resources makes it clear that reusing drainage water could be a strategic asset that could help Iraq meet its development goals for 2042. The terrain and poor quality of drainage water limit the potential for reusing drainage water in agriculture, so other options have been explored. These include the potential for reusing drainage water to maintain the development of green belts around cities, reinject oil fields, support the lateral expansion of the Hammar Marsh, and maintain minimum flow along the Shatt al-Arab River. The following graph demonstrates Iraq's ability to meet its goals for 2042 and beyond through large-scale drainage water reuse.

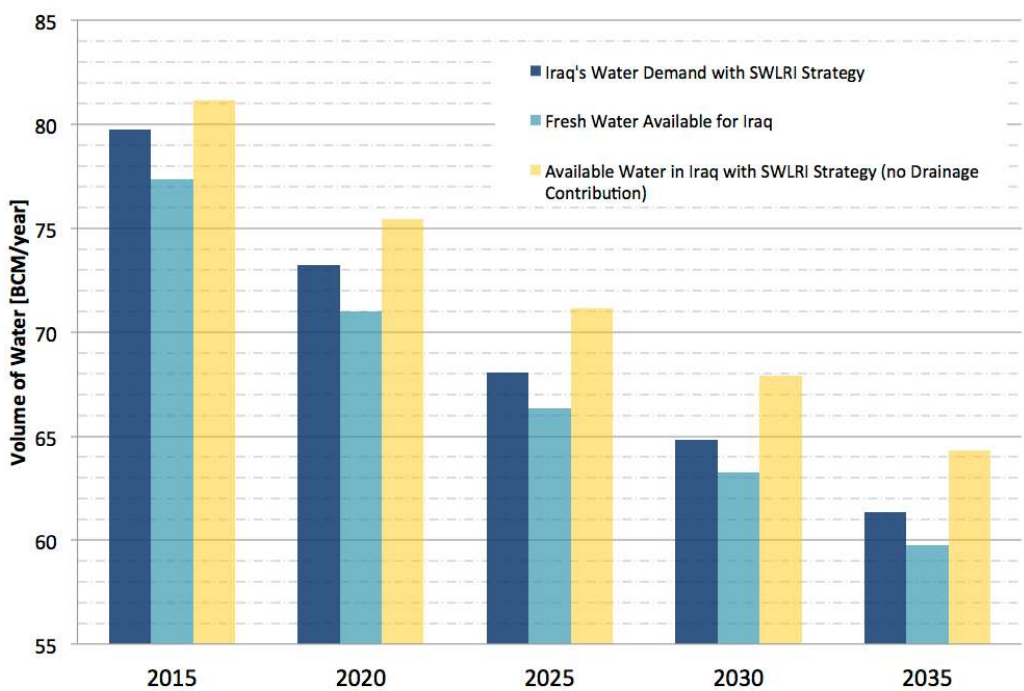



**Illustration74/ Figure 3-57: Water balance - with and without reuse of agricultural drainage water**

## 3.5.6 Salinity

### *1.4.1.2 Facts and needs*

**Current situation**

Salinization is one of the most active soil degradation phenomena in central and southern Iraq. About 11% of cultivated land is severely affected by salinity; 41-41% of the land has been abandoned (FAO, 2011). Even in cultivated land that was not abandoned, yields decreased by 11-41% as a result of salinization. The main causes are increased concentrations of dissolved salts in the upper soil layer and subsoil, which interfere with growth due to increased compaction.

Osmosis in the soil. This undesirable physical process leads to the conversion of highly productive lands into saline lands dominated by salt-tolerant plants such as tamarisk. In fact, salinity is not a new phenomenon in Iraq; it has been a persistent problem since Babylonian times (Schnepf 2011, 2004, FAO), negatively impacting crop production. Thus, food security faces a severe challenge due to the salinization of agricultural lands in Iraq.

Research shows that more than 2.4 million hectares are affected annually by salinity, resulting in significant economic losses. Agricultural strategies at the national level have not been well implemented, and no tangible progress has been made in controlling soil salinity in recent decades.

### Main challenges

Factors contributing to the salinity problems in Iraq include poor irrigation practices, groundwater salinization, the use of saline irrigation water, intrusion into the Gulf, and salt transport by wind and rain, in addition to climate change. Irrigation practices using surface irrigation methods without drainage systems have led to waterlogging, elevated groundwater levels, and salt accumulation in the surface soil after evaporation. Similarly, and more importantly, the poor economic situation of farmers, coupled with limited investment in improving drainage or irrigation practices, exacerbates soil salinization.

Most groundwater in central and southern Iraq is shallow and contains high levels of salts. In most areas, groundwater contains a mixture of salts. The concentration of salts in groundwater varies between 0.111 to 0.111 parts per million (ppm), and in many areas, it can reach 0.411 ppm. This depends on many factors, most notably the drainage system and the rate of evaporation and transpiration from groundwater. Finally, the effect of evaporation and transpiration is very important for groundwater salinity. Both change with the seasons due to humidity and wind.

The presence of salts in irrigation water is a cause for concern. The salt content of irrigation water varies from one region to another within the Mesopotamian plains. Generally, the quality of irrigation water is not very high, especially in the southern parts of Iraq, due to the scarcity of water from the Tigris and Euphrates rivers. Seawater also affects soil salinity in the southern parts of Iraq near the Shatt al-Arab, where the soils consist of marine sediments or tidal seawater. Salts can be transported by wind and rain, adding further salts to the soil. Wind-driven salt movement can be more intense in some areas near the Western Desert, and in some cases, the transport of salts by rain can be of local significance, as in the Euphrates Valley.

Soil salinization has a significant impact on farmers and their livelihoods. Most farmers have little ability to invest in proper maintenance of irrigation and drainage systems. Drought events and poor irrigation practices have led some farmers to use land in unsustainable ways, which

Which leads to a state of deterioration and accumulation of salts in the soil, which destroys the productivity of the land, and thus the abandonment of the workforce.

The potential impacts of climate change also threaten to increase salinity. Iraq has become one of the most affected countries in the Middle East (UNDP, 2010).[84]As a result of climate change, from 1.0 to 1414, the average annual temperature in Iraq increased from 0-4°C.oWith rising temperatures, more frequent droughts, and declining rainfall, salinity is becoming more intense than ever due to severe evaporation and water shortages (IPCC, 2007).

### *1.4.1.4 Future concerns*

The multiple challenges of salinization underscore Iraq's difficulty in increasing agricultural soil productivity. Furthermore, dependence on other countries for water resources, water scarcity, arid climate, social instability, and institutional weaknesses further complicate the situation. The impact of soil salinization on agriculture in Iraq must be mitigated to stimulate agricultural production and prevent unemployment and impoverishment of farmers.

#### *1.4.1.1 Opportunities and Strategies*

**Using drainage systems to reduce soil salinity**

One way to reduce soil salinity is to establish drainage systems to properly drain irrigation water and provide methods to leach salts from the soil, successfully reclaim agricultural land, and prevent future salinization.

**Increasing production in saline soils**

To increase production in highly saline soils, Iraq could develop and utilize more salt-tolerant crop varieties. Iraqi researchers have successfully developed a salt-tolerant wheat variety that grows well in saline soils. However, this technology limits the range of crops that can be grown. Investing in research and development of new varieties of a wider range of salt-tolerant crops could bring numerous benefits to Iraq.

**Comprehensive efforts on a national scale to reduce salinity**

Concerted efforts have been initiated by the Iraqi government to adopt policies, create partnerships with local communities, and develop plans for public awareness and technical solutions. Iraq has also developed new programs to combat salinity, for example. The National Environmental Protection Strategy (2014-2010) highlights a focus on reducing salinity, conserving water, and improving land management.

[84]http://www.uniraq.org/documents/unep-undp-press-release-climate-change-4-july-2010-eng.pdf

The following recommendations include:

0- Enhancing supplementary irrigation in rain-fed agricultural systems in the upper Tigris Basin;

4- Providing incentives to adopt improved practices and new agricultural patterns to increase water productivity.

Agricultural income in irrigated areas in the lower Tigris and Euphrates basin;

4- Enhancing farmers' adoption of advanced irrigation systems by encouraging investment and providing

Credit facilities;

4- Developing water laws and control to encourage decreasing irrigation and reduce waste in water use; 2- Developing and implementing a comprehensive strategic plan to combat soil and water salinization in the lower reaches of the Tigris and Euphrates basin;

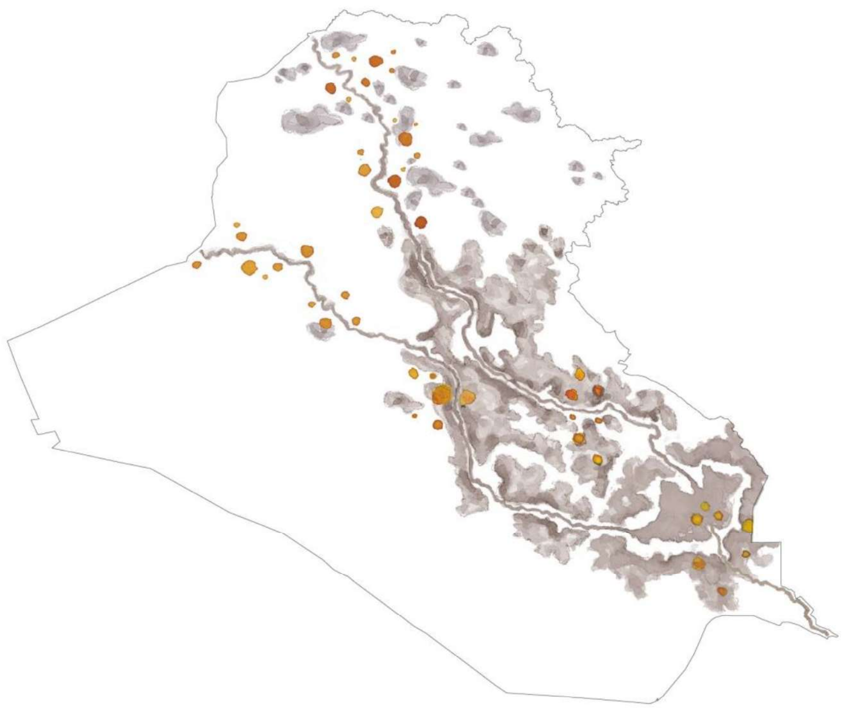
1- Supporting public investments in agricultural drainage systems, disposal and reuse of wastewater.

puncture;

- Developing irrigation water use laws to reduce runoff and soil erosion problems.

### 1.1 Energy security

Iraq's energy vision is to be energy independent, including renewable energy as a key component, while expanding energy access for the Iraqi people. Hydropower will be a component, but it will not be pursued primarily, but rather as a byproduct of water control infrastructure.



## 3.3.1 Facts and needs

#### *1.1.2.2 Introduction*

Expanding reliable access to electricity is a measure of modernity and prosperity. Despite its abundant natural resources, Iraq suffers from a severe shortage of electricity, a major obstacle to the country's development. Recognizing this, the Iraqi government has worked to increase production, and as a result, power plants are producing more electricity than ever before. However, supply is still insufficient to meet demand: power outages occur daily, and backup diesel generators are widely used.

Energy shortages cost the economy billions of dollars, and generators release massive amounts of carbon into the atmosphere, reducing the quality of life for all Iraqis. To secure the energy the country needs, Iraq will need to increase generation capacity, improve distribution and transmission infrastructure, and diversify production methods to sources such as solar energy. To produce more energy, The Iraqi government will need to ensure sufficient water supply to simultaneously generate hydropower, re-inject oil fields, and meet the minimum discharges of power plants. Energy security is therefore closely linked to water security, as detailed below.

#### *1.1.2.4 Current conditions*

Most of Iraq's current energy infrastructure was established a quarter century ago.5 GW Peak production in the year0211 by power plants built before 1552, before War, sanctions, and stunted growth. The next decade saw little progress, as%0 (0.12 MW) Only during the 1990s as a whole was there a devastating decline and collapse in generation.

Despite the war and violence since a year0222, Iraq has been able to achieve significant energy gains: it was Net daily peak production in the year0211 is about 22% higher than it was in .022. This major expansion represents a significant victory despite the insecurity that has rocked the country over the past years.10 past. It is also a testament to the influx of foreign capital. Which stimulated local development in Iraq.

However, these gains are still far from being sufficient. In the year0211, was produced Iraq's energy consumption is 1.5 gigawatts, which is less than the demand by 1.5 gigawatts.22%. In addition to the lack of capacity Generation, failure to follow up on the maintenance of the transmission and distribution network (It led to great inefficiency in T&D. System: Transmission and distribution losses in Iraq are estimated at approximately0.2% of the generated electricity. On Although recent capacity additions have helped improve the sector's overall efficiency, they remain low by international standards and represent a significant component of Iraq's energy balance.

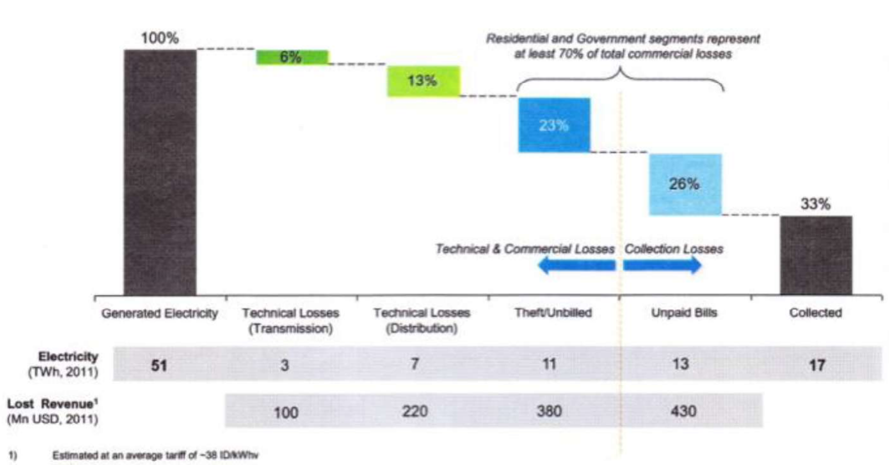



**Illustration** *72* **/ shape53-3 Estimated power system losses ( )***INES, 2013-2030*

Another aspect of Iraq's energy dilemma is the heterogeneity of resources. It is not surprising, given Iraq's oil wealth, that fossil fuels dominate domestic energy consumption.

The country. Oil constitutes more than52% of Iraq's primary energy mix, compared to less than 12% in the rest of the Middle East. Reliance on a single source puts Iraq's prosperity at risk. In an unstable situation due to the lack of exploitation of other potentials (more details about the proposed power generation facilities in Iraq are also shown in the attached map “Energy Security -21").

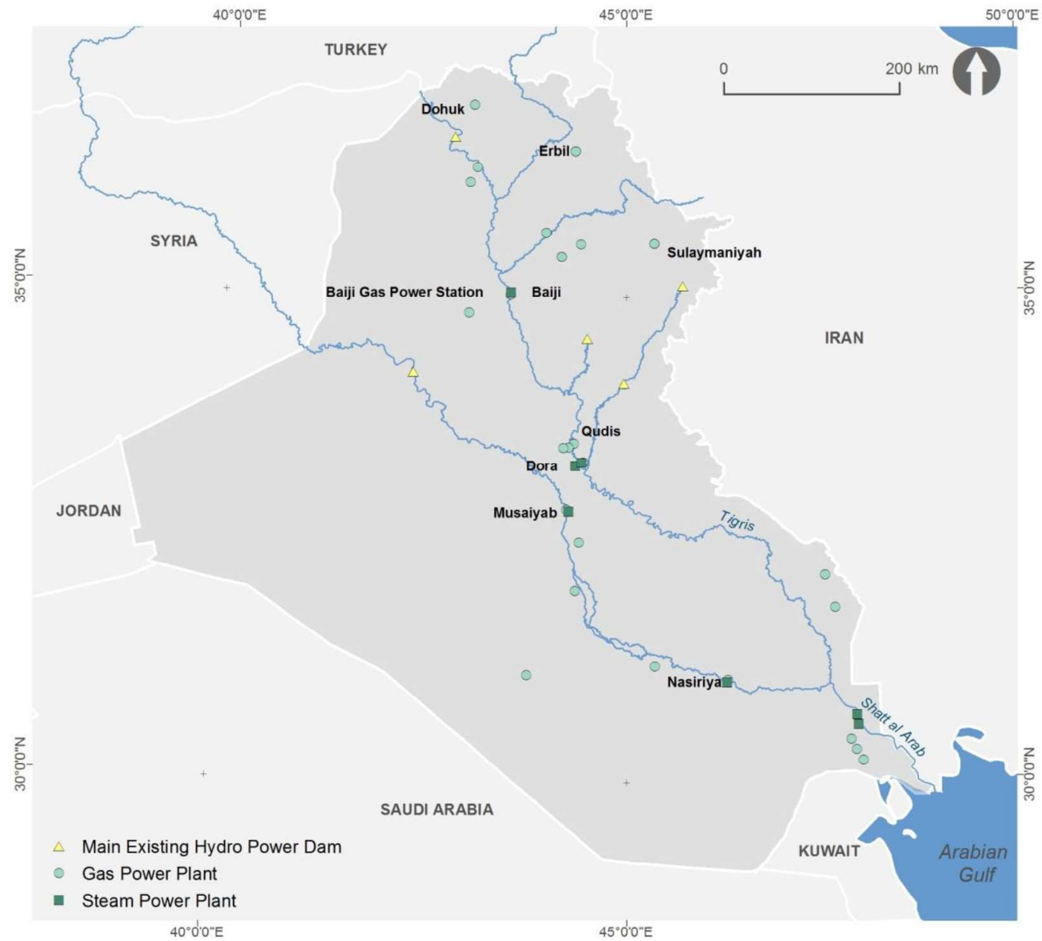



**Illustration73/ Figure 3-52: Site map of existing power plants**

**table*21*/42-3- Name of the location of existing power plants (except hydropower)**

| Capacity (MW) | Name | Type |
|---|---|---|
| 1,400 | Qudis | Gas |
| 780 | Sulaymaniyah | Gas |
| 636 | Baiji Gas Power Station | Gas |
| 520 | Dohuk | Gas |
| 520 | Erbil | Gas |
| 498 | Khor Alzuber | Gas |

| Capacity (MW) | Name | Type |
|---|---|---|
| 500 | Musaiyab | |
| 420 | Al-Yousifiya | |
| 400 | South of Baghdad / 2 | |
| 325 | Kikkuk (Taza) | |
| 280 | Mosul GPS | |
| 250 | Akaz | |
| 252 | Najaf /1 | |
| 250 | Najaf /2 | |
| 246 | South of Baghdad / 1 | |
| 240 | Mulla Abdulla GPS | |
| 222 | New Mulla Abdulla GPS | |
| **2,048** | **Gas Power Plants < 200 MW** | |
| **9,787** | **Total Gas Power Plants** | |

| Capacity (MW) | Name | Type |
|---|---|---|
| 1,320 | Baiji | Steam |
| 1,200 | Musaiyab | |
| 840 | Nasiriya | |
| 640 | Dora | |
| 400 | Harthah | |
| 200 | Najibiya | |
| 220 | South Baghdad | |
| **4,820** | **Total Steam Power Plants** | |

Natural gas offers a cheaper and cleaner alternative to oil for energy production. In fact, the general trend in the Middle East over the past decade has been toward increased gas consumption for power generation and industrial energy use. Despite the significant economic gains in using natural gas instead of liquid fuels, particularly in electricity generation, approximately2% of gas production In Iraq it was set on fire in the year0211, due to the lack of facilities to collect and benefit from it. In production. This is a waste of wealth and must stop if Iraq wants to take control of its energy supply.

An additional potential source of energy in Iraq is alternative technologies, such as hydropower, solar power, and wind power. Although the output is relatively small, Iraq currently generates electricity from hydropower plants across the country. According to the Ministry of ElectricityIn Baghdad, hydropower production in Iraq in 2013 MoEl

(Except for the Kurdistan Region)4,757 GWh/year or1..% of the total energy generated during the same year (200,121 GW/year). The average daily energy produced from hydropower was 102 MW. Existing hydropower plants could produce more, but they are limited. With low water levels at the top of reservoirs, as well as constraints imposed by the need to match irrigation discharges, and safety concerns (as is the case with Mosul Dam, Iraq's largest dam).

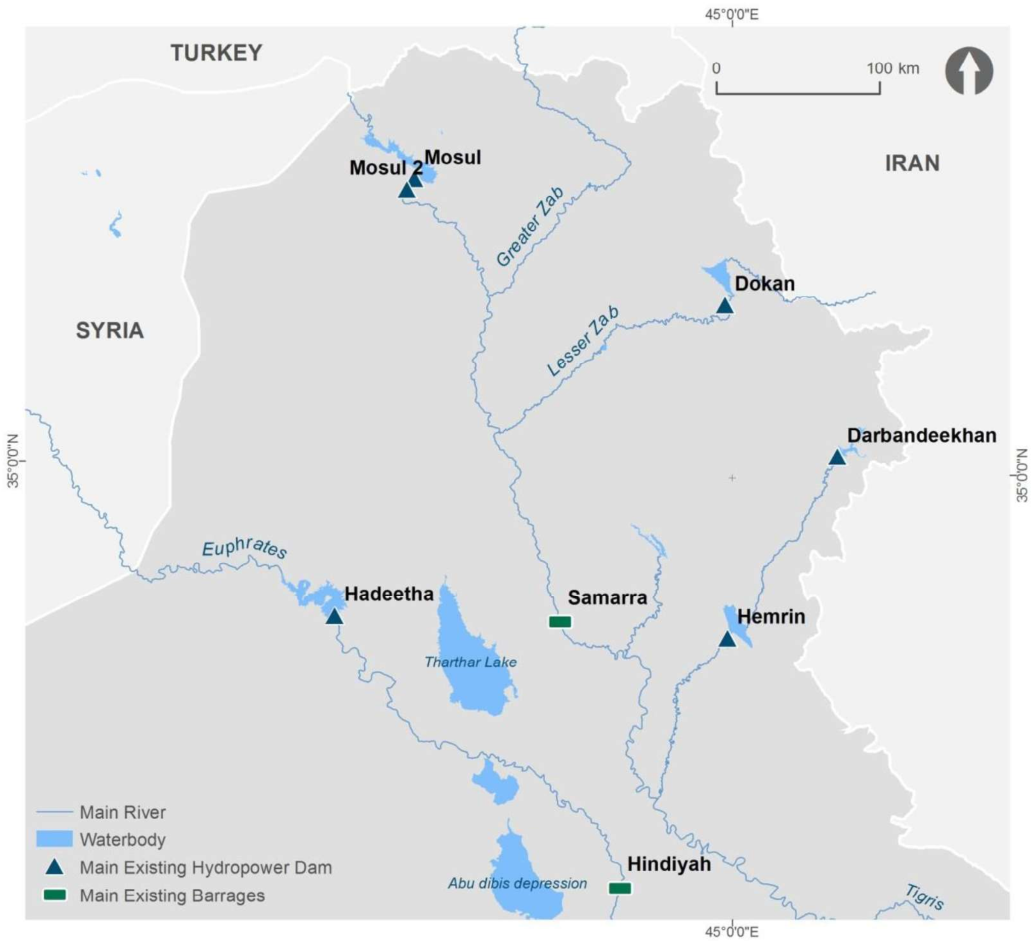



**Illustration72/ Figure 3-21: Map of the locations of the main hydroelectric dams in Iraq**

**table22/21-3: Name the location of the most important hydroelectric dams in Iraq.**

**EXISTING HYDROPOWER PLANTS**

| Year Proposed for Rehabilitation | Annual Energy Generation [GWh/yr] | Installed capacity (MW) | DAM | ID |
|---|---|---|---|---|
| 2015 | 1,746 | 600 | Hadeetha | DAM-001 |
| 2015 | 211 | 50 | Hemrin | DAM-003 |
| 2015 | 2,196 | 750 | Mosul | DAM-004 |

| | | | | |
|---|---|---|---|---|
| 2015 | 794 | 400 | Dokan | DAM-005 |
| 2015 | 592 | 240 | Darbandeekhan | DAM-006 |
| 2015 | 0 | 0 | Udhaim | DAM-007 |
| 2015 | 420 | 60 | Mosul-2 | DAM-008 |
| | **5,959** | **2,100** | | **Total** |

The repercussions of the energy shortage have been numerous. The energy shortage has imposed significant costs on the economy in the form of lost production time, damage to capital assets due to irregular electricity supply, and the inability to continue normal business operations on a reliable schedule. The total cost to the Iraqi economy resulting from the electricity shortage is estimated to be more than$2 billion annually. A major aspect of the damage is the economy. It is the inability to modernize agriculture. Agriculture in Iraq, which currently provides about5 in percent of the country's GDP and02 percent of its workforce has declined over the The years11. All previous attempts to rejuvenate this sector, and thus achieve The efficiency needed to remain competitive has been undermined. Among other things,[85], due to energy shortages: There was not enough supply to support modern field irrigation technology and pressurized irrigation.

The damage caused by the lack of energy is not limited to the economy or its various sectors. In a country that experiences cold winters and extremely hot summers, the shortage also imposes significant hardship on individuals. The lack of a reliable power supply from the electricity grid has led to the widespread installation of private diesel generators, which can be costly even for those who can afford them. The generators also produce noise, pollute the air, and emit significant amounts of carbon into the atmosphere.

The first step in solving Iraq's long-standing energy problem is to increase generation capacity by adding diverse energy sources such as gas, solar, wind, and hydropower. In addition, the transmission and distribution infrastructure must be rehabilitated and upgraded. Improving existing transmission and distribution systems alone can lead to significant savings and often postpone the need for new supplies. Moreover, increasing the technical efficiency of systems can be achieved in just a few years.

Overall, the industrial and energy sectors offer the greatest opportunity for future development of Iraq's economy. However, this opportunity depends on adequate water supplies: Power plants require water for cooling; hydropower plants require minimal discharge to generate energy; and oil fields

[85]Although energy scarcity was a contributing factor in limiting agricultural modernization in Iraq, it was not the only reason. More specifically, it was also poor Poor land management and policies are obstacles to agriculture in Iraq.

Oil requires water for injection to maintain the required amount of pressure to maintain a good flow rate. Unless a radical change is achieved in the water sector, Iraq will not be able to meet its fresh water needs within a year.0202 - To meet municipal and industrial needs, including: That's oil and power plants.

Although the water needs of the energy sector are small compared to other water consumers, the fragility of the situation in Iraq, particularly in the south, could be exacerbated by the water needed for injection for oil production and, to a lesser extent, by water use in the energy sector.

#### *1.1.2.1 Future needs*

The National Integrated Energy Strategy (It is a strategy created under the guidance of INES. Prime Minister's Advisory CouncilMinistries of Oil, Electricity, Planning and Finance (PMAC) Mining, Industry and Environment. The final report describes[86]The current challenges facing Iraq's energy sector, as well as the opportunities offered by its resources, define a vision and a set of national policy objectives, and lay out a long-term plan for political commitments, infrastructure development, and institutional reform designed to achieve that vision. The report covers a time period extending from the present to0232. The SWLRI Master Plan, rather than imposing a new energy strategy which may It is not appropriate, as the proposals of the National Integrated Energy Strategy have been combined.INES To the extent practical, our data allows.

Each of the strategiesIt envisions an energy-independent future for Iraq. By 2021, the Iraqi government hopes to generate enough energy to meet demand, which by 2031 will be SWLRI and INES. It will require a total of05,222 megawatts. Below is a chart of this planned expansion.

86 The full report is not publicly available. The executive summary can be found at this link.
file:///Users/VA/Downloads/Summary_of_the_Final_Report_b9270.pdf.

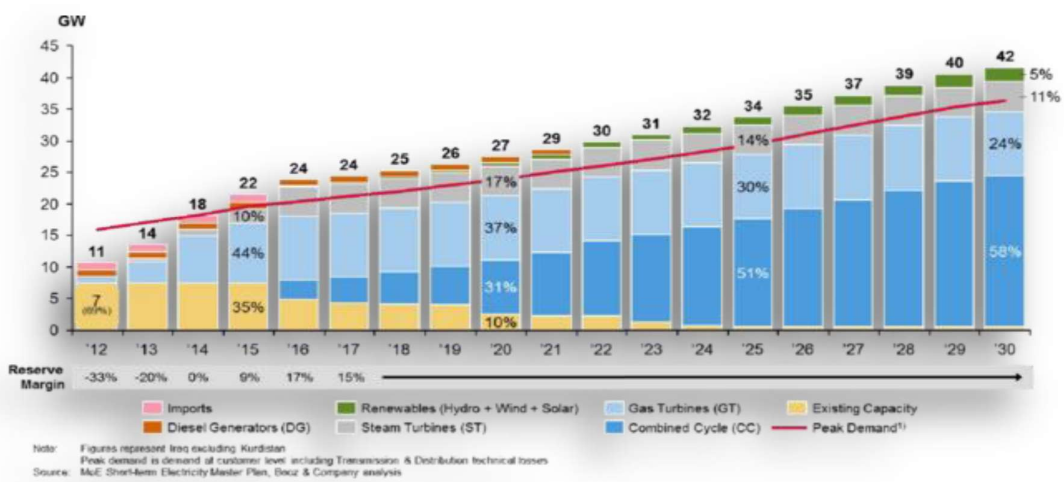


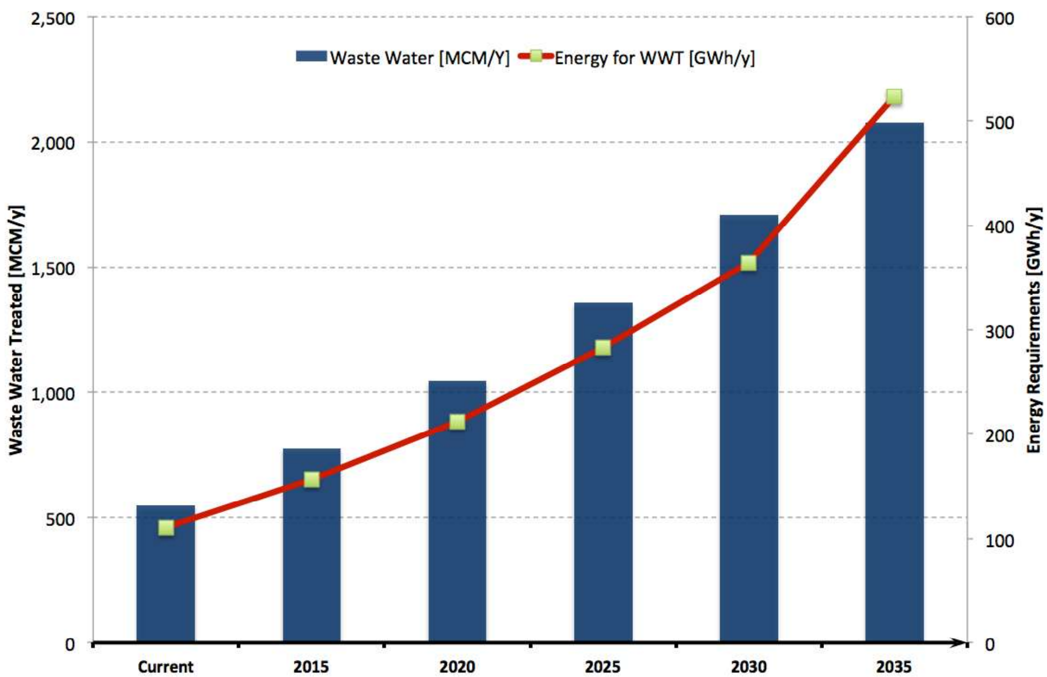

**Illustration75/(*INES, 2013-2030*) shape24-3- Planned expansion of Iraq's generating capacity**

The relationship between water, energy, food, and security is clearly demonstrated when discussing Iraq's future energy needs: In order to achieve a degree of food security (as well as maintain sufficient water for other key needs, such as drinking water), Iraq must increase the efficiency of its agricultural sector. A key element of agricultural efficiency is the use of pressurized irrigation, which requires more energy. To obtain the energy it needs, Iraq must have enough water to operate its power plants and oil fields. Consequently, a certain degree of efficiencies must be achieved across all sectors simultaneously to meet the country's needs. Before anyone can say whether Iraq will be able to meet its future energy needs, they must first understand what those needs are. The following describes Iraq's projected energy and water needs for 2015.0231.

**Municipal and industrial sectors**

Meeting the needs of the municipal and industrial sectors is not an option; it simply must be done. This sector, which includes drinking water, waste treatment, industrial processes, oil production, and power plants, is of pivotal importance to the health, safety, and prosperity of the country. Through the National Water Development Strategy's observations,The municipal and industrial sector is given top priority over all NWDS. Other competing sectors that use and are used as a “restriction” in this master plan when approving water use.

Over the next twenty years, Iraq will need to increase its capacity to treat municipal and industrial wastewater.The need for wastewater treatment (WT) and drinking water (WWT) will grow. Water from municipal and industrial waste from105 million cubic meters annually to 2,078 million meters cubic meters annually. At the same time, the need for desalination of water in water treatment plants (WTP and integrated units (/ It will grow from the current 0.503 million cubic meters annually to 552.0 million cubic meters annually. Consequently, energy consumption will increase from 1510 gigawatt hours (GWh) to 1.500 GWh. Year to0.52 GWh/year and the estimated cost of this energy will change from 50 million Dollar to$135 million annually.



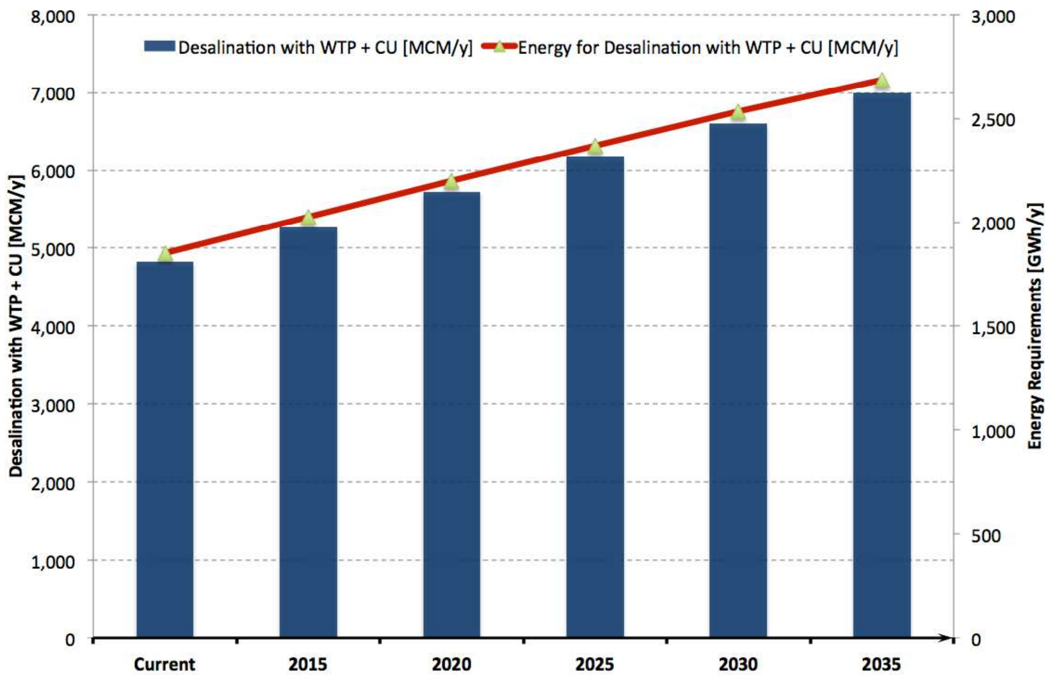



**Illustration75/ shape22-3: Expected energy consumption requirements for municipal and industrial water treatment (figure above) and desalination (Figure below) Over the years21 next**

The above estimates do not include the energy requirements of the oil sector (i.e., energy needed to desalinate/treat water for oil field re-injection and for refineries).Already processing these INES Energy issues and prospects in Iraq are comprehensively addressed. The focus here is on how these prospects are affected and influenced by water.

## oil sector

To get oil out, you need pressure. When pumping oil from a well, you have to find a way to maintain reservoir pressure even as the oil is being extracted. If you don't, flow rates will slow and larger quantities of gas will be produced, but it could also damage the reservoir, affecting the long-term viability of the field. The water requirements for injection (or other materials such as carbon dioxide) vary, but to meet the oil production levels projected by the Ministry of Oil, it is estimated that Iraq's net water requirement for injection will increase from 0.222 billion cubic meters per year in 2011 to 1.574 billion cubic meters in 2031[87]For comparison, this is the amount of water this strategy expects to be needed.

87 This estimate is based on production and water injection data from southern Iraqi fields provided by the Ministry of Oil and operators. The average replacement ratio is 141, meaning 141 barrels per day. Of water must be injected to fill the "space" in the reservoir created by producing one barrel of oil. This applies to all oil production in Iraq. This estimate is

To irrigate about24,155 million dunums or 0.04% of the total irrigated land in Iraq in The future. Water requirements for oil field injection are highest in southern Iraq, where water resources are most scarce, and will rise to1.227 billion cubic meters per year By the year0231.

The following table shows the table:01-3, Estimated quantity of water required for oil field reinjection Over the next two decades for all of Iraq. All data shown is based on information provided by the Iraqi Ministry of Oil.

**Illustration*76*/ shape24-3: Water requirements of the oil industry according to the Ministry of Oil**

| OVERALL CONSUMED WATER ($Mm^3/y$) | | | | | | Oil Field |
|---|---|---|---|---|---|---|
| **2035** | **202020252030** | | | **2015** | **Current** | |
| 1 | 1 | 1 | 1 | 1 | 0 | Eastern Baghdad |
| 11 | 12 | 12 | 9 | 0 | 0 | Badra |
| 15 | 16 | 16 | 16 | 6 | 4 | Al-Ahdab |
| 15 | 15 | 15 | 16 | 11 | 11 | Kirkuk |
| 16 | 16 | 17 | 17 | 17 | 5 | Bai Hassan |
| 15 | 16 | 16 | 16 | 0 | 0 | Qaiyarah+Najma |
| 13 | 13 | 14 | 14 | 0 | 0 | Khabaz |
| 523 | 535 | 424 | 224 | 122 | 110 | Rumaila |
| 256 | 279 | 247 | 179 | 61 | 28 | West Qurna 1 |
| 227 | 163 | 131 | 59 | 15 | 0 | West Qurna 2 |
| 98 | 105 | 101 | 94 | 44 | 36 | Zubair |
| 78 | 74 | 74 | 4 | 0 | 0 | Majnoon |
| 17 | 15 | 10 | 8 | 0 | 0 | Garraf |
| 180 | 184 | 110 | 65 | 0 | 0 | Halfaya |
| 51 | 60 | 61 | 50 | 7 | 0 | Missan Oil Fields |
| 56 | 50 | 48 | 41 | 31 | 28 | KRG area |
| **1574** | **1553** | **1297** | **814** | **316** | **222** | **TOTAL** |

**power stations**

Maintaining minimum water levels is key to ensuring water supply for both existing and future power plants. Closed, unitized recirculation systems will be preferred over open or other systems. Minimum levels must be ensured to be3242 meters above Sea level and045 meters above sea level at Al-Musayyab Steam Power Plant in

Produced water network: We assumed that the most economically viable approach is to treat and reinject all produced water along with the oil. If the produced water is not reinjected, then, in most cases, it will require additional treatment to remove oil and salts before it is suitable for reuse (for agriculture or other purposes). When the produced water is used for other purposes, the net injection water requirement will obviously increase.

Babylon and at the Nasiriyah Steam Power Station in Dhi Qar on the Euphrates River, and02 m above ground level Sea level at the Dora power station in Baghdad on the Tigris River.

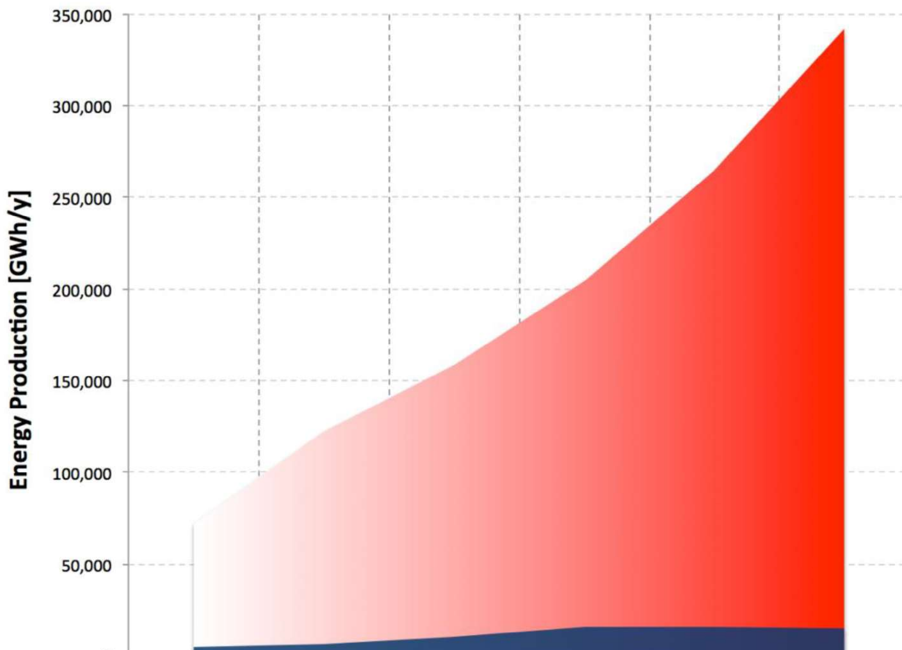
**Illustration77/22-3: Minimum water levels to be ensured at selected sites**

**MINIMUM WATER LEVELS**

| Minimum water level required (masl.) | River | Governorate | Steam Power Station Name |
|---|---|---|---|
| 30.7 | Euphrates | Baby | Al-Mussayab Steam |
| 2.8 | Euphrates | Dhi Qar | Al-Nassiriya Steam |
| 27 | Tigris | Baghdad | Al-Doura Steam |
| 27.5 | Tigris | Baghdad | Baghdad South Steam |
| 109 | Tigris | Salah El Deen | Baiji Steam |
| 9 | Shatt Al Arab | Basrah | Al-Hartha Steam |
| 7 | Shatt Al Arab | Basrah | Al-Najibiya Steam |

**hydroelectric power**

The Ministry of Electricity estimates that power generation in Iraq, excluding the Kurdistan Region, for the year0231 will be . 301023 GWh/year, from hydropower and other fossil fuel alternatives Covers up to1% of the energy mix or 12,252 GWh/year at a rate of 1,512 Megawatt-hour/day.




| | 2013 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|---|
| Annual Energy Generation [GWh/yr] | 72,101 | 122,508 | 158,323 | 204,610 | 264,429 | 341,736 |
| Share of Hydro [GWh/y] | 4,757 | 6,410 | 10,541 | 15,361 | 15,754 | 15,044 |

**Illustration78/ shape23-3: The Ministry of Electricity's objectives for producing electricity and hydropower in Iraq (excluding the Kurdistan Region)**

To expand access to energy within Iraq with hydropower, which has been identified as a priority by the National Water Development Strategy.The following objectives were reviewed: NWDS

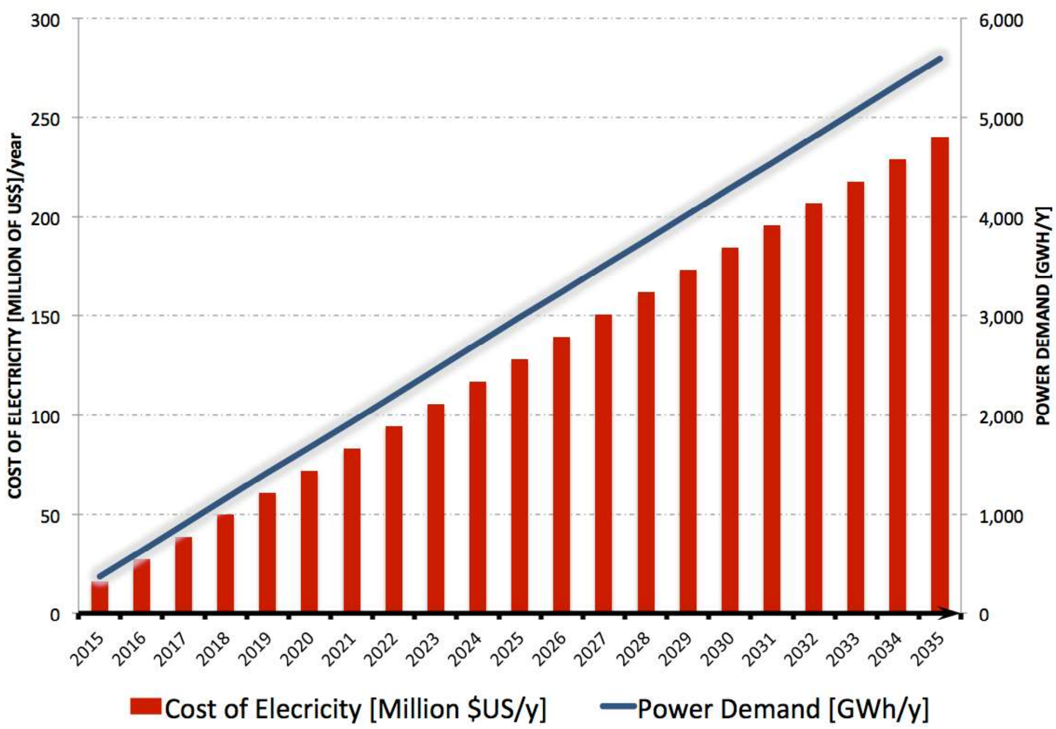
- A minimum price for energy sales should be determined.
- The maximum cost of producing a unit of energy should be determined. A fixed
- profit margin should be established for hydropower projects.
- The minimum multiplier effect of hydropower projects should be determined. It
- is not important to determine the minimum investment in hydropower.
- It is not important to consider determining the minimum power factor of the tank.
- The minimum overall production efficiency of energy projects should not be specified. Hydroelectric.

In practical terms, one direct implication of implementing these priorities is that the pricing structure associated with energy production must be carefully considered, both from the perspective of the investments required to build energy production facilities and from the perspective of the long-term prices associated with energy generation. All of these factors will be linked to the selling price of energy in Iraq, and therefore expanding energy access will require significant efforts.

To ensure fair and equitable pricing structures to recover investment costs and also allow access to energy to be affordable to the people of Iraq.

**Irrigation**

In the notes of the National Water Development StrategyThe Iraqi government stated that NWDS should There should be no restrictions on the maximum capacity allocated to irrigation projects or on the budget allocated to the technology required in this sector. The relevant ministries take seriously the need to improve agricultural standards in order to conserve much-needed water and feed the population. These improvements are expensive: the cost of implementing and maintaining pressurized irrigation for irrigated lands is, on average,3 to 1 times more than the current cost per dunum. In order to convert the 12.92 million dunums included in this strategy[88]From the irrigation system to the pressurized irrigation, which is the goal for the year0231, will require 2,289 MW (current power supply he763 MW; more details in Appendix H) and 5.592 GWh/year It will be consumed annually at a cost estimated at$240 million annually. However, the cost of the situation Currently, it is much bigger than that.




Iraq currently irrigates 114,035 million dunums. Currently, pumps serve less than 0% of the land, while the rest of the land is served by spate irrigation.

**Illustration79/ shape22-3: Change in electricity demand and electricity cost (in today's dollars) over time for irrigation projects**

Although the strategy for meeting energy needs in the agricultural sector is ambitious, a multi-step process can be adopted for gradual increases in generation. The National Integrated Energy Strategy estimatesThat the sector's vital infrastructure can be ready in less than two years. From three years, the minimum energy production targets may be increased over time to accommodate the construction schedule for new irrigation projects.

### 3.3.5 Opportunities and Strategies

Iraq has more options than most countries when it comes to energy supplies. With the third-largest oil reserves, world-class natural gas reserves, abundant sunshine, and an enviable amount of water relative to other Middle Eastern countries, it has the potential for a healthy energy mix. But natural resource wealth is only one aspect of energy supply. Considerations also include technological capability, institutional capacity, financing, and market conditions, which can act as either constraints or enablers of energy security.

All electricity generation technologies have specific characteristics that make them suitable or unsuitable for different roles in the system. Numerous technical criteria influence the preference for a particular generation source, particularly in terms of its role in the system (e.g., peaking, baseline, or reserve). Other considerations include cost, reliability, efficiency, and experience with the technology and its operation.

When considering Iraq's options, I used three priorities as guidelines in the selection process:

- Integrating renewable energy sources (such as solar, wind, hydropower, etc.) into development plans;
- Defining a strategy that leads to increased access to energy services by all people in Iraq.
- Determine an energy strategy that does not rely primarily on hydropower as a means of electricity production.

Iraq's diversification of domestic energy production creates more stable supplies and job opportunities, and helps protect the environment. However, given the water needed to generate electricity and to conserve and recycle it whenever possible, diversifying water resources for future production must also be considered.

### *1.1.4.2 Power plants*

Within the framework of the planForty new stations will be built between now and 2021, adding to INES. Value capacity00222 MW to the 2222 MW of currently available active capacity. It will These new stations consist of steam and gas turbines, and are capable of operating on

Natural gas is long-term and can also run on fuel oil when needed. This flexibility in fuel requirements will be important over the next few years as gas infrastructure is developed and gas supplies may remain constrained. By 2020,021 will be There is sufficient capacity available in the system (after adjusting for local operating conditions and expected technical losses) to meet peak demand with a reserve margin of11%. The fleet will then expand. To keep pace with growing demand, newer stations will replace existing, inefficient stations.

The only capacity that can be added after a year.021 is obtained from fossil fuels It will be through the "combined cycle gas turbine" technology.Which is more, CCGT) Fuel technologies are fuel-efficient and environmentally friendly. Renewable generation will be used in the short term to supply remote, off-grid demand sites. In the medium to long term, solar and wind power capacity will be developed and connected to the grid. Hydropower development will be explored, but it should always be considered as a by-product of any multi-purpose dam. By the yearBy 2023, renewable capacity is expected to exceed 222 MW, representing approximately 0-1% of the total system capacity.

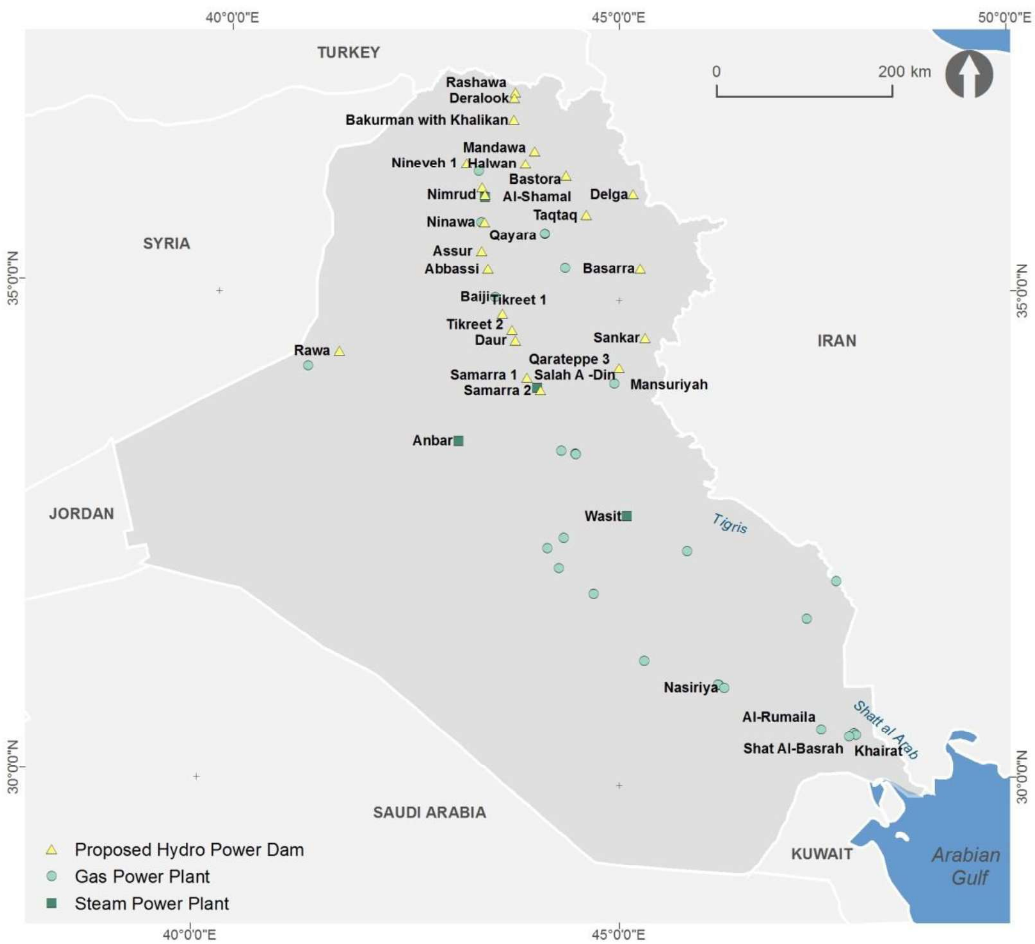


**Illustration31/ Figure 3-25: Planned power plants for the year 2135**

**table23/23-3: Names of locations of planned new power stations**

**NEW POWER PLANTS**

| Capacity (MW) | Name | Type |
|---|---|---|
| 1,800 | Nasiriya | Gas |
| 3,000 | Al-Rumaila | |
| 1,400 | Khairat | |
| 1,250 | Shat Al-Basrah | |
| 1,014 | Baiji | |
| 500 | Qudis New | |
| 750 | Ninawa | |
| 740 | Mansuriyah | |
| 3,000 | Besmaia | |
| **6,603** | | **Gas Power Plants < 500 MW** |
| **20,057** | | **Total Gas Power Plants** |

| Capacity (MW) | Name | Type |
|---|---|---|
| 1,642 | Anbar | Steam |
| 1,400 | Al-Shamal | |
| 1,260 | Salah Ad-Din | |
| 1,320 | Wasit | |
| 1,400 | Al-Yousifia | |
| **7,022** | **Total Steam Power Plants** | |

As a result of these changes in the generation fleet, Iraq's fuel consumption for power generation will shift strongly towards the use of natural gas and the need for imports will end by the year .021. Crude oil will be gradually phased out as an energy fuel and redistributed for export. Refineries and industry. Natural gas, which fuels a quarter of energy production today, will fuel four-fifths by the year0232. In parallel with these improvements in generating capacity, Iraq will expand It will strengthen and eliminate bottlenecks in the transmission and distribution network. Technical losses will be reduced to acceptable levels, and a smart grid program will be launched to monitor network performance and improve peak load management.

A recent and tangible trend in the energy sector is the regional interconnection of electricity grids. This ranges from bilateral electricity sales arrangements between two neighboring countries to the entire regional market, open to many countries. Once Iraq achieves energy self-sufficiency, it will be

Iraq is capable of developing a strategy for international energy exchange, either as a primary source or as part of a cooperative regional network for reserve exchange and load balancing. Iraq already has energy exchange agreements with neighboring countries such as Iran and Turkey, and its location provides a strategic location for potential energy circulation from the Middle East to Europe. In a potential future environment where the solar energy potential of the Middle East is developed to a point where it can provide significant carbon-free energy for export, Iraq could be an important crossroads for regional and Western energy markets.

#### *1.1.4.4 Hydroelectric power*

In the information collected during the processThe Iraqi government has decided that NWDS should not be The pursuit of hydropower is the primary reason for building new water control facilities. Instead, it can only be a byproduct of any new dam. With a mix of non-fuel energy sources, Iraq's goal is to increase production to1% in Iraq and 15% in the region Kurdistan. One of these goals is for hydropower to cover a significant portion of the Kurdistan Region, where hydropower potential is highest.

Strategy Team Evaluations52 new hydropower dams were built, and three of them were ultimately selected for inclusion in the strategy. New hydropower projects were selected for SWLRI. Meeting specific goals and objectives. Specifically, new dams were preferred based on a number of technical, economic, social, and environmental criteria.

This strategy assumes that the Mosul Dam will be rehabilitated, the reservoirs will be operated more efficiently, and a new5 new medium and large hydropower dams in the Kurdistan region in Northern Iraq in order to expand the total existing capacity of0022 to 3122 MW. And if Fully executed,5 new dams in the Kurdistan Region will add 4.5 megawatts, with energy Hydroelectric covering up to10% of the regional energy mix.

**table*24*/22-3 Names of recommended new dam locations**

**HYDROPOWER DAMS RECOMMENDED FOR IRAQ**

| Year Proposed for Construction | Reservoir Full Storage Capacity [mill m3] | Annual Energy Generation [GWh/yr] | Installed capacity (MW) | DAM | ID |
|---|---|---|---|---|---|
| 2017 | 4,937 | 943 | 129 | Mandawa | DAM-014 |
| 2017 | 112 | 108 | 24 | Bakurman with Khalikan | DAM-015 |
| 2019 | 425 | 624 | 97 | Delga | DAM-017 |
| 2017 | 60 | 30 | 5 | Basarra | DAM-018 |
| 2020 | 350 | 457 | 77 | Ninawa-1 | DAM-019 |
| 2024 | 110 | 375 | 63 | Khamam | DAM-021 |
| 2025 | 20 | 120 | 20 | Nimrud | DAM-022 |

| | | | | | |
|---|---|---|---|---|---|
| 2021 | 150 | 895 | 138 | Qayyara | DAM-023 |
| 2022 | 100 | 950 | 147 | Assur | DAM-025 |
| 2025 | 80 | 396 | 61 | Abbasi | DAM-027 |
| 2022 | 65 | 703 | 102 | Tikreet-1 | DAM-029 |
| 2028 | 85 | 751 | 109 | Tikreet-2 | DAM-030 |
| 2020 | 90 | 475 | 69 | Daur | DAM-031 |
| 2020 | 110 | 166 | 24 | Samarra-1 | DAM-032 |
| 2022 | 35 | 482 | 70 | Samarra-2 | DAM-033 |
| 2021 | 30 | 178 | 30 | Sankar | DAM-038 |
| 2021 | 1,044 | 406 | 69 | Qarateppe-3 | DAM-042 |
| 2023 | 1,000 | 314 | 48 | Rawah | DAM-043 |
| 2018 | 2,380 | 737 | 200 | Taqtaq | DAM-047 |
| 2018 | 75 | 18 | 3 | Bastora | DAM-062 |
| 2016 | 72 | 825 | 261 | Rashawa | DAM-073 |
| 2019 | 8 | 176 | 24 | Halwan | DAM-083 |
| 2018 | 0 | 155 | 37 | Deralok | DAM-087 |
| | **11,339** | **10,283** | **1,808** | **TOTAL** | |

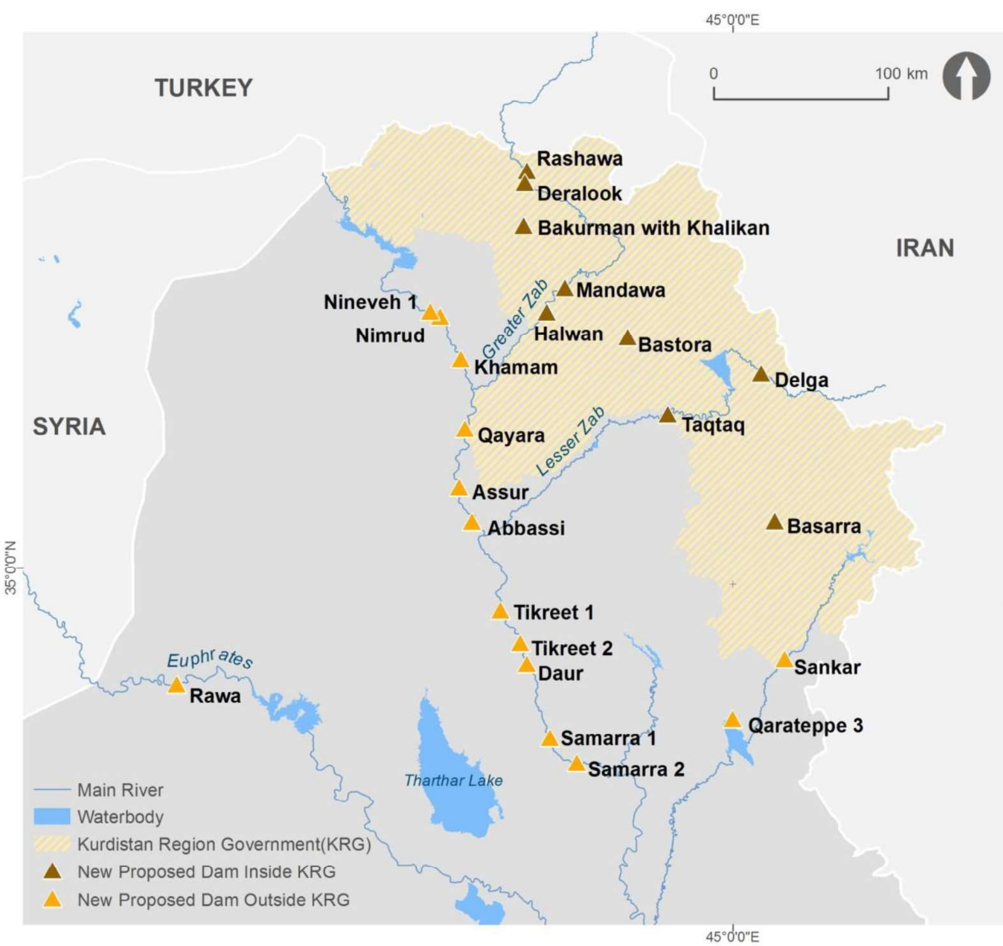
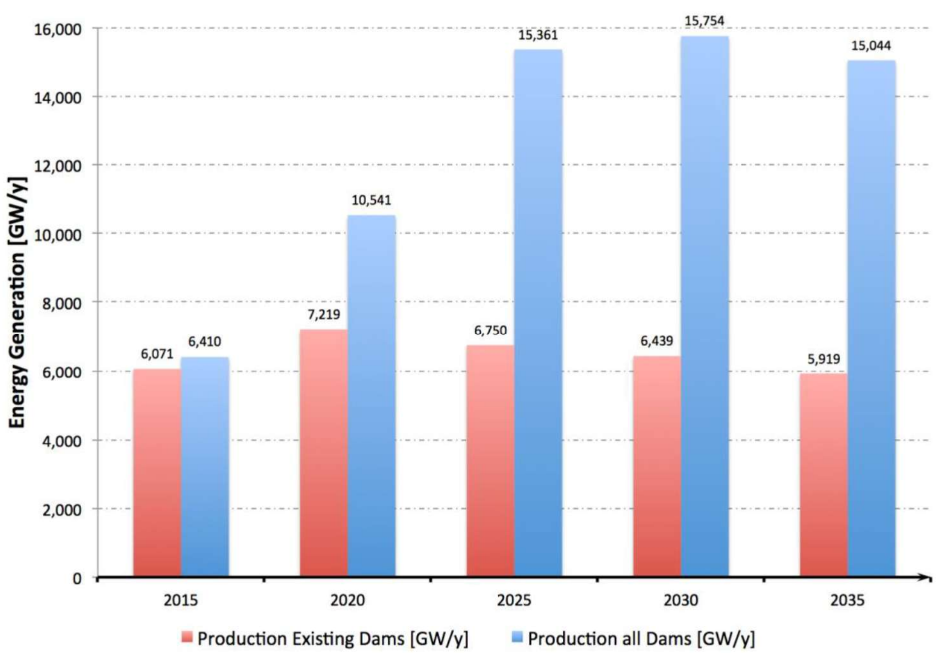


**Illustration*81*/ shape22-3: Site map of recommended new dams**

With the exception of the Kurdistan Region, only 4 of the 8 projects evaluated achieved a positive return on investment.[89] These four projects are small-to-medium-sized dams that could help increase the share of hydropower in the energy mix. If built—and assuming the Mosul Dam is rehabilitated—hydropower could reach 4.4% of the country's energy production.[90] These relatively small dams are "on-river" dams with low storage capacity and limited impact on the water resources management of the Tigris River.

After a comprehensive analysis of the data, options, and priorities of the Iraqi government, the best option for Iraq is to leverage its other resources, such as natural gas and solar energy, rather than continuing to build dams. As highlighted in the Integrated National Energy Strategy (INES), Iraq does not need to build new dams to meet its 2020 energy targets, and given the expected costs and environmental damage from dams, a cost-benefit analysis is not in their favor. Iraq has other energy options that must be explored for a balanced and energy-secure future.

The projected hydropower production takes into account the proposed year of construction and/or rehabilitation of each dam, the hydrological cycles, and the expected lower discharges to Iraq, as shown in Figure2-3., next.




These 10 projects yield a return on investment on paper. It should be noted, however, that dams often suffer from low expected returns.

90 If Mosul Dam is not rehabilitated, the hydroelectric power level will be closer to 343% of the energy mix.

**Illustration*82*/ shape27-3: Expected hydropower production (GWh/year)**

Although alternative energy sources were once expensive to exploit, their costs have steadily declined as their potential benefits have increased. For example, the cost of solar photovoltaic cells has fallen by 81% in the past two decades, and their long-term potential is well worth considering. Another renewable technology, solar thermal systems, could rival conventional thermal technology in achieving high levels of solar insulation. As Iraq looks to its future, it must capitalize on the full potential of its natural resources.

### *1.1.4.1 Oil production*

This strategy assumes that by 2042, Iraq will be able to provide 69.2% of the water required by the oil industry from alternative sources such as seawater and drainage systems.

**table*25*/25-3: Distribution of water supplies to the oil industry**

| ALTERNATIVE SOURCES OF WATER TO OIL INDUSTRY [BCM/Y] | | | | | | |
|---|---|---|---|---|---|---|
| **2035** | **2030** | **2025** | **2020** | **Current 2015** | | |
| 1.773 | 1.751 | 1.467 | 0.954 | 0.394 | 0.267 | Total Water Requirements for Oil Industries |
| 1.227 | 1,198 | 1.015 | 0.593 | 0.249 | 0.179 | Total Water Needed for Oil Sector from Alternative Sources |
| 0.550 | 0.521 | 0.338 | 0.211 | 0.162 | 0.179 | Water Needed from the Drain |
| 0.677 | 0.677 | 0.677 | 0.382 | 0.087 | 0.000 | Water from CSFF |
| **SHARE OF ALTERNATIVE SOURCES** | | | | | | |
| **2035** | **2030** | **2025** | **2020** | **2015** | **Current** | |
| 31.0% | 43.5% | 33.3% | 35.6% | 0.0% | 0.0% | Share of Drainage Water to Oil Field Reinjection |
| 69.2% | 68.4% | 69.2% | 62.2% | 63.1% | 66.8% | Share of alternative sources of water to the oil Industry |

Treating and desalinating such water could be very costly for Iraq. The average cost of desalination is \$1-\$1.1/m³, and by 2014, Iraq is expected to pay more than \$110 million/year in current dollars to desalinate the necessary water and re-inject it into oil fields.

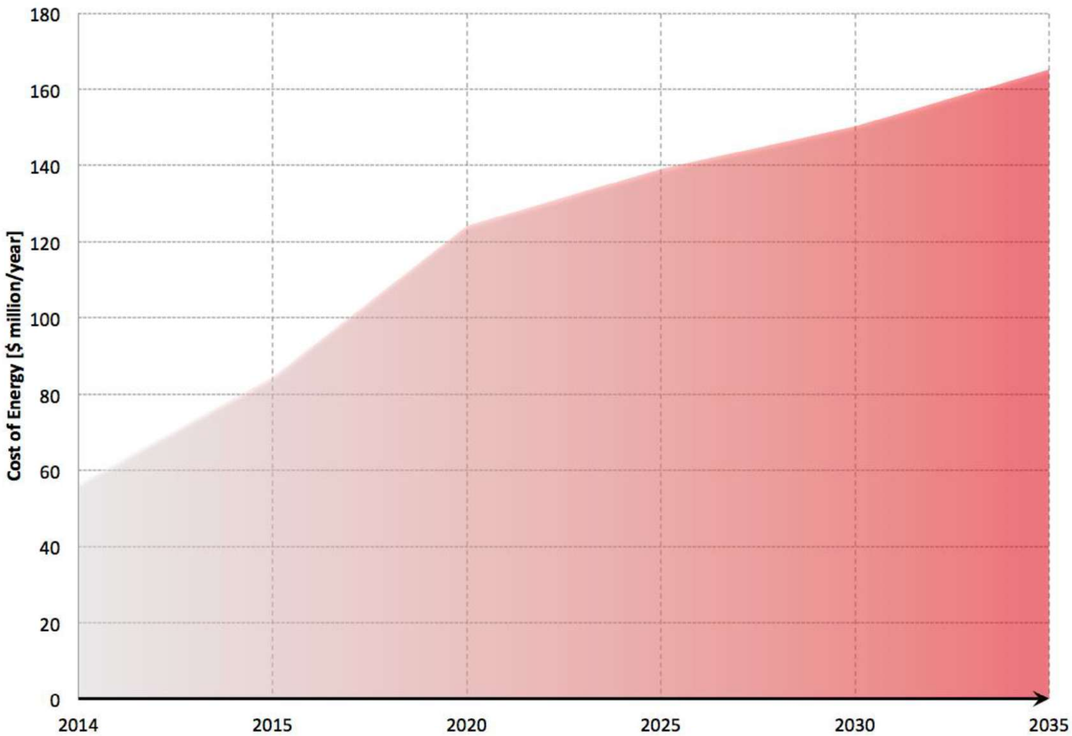



**Illustration33/Figure 3-23: Expected cost of energy required to desalinate water for reinjection into oil fields**

Changes are also needed within other industrial sectors. The SWLRI strategy assumes that other industrial sectors will adopt more efficient water use standards through recycling and closed-loop systems. The total amount of water the strategy assumes the industrial sector will require by 2042 is 2.73 billion cubic meters/year. If no action is taken and water inefficiency continues at current levels, then industry will require significantly more water to achieve the same goals.

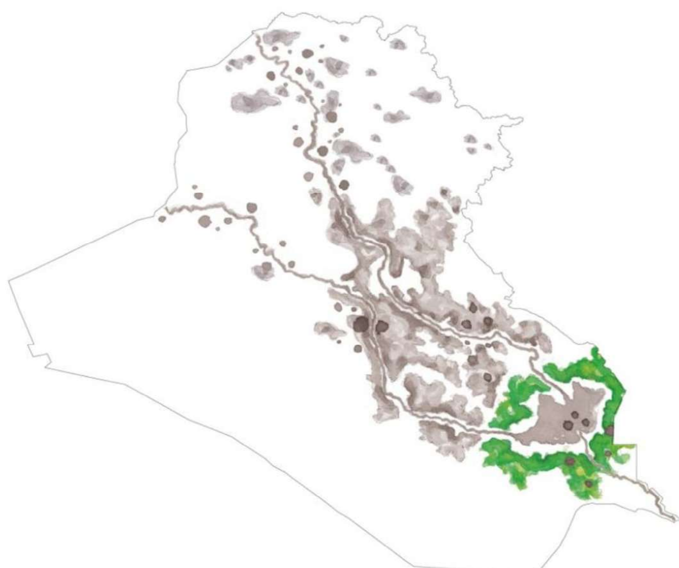
### 1.1 Environmental conservation

Three decades of war and a decade of sanctions, coupled with the collapse and deterioration of basic infrastructure, have been disastrous for Iraq's environment. Declining river discharges, high concentrations of salts and other pollutants in freshwater systems, contamination and degradation of groundwater, deterioration of ecosystems, and a decline in biodiversity have all caused significant harm to public health and the environment throughout the country. The cost of environmental degradation in Iraq has been estimated at between 4% and 8.1% of the country's annual gross domestic product.[91].

91 Ministry of Environment. Local Environmental Strategy and Action Plan for Iraq 2012-2013. 2013

It is recognized that there is an urgent need to adopt sound environmental management measures in Iraq, particularly those related to water and land. Consequently, efforts have been made over the past decade to integrate environmental concerns into reconstruction and rehabilitation project plans. Improving land and water management practices is essential to addressing many environmental issues, and thus addressing environmental issues is essential for sustainable economic development, food security, and human health.

Freshwater and inland wetland ecosystems are of paramount importance in Iraq: the Tigris and Euphrates river basin and their tributaries, as well as the marshes in southern Iraq, are home to a large proportion of the country's population and provide water and raw materials for households and the development of key economic sectors (urban development, agriculture, industry, oil and gas, etc.). The spatial distribution of water resources has shaped residential settlements and economic development over centuries. In addition to the significant economic importance of water and land resources, inland ecosystems, freshwater, and wetlands are of great environmental importance, as they provide key resources and environmental functions for the country as a whole..



## 3.4.1 Current status

Iraq faces direct challenges to its environmental health. Population growth and economic activity create a need for housing, food, energy, and water. Natural hydrological fluctuations lead to drought, and the potential impacts of climate change, population growth, agricultural development goals, and expanding oil production will place increased pressure on water and ecosystems.

A cultural and environmental concern is the continued preservation and restoration of the Mesopotamian marshes, which are under threat unless water use efficiency is improved at the catchment level to allow sufficient quantities of water of appropriate quality to reach the southern part of Iraq.

The Iraqi Environmental Management Strategy outlined in this document is designed to meet the needs of Iraq's population and address ways to improve land quality and support ecosystems. It is essential to place greater emphasis on finding additional ways to address Iraq's existing environmental problems, improve water use efficiency, address pollution issues, and restore the natural conditions of sensitive lands throughout the country.

# 3.4.5 Future needs

Water and land resources are essential components of the environment and ecosystem functions. The main issues affecting the environmental quality of Iraq's water and land resources are summarized in the table below.

**Illustration84/ Table22-3 Environmental issues and related contributing factors**

| Associated Factors | Environmental Issues |
|---|---|
| Mismanagement and overexploitation of water resources | Water Stress and Drought |
| Reduced flow in Iraq's Rivers | |
| Climate Change | |
| Reduced areas of inundation in the Mesopotamian Marshes | |
| Mismanagement of land and degradation of soil quality | Land Degradation and Desertification |
| Loss of topsoil and degradation of soil structure | |
| Poor planning of land development (urbanization, infrastructure, industry, oil & gas exploration and development | |
| Overexploitation of soil for agricultural and other uses | |
| Contamination of freshwater with untreated municipal wastewater, industrial wastewater and agricultural runoff | Degraded Water Quality |
| Poor Irrigation practices | Salinization of soil and water |
| Reduced flow in the Tigris and Euphrates Watersheds | |
| Climate change | |
| Uncontrolled emissions of pollutants to air, water and soil from point and nonpoint sources | Environmental pollution (soil), surface and ground water, air) |
| Mismanagement of hazardous chemicals | |
| Mismanagement of solid and liquid waste | |
| Wars (bombing of industrial plants and infrastructure, use of depleted uranium and chemical weapons, remnants of war) | |
| Lack of wastewater treatment capacity | |
| Lack of emission abatement systems | |
| Lacking environmental standards | |
| Weak enforcement of existing environmental laws and regulations | |
| Degradation of natural vegetation and forest | Degradation and loss of natural and semi-natural habitats, especially freshwater and wetland habitats |
| Destruction of wetlands | |
| Habitat fragmentation and loss | |
| Overexploitation of wildlife (fishing, hunting, illegal trade) | |
| Introduction of alien species and invasive species | |

Environmental protection requires efforts to enhance natural resources, protect biodiversity, and prevent water and land pollution. Sustainable economic development is only possible through the optimal use of water and land and the conservation of Iraq's natural resources.

## 3.4.3 Opportunities and Strategies

#### *1.2.1.2 Integration of the environment strategy with the water, food and energy security strategy.*

Organized efforts to preserve and protect Iraq's environment through the management of the country's freshwater and land resources are included in SWLRI's Water, Food, and Energy Security Strategy.

For example, efforts to control irrigation revenue flows are not only essential for sustainable economic development in the agricultural sector, but are also essential for protecting water quality and preventing harm to riparian flora and fauna. In the municipal and industrial sectors, plans to further integrate sanitation and wastewater treatment systems across the country offer opportunities to prevent pollution of precious freshwater resources and protect human health. Furthermore, the appropriate application of non-conventional wastewater treatment technologies presents opportunities to create wetlands and other ecological zones, helping to protect biodiversity while providing areas that can have recreational value for local communities.

Water reuse strategies have been proposed to address the water needs of marshland restoration and urban greenbelts, as well as to maintain river discharges. These efforts also help support biodiversity and provide numerous other benefits, including the opportunity to create ecotourism sites and local parks. Furthermore, reusing water to support oil well injection (as well as seawater harvesting) reduces the demand for freshwater for industrial water consumption, thus freeing up more water for other uses.

#### *1.2.1.4 Minimum Expenses*

Minimum discharges are necessary to deliver water to various sectors, including municipal, industrial, and environmental uses. Certain points along rivers in Iraq have established minimum discharge rates, ensuring that river levels are high enough to supply water to municipal and industrial intakes. These minimum discharges must ensure122% of the time, because Our strategy is designed to meet these discharge requirements even under extreme drought conditions. In other locations, such as the Shatt al-Arab River, minimum discharge must be maintained to ensure that the salt front from the Gulf does not intrude and reach Basra. Discharge requirements over time that support the specific condition of an adjacent (riparian) ecosystem, both within the river and on both sides of the river, are commonly referred to as environmental discharge or environmental discharge requirements. Ackerman and Dunbar have explained:92(0220) The volume of water needed to support environmental discharges is a function of River conditions, its size, the degree of development within the watershed, and the specific objectives for river use by the people or governments that regulate the river.

The observed situation in Iraq's rivers and along river banks indicates that current discharge rates along rivers must be increased in certain locations to improve environmental conditions and water quality in Iraq. Maintaining minimum environmental discharges also helps maintain a healthy balance between groundwater and surface water exchanges. Sharp declines in water discharge can upset this balance and, as is well known, lead to deteriorating water quality conditions in some parts of Iraq.

92 Ackerman, W. and Dunbar. Defining environmental river flow requirements—A review. Hydrology and Earth System Sciences, 8(2), pp. 810–811. 4114

There is an urgent need to maintain minimum discharges to support municipalities and industries, and to identify mechanisms to increase discharges along the southern parts of Iraq so that water quality can be improved. The current water quality in Basra, for example, is in a severely deteriorated state due to a combination of pollutant concentrations and low discharges that harm the environment and also expose the population to harmful conditions. The proposed minimum environmental discharges recommended in this strategy are in line with those identified by the Master Plan.1550 (Russian study) illustrated in The table below

**table*26*/27-3 Summary of Minimum Flows and Minimum Environmental Flows**

| MINIMUM ENVIRONMENTAL FLOW (m3/s) | /s )3MINIMUM FLOW (m | LOCATION |
|---|---|---|
| | | **Tigris** |
| 220 | 220 | Mosul City |
| 275 | 275 | Baiji |
| 350 | 350 | Baghdad |
| 140 | 140 | Downstream Kut Barrage |
| 100 | 35 | Downstream Amara Barrage |
| 90 | 20 | Qalat Saleh |
| | | **Euphrates** |
| 177 | 150 | Haditha City |
| 177 | 70 | Downstream Hindiyah Barrage |
| 177 | 40 | Nasiriyah |
| | | **Shatt Al-Arab** |
| 210 | 50 | Basrah (from Tigris River) |

#### *1.2.1.1 Public awareness of environmental conditions in Iraq*

Technical strategies for addressing Iraq's environmental and water challenges are only part of a larger process. Broad public awareness campaigns targeting the Iraqi population about the current state of the environment, the link between Iraq's water resources and its environment, and ideas on how people can reduce their impact on the environment are valuable investments Iraq can make. Public relations or media outlets under the auspices of the Ministry of Water Resources, another competent body within the Iraqi government, or even a non-governmental organization can organize such campaigns.

#### *1.2.1.2 The need to develop an environmental impact assessment*

The need to conduct an environmental impact assessment during the planning phase of proposed projects in Iraq can provide an opportunity to prevent or mitigate environmental impacts. Projects should be assessed to identify areas of sensitive habitat or endangered species within the project area, determine the impacts of the quantity and quality of water available at the project, and assess the social and health impacts of the project. Once these conditions are studied, strategies can be identified to mitigate or prevent harm.

#### *1.2.1.3 Drafting new environmental laws and legislation*

Existing environmental laws and regulations must be evaluated as part of an effort to implement political and legal reforms in Iraq. New laws and regulations must be formulated.

Implementation mechanisms, in order to address air and water quality, land degradation, marine and coastal environment, biodiversity protection, mismanagement, pollution associated with oil and gas production, means of treating contaminated areas, and management of harmful chemicals.

## 3.4.4 Mesopotamian Marshes

### *1.2.2.2 Facts and needs*

The Iraqi Marshlands are located in the southern part of the Mesopotamian Basin, in the largest wetlands of the floodplains created by the Tigris and Euphrates river systems. Historically, the marshlands were the largest wetland ecosystem in western Eurasia, covering more than02222 kilometers Square (the original boundaries of the marshes and the boundaries proposed by the Iraqi Marshlands Recovery Center,CRIM Also given in the attached map "Environmental Security -21). The marshes are the natural landscape. The unique aquatic environment of the desert fosters the traditions, values, and livelihoods of the people whose ancestors have lived in the area for thousands of years, and whose culture is considered the cradle of Arab civilization. It also provides for important wildlife, including many endemic and endangered species. The marshlands encompass three of the largest cities in southern Iraq: Nasiriyah to the west, Amarah to the northeast, and Basra to the south, and cover three governorates: Basra, Dhi Qar, and Maysan. Three distinct marshland areas exist in the south: the Hawizeh Marsh, the Central Marsh, which officially includes the Abu Zarq Marsh, and the Hammar Marsh. Land uses within and adjacent to the marshland areas include villages, towns, agricultural areas, and oil fields. A general layout of the marshlands is shown in the figure below.


**Illustration35/ Figure 3-22: Scheme of the Mesopotamian Marshes in Iraq**

**Revitalizing the marshes**

In the year.022 The New Aden Master Plan was prepared for the Ministry of Water Resources and the Ministry of Environment. The Ministry of Municipalities and Public Works proposed an innovative strategy for water management and allocation to restore the marshes. This plan was developed with the help of several advanced computer models, which assisted in the assessment of topography, hydrology, hydraulics, water quality, socio-economic conditions, and water distribution. The use of the model allowed for determining the volume of water required to restore the marshes. By combining small, scheduled inflows with regulated outflows, it is possible to reduce water loss from evaporation in the marshes and improve water distribution within the marsh areas for revitalization.

**Benefits of revitalizing the marshes**

The benefits of marshlands come in the form of diverse ecosystem services, which are quantifiable and an integral part of the financial valuation of marshlands. These include:

- An attractive environment that serves communities and reduces rural migration from the marshes to urban centers.
- Carbon sequestration, i.e. the absorption of carbon dioxide (from the atmosphere by $CO_2$ Plants growing in a marsh environment.
- Flood risk mitigation, which means protection from inland flooding that can spread as waves from the Gulf up the Shatt al-Arab and Shatt al-Basra rivers.
- Production and sale of goods from the marshes, including dairy products from buffalo, milk from cows, fish, reeds, etc.
- groundwater recharge
- Water purification: Wetlands naturally help reduce nutrients and other pollutants, because wetland plant species absorb some of the components in the marsh water.
- Preventing erosion, sand and dust storms, and desertification.
- Improving the local climate, including reducing local temperatures and increasing local humidity.
- Improving soil structure by rehydrating the underlying bentonite clay layers and introducing organic matter.
- Land value
- Ecotourism (""eco-tourism"

The New Aden study also calculated the value of the marshes based on several ecosystem indicators, including direct use value, which is attributed to the direct benefit from ecosystem services, and indirect use value, which is attributed to the indirect benefit from ecosystem services through positive externalities provided by ecosystems. The calculation estimated[93]The value of the marshes is equivalent to$340 billion annually, if the marshes were fully restored Historical. This value is approximately$30,322 per hectare of marshes annually.

Analysis of approximately122 inland wetlands internationally recognized to that services The ecosystems provided by these wetlands have an annual value ranging from$10,122 per hectare To about$1,120,222 per hectare[94]The average value of a unit of wetland is

93 New Aden Group. New Aden Master Plan for Integrated Water Resources Management in the Marshlands. Final Report Prepared for the Ministries of Water Resources, Municipalities and Public Works and Environment in Iraq. September.022.

94 De Groot Brander (2010). Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services 1, 12-1.

The interior included in the study of De Groot et al.0210) He is111,$0.5 per hectare Annually. Applying this value unit indicates that the value of the Iraqi marshes that are being revived is12% From the borders set by the Iraqi Marshlands Revitalization CenterIt is more than $242 billion CRIM. Thus, the assessment of the marshlands in Iraq based on the New Eden study is very conservative compared to international assessments of similar ecosystems. It should also be noted that even with this conservative assessment, marsh restoration produces a higher economic return than agriculture for three governorates in southern Iraq..

**Water quality in the marshes**

The deteriorating quality of water reaching the marshes threatens the population and ecosystems of the marshlands. The marshes, at the southern end of Iraq's river network, are a focal point where rivers and their harmful constituents converge. Water pollution includes pathogens that are harmful to human health; agricultural runoff, which introduces nutrients that support algal blooms and harm aquatic species; and total dissolved solids (TDS) (salinity), which can make marsh water unsuitable for agriculture and livestock and unpalatable to humans.

### *1.2.2.4 Needs*

Sustainable development in Iraq goes hand in hand with the restoration and preservation of the ecological health of the Mesopotamian Marshes. The first step is to provide a guaranteed quantity of water. In parallel with this effort, setting quality targets for the water flow into the marshlands is critical for the people living in the area, as well as for wildlife, aquatic species, livestock, and agriculture. Setting water quantity and quality targets and successful management of water resources in the marshlands requires effective infrastructure (i.e., gates, culverts, barriers, etc.) to control inflow and outflow to and from the marshes, as well as transboundary flows between the marshes. Defining the marshlands' boundaries and formalizing the national vision for the area, which includes a site registered on the Ramsar Convention's List of Wetlands of International Importance and an area designated as the country's first national park, is also important.[95], will lead to long-term protection.

95 On July 3, 2013, the Iraqi Council of Ministers approved the designation of the Central Marshes of Iraq as the country's first national park.

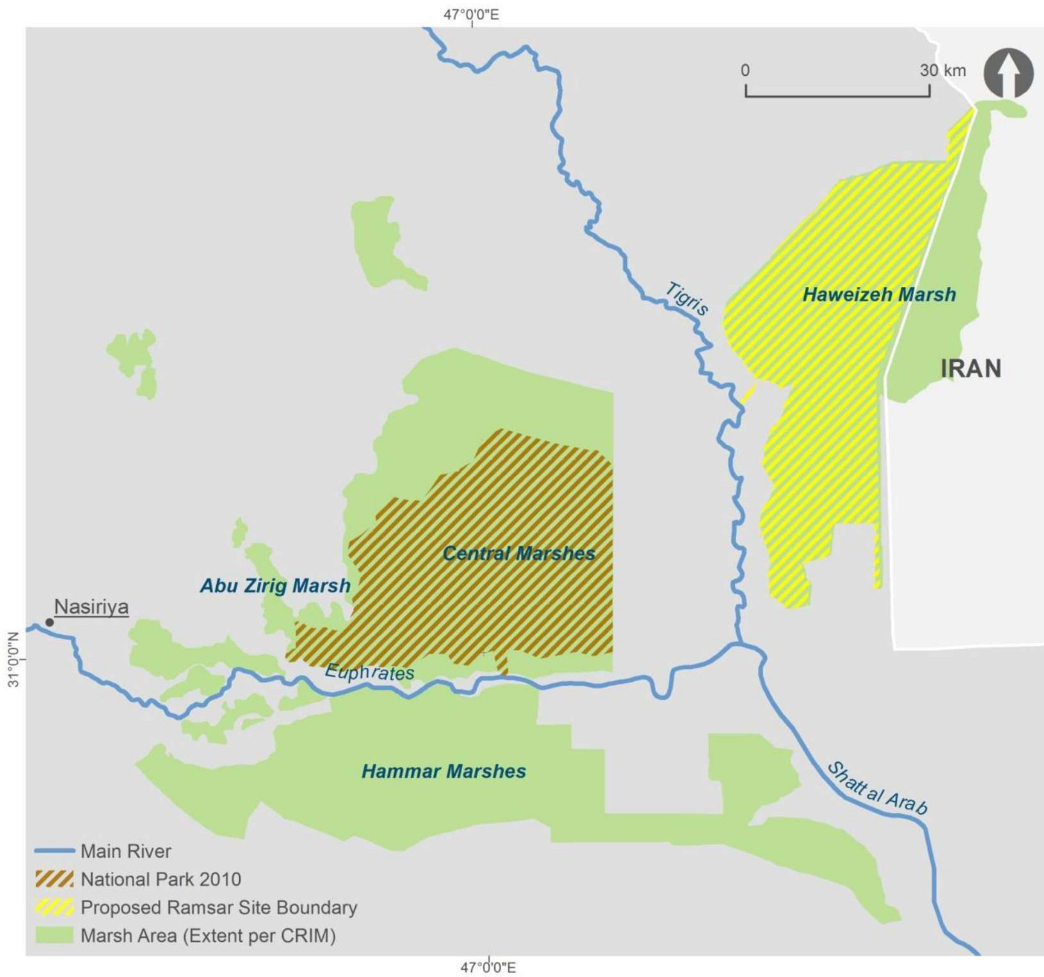



**Illustration32/ Figure 3-71: The Central Marshes are named as the first national park in Iraq, and the Hawizeh Marsh is registered as a wetland of international importance. Internationally, under the auspices of the Ramsar Convention. The map shows the borders of these so-called areas.**

### *1.2.2.1 Strategy*

With the results of various assessments conducted during the New Eden Study, the SWLRI strategy team was able to calculate the value to Iraq of allocating water to the marshes. The analysis results show that Iraq must allow a minimum of 2.412 billion cubic meters of freshwater to be consumed by the marshes annually to avoid suffering significant social and economic losses. Importantly, this allocation will restore 21% of the marshland area assessed by CRIM, inundating 4,820 square kilometers of marshland under average hydrological conditions for 2014. The allocation to the marshes represents the amount of freshwater estimated to be consumed by the marshes through evaporation or released outside the marshland areas, which cannot be recovered or reused for an alternative purpose. The freshwater volume assessed for the marshlands under this strategy does not include discharges from

Iran, which enters the Hawizeh Marsh. Due to the lack of an agreement between Iraq and Iran regarding the waters that reach the Hawizeh Marsh, these waters are not included in Iraq's marshland management strategy.

If the volume of water flowing through Iraq's rivers increases and exceeds the needs of upstream users (for example, as a result of a period of high flow upstream, perhaps related to a flood or above-average flow), this strategy recommends diverting that excess discharge to the marshes. If Iraq allocated more than 2.412 billion cubic meters of freshwater to the marshes annually, the country could reap significant financial benefits due to the associated increase in marsh inundation area and the resulting increase in the ecosystem services they provide. For example, a larger inundated area would expand vegetation cover in marshland areas, which would increase the carbon sequestration of marshland crops and expand the area where reeds can be harvested or fished. The relationship between the volume of water allocated to the marshes and the financial benefits is shown below.

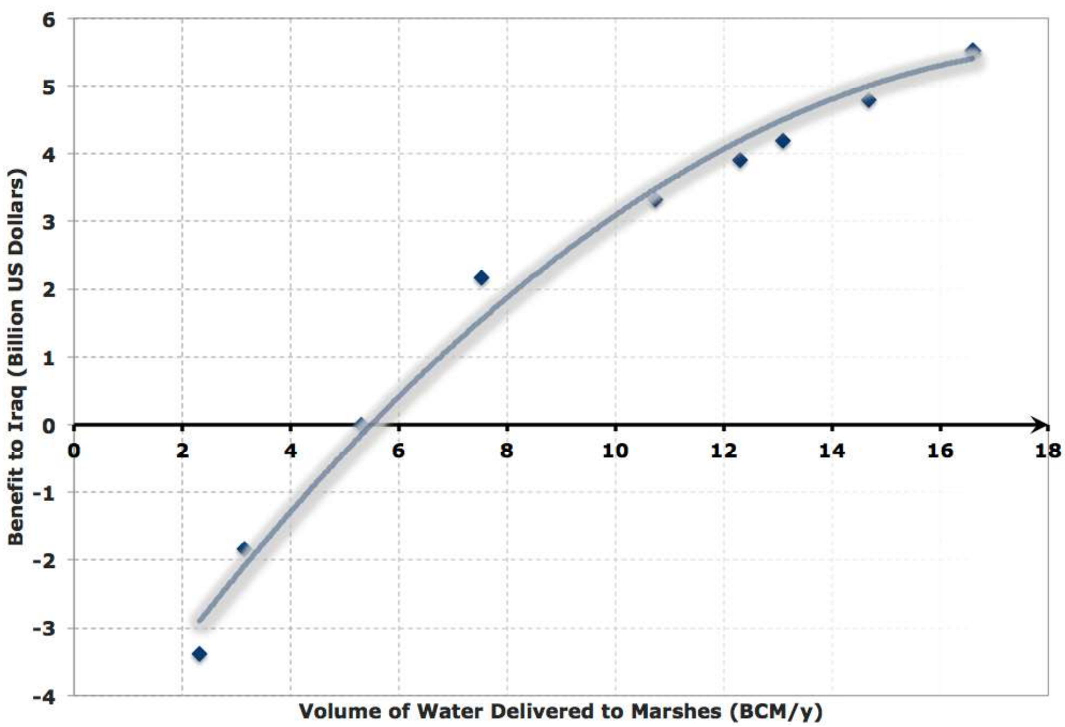



**Illustration87/ appearance74-3: Comparing the volume of water allocated to the marshes to the financial benefits achieved by the marsh residents and Iraq as a whole.**

If no minimum amount is allocated14,321 billion cubic meters of fresh water to the marshes, The benefits achieved in Iraq will be negative, represented by the costs borne by the country. In such a case, the costs will be greater than the benefits due to the economic consequences resulting from the displacement of the marsh population, lost economic opportunities, and environmental damage that may result from the desertification of the marsh areas, etc. On average, five years out of ten (i.e.12% of (time), the marshes will have more than14,501 billion cubic meters of fresh water annually by general0231, as shown in the volume-duration curve below. The decrease in inflows into Iraq will make future use of Lake Tharthar unfeasible, as storing water in the lake could cause significant evaporation or make it too saline for most uses. Diverting excess discharges around the lake means that higher than minimum discharges will occur at sites downstream. These excess flows must be allocated to the marshes. Failure to achieve the efficiencies targeted in this strategy for the agricultural, municipal, and industrial sectors will have a direct impact on the amount of water available to the marshes. In other words, the environment will pay a heavy toll due to Iraq's inability to implement this strategy and manage its water resources at a national level.

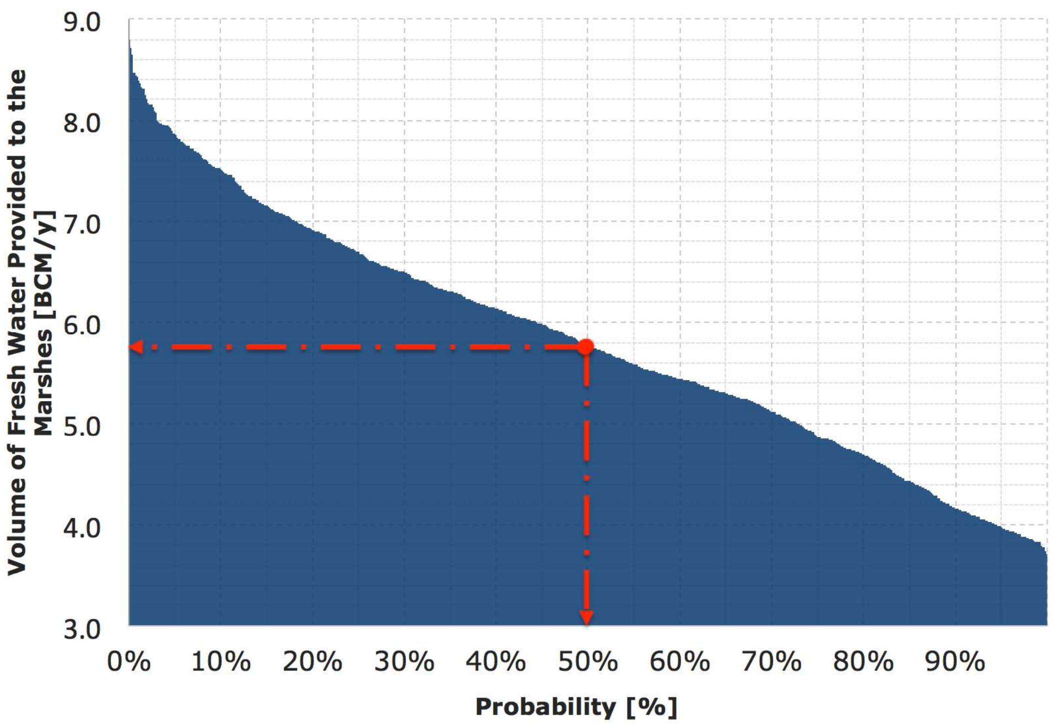



**Illustration88/ appearance72-3: Duration curve of the volume of inflows into the marshes in 2135**

During drought years, all sectors of the Iraqi economy must be reduced, including water allocations to the marshes. This strategy has given the Ministry of Water Resources tremendous flexibility during drought events, with the reduction reaching 0.2% of the amount allocated to the marshes. However, a statistical analysis of water allocations to the marshes shows that the composite hydrological dataset for 110 years indicates that by 2014, the largest reduction in the marshes will be around 41%, such that even during drought conditions, the marshes could still receive at least approximately 4.4 billion cubic meters of fresh water.

Although allocating water to the marshes necessarily excludes other sectors such as agriculture, the returns from allocating the targeted amount to the marshes are exponentially greater than those calculated for agriculture: 2.842 billion cubic meters per year would allow for the restoration of 50% of the marshes, while simultaneously meeting the water needs of more than 4.1% of the total irrigated land. In other words, by providing at least 2.842 billion cubic meters per year to the marshes, Iraq would lose only 42,000 dunams of irrigated land, representing less than 1% of the total planned agricultural land in Iraq.

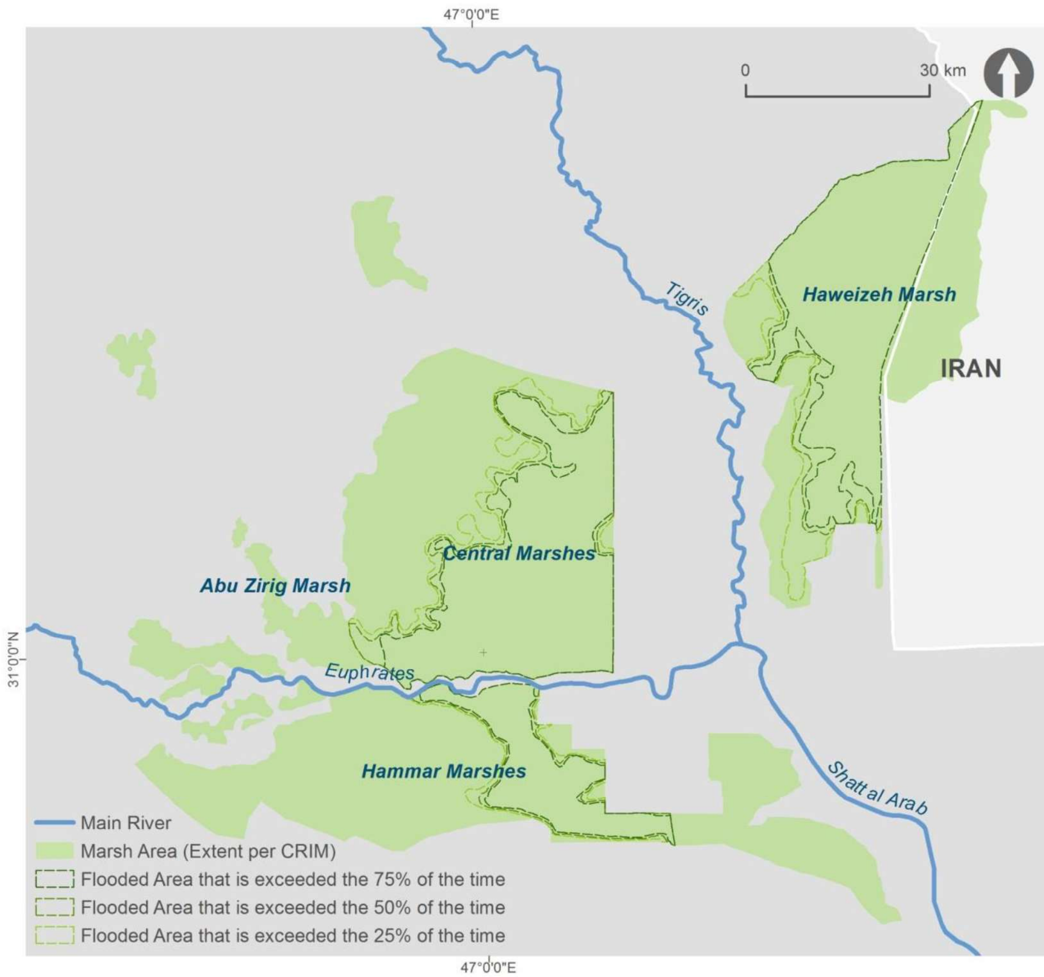



**Illustration*89*/ appearance73-3: Floods occur frequently in areas within the marshlands.**

### Water allocations

Marshes vary in their water consumption, as shown in the table below.

**table27/23-3: Annual allocation of fresh water to each marsh**

| Consumption [BCM/year] | Outflow (BCM/year) | Evaporation (BCM/year) | Inflow (BCM/year) | Marsh |
|---|---|---|---|---|
| 1.253 | 1.554 | 1.253 | 2,808 | Haweizeh March |
| 2.328 | 1.388 | 2.328 | 3,717 | Central Marsh |
| 0.18 | 0.031 | 0.18 | 0.211 | Abu Zirig Marsh |
| 2,064 | 1.142 | 0.922 | 2,064 | Hammar Marshes |
| **5.825** | **4.115** | **4.683** | **8.8** | **Total** |

It is important to note that the discharges from the Central and Abu Zarq marshes flow into the Hammar marshes. Discharges from the Hawizeh marsh enter the Tigris River system either through the Kasara or Suwayb outlets. The discharge at the Kasara outlet can be reused downstream along the Tigris River, and the discharge from the Suwayb outlet enters the East Tigris Drainage System and contributes to the minimum drainage requirements along the Shatt al-Arab. Due to the conditions of these discharges, the water consumed by the Hawizeh, Central, and Abu Zarq marshes each year is less than the volume allocated to those marshes. Some of the discharges entering these marshes are reused for other purposes.

On the other hand, the discharge from the Hammar Marsh into the Shatt al-Basra River is lost from the system. Therefore, the amount of water allocated to the Hammar Marsh is equal to the amount of water consumed by the marsh each year.


**Illustration** *90*/ **appearance72-3: Water balance in marshes under average hydraulic conditions in 2135**

#### Al-Hawizeh Marsh

The Hawizeh Marsh lies along the eastern border between Iraq and Iran and is supplied by Iraqi drainages entering the marshes along the Tigris River and by Iranian drainages entering the marshes along the Karkheh River. However, there is no agreement between Iraq and Iran regarding the drainages entering Iraq along the Karkheh River; therefore, the approximately 1.19 billion cubic meters of Iranian discharge are not considered part of the water allocated to the Hawizeh Marsh in the current analysis. The marsh areas are separated by the international border between Iraq and Iran, with approximately 80% of the marshlands in Iraq and approximately 20% in Iran. Iran has constructed a dam (barrier) with several canals that divide the eastern and western parts of the marshlands near the border.

A total of 137,700 hectares of this marsh within Iraq has been designated as Ramsar Site No. 0.08.[96]Due to the deterioration of the marsh, it was added to the Montreux Register as of April 4, 2011. As a party to the Ramsar Convention, Iraq is urged to take immediate action to address this deterioration and prevent its future occurrence. The proposed Marshlands Conservation Strategy should assist the Government of Iraq in addressing the restoration needs of the Hawizeh Marsh.

As part of the SWLRI strategy, approximately 0.424 tons of fresh water from the billion cubic meters of water
Tigris River will be consumed by the Hawizeh Marsh annually by 2020. 2035. For better management
Regarding water quality issues in the marshes, a barrier extending from east to west was constructed by Iraq as part of a comprehensive marsh restoration effort to divide the marsh areas into a northern and southern zone. The northern zone within the marsh has better water quality than the southern zone, and the continued existence of this barrier will help separate the upper and lower water quality zones of the marsh, improving ecosystem health and enabling better management of water quality at the marsh's outlet.

One outlet of the Hawizeh Marsh is currently managed by the Al-Kassara Regulator, which returns water from the northern part of the marsh to the Tigris River. The second outlet is managed by the Al-Suwaib Regulator, which directs water to the East Tigris Drain. The water from the southern part of the Hawizeh Marsh is too saline for agricultural use and should therefore not be returned to the Tigris River. Ensuring that the discharges from the northern and southern marshes are managed separately is an important strategy that must be continued in the future.

Maximum salinity limits must be respected at the mouth of the Tigris River at its confluence with the Kasara River, because the Shatt al-Arab Irrigation Project draws water from the Tigris River south of the Hawizeh Marsh, and its maximum salinity tolerance is 0.411 mg/L of total dissolved solids (TDS). Therefore, discharges from the Kasara River must be carefully managed.

**Abu Zarq Marsh**

The Abu Zarq Marsh lies between the Euphrates and Gharraf rivers. It is considered part of the Middle Marsh, but since the construction of regulators on it began in 1411, it can be managed separately. However, the water in the marsh enters the Central Marsh. The water reaching this marsh is supplied by the Gharraf River, which carries water from the Tigris River via a dam in Kut. As part of the SWLRI strategy, approximately 1.08 billion cubic meters of freshwater per year from the Tigris River (via the Gharraf River) is being consumed by the Abu Zarq Marsh by 1412. The outflow is managed

96 Ramsar Convention on Wetlands. The detailed Ramsar List. Available athttp://www.ramsar.org/cda/en/ramsar-documents-list-anno-iraq/main/ramsar/1-31-218^16559_4000_0_Date of entry: March 9, 2021.

Through ferries and gates, it heads towards the Euphrates River, eventually mixing with the waters of the Central Marshes and the Hammar Marshes.

## Middle Marsh

The Middle Marsh is located southwest of the Hawizeh Marsh and between the Gharraf and Tigris rivers. Water reaching the northern side of the marsh originates from the Tigris River, and it occasionally receives discharges along its western side from the Abu Zarq Marsh and along its southern side from the Hammar Marsh. As part of the SWLRI strategy, approximately 4.448 billion cubic meters of freshwater per year from the Tigris River will be consumed by the Middle Marsh by 2014. This discharge entering the Middle Marsh will travel from the Tigris to the tail end of the Batira and Arid rivers to reach it.

A portion of the Central Marsh has been designated as the first and only national park in Iraq. The establishment of a national park in the marshes is significant because it underscores the need to continue protecting this unique ecosystem and creates an opportunity to encourage ecotourism in the region.

To improve the environmental conditions in the Middle Marsh and Al-Hammar Marsh, it was proposed to remove the barriers in the far south of the Euphrates River along the stretch of the Euphrates River that runs between the two marshes from the source of Al-Chibayish.

Removing these barriers will restore the historical (natural) conditions between the two marsh areas and support an improvement in water quality in the Hammar Marsh. In addition, it has been proposed to remove the barriers that extend across the[97]To the Euphrates River and prevent the flow of the Euphrates from reaching Al-Qurna and replace it with a regulator so that it becomes possible to completely control the exchange of water between the Middle Marsh and the Hammar Marsh, and the Euphrates River between the marshes and the Shatt al-Arab. The diagram below illustrates this situation.

97 The current barrier is located at 32°12'.42" North0 02°13'1040" East4


**Illustration24/ Figure 3-75: Schematic diagram showing the proposed conditions between the Central and Hammar Marshes to be implemented as part of this strategy.**

**Donkey's Marsh**

The Hammar Marsh is located south of the Euphrates River and north of the main estuary, west of the Shatt al-Arab. The Euphrates River supplies the marsh on its northwestern edge, while the Abu Zarq and Middle Marshes supply it along its northern edge. As part of the SWLRI strategy, approximately 4.114 billion cubic meters of freshwater is consumed by the Hammar Marsh annually, which also includes discharges from the Euphrates River, Abu Zarq and Middle Marshes. Water flowing from the Hammar Marsh reaches the Gulf via the Shatt al-Basra.

To date, the Hammar Marsh has the worst water quality of all the marshes, and due to its geographical location, it experiences the highest rates of evaporation. To help improve this situation, removing the southern bank of the Euphrates River, within the section of the river that runs between the Hammar Marsh and the central marsh above Chibayish, would improve water quality in the Hammar Marsh.

Additionally, to mitigate the high salinity concentrations in the marsh, flows to the Hammar Marsh could be supplemented with a portion of the main downstream (MOD) flow via a pumping station. We estimate that the salinity of the water in the main downstream will not negatively impact salinity in the Hammar Marsh, and it will provide Iraq with an opportunity to reuse some of its drainage water, while simultaneously increasing the water available for marsh restoration efforts. It has been noted that other portions of the main downstream discharges are proposed for reuse in the oil sector and to support green belts.

It has been proposed that the discharge from the Hammar Marsh be controlled at the Aramco causeway, where a new connection to the main outfall should be constructed to direct the water from the main outfall to the Shatt al-Basra River and ultimately to the Gulf. Alternatively, the discharge from the Hammar Marsh could be reused in the petroleum sector. The Hammar Marsh area, located east of the Aramco causeway, is proposed to be supplemented by tidal flows from the Shatt al-Arab. This could be facilitated by removing the barrier currently preventing flows from reaching the marsh at Karmat Ali Creek.

### 3.4.5**desertification**

## *2.2.2.0Facts and needs*

The consequences of land degradation and desertification are enormous, causing social, economic and environmental devastation for the communities and countries that face such damage. Iraq, due to its climate and land use, as well as environmental damage events (such as wars and the draining of the Mesopotamian Marshes), suffers from land degradation and desertification on a large scale.

While the word "desertification" suggests that this phenomenon may be associated with the movement of sand dunes or the expansion of desert areas, the process of desertification is actually related to the degradation of land in arid environments.[98]Desertification, as defined in the United Nations Convention to Combat Desertification, is a phenomenon causing “land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities,” where land degradation is “the reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rain-fed and irrigated cropland, rangeland, forest and woodland resulting from land uses or from a process or combination of processes, including processes resulting from human activities and habitation patterns.”[99].

Arid and semi-arid lands are more prone to desertification and land degradation. According to the Food and Agriculture Organization of the United Nations Country Profile for Iraq, 97% of the total area of Iraq consists of

98 National Conference on Combating Desertification and Zoe Environment Network. Desertification: A Visual Composition. Figure 0, Bresson, France. 0211

99 United Nations. National Conference to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification in Africa. September 10, 1950

Arid lands with little and irregular rainfall, more than 21% of the country is desert[100], making Iraq highly vulnerable to desertification.

**Current situation**

The Iraqi Ministry of Environment estimated in 2011 that 4.4% of the country's land area was affected by desertification, while an additional 54% was threatened by it.[101]It was also estimated that Iraq loses approximately 421 square kilometers of arable land annually due to various types of land degradation.[102]The effects of climate change as well as recurrent droughts are increasing and continuing to increase land degradation and desertification in the most vulnerable areas of Iraq.

Among Arab countries, Iraq is estimated to have the highest percentage of irrigated agricultural land that is described as suffering from desertification.[103]More than 10% of agricultural land is threatened by desertification.[104], which is closely linked to irrigation and drainage practices. Irrigating with too much or too little water relative to crop needs leads to waterlogging and salt buildup in the soil, which over time harms soil fertility and prevents successful crop growth, subsequently leading to vegetation decline and desertification. In some places, the lack of drainage infrastructure means that drainage water is returned to freshwater supplies, increasing the salinity of the water used for irrigation below. The gradual increase in salinity in irrigation water introduces more salts into the soil, promoting the expansion of desertification in irrigated lands.

Iraq's rangeland vegetation has historically been the primary food source for livestock for nomadic and non-nomadic pastoral communities who raise their herds in deserts (in the Jazira Desert, the Western Desert, and the Southern Desert) and semi-desert-steppe (in the northern highlands and parts of the Mesopotamian Plain), where soils have low agricultural potential. Overexploitation, misuse, and land degradation in Iraq have increased dramatically during the 20th century, and today more than 1% of rangeland is degraded.[105].

Iraq's forests cover only a small percentage of the country as a whole, primarily in the mountains of the north and northeast, but forest degradation also has an impact on land degradation and the expansion of desertification.

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Country profile of Iraq, 0211 FAO 100

Global Environment Outlook 1 - The Future We Want, Nairobi, 2010 UNEP 101

102 Climate change in Iraq onhttp://iq.one.un.org/documents/468/Climate%20change%20In%20Iraq%20Fact%20sheet%20-%20English.pdf

103 Arab Forum for Environment and Development, The Arab Environment: Challenges of the Future Arab Forum for Environment and Development - AFED Report8002, 8002

104Environmental Challenges in the Mediterranean 8000-8000, Chapter 9, pp. 901-939. Kluwer Academic Publishers, The Netherlands. Marquina, A. SM. (ed.): The potential impact of desertification on Turkey, Lebanon, Syria and Iraq. In Karaca, A. K. Haktanir.

105Agriculture in Iraq: Resources, Potential, Constraints, Needs, and Research Priorities. 8008, USDA-ARS, ResearchLab NCSC, Locusts AA

Between 1990 and 2008 alone, nearly 41% of Iraq's forests were destroyed.[106]In addition, the removal of vegetation and deforestation leads to the erosion of the topsoil, reducing soil fertility and increasing its contribution to desertification.

### *2.2.2.4needs*

Historically, water resource management for agriculture has been a major environmental issue in Iraq, as irrigated agriculture, rain-fed agriculture, and pastoralism have been combined with dryland farming in rangelands and drylands. These land uses have been socially and economically intertwined for thousands of years. Integrated water and land management is a key strategy for combating land degradation and desertification in Iraq. Sustainable agricultural practices emphasize best practices in irrigation and drainage and reverse desertification or the degradation of agricultural land. Without the implementation of effective measures to prevent and mitigate desertification, agricultural and livestock production in the country is certain to decline, threatening food production targets and farmers' livelihoods. In addition, efforts to strengthen forest management, rangeland management, and marshland management also increase Iraq's need to combat desertification and land degradation.

### *2.2.2.2Strategy*

The strategy for addressing land degradation and combating desertification in Iraq is based on the Drought Management and Mitigation Strategy, the Mesopotamian Marshlands Conservation and Restoration Strategy, and the Agricultural Land Management Strategy already discussed in this document. These strategies include efforts to improve the environment and natural ecosystem functions in drylands, thereby preventing land degradation and the spread of desertification. The integrated water resources management elements adopted in the current strategy balance water distribution among Iraq's various water users, including the cultivation of approximately 4.4 million hectares of land by 2024 and the flooding of 4,820 square kilometers of marshlands when at least 2 billion cubic meters of water are allocated annually to the marshes, which will significantly contribute to the overall desertification strategy.

**Agricultural land management**

The best practices set forth in the agricultural strategy focus on sustainable land management. The proposed mechanisms for conserving fertile soils and preventing erosion, salinization, and waterlogging are integral to maintaining land health and thus preventing desertification. In areas where desertification is particularly pronounced, reclamation and rehabilitation measures must be adopted to reverse degradation. Monitoring land management practices and collecting crop-related data are also essential.

106Environmental Challenges in the Mediterranean 8000-8000, Chapter 9, pp. 901-939. Kluwer Academic Publishers, The Netherlands. Marquina, A. (ed.), and the potential impact of desertification on Turkey, Lebanon, Syria and Iraq. In: Omar, A. SM., Karaca Hotel, Haktanir, K.

Agriculture supports efforts to combat desertification. Further details on measures to protect agricultural land from soil salinization are detailed in the Food Security Strategy of this document. Furthermore, methods for improving water quality in rivers through the implementation of wastewater treatment facilities are addressed in the Water Security Strategy.

**Preserving the environmental integrity of the marshes**

Mitigating desertification is one of the most important ecosystem services provided by marshlands. Waterlogging in the marshlands eliminates a source of dust that can contribute to dust storms and land degradation. The water available to support vegetation within the marshes helps protect the natural cover of the region. Therefore, efforts invested in marshland conservation have a direct benefit in controlling desertification mitigation in Iraq.

### 3.4.6**climate change**

#### *4.4.1.0facts*

Climate change is an international problem driven by the emissions and accumulation of radiatively active gases (also referred to as greenhouse gases) produced by human activities such as burning fossil fuels. Increased concentrations of these gases in the atmosphere have led to an increase in average global temperatures on land and in the oceans worldwide. The current global average annual temperature is approximately 1.2°C higher than the average temperature for the period from 1961 to 1990. The graph illustrating these changes over time is taken from the 2013 Intergovernmental Report on Climate Change.[107].

107 Intergovernmental Panel on Climate Change. Climate Change 2013: The Physical Science Basis. Working Group I. Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. International Conference on Climate Change. New York. Cambridge University Press. 2001.0213.

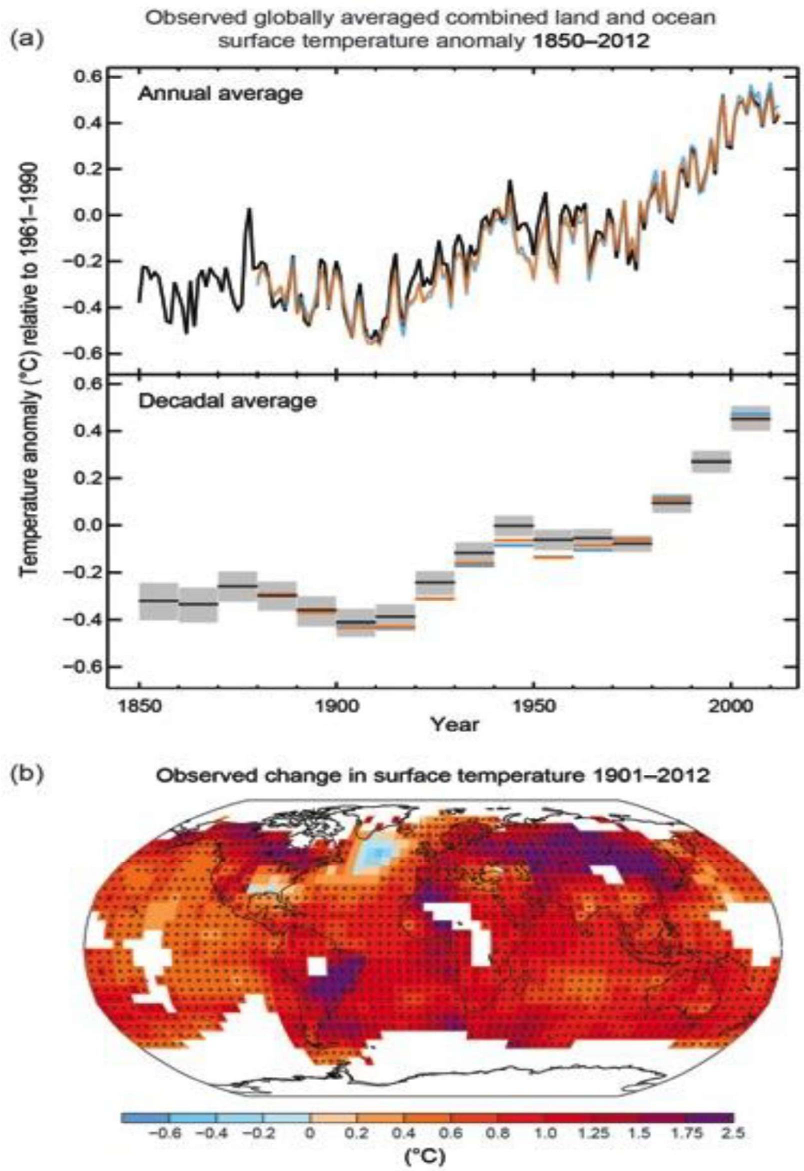


**Illustration *92*/ appearance72-3: The observed global mean annual and decadal surface temperature in the cases is oscillating from 4351-2142 and the observed surface temperature map changes from 4214 to 2142. Taken from the Intergovernmental Panel on Climate Change Climate Action Team/a report (2143)**[108]

There is scientific consensus that rising temperatures are disrupting the Earth's water balance, including changes in the intensity and frequency of floods and droughts, glacier retreat, reduced snowpack, and sea level rise. These and other changes are expected to occur unevenly across the globe, meaning that different regions will be affected differently. The precise extent and severity of the changes are difficult to predict with certainty.

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[108] Image prepared for the first report of the Intergovernmental Panel on Climate Change Working Group. Reproduction of this image is subject to permission. Free and without prior official permission. The image is available on the website: /http://www.ipcc.ch/report/ar5/wg1

Absolutely, but it is seen as wise for governments and individuals to take action to reduce greenhouse gas emissions and identify strategies to mitigate the effects of climate change.

Reducing greenhouse gas emissions can be achieved through direct and indirect means. Industrial activities, transportation, construction, manufacturing, and other processes that rely on fuels (such as oil, gas, and coal) contribute to greenhouse gas emissions. Therefore, finding ways to reduce fuel consumption by gaining efficiency or identifying alternative fuel sources can reduce emissions. Another way to manage emissions is by preserving and expanding plants, which absorb carbon dioxide as part of photosynthesis, thus offsetting or balancing the expansion of emissions.

## Implications for Iraq

The latest report, published in 2014 by the Intergovernmental Panel on Climate Change, compares four different greenhouse gas emission scenarios and addresses four different conditions for increases in atmospheric radiative forcing. Higher greenhouse gas emissions mean greater radiative forcing, resulting in warmer land and ocean temperatures. One scenario assessed low greenhouse gas emissions, two scenarios assessed stable alternative emission levels, and the fourth scenario assessed high emissions.

Under a lower-emissions scenario, Iraq could expect an increase in average temperatures over the next 41 years of 1 to 4°C during summer and winter compared to the average temperatures during those seasons recorded between 1981 and 1992. Rainfall patterns could also change under the above scenario, ranging from a 1% decrease to a 20% increase, compared to the period between 1981 and 1992. As expected, low-emissions scenarios project more moderate changes in warming and rainfall patterns, while high-emissions scenarios project more severe warming and changes in rainfall patterns. Since much of Iraq already experiences arid or semi-arid conditions characterized by limited water availability, and its population is also expected to grow rapidly, the effects of climate change could place further pressure on the country's water situation.

Specific impacts that Iraq is expected to face include:

0- Changes in the severity and frequency of droughts and
floods. 4- Increases in temperature.
4- Increase in water requirements for crops due to high temperatures.

4- The increase in the water level along the Gulf coast and its spread upwards.

Length of coastal waterways.

## 2- Water shortage due to low rainfall.

This strategy estimates that, over the next 41 years, if there is a one degree Celsius increase in temperature and a 1% decrease in rainfall,[109]This would result in a further 41.4% reduction in available freshwater. To put this in perspective, such a reduction would cause a 44% decrease in the amount of water available for agriculture, a 1.0% decrease in the amount of freshwater reaching the marshes, and a 44.1% decrease in the amount of water reaching the Shatt al-Arab. Under these conditions, the area irrigated by surface water would decrease by 44.8% (from 14.04 million dunams to 848.0 million dunams). More details are provided in Table 4-4.

Ultimately, the impact of climate change was not included in the central scenario chosen by this strategy for planning purposes. This choice, though controversial, was based on the fact that the strategy made several conservative assumptions on several other variables that would significantly impact the amount of water supplied to Iraq. Essentially, the assumption that Iraq's upstream countries would develop 0.11% of their potential projects would have a far greater impact on the amount of water Iraq would receive over the next 41 years, even under the worst-case climate change models. The worst has already been planned for, so introducing climate change considerations is unnecessary.

**table*28*/22-3: Changes in freshwater availability to Iraq by 2135 with or without climate change contribution.**

| % Change | Water Available to Iraq if Climate Change IS accounted | Water Available to Iraq if Climate Change IS NOT accounted | |
|---|---|---|---|
| **18.2%** | **23,305** | **28,487** | Fresh Water from Riparian Countries |
| 8.4% | 9.159 | 9.999 | Euphrates |
| 27.8% | 7,089 | 9.822 | Tigris |
| 14.6% | 2.815 | 3.294 | Greater Zab |
| 11.8% | 1.925 | 2,182 | Lesser Zab |
| 27.3% | 2,318 | 3,189 | Diyala |
| **24.0%** | **16,665** | **21,919** | Fresh Water Generated Inside Iraq |
| 32.2% | 0.761 | 1.123 | Euphrates |
| 22.3% | 3,939 | 5,073 | Tigris |
| 24.2% | 5.659 | 7,462 | Greater Zab |
| 24.0% | 3,457 | 4,551 | Lesser Zab |
| 25.2% | 0.715 | 0.956 | Adhaim |
| 26.4% | 1.315 | 1.788 | Diyala |
| 15.5% | 0.818 | 0.967 | Tharthar |

[109]This figure is consistent with the IPCC Working Group I report.

| % Change | Water Available to Iraq if Climate Change IS accounted | Water Available to Iraq if Climate Change IS NOT accounted | |
|---|---|---|---|
| 16.5% | 3,405 | 4,076 | Return flow to the Rivers |
| 20.4% | 43,375 | 54,482 | Total Surface Water |

**FRESH SURFACE WATER CONSUMPTION [BCM/Year]**

| % Change | Fresh Surface Water Consumption if Climate Change IS accounted | Fresh Surface Water Consumption if Climate Change IS NOT accounted | |
|---|---|---|---|
| 0.0% | 7,504 | 7,504 | Municipal & Industrial |
| 24.9% | 24,185 | 32,187 | Agriculture |
| 0.0% | 0.329 | 0.329 | Fish Farms and Livestock |
| 19.6% | 4.685 | 5.825 | Total Marshlands Consumption |
| 32.6% | 2.285 | 3,391 | Flow to the Gulf via the Shatt Al Arab River |
| 0.0% | 0.959 | 0.959 | Evaporation from Rivers |
| 20.0% | 3,427 | 4,287 | Evaporation from reservoirs |
| 20.4% | 43,375 | 54,482 | Total Freshwater Consumption |

| % Change | Climate Change IS accounted | Climate Change IS NOT accounted | |
|---|---|---|---|
| 22.8% | 9.848 | 12,763 | Irrigated land [Million Du] |

### 2.2.4.4needs

There are many uncertainties regarding the impacts of climate change. To document conditions and be able to make judgments about trends that can shed light on long-term impacts, data collection and monitoring of meteorological, hydrological, and coastal conditions are crucial. In many respects, the threats related to climate change are no different from those that challenge the overall development and growth of Iraq's economy, such as controlling water demand, identifying innovative ways to increase water supplies, and managing environmental and hydrological risks.

### 2.2.4.2Strategy

The water and land resource management strategies proposed in the SWLRI strategy address multiple development needs and uncertainties about the future. As this plan is multidisciplinary and integrated across all water use sectors in Iraq, many of the different components of the strategy are designed to be flexible to accommodate uncertainties, including those related to climate change and other factors. Furthermore, strategies for extreme weather events, such as drought and flooding, and their associated infrastructure also serve as adaptation measures to the impacts of climate change. Below is a description of the key strategies that will enable Iraq to mitigate and manage climate change.

**The role of SWLRI digital tools in supporting climate change adaptation**

The digital tools developed for the SWLRI project, particularly the planning model and the 1000-year hydrological time series, were explicitly created to develop a robust plan for Iraq's future in light of the country's changing hydrological conditions. The 1000-year hydrological time series was used to assess several alternative hydrological events that Iraq could face in the future, including extreme floods and droughts due to either climate change or natural variability. Using these tools, new cropping patterns were selected and other water-use efficiencies were proposed for implementation in Iraq as part of this strategy to ensure that the country is well-positioned to cope with future conditions of reduced water availability that may be exacerbated by climate change. Therefore, the ongoing maintenance of the SWLRI datasets, along with periodic model updates and a five-year strategy update, is essential to support Iraq's need to develop adaptation measures to respond to potential future climate change impacts.

**Data collection**

Good data will help Iraq monitor conditions and identify trends related to climate change. Expanding current data collection efforts, including water quantity, water quality, meteorological, ecological, and agricultural data, will help better understand conditions within the country. Continued assessment and interpretation of this data, particularly comparing current conditions with historical conditions, will also support early detection of trends in water availability and potential impacts of climate change.

**Preservation and continuous support of the Mesopotamian marshes**

Restoring the Mesopotamian marshes will serve two purposes related to Iraq's climate change mitigation strategy. First, the expansion of marsh areas coincides with the expansion of wetland vegetation, which will act as an important "sink" for absorbing carbon dioxide from the atmosphere, offsetting a portion of Iraq's greenhouse gas emissions. Second, the marsh pond areas help improve local climatic conditions in the marshes and prevent desertification in nearby areas.

## *2.2.4.2Flood risks*

Strong flood risk mitigation strategies protect Iraq from future climate change-related flooding. Real-time monitoring of rainfall and runoff conditions, reservoir management to accommodate flood loads, and maintenance of flood control infrastructure are integral parts of the strategy to protect Iraq from current and future flood damage. The current strategy sets standards that enable the operation of Iraq's key flood control infrastructure to mitigate floods with 500-year return periods.

#### Drought management

Implementing the drought management strategies outlined in this document also supports Iraq's needs under potential climate change conditions. Since the Drought Management Authority in Iraq provides monthly water supply guidelines and guides approved agricultural practices prior to each summer planting season, strong guidance will be in place for how water is allocated during potential droughts, whether or not they are the result of climate change. Consistent data collection will support the process of revising drought management strategies as needed for future situations.

In addition, the strategy's proposed dynamic drought management policy supports efforts to adapt reservoir operations, which can be adjusted monthly based on water availability and demand forecasts. This creates a highly flexible plan that can serve Iraq's needs during droughts and is prepared for the impacts of climate change.

### Dust storm mitigation

As a result of rising temperatures and land degradation, the frequency and intensity of dust storms are expected to increase. Potential increases in temperature and higher evaporation rates that could result from climate change could exacerbate land degradation, contributing to a further increase in dust storms. Land management principles to combat desertification and protect the health of agricultural land (detailed in the food security strategy presented in this document), as well as the construction of proposed green belts, are all elements that would assist Iraq's efforts to mitigate the effects of dust storms.

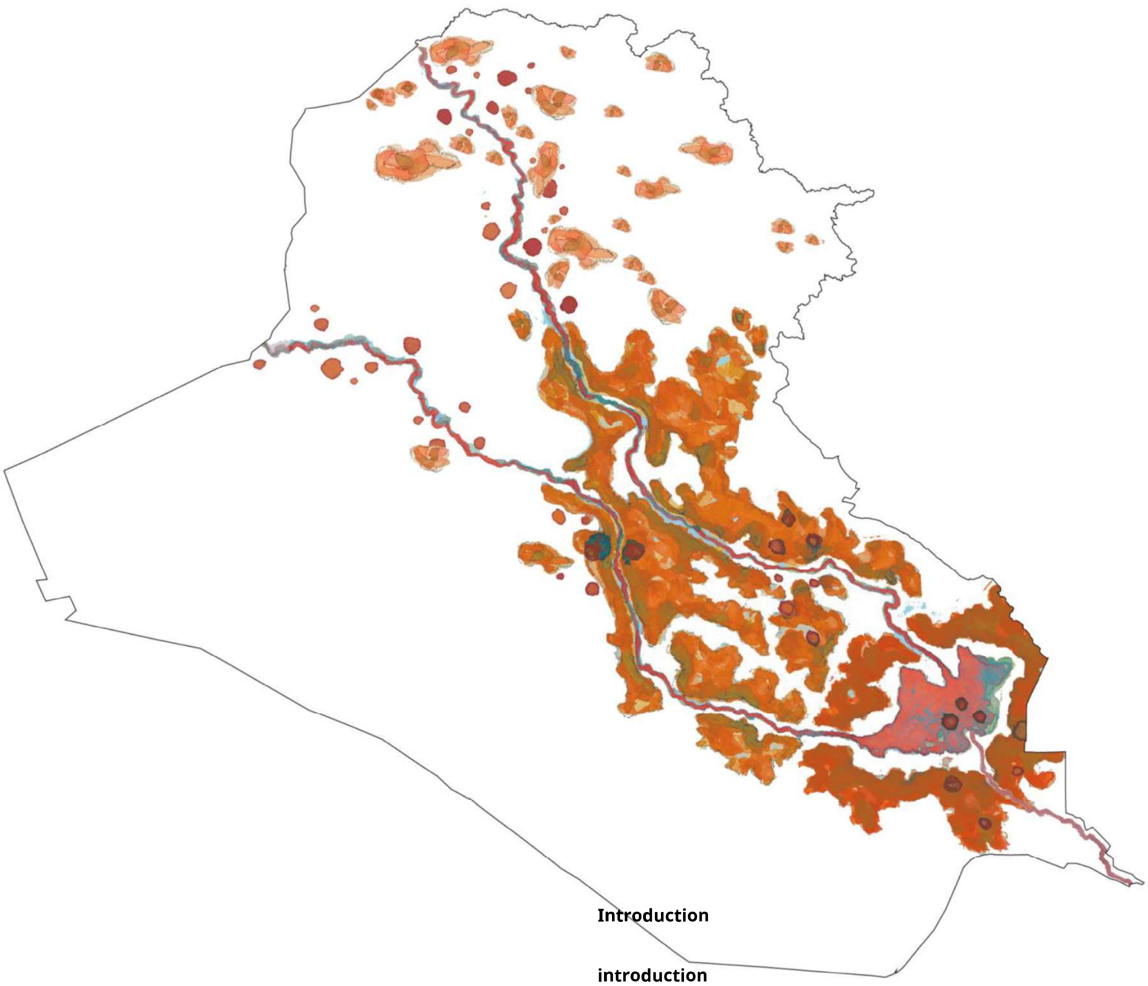
#### Communication and cooperation with neighboring coastal countries

The uncertainty of climate change may bring emphasis on the importance of Iraq making efforts to improve communication and cooperation with its upstream neighbors. Sharing information and developing plans, as well as sharing information on reservoir management and natural hazards (such as droughts and floods), will allow Iraq to be more informed about the plans and actions its neighbors may take to adapt.

With changing climate conditions, Iraq and its riparian neighbors can benefit greatly by taking a regional approach to managing and adapting to future climate change.

# Part Four

## Implementation and investment strategies



**Introduction**

**introduction**

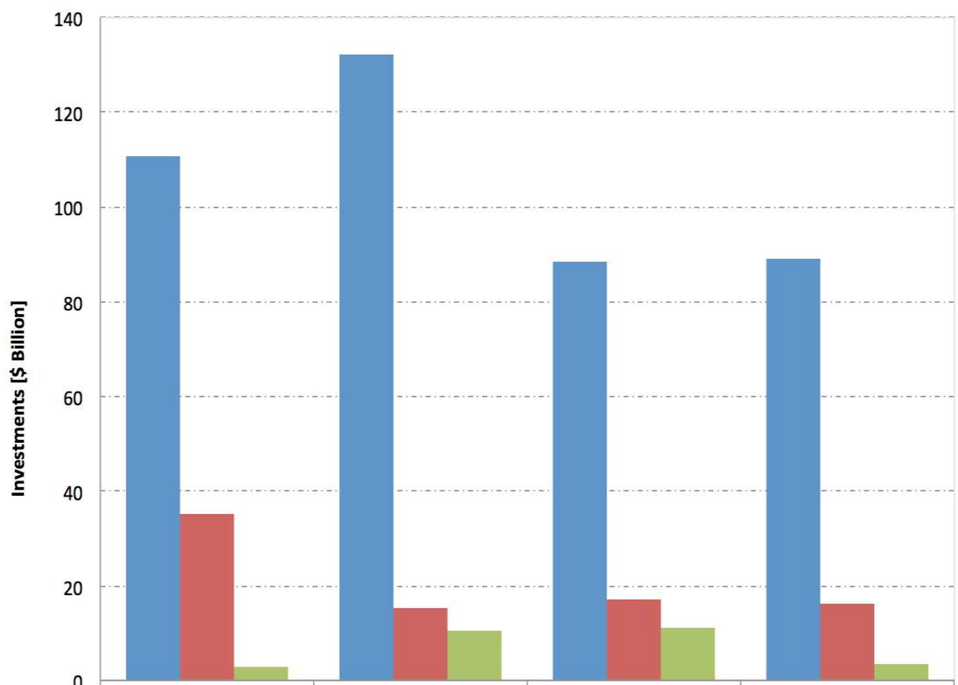
## Investment strategy by sector

# 4 Part Four: Implementation and Investment Strategies

## 2.0 Introduction

Iraq is estimated to have the fifth-largest oil reserves and the thirteenth-largest gas reserves in the world, as well as significant potential for further discoveries. These resources, if properly utilized, could fuel the country's social and economic development.

Energy is the cornerstone of the Iraqi economy, with oil exports accounting for 95% of government revenues and over 1% of its GDP in 2010. The speed of post-conflict redevelopment in Iraq depends largely on the oil sector, the speed and scale of production and exports, and the effective management of revenues. As of 2014, Iraq was producing over 4 million barrels per day and was the world's third-largest oil exporter. Even conservative forecasts regarding future oil production have a profound impact on the Iraqi economy.




| | 2012-15 | 2016-20 | 2021-25 | 2026-30 |
|---|---|---|---|---|
| Ministry of Oil | 110.7 | 132 | 88.4 | 89 |
| Minsitry of Electricity | 35.2 | 15.3 | 17.3 | 16.4 |
| Ministry of Industy | 2.9 | 10.4 | 11 | 3.5 |

**Illustration23/ Figure 24: Expected distribution of required investments in the energy sector between 2131 and 2142 (*INES,2013*)**

While oil revenues dominate, the sector contributes less than 4% of total employment. Although many jobs are created indirectly (through suppliers, service companies, etc.), the major impact of oil on the broader labor market is through revenues that enable Iraq to maintain one of the largest public sectors in the world relative to its population. The primary reliance on the success of the oil sector makes the economy highly dependent on, and thus susceptible to, global oil market conditions. Sound management of national finances, coupled with diversified growth, is essential to mitigate these risks. In this regard, the majority of the government budget is currently devoted to developing the oil sector. The Integrated National Energy Strategy[110]
It is estimated that $141 billion ($241 billion in capital costs and $1.0 billion in operating expenses) will be spent between 2014 and 2017. Approximately 60% of these costs are concentrated between now and 2017 (INES).

This distribution means that the Iraqi government's ability to invest in the water sector will be limited over the next few years until profits from the oil sector bear fruit. Between 2012 and 2030, the revenues generated from these expenditures are estimated to reach nearly $1 trillion. Taking this into account will require the preparation of major capital investment plans for the period after 2010.

Maintaining current levels of energy production, Iraq's GDP in 2014 will be five times higher (in real terms) than it is today. However, even if this is achieved, these revenues come with significant risks. They represent a very large proportion of Iraq's national wealth, equivalent to about two-thirds of GDP. This figure has been reduced over the forecast period, but the Iraqi government's export revenue share is expected to remain above 21%, significantly higher than other major oil-exporting countries' GDP figures. With a large and growing population, Iraq needs to develop a self-sufficient and productive economy without relying on the oil sector, a task that could be complicated by the magnitude of these oil revenues.

### 2.4 Introduction

The investment strategy in the water sector is in line with the proposals made for institutional and legal reform in the Master Plan, which can be divided into four main areas: (a) the agricultural sector (irrigation and drainage), including a number of necessary irrigation facilities such as main canals, pumps and dams. (b) multi-purpose dams and hydroelectric dams. (c) municipal and industrial water facilities (treatment plants, pumps

[110] The Integrated National Energy Strategy for Iraq (2012-2030), a report describing the current situation in the country and future prospects For the energy sector

(Reservoirs, distribution networks). (c) Non-infrastructure investments such as capacity building, development of new institutions, research and development, etc.

All of this goes hand in hand with the common operating, maintenance and replacement expenses to keep the infrastructure efficient and continually fit for the relevant service needs.

Priority should be given to the main investments, which are:

- Rehabilitation of Mosul Dam.
- Rehabilitation of the irrigation canal linking the Tigris and Euphrates rivers.
- Expansion of the Samarra Dam and the flood escape canal on the Tigris River.
- Completion of the main drainage network in Iraq.

The comprehensive investment strategy is built around a single central scenario, which assumes that the development of the Type 2 agricultural system will be achieved everywhere, that overall irrigation efficiency will improve to 60%, and that a cropping intensity of 115% will be targeted. This scenario also assumes that the marshes will be replenished with an average of 2.842 billion cubic meters annually, and that no new major dams will be built in Iraq.

The strategy's investments and objectives are then achieved consistently over the next two decades. Low and high scenarios were also considered to assess whether Iraq's socioeconomic impacts are progressing or lagging behind the objectives set by the strategy. This means that Iraq would be able to implement agriculture under Type 0 (low scenario) or Type 4 (high scenario). A sensitivity analysis was also conducted of what would happen if land in the central scenario were distributed according to classification alone (and not based on the principle of equitable distribution of funds). Further details are provided in Appendix 8.B.

The following Table 4-0 illustrates the results of the comparison between the four scenarios. The return on investment (ROI), payback period (PBP), and benefit-cost ratio (BCR) of the central scenario show better performance when compared to the same scenario, assuming that the land is developed not according to the principle of equitable distribution of funds, but rather purely according to the classification of each individual irrigation project.

**table*29*/4-2: Scenario comparison based on key economic indicators**

| BCR | PBP | ROI | Scenario |
|---|---|---|---|
| 0.88 | 29.88 | 0.76 | **FT1** |
| 1.17 | 019.0 | 1.41 | **FT2** |
| 1.16 | 18.95 | 1.38 | **FT2 ranking** |
| 1.45 | 16.00 | 2.19 | **FT3** |

## 4.4Investment strategy by sector

The funds are distributed among three main regions of Iraq, which are:

- Kurdistan Region, including the governorates of Dohuk, Erbil and Sulaymaniyah.
- The central region, including the provinces of Anbar, Babil, Baghdad, Diwaniyah, Diyala, Karbala, Kirkuk, Najaf, Nineveh, Salah al-Din and Wasit.
- The southern region, including the governorates of Basra, Maysan, Muthanna and Dhi Qar.

The principle of equitable distribution of funds was applied to divide investments equally, first, on a per capita basis between the three regions, and second, between all governorates. The ranking of each individual project is used as a factor to prioritize multiple projects within the same governorate.

In other words, if a governorate has more than one project to implement, the project with the highest ranking will be developed first.

### 4.3.1 Agriculture sector

In the strategy, priority is given to: (a) the rehabilitation and modernization of old irrigation projects (including the introduction of pressurized distribution systems and improved drainage). (b) the reclamation of new irrigated areas.

Currently, Iraq has 0.41 million hectares (2.44 million dunams) under either partially or fully developed irrigation projects. In the central scenario, the Government of Iraq's goal is to reclaim and develop an additional 0.814 million hectares (441.0 million dunams) by 2035, bringing the total to 4.44 million hectares (41.04 million dunams). Most of the land proposed for reclamation is already cultivated and irrigated, but inefficiently. Therefore, investments are needed to level the land and build a modern and efficient irrigation and drainage network. Table 4-4 below provides summary information on rehabilitation and reclamation activities in Iraq. Further details are available in the annex that follows this report.

**table*30*/2-2: Summary of rehabilitation and reclamation works for irrigation projects**

| RECLAMETION COSTS [Millions $] | Rehabilitation COSTS [Millions $] | To be developed in the Plan [th Du] | Developed until 2013 [th Du] | Governorate |
|---|---|---|---|---|
| 735 | 579 | 191 | 256 | Anbar |
| 4,070 | 1,214 | 875 | 538 | Baby |
| 1,252 | 1,759 | 277 | 738 | Baghdad |
| 1,022 | 62 | 200 | 20 | Basrah |
| 5,993 | 713 | 1,222 | 207 | Diwaniyah |
| 2,011 | 1,696 | 459 | 807 | Diyala |
| 167 | 6 | 34 | 2 | Dohuk |

| RECLAMETION COSTS [Millions $] | Rehabilitation COSTS [Millions $] | To be developed in the Plan [th Du] | Developed until 2013 [th Du] | Governorate |
|---|---|---|---|---|
| 254 | 67 | 63 | 42 | Erbil |
| 277 | 335 | 71 | 133 | Karbala |
| 395 | 1,344 | 113 | 568 | Kirkuk |
| 3,201 | 268 | 687 | 104 | Missan |
| 1,503 | 161 | 326 | 62 | Muthanna |
| 709 | 131 | 187 | 50 | Najaf |
| 2,373 | 541 | 613 | 285 | Ninawa |
| 1,994 | 975 | 517 | 466 | Salah Ad-Din |
| 224 | 23 | 56 | 14 | Sulaymaniyah |
| 2,255 | 605 | 504 | 234 | Thi-Qar |
| 4,633 | 1,996 | 1,052 | 948 | Wasit |
| **33,068** | **12,475** | **7,446** | **5,474** | **TOT** |

### 4.3.2 Rehabilitation of existing irrigation projects[111]

Over the next two decades, Iraq will rehabilitate 28,111 dunums in the north, 441,111 dunums in the south, and 4,996,000 dunums in central Iraq, bringing the total 2,4.4,111 dunums. The total cost of rehabilitation amounts to more than $4.42 billion.

The estimated average capital investment for rehabilitation and modernization of the developed projects will be $4.40/dunum, with a total investment of $4.42 billion for the 28 officially developed projects.

[111] Rehabilitation investments for the agricultural sector are also shown in the "Food Security 25" map attached to this report.

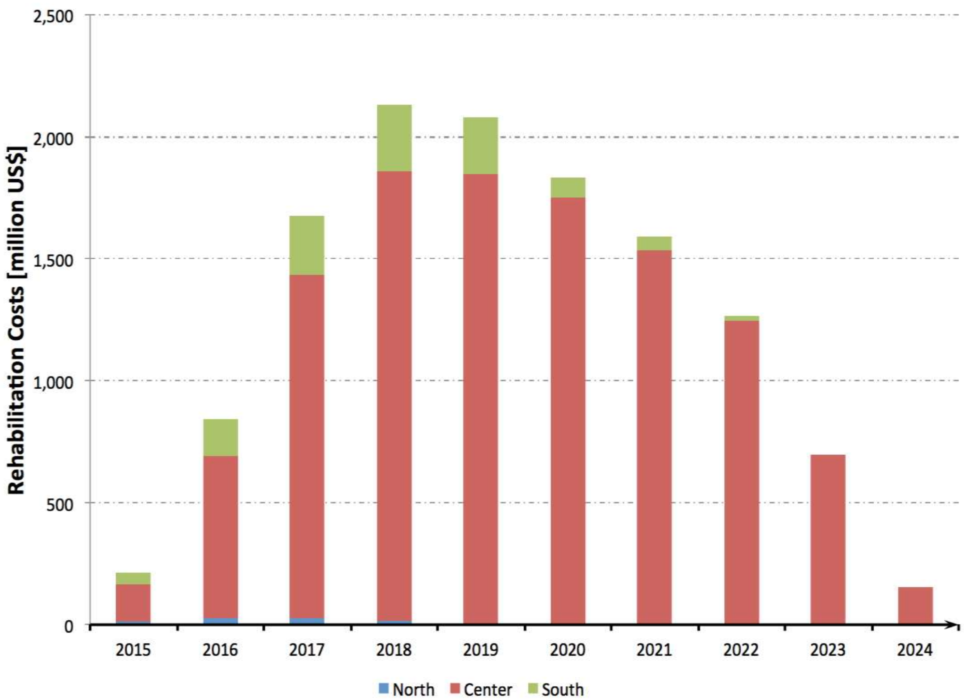



**Illustration22 / Figure 2-2: Distribution of capital costs***CAPEX***Required to rehabilitate existing irrigation projects**

A total of 4.04 km of main and subsidiary canals will be preserved in partially developed irrigation projects. In parallel, a total of 4.111 km of main and subsidiary drains will be preserved in partially developed irrigation projects.

Figure 4-4 depicts the distribution of rehabilitation expenditures over time and across the three regions of Iraq. Similarly, Figure 4-4 depicts the distribution of land use over the rehabilitation timeline and across the three regions. The vast majority of funds are requested in the central region, where most existing and legacy irrigation projects are located. Funds will be disbursed between 2010 and 2014.

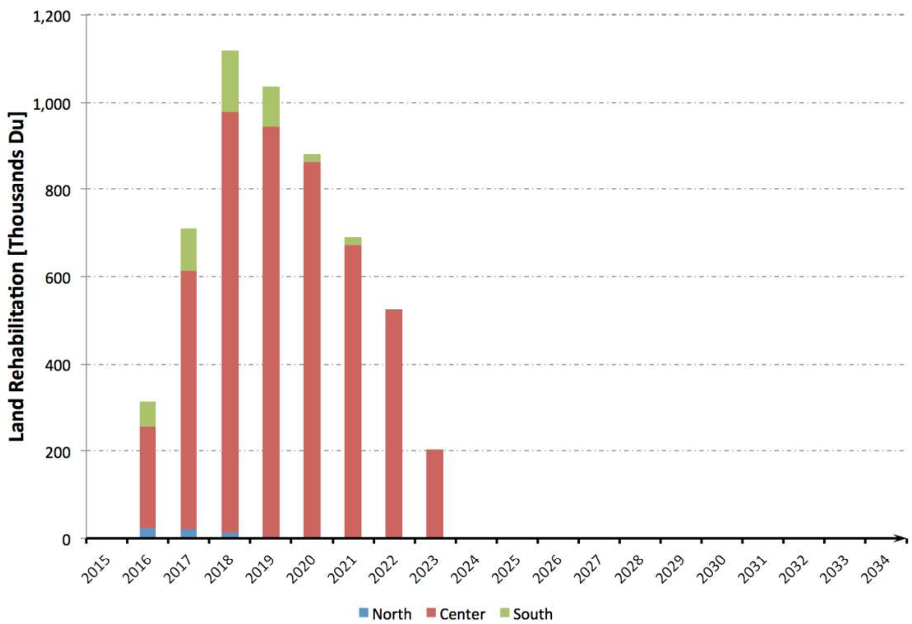



**Illustration25/ Figure 2-3: Distribution of land rehabilitation over the twenty-year implementation plan**

### 4.3.3 Reclamation of new irrigation projects[112]

In addition to rehabilitating and modernizing existing and already developed irrigation projects, by the year 0232 Iraq will reclaim 522,1,21 dunums in the south, 1,122,122 dunums in the center, and 110,122 in the north, for a total of 2,022,020 dunums. The estimated total cost For reclamation is$3,342.5 billion.

The average implementation horizon for each irrigation project depends on its size: three years if the project is smaller than02222 dunums, five years if the project is between 02222 and 122222 dunums Its size and5 years if it is larger than 122,222 dunums. These projects are larger than 122,222 The dunum will be built in phases.

The following tables describe:3-0 and 0-0 How to develop an irrigation project and the investment rate Capitalism over time depending on being greater than122,222 dunums or between 02,222 dunums and 122,222 dunums or less than 02,222 dunums. Furthermore, it is also assumed that each An irrigation project will need several years before it reaches full design irrigation efficiency and type of agriculture ( That is to say, all projects start at the type of agriculture (FT0). Current). Irrigation projects that cover an area of less than02222 dunums will realize the potential Complete in the third year. And irrigation projects that cover an area of more than02222 dunums but it

112Rehabilitation investments for the agricultural sector are also shown in the "Food Security 25" map attached to this report.

Younger than122,222 dunums will take five years to achieve the full potential of FT2 type of agriculture. And the larger projects122,222 dunums will take 5 years. Total design changes are reported. Irrigation efficiencies in the table1-0.

**table*31*/3-2: Distribution of construction phases for irrigation projects of different sizes**

| >100,000 donums | >40,000 donums | < 40,000 donum | Year |
|---|---|---|---|
| 0% | 0% | 0% | 1 |
| 15% | 34% | 60% | 2 |
| 20% | 33% | 40% | 3 |
| 20% | 33% | | 4 |
| 15% | 0% | | 5 |
| 15% | | | 6 |
| 15% | | | 7 |
| 0% | | | 8 |

**table*32*/2-2: Distribution of investments for irrigation projects of different sizes**

| >100,000 donums | >40,000 donums | < 40,000 donum | Year |
|---|---|---|---|
| 5% | 10% | 20% | 1 |
| 15% | 25% | 40% | 2 |
| 15% | 30% | 40% | 3 |
| 15% | 25% | | 4 |
| 15% | 10% | | 5 |
| 15% | | | 6 |
| 15% | | | 7 |
| 5% | | | 8 |

**table*33*/5-2: Changes in overall irrigation efficiency for irrigation projects of different sizes**

| >100,000 donums | >40,000 donums | < 40,000 donum | Year |
|---|---|---|---|
| 35% | 35% | 35% | 1 |
| 38% | 40% | 46% | 2 |
| 42% | 49% | 60% | 3 |
| 48% | 55% | | 4 |
| 52% | 60% | | 5 |
| 56% | | | 6 |
| 60% | | | 7 |
| 60% | | | 8 |

Large-scale investment in the agricultural sector begins after a year.0212, or upon expected completion For major infrastructure in the industrial/oil sector, whichever is closer.

The average capital investment for irrigation reclamation projects will be00101 US dollars/dunum And the total investment$3,342.5 billion for the 112 official projects (excluding projects Irrigation 0 3. Developed.

Reclamation of new irrigation projects begins after a year.021 and should be completed approximately by 0230.

It is expected that the largest investments will be in the central part of Iraq (see figure). 0-0) As it is expected that Iraq will invest$0.4001 billion over a 2-year period. The northern part of the country needs investment.$24.01 billion additional while the cost will be In the south$24,551 billion.

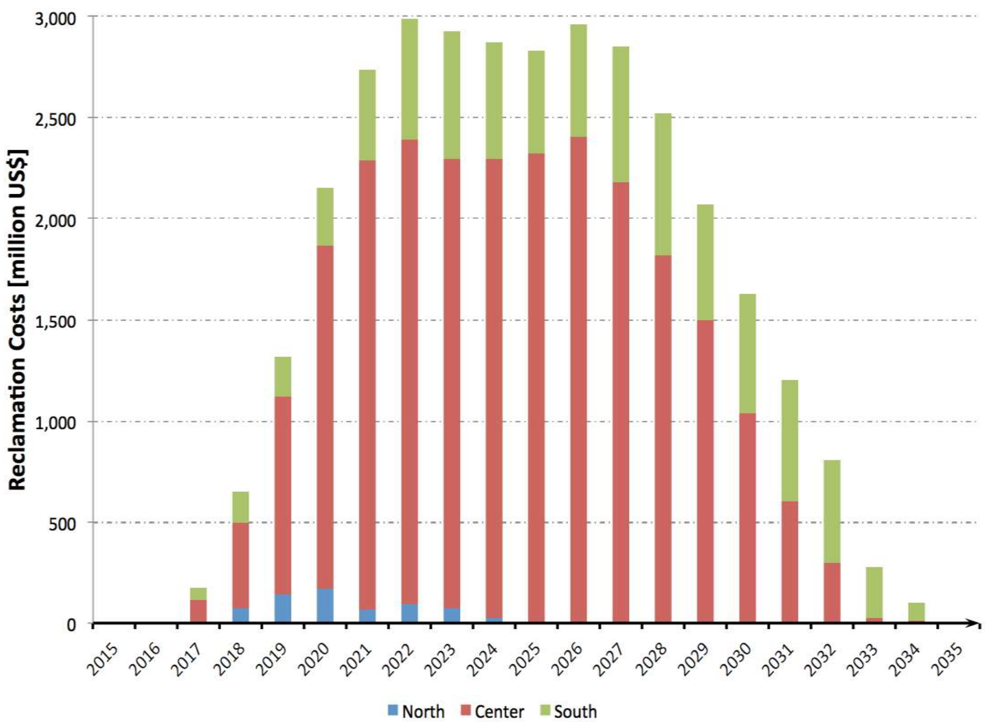


Illustration96/ shape2:2 Distribution of capital expenditures required for the reclamation of new irrigation projects

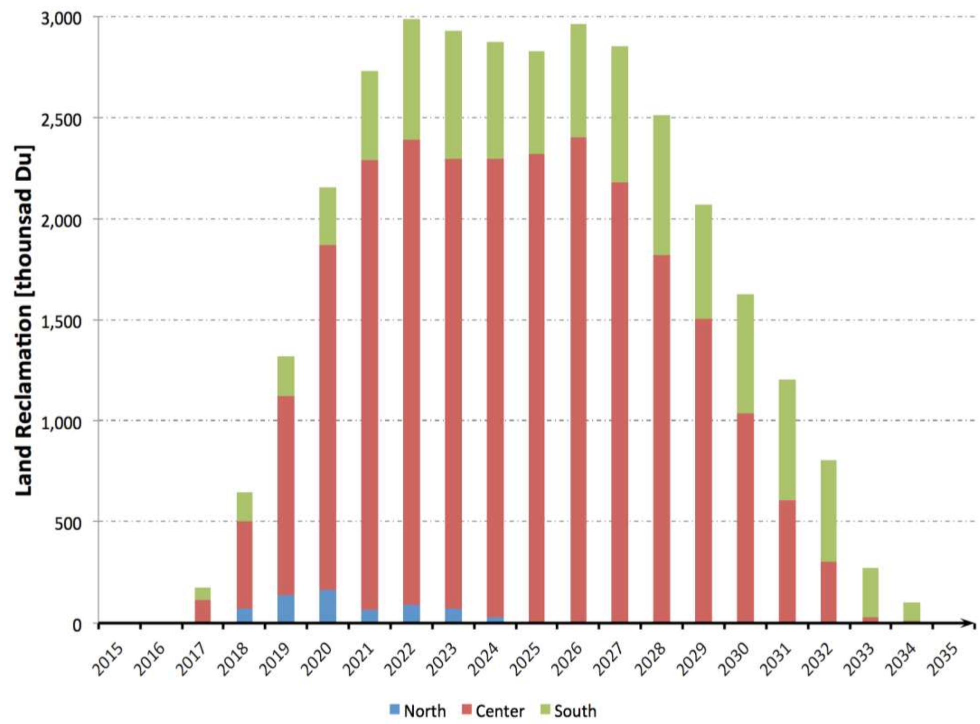



Illustration27/ Figure 2-5: Distribution of land reclamation during a 21-year implementation plan

### 4.3.4 Cost and benefit in the agricultural sector[113]

Average annual returns from the agricultural sector in the final years of the planning period, once all investments are implemented, are expected to exceed US$44 billion per year. To achieve this goal, farmers are expected to spend US$8.44 billion per year to generate a net return of approximately US$4.8 billion per year. The additional US$4.248 billion per year in operation, maintenance, and replacement costs is assumed to be covered by the government (see Figure 4-8, below).

Considering that in the fully implemented central scenario, 44.211 billion cubic meters of water will be allocated annually to agricultural production, the average net value generated per cubic meter of irrigation water in 2014 is US$1.44/cubic meter/year, and the average unit operating cost is US$1.18/cubic meter/year. Figure 4- and Figure 4-8, below, show the net value per cubic meter of water and the benefit per year for each of the three alternative scenarios.

[113]Total investments in the agricultural sector are also shown in the "Food Security - 12" map attached to this report. The maps give Total investments for each governorate separately.

Similarly, it is possible to compare how different types of agriculture will change land development, the net value of water, and the benefits associated with agriculture.

The results are that, depending on which type of agriculture is chosen, both a slow development level (associated with Type 0 agriculture), a central scenario (associated with Type 4 agriculture), and a fast development level (associated with Type 4 agriculture) are possible. Further details are also available in Appendix 8.B.

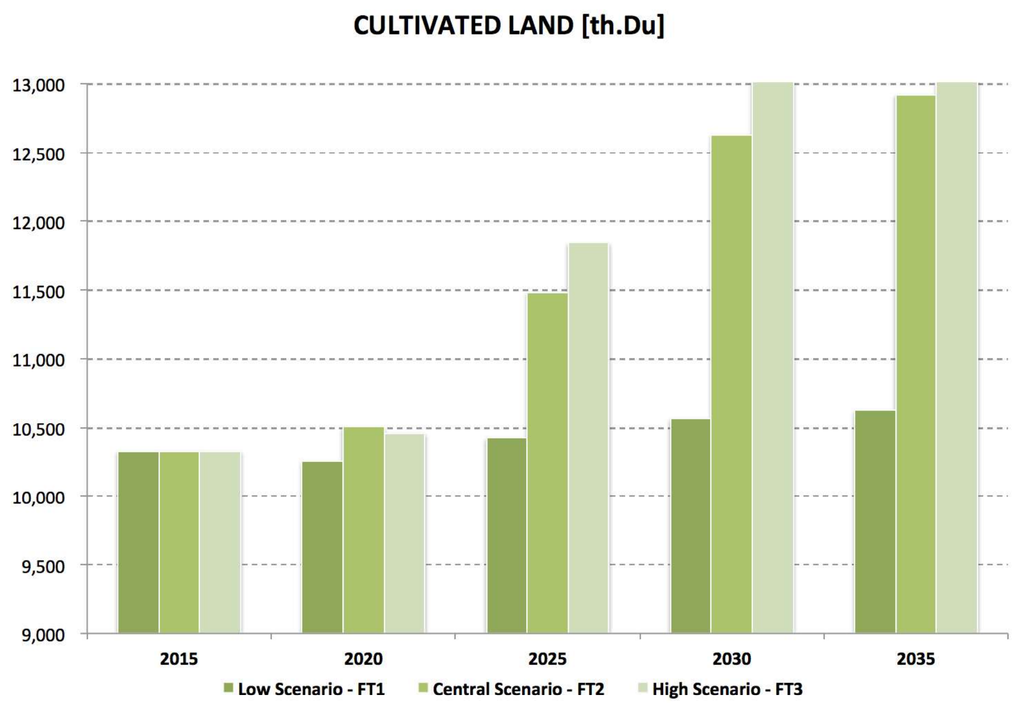



**Illustration** *98*/ **shape2-2: Comparison of the amount of developed land under different scenarios**

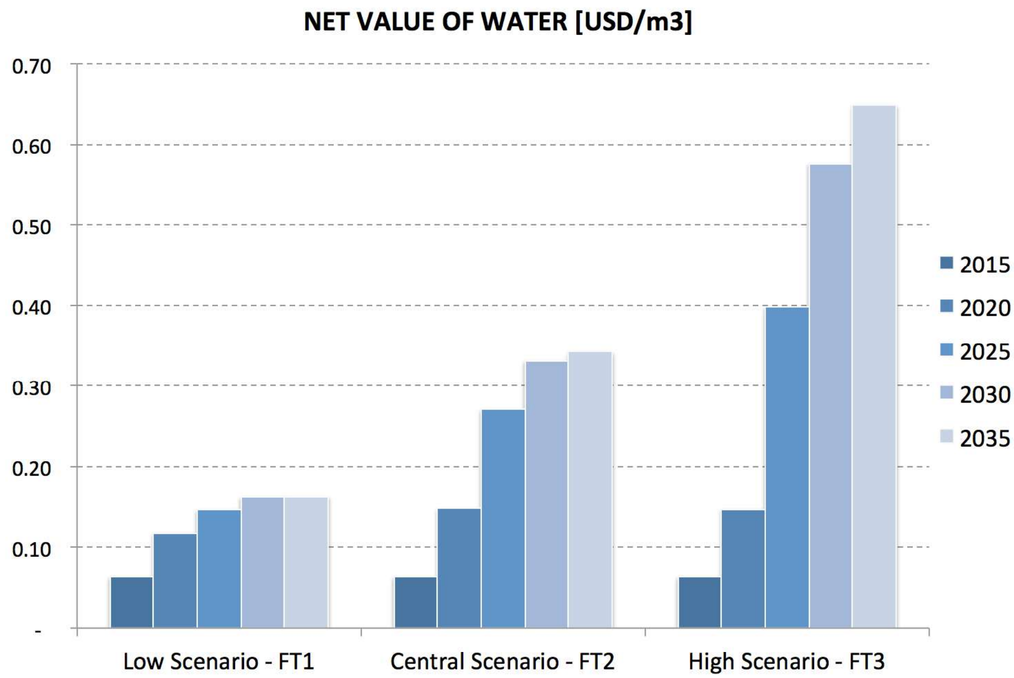



**Illustration22/ Figure 2-7: Change in net water value with different development scenarios over the next 21 years**

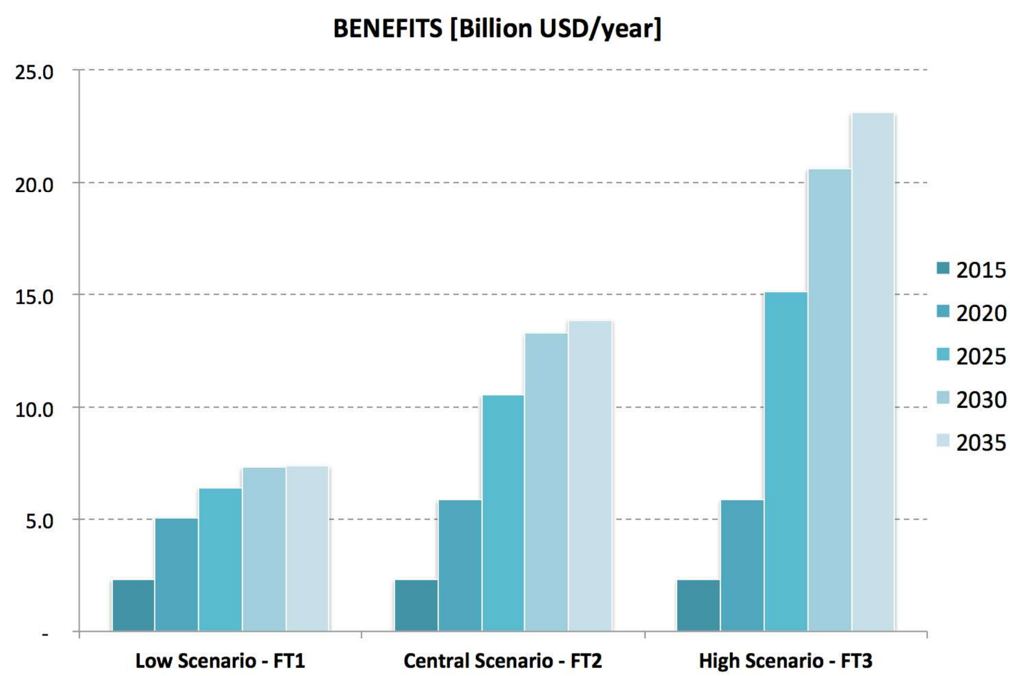



**Illustration411/Figure 2-3: Benefits associated with each development scenario over the next 21 years**

### 4.3.2 Completion of the main drainage network

Additional investments are required to complete existing main sewers and build new ones.

Completing the network of exchanges is essential to the strategy's success, and therefore all related investments are included within the first five years. The following table, Table 4-1, details these investments.

**table*34*/ Table2-2: Investment costs for completing, operating and maintaining the main drainage network (cost expressed in millions of US dollars)**

| TOTAL | 2030-2035 | 2025-2029 | 2020-2024 | 2019 | 2018 | 2017 | 2016 | 2015 | Name of drink |
|---|---|---|---|---|---|---|---|---|---|
| **295,024** | **73,756** | **73,756** | **73,756** | **14,751** | **14,751** | **14,751** | **14,751** | **14,751** | **MOD - Main Outfall Drain** |
| | 73,756 | 73,756 | 73,756 | 14,751 | 14,751 | 14,751 | 14,751 | 14,751 | Drain |
| **124,986** | **31,246** | **31,246** | **31,246** | **6,249** | **6,249** | **6,249** | **6,249** | **6,249** | **EED - Euphrates East Drain** |
| | 31,246 | 31,246 | 31,246 | 6,249 | 6,249 | 6,249 | 6,249 | 6,249 | Drain |
| **65,944** | **16,486** | **16,486** | **16,486** | **3,297** | **3,297** | **3,297** | **3,297** | **3,297** | **GGD - Greater Gharraf Drain** |
| | 16,456 | 16,456 | 16,456 | 3.291 | 3.291 | 3.291 | 3.291 | 3.291 | Drain |
| | 0.030 | 0.030 | 0.030 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | Structures |
| **215,922** | **0.000** | **0.000** | **0.000** | **53,981** | **53,981** | **53,981** | **53,981** | **0.000** | **WED - West Euphrates Drain** |
| | 0.000 | 0.000 | 0.000 | 53,981 | 53,981 | 53,981 | 53,981 | 0.000 | Drain |
| **68,091** | **8,522** | **8,522** | **8,522** | **10.632** | **10.632** | **10.632** | **10.632** | **0.000** | **ETD-C - East Tigris Drain - Central Part** |
| | 8,522 | 8,522 | 8,522 | 10,482 | 10,482 | 10,482 | 10,482 | 0.000 | Drain |
| | 0.000 | 0.000 | 0.000 | 0.150 | 0.150 | 0.150 | 0.150 | 0.000 | Structures |
| **196,441** | **11,960** | **11,960** | **11,960** | **40,140** | **40,140** | **40,140** | **40,140** | **0.000** | **ETD-S East Tigris Drain - Southern Part** |
| | 11,960 | 11,960 | 11,960 | 40,140 | 40,140 | 40,140 | 40,140 | 0.000 | Drain |
| **966.409** | **141,970** | **141,970** | **141,970** | **129,050** | **129,050** | **129,050** | **129,050** | **24,298** | **Total** |

### 4.3.6 Construction/rehabilitation of other infrastructure

Other infrastructure requiring construction and rehabilitation includes dams, regulators, irrigation and drainage pumps, and irrigation canal rehabilitation. Rehabilitation work is a priority of the strategy and is expected to be implemented within the first five years. Details are shown in the table below.

**table*35*/ Table7-2: Other construction and rehabilitation projects (US$ million)**

| Costs | Duration | Start | Project Title | ID |
|---|---|---|---|---|
| 15.38 | 20 | 2015 | Erosion Control along Shatt Al Arab River | OTH-004 |
| 340.03 | 20 | 2015 | Dredging and Sediment Removal of Main Rivers and Barrages | OTH-010 |
| 8.40 | 4 | 2015 | Remove water weeds | OTH-018 |
| 5.80 | 2 | 2015 | Channels Expansion | OTH-019 |

| | | | | |
|---|---|---|---|---|
| 71.06 | 3 | 2015 | Basrah Canals Regulation | OTH-021 |
| 500.00 | 20 | 2015 | Combat desertification | OTH-044 |
| 45.00 | 3 | 2017 | Completion of the Thartar Head Race Canal | OTH-047 |
| 150.00 | 3 | 2017 | Sweet Water Canal Repair and Maintenance | OTH-048 |
| 0.00 | 20 | 2015 | Use of Slebat Depression for Flood Control | OTH-049 |
| 5.00 | 2 | 2020 | Dyala Weir Flood Escape Construction | OTH-050 |
| 0.00 | 20 | 2015 | Utilize existing Desilting Basin at Falluja Barrage | OTH-051 |
| **1,140.67** | | | | |

## 4.3.7 Multipurpose and hydroelectric dams

The rehabilitation of Mosul Dam is a top priority for the Iraqi government, along with the expansion of the Tharthar Regulator and the Mahrab Canal, as well as the rehabilitation of the irrigation canal. This strategy does not include the countless small dams being built in the Kurdistan Region. Instead, it focuses on medium-sized dams that the Iraqi government and the Kurdistan Region plan to develop for hydropower purposes.

Within this scope, it is expected to be accomplished.5 new dams in the Kurdistan Region between 2011 and 2017 and0202. This strategy also includes the opportunity to build 10 new hydroelectric dams, Especially along the Tigris River, and within the time period between the years0232-0202.

The total investment required to build new dams is4052. billion US dollars.

**table*36*/ Table3-2: The cost of building two new dams in the Kurdistan Region**

**CONSTRUCTION OF NEW HYDROPOWER DAMS PROPOSED FOR KRG**

| Duration | Construction Costs [Million US$] | Year Proposed for Construction | DAM | ID |
|---|---|---|---|---|
| 6 | 630 | 2017 | Mandawa | DAM-014 |
| 5 | 260 | 2017 | Bakurman with Khalikan | DAM-015 |
| 5 | 287 | 2019 | Delga | DAM-017 |
| 5 | 40 | 2017 | Basarra | DAM-018 |
| 4 | 1,000 | 2018 | Taqtaq | DAM-047 |
| | 0 | 2018 | Bastora | DAM-062 |
| 6 | 354 | 2016 | Rashawa | DAM-073 |
| 5 | 114 | 2019 | Halwan | DAM-083 |
| 5 | 125 | 2018 | Deralok | DAM-087 |
| | **2,810** | | **TOTAL** | |

**table*37*/ Table2-2: The cost of building 42 new dams in Iraq**

**CONSTRUCTION OF NEW HYDROPOWER DAMS PROPOSED FOR IRAQ**

| Duration | Construction Costs [Million US$] | Year Proposed for Construction | DAM | ID |
|---|---|---|---|---|
| 4 | 219 | 2020 | Ninawa-1 | DAM-019 |
| 5 | 263 | 2024 | Khamam | DAM-021 |

| | | | | |
|---|---|---|---|---|
| 5 | 82 | 2025 | Nimrud | DAM-022 |
| 5 | 398 | 2021 | Qayyara | DAM-023 |
| 6 | 536 | 2022 | Assur | DAM-025 |
| 5 | 223 | 2025 | Abbasi | DAM-027 |
| 5 | 394 | 2022 | Tikreet-1 | DAM-029 |
| 5 | 432 | 2028 | Tikreet-2 | DAM-030 |
| 5 | 276 | 2020 | Daur | DAM-031 |
| 4 | 56 | 2020 | Samarra-1 | DAM-032 |
| 5 | 160 | 2022 | Samarra-2 | DAM-033 |
| 5 | 108 | 2021 | Sankar | DAM-038 |
| 5 | 174 | 2021 | Qarateppe-3 | DAM-042 |
| 5 | 156 | 2023 | Rawah | DAM-043 |
| | **3,477** | | **TOTAL** | |

The total investment required to rehabilitate existing dams is34.23 billion US dollars.

**table*38*/41-2: Cost of rehabilitation of existing hydroelectric dams**

**REHABILITATION OF EXISTING HYDROPOWER PLANTS**

| Duration | Rehabilitation Costs [Million US$] | Year Proposed for Rehabilitation | DAM | ID |
|---|---|---|---|---|
| 5 | 5 | 2015 | Hadith | DAM-001 |
| 5 | 10 | 2015 | Hemrin | DAM-003 |
| 5 | 3,500 | 2015 | Mosul | DAM-004 |
| 5 | 25 | 2015 | Dokan | DAM-005 |
| 5 | 100 | 2015 | Derbendekhan | DAM-006 |
| 5 | 20 | 2015 | Adhaim | DAM-007 |
| 5 | 13 | 2015 | Mosul-2 | DAM-008 |
| | **3,673** | | **TOTAL** | |

### 4.3.8 Municipalities and industries

Among the expenditures required for the municipal and industrial sectors is the construction of water and sewage facilities, with$0.431 billion and $12.425 billion, respectively, including capital investments. And operating costs.

The industrial sector will also require significant capital and operating expenditures, which are estimated at1435 billion dollars

In general, the budget of the Ministry of Municipalities and Public Works will be more than$52 billion. The table shows11-0, the following details the expected expenditures in the water sector by governorate for the two sectors: Municipalities and industries, including capital costs ((OPEX) and operating costs (CAPEX).

**table*39*/44-2: Governorate Distribution of Capital and Operating Expenditures (in billions of dollars) for Water, Wastewater, and Industries**

**During the years21 next.**

| INDUSTRIES | | SANITATION | | WATER | | |
|---|---|---|---|---|---|---|
| OPEX | CAPEX | OPEX | CAPEX | OPEX | CAPEX | GOVERNORATE |
| 0.09 | 0.17 | 0.73 | 1.02 | 0.49 | 0.30 | Dohuk |
| 0.09 | 0.17 | 1.69 | 3.39 | 1.18 | 0.87 | Ninawa |
| 0.13 | 0.26 | 1.12 | 1.55 | 0.62 | 0.44 | Erbil |
| 0.24 | 0.41 | 1.39 | 1.91 | 0.82 | 0.53 | Sulaymaniyah |
| 0.00 | 0.01 | 0.93 | 1.83 | 0.60 | 0.45 | Kirkuk |
| 0.01 | 0.02 | 0.53 | 1.09 | 0.37 | 0.32 | Salah Ad-Din |
| 0.02 | 0.04 | 0.91 | 1.80 | 0.65 | 0.46 | Anbar |
| 0.00 | 0.00 | 0.59 | 1.22 | 0.46 | 0.35 | Diyala |
| 0.03 | 0.07 | 5.30 | 10.28 | 3.09 | 2.31 | Baghdad |
| 0.01 | 0.02 | 0.60 | 1.20 | 0.44 | 0.31 | Wasit |
| 0.04 | 0.09 | 0.73 | 1.51 | 0.57 | 0.42 | Baby |
| 0.01 | 0.01 | 0.61 | 1.21 | 0.43 | 0.30 | Karbala |
| 0.01 | 0.02 | 0.60 | 1.17 | 0.40 | 0.28 | Missan |
| 0.03 | 0.05 | 0.55 | 1.12 | 0.41 | 0.30 | Diwaniyah |
| 0.00 | 0.01 | 0.79 | 1.56 | 0.53 | 0.38 | Najaf |
| 0.00 | 0.00 | 0.98 | 1.95 | 0.67 | 0.50 | Thi-Qar |
| 0.01 | 0.03 | 0.28 | 0.58 | 0.23 | 0.17 | Muthanna |
| 1.04 | 2.21 | 1.71 | 3.31 | 0.94 | 0.77 | Basrah |
| **1.77** | **3.60** | **20.05** | **37.72** | **12.89** | **9.46** | **TOTAL** |

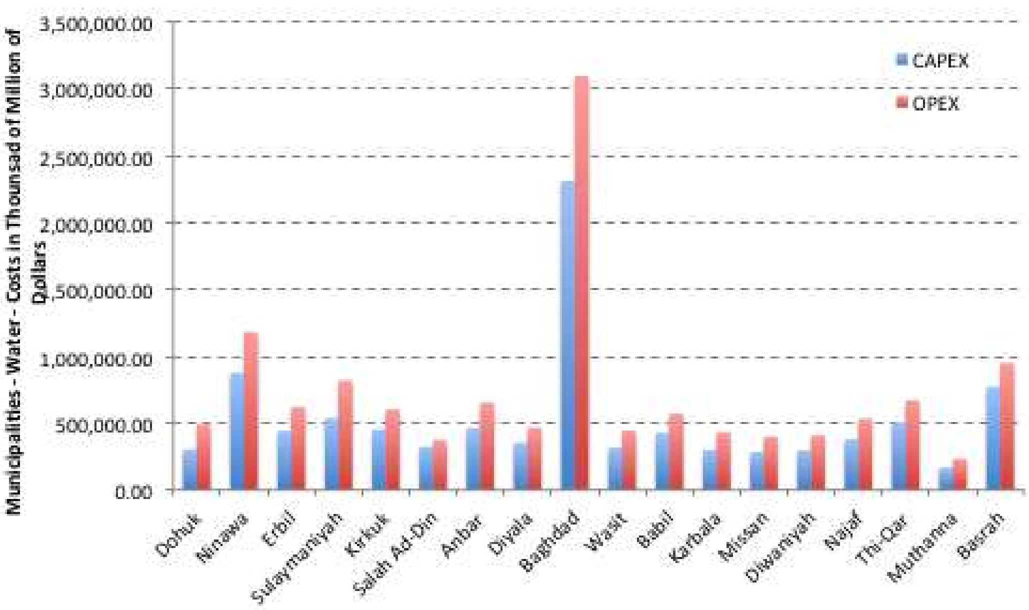



**Illustration414/ Figure 2-2: Summary of municipal and industrial investment by governorate**

**table*40*/ Table42-2: Capital expenditures + operating expenditures (US$ billion) for the municipal water sector**

| YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| - 2030 2035 | 2025-2029 | 2020-2024 | 2019 | 2018 | 2017 | 2016 | 2015 | GOVERNORATE |
| 0.27 | 0.20 | 0.18 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | Dohuk |
| 0.72 | 0.53 | 0.46 | 0.08 | 0.07 | 0.07 | 0.06 | 0.06 | Ninawa |
| 0.37 | 0.27 | 0.24 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | Erbil |

| YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| - 2030 2035 | 2025-2029 | 2020-2024 | 2019 | 2018 | 2017 | 2016 | 2015 | GOVERNORATE |
| 0.46 | 0.35 | 0.31 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 | Sulaymaniyah |
| 0.36 | 0.27 | 0.24 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | Kirkuk |
| 0.25 | 0.17 | 0.15 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | Salah Ad-Din |
| 0.39 | 0.29 | 0.25 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | Anbar |
| 0.30 | 0.21 | 0.18 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | Diyala |
| 1.80 | 1.37 | 1.25 | 0.22 | 0.21 | 0.19 | 0.18 | 0.17 | Baghdad |
| 0.26 | 0.19 | 0.17 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | Wasit |
| 0.35 | 0.25 | 0.22 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | Baby |
| 0.25 | 0.18 | 0.17 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | Karbala |
| 0.23 | 0.17 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | Missan |
| 0.25 | 0.18 | 0.16 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | Diwaniyah |
| 0.31 | 0.23 | 0.21 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | Najaf |
| 0.41 | 0.30 | 0.26 | 0.05 | 0.04 | 0.04 | 0.04 | 0.03 | Thi-Qar |
| 0.14 | 0.10 | 0.09 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | Muthanna |
| 0.60 | 0.44 | 0.38 | 0.07 | 0.06 | 0.06 | 0.05 | 0.05 | Basrah |
| **7.71** | **5.71** | **5.08** | **0.89** | **0.83** | **0.77** | **0.71** | **0.66** | **TOTAL** |

## 4.3.9 Non-structural investments

Unsurprisingly, given the level of deterioration of Iraq's infrastructure over the past two decades, the bulk of investment in the water sector is for the rehabilitation or construction of various infrastructure projects. A related, though less central, need is to develop non-structural investments. These include establishing a national database for irrigation and agricultural sector projects, establishing a national hydro-meteorological/ flood forecasting system, and advancing ministerial training and capacity building.

**table*41*/ Table43-2: Non-structural investments (million US dollars)**

| Duration | Start | Costs | Project Title | ID |
|---|---|---|---|---|
| 20 | 2015 | 40.0 | Promote Water Saving Technologies in Irrigation | OTH-001 |
| 20 | 2015 | 6.3 | Promote Development of Water User Associations | OTH-002 |
| 20 | 2015 | 400.0 | Promote Research on Water Resources Management at University Level | OTH-003 |
| 5 | 2015 | 10.0 | Development of specialized labs for soil testing and management | OTH-005 |
| 20 | 2015 | 35.0 | Support and encourage agricultural research | OTH-006 |
| 20 | 2015 | 1.0 | Develop data collection and monitoring programs for Agriculture Projects | OTH-007 |
| 1 | 2015 | 0.8 | Prepare a strategy for the Reform of Institutional and Legislation Water Sector | OTH-008 |
| 20 | 2015 | 1,000.0 | Support farmers with soft loans for reclamation projects | OTH-009 |
| 20 | 2015 | 3.5 | Promote Data and Information exchange with neighboring countries | OTH-011 |
| 20 | 2015 | 15.0 | Negotiation with Neighboring Countries on Water Quality and Quantity | OTH-012 |
| 20 | 2015 | 135.0 | Establish Drainage System Operations & Maintenance Protocols & Standards | OTH-013 |
| 3 | 2015 | 5.0 | Improve understanding of shared groundwater aquifers with neighbors countries | OTH-014 |
| 4 | 2015 | 3.5 | Training on Negotiation | OTH-015 |
| 20 | 2015 | 20.0 | Support Iraq Marshes and establish Ramsar Sites | OTH-016 |
| 20 | 2015 | 0.0 | Reclaim land to strengthen negotiation with Riparian Countries | OTH-017 |
| 4 | 2015 | 9.8 | Develop a Center for Irrigation Control | OTH-020 |
| 3 | 2015 | 5.1 | Implement Pilot Farm in Karbala | OTH-022 |
| 3 | 2015 | 3.5 | Study Impact of Saline Water Usage for Irrigation | OTH-023 |
| 20 | 2015 | 15.8 | Promote Development of Green Belts | OTH-024 |
| 2 | 2015 | 1.4 | Dam Program Project Security | OTH-025 |
| 1 | 2015 | 0.2 | Establish Dam Safety Program | OTH-026 |
| 1 | 2015 | 0.2 | Dam Program Project Documentation Implementation | OTH-027 |
| 3 | 2015 | 39.0 | Establishing a Water Control and Operations Center in Baghdad | OTH-028 |

| Duration | Start | Costs | Project Title | ID |
|---|---|---|---|---|
| 3 | 2015 | 15.8 | Establish Gauging Stations for Water | OTH-029 |
| 20 | 2015 | 20.0 | Training and Capacity Building | OTH-030 |
| 5 | 2015 | 5.0 | Seek for external assistance to improve administration capabilities at the Ministry | OTH-031 |
| 5 | 2015 | 10.0 | Investment for University Research Centers | OTH-032 |
| 3 | 2015 | 0.7 | Development of Training Center | OTH-033 |
| 3 | 2015 | 0.8 | Advance Degree Educational Program | OTH-034 |
| 20 | 2015 | 200.0 | Reforestation Programs | OTH-035 |
| 20 | 2015 | 0.0 | Support Agriculture Sector with Special Banks | OTH-036 |
| 20 | 2015 | 35.0 | Provide subsidies to farmers and Special Loans | OTH-037 |
| 5 | 2015 | 1.3 | Create special laws to protect Agriculture Sector | OTH-038 |
| 20 | 2015 | 250.0 | Increase Agricultural Extension Services | OTH-039 |
| 3 | 2015 | 0.5 | Define Policies for Agriculture Market's Prices | OTH-040 |
| 1 | 2015 | 0.0 | Activate Investment Law | OTH-041 |
| 20 | 2015 | 20.0 | Resolve Disputes over agricultural lands | OTH-042 |
| 3 | 2015 | 3.5 | Setting up protected areas for animal breeding | OTH-043 |
| 20 | 2015 | 20.0 | Creation of an Irrigation Advisory Service (IAS) | OTH-045 |
| 5 | 2015 | 0.5 | Improve operation policies of MOD by diverting water into Dalmaj Lake | OTH-046 |
| 3 | 2017 | 12.5 | Construction of submerged weir in Muthanna Governorate | OTH-052 |
| 3 | 2015 | 23.5 | Construction of cross regulators in Muthanna Governorate | OTH-053 |
| 5 | 2015 | 50.0 | Provide Assistance to the MOWR During the Implementation of the SWLRI Project | OTH-054 |
| | | **2,418.73** | **TOTAL** | |

## 1.1 Investment Summary

A summary of the investments is shown in Table 4-04 and Figure 4-01 below. Details of the basis for cost estimates are provided in Appendix 4.1.D. The selection process for prioritizing investments is described in Appendix 5.D., while full details of each investment and intervention package are provided in Appendices 1.D., 2.D., 3.D., and 4.D.

**table*42*/ Table42-2: Investment Summary (US$ Million)**

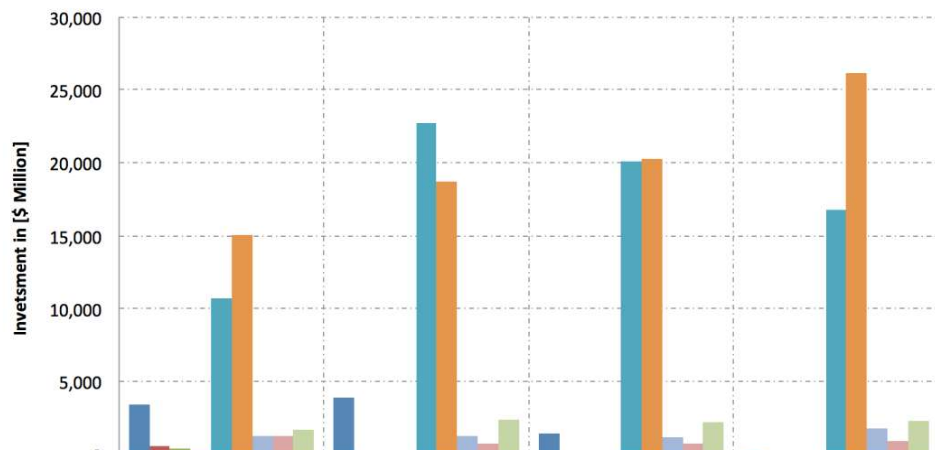
| | | | | YEAR | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TOTAL | 2030-2035 | 2025-2029 | 2020-2024 | 2019 | 2018 | 2017 | 2016 | 2015 | |
| **10,097,202** | 259,402 | 1,438,195 | 3,336,871 | 1,323,328 | 1,243,065 | 968,143 | 793,599 | 734,600 | **Dams** |
| 6,424,202 | 259,402 | 1,438,195 | 3,336,871 | 588,728 | 508,465 | 233,543 | 58,999 | 0.000 | New Construction |
| 3,673,000 | 0.000 | 0.000 | 0.000 | 734,600 | 734,600 | 734,600 | 734,600 | 734,600 | Rehabilitation |
| **587,888** | 0.000 | 0.000 | 0.000 | 56,000 | 87,500 | 147,796 | 148,296 | 148,296 | **Barrages** |
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | New Construction |
| 587,888 | 0.000 | 0.000 | 0.000 | 56,000 | 87,500 | 147,796 | 148,296 | 148,296 | Rehabilitation |
| **397,700** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 126,667 | 134,992 | 136,042 | **Regulators** |
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | New Construction |
| 397,700 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 126,667 | 134,992 | 136,042 | Rehabilitation |
| **966.409** | 141,970 | 141,970 | 141,970 | 129,050 | 129,050 | 129,050 | 129,050 | 24,298 | **Main Drains and Canals** |
| 539,778 | 30,192 | 30,192 | 30,192 | 110,791 | 110,791 | 110,791 | 110,791 | 6,038 | Capex |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 426,631 | 111,778 | 111,778 | 111,778 | 18,259 | 18,259 | 18,259 | 18,259 | 18,259 | Opex |
| **65,887,580** | 12,060.322 | 20,102.586 | 23,742.406 | 3,843.764 | 3,065.096 | 1,978.653 | | 882.223 | 212,529 | **Irrigation Projects** |
| 33,068,275 | 4,010,223 | 13,236,765 | 13,680,773 | 1,318,106 | 648,987 | 172,150 | 1.271 | 0.000 | Reclamation |
| 12,475,155 | 0.000 | 0.000 | 5,535.406 | 2,076,829 | 2,131,664 | 1,677,254 | 841,472 | 212,529 | Rehabilitation |
| 20,344,150 | 8,050,099 | 6,865,821 | 4,526,227 | 448,829 | 284,445 | 129,250 | 39,480 | 0.000 | Opex |
| **80,121,592** | 26,106,961 | 20,278,595 | 18,702,507 | 3,323,334 | 3,156,496 | 2,997,960 | 2,848,262 | 2,707,477 | **Municipalities** |
| 10,097,437 | 2,701,449 | 2,893,572 | 2,251,208 | 450,242 | 450,242 | 450,242 | 450,242 | 450,242 | Water |
| 37,722,259 | 10,777,788 | 8,981,490 | 8,981,490 | 1,796.298 | 1,796.298 | 1,796.298 | 1,796.298 | 1,796.298 | Sanitation |
| 32,301,896 | 12,627,724 | 8,403,533 | 7,469,809 | 1,076,794 | 909,957 | 751,421 | 601,722 | 460,937 | Opex |
| **5,377,696** | 1,732,072 | 1,196,793 | 1,243,355 | 305,771 | 271,893 | 239,349 | 208,633 | 179,830 | **Industries** |
| **3,559.401** | 767,992 | 767,992 | 767,992 | 168,948 | 174,364 | 299,597 | 305,705 | 306,811 | **Other investments** |

**TOTAL INVESTMENT 4,449.883 5,450.760 6,887.214 8,127.463 9,150.195 47,935.101 43,926.131 41,068.720 166,995.467**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **8,349,773** | **2,053,436** | **2,196,307** | **2,396,755** | **457,510** | **406,373** | **344,361** | **272,538** | **222,494** | **Design and Survey Costs** |

**TOTAL INVESTMENTS 4,672.377 5,723.298 7,231.575 8,533.836 9,607.705 50,331.856 46,122.438 43,122.156 175,345.241**

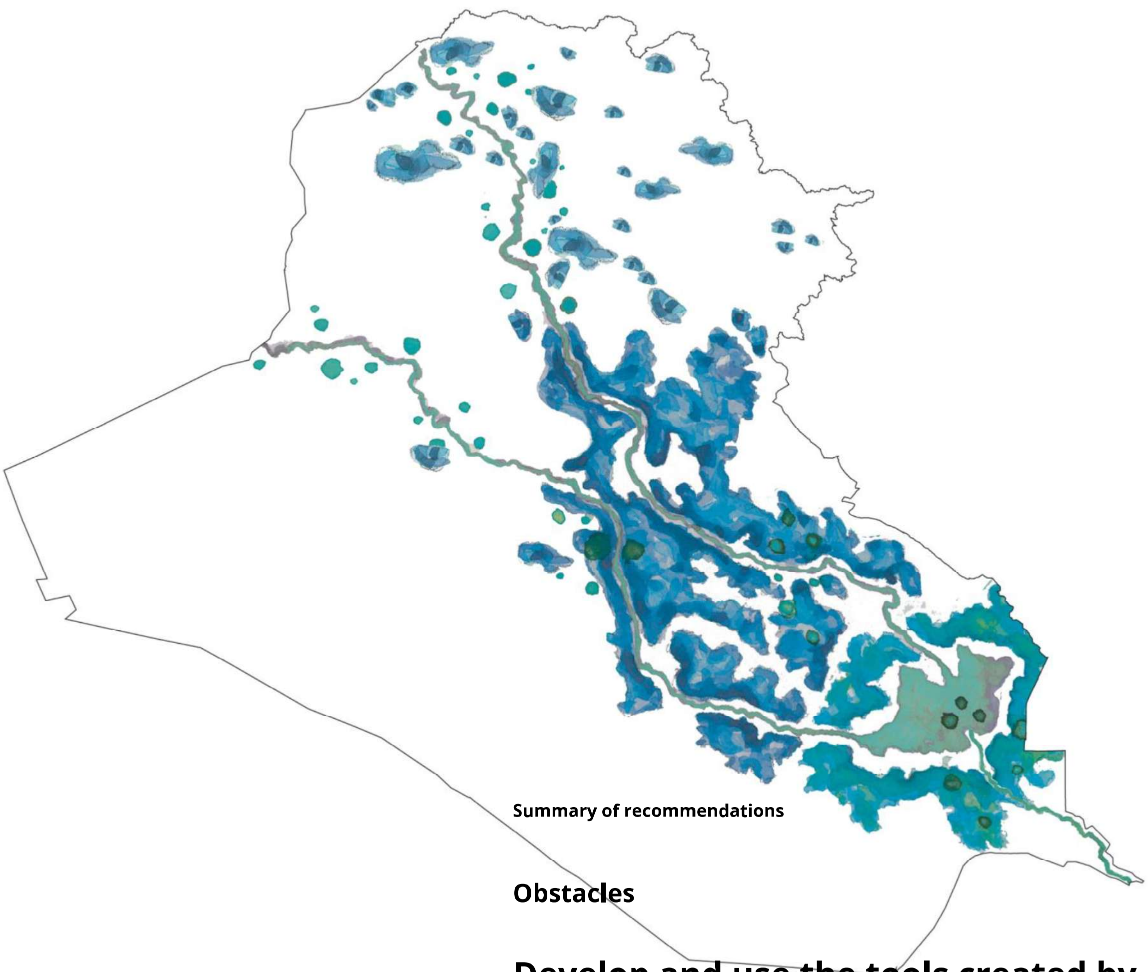



| | 2015-2019 | 2020-2024 | 2025-2029 | 2030-2034 |
|---|---|---|---|---|
| Dams | 3,405 | 3,850 | 1,438 | 259 |
| Barrages | 588 | 0 | 0 | 0 |
| Regulators | 398 | 0 | 0 | 0 |
| Main Drains and Canals | 239 | 36 | 36 | 36 |
| Irrigation Projects | 10,667 | 22,722 | 20,054 | 16,768 |
| Municipalities | 15,034 | 18,703 | 20,279 | 26,107 |
| Industries | 1,205 | 1,243 | 1,197 | 1,732 |
| Other investments | 1,255 | 768 | 768 | 922 |
| Design and Survey Costs | 1,640 | 2,366 | 2,189 | 2,291 |

**Illustration412/ Figure 2-41: Summary of the investment strategy for the next 21 years**

# Part Five

# Ways forward



Summary of recommendations

## Obstacles

## Develop and use the tools created by the strategy.

**A new path to decision-making and planning**

# Part 1: Ways Forward

### 1.1 Summary of Recommendations

## 2.1.1 Urgent measures

While each component of the proposed strategy contributes to the necessary changes in water and land resource management in Iraq, there are a number of vital structural and institutional changes that must be implemented from the outset. This means that the Mosul Dam must be rehabilitated as soon as possible, along with the expansion of the Samarra Dam and the canal escape route. To protect water quality and prevent desertification, all agricultural drainage infrastructure proposed in the strategy, including the general outlet, the East Tigris Drainage, the East Euphrates Drainage, and the Great Gharraf Drainage, must be fully constructed and rehabilitated.. Finally, in light of the expected declines in discharges and increased salinity in the Euphrates River, the possibility of supporting irrigation and developing the lower part of the basin depends on mixing the waters of the Tigris and Euphrates through the rehabilitation of the irrigation canal.

In order to implement the many recommendations contained in the strategy, and thus achieve the full benefits of the project,There are a number of structural changes in the water sector that need to take place, SWLRI. It is not surprising that this issue is given importance and priority, as these changes are required at several levels, including the legal level as well as the policy level. In fact, these reforms are very important for the successful implementation ofTherefore, this strategy recommends that there should be SWLRI, A legal and institutional review will be conducted upon completion of this project. Although this strategy recommends a number of reforms that are considered vital to water and land management, a thorough review of Iraq's legal and institutional instruments is necessary to address key issues, such as improving water quality and land management, water conservation, and ensuring sustainable development. The review should lead to the development of a strategy for legal and institutional reform, which will create a framework for the full implementation of the plan's recommendations.SWLRI Home

Finally, the urgent need to implement the strategy requires the Ministry of Water Resources (MoWR Move quickly to develop terms of reference for proposed projects, oversee field implementation, manage consultants and contractors, and operate according to a very ambitious yet realistic timetable so that changes are implemented as quickly as possible. To assist in this endeavor, this strategy has been divided into five-year phases so that objectives can be achieved gradually. Furthermore, as emphasized elsewhere, the strategy's planning models and analytical tools need to be updated continuously (e.g., annually) to adapt to realities on the ground.

### 2.1.5 Objectives for the agricultural sector

Achieving the agricultural sector's goals requires adopting a wide range of changes that will improve water use, enhance crop yields, and protect the health of land and water. Eight agro-climatic zones have been identified to help determine appropriate practices for each region, and a total of30 strategic crops in developing a unique crop composition Each region has its own specific climatic and soil conditions. Furthermore, crops with high water requirements, such as rice, have been reduced in the overall crop mix to make more efficient use of water.

The overall irrigation efficiency in the field is being increased to reach2.%, and control the agricultural density To increase from51% on average now to 111% by 2031. Pressurized irrigation systems Both on- and off-farm efforts will also help promote water conservation. Completing the drainage network will help improve soil quality, prevent waterlogging and soil salinization, and support improvements in water quality. All of the above efforts fit together within the context of creating a new system in Iraq where market-oriented agricultural practices will improve profits and production, and stimulate continued investment in the agricultural sector.

In addition, the high evaporation losses resulting from large-scale fish farms are unsustainable in the long term and must be eliminated. Appropriate support mechanisms must be provided to help farmers transition to new farming technologies to mitigate the challenges they may face with some of the proposed changes in the sector. Developing and expanding the role of water user associations will contribute to the overall process of supporting farmers and improving agricultural practices.

### 2.1.3 Drainage water objectives

Water scarcity requires efficient water use and innovative ways to reuse water. Basin water will be reused wherever possible to support the oil sector, green belts, and increase discharges to the Hammar Marsh and Shatt al-Arab.

### 2.1.4 Objectives of the municipal and industrial sectors

The proposed water use efficiencies for the municipal and industrial sectors will save more than0 billion meters cubic meter of water annually by the year0231. About 100 liters per person per day will be available in Rural communities and.0.1 litres per person per day in urban communities. The expansion of networks Treating wastewater across the country will allow for the treatment of0.2% of Total wastewater generated. This strategy also took into account the investment required to treat water at higher rates (up to52%), which in turn can help alleviate

Water scarcity has been severe in the previous years.0231, amounting to 142 billion cubic meters An additional amount of treated water is released annually into rivers, which in turn can be directed to the agricultural sector, for example. Such an additional amount of water could be sufficient to ensure that Iraq reaches development.122% of its agricultural sector.

## 2.1.2 Energy sector objectives

There are plans for Iraq to cover1% of its total energy needs from renewable energy sources, Including share343% provided by existing and newly proposed hydropower facilities. Energy strategies differ between Iraq and the Kurdistan Region, as the region's plan is to increase hydroelectric power production to reach10%. In line with the National Water Development Strategy (NWDS), This strategy urges the Iraqi government to reduce its reliance on hydropower, as future water availability along the Tigris River remains uncertain, and the true long-term benefits of the technology are questionable. Instead, alternative sources, such as solar power, should be considered, which are more abundant and secure.

### 2.1.6 Objectives of reservoir operation and water management

Preventing hazards such as drought and flooding requires a change in how reservoirs are managed and operated throughout the year. New adaptive drought management policies will help the country make optimal use of available water resources and facilitate an objective and transparent approach to water reduction during droughts. The proposed summer drought management policy serves as a forecasting system that will prevent farmers from making large investments in a particular season when water scarcity would prevent full allocation to the agricultural sector. Flood risk mitigation will continue, but the flood risk for Baghdad has been adjusted to a 211-year flood risk, a moderate and economically acceptable probability, in line with international standard practices for the levels of protection provided by flood control infrastructure.

## 2.1.7 Environmental Goals

Expanding wastewater treatment capacity throughout Iraq, as well as expanding the agricultural drainage network, will significantly improve water quality in Iraqi rivers. Biodiversity and environmental sustainability will be achieved by allocating at least 5.305 billion cubic meters of water annually to the marshes, creating green belts, and implementing non-traditional wastewater treatment technologies. The minimum permissible discharge along the Shatt al-Arab is 21 $m^3/s$. This discharge will prevent the intrusion of the salinity front from the Gulf. However, over the course of the plan's implementation, Additional measures should be taken to identify ways to increase water flow throughout the country to improve water quality.

When planning rehabilitation or land reclamation for existing or new irrigation projects, as well as other major infrastructure projects, a detailed assessment of the project area should be conducted to identify environmentally sensitive areas. This will then identify areas that should be preserved or restored to support overall environmental health and biodiversity within Iraq.

### 2.1.8 Objective of the agreement with the riparian states

Iraq is committed to implementing an Integrated Resource Management Plan that sets achievable goals for improved water and land management. However, its success largely depends on upstream neighbors doing the same. Although this strategy attempts to prepare Iraq for the worst by assuming that 100% of planned agricultural and water infrastructure projects will be developed in riparian countries, it also assumes that these countries will use specific crop rotations to achieve some efficiencies in the agricultural sector.[114] If this is not achieved, Iraq will receive poor quality water across its borders, which will hinder Iraq's goals for agricultural development and threaten the ability to deliver potable water.

Iraq seeks credibility regarding the discharges and quality of the water it receives along the international rivers it shares with Turkey, Syria, and Iran. This credibility is expected to come in the form of an agreement between Iraq and its neighbors, as well as a long-term commitment to regional cooperation on water, water quality, the environment, and economic development. Every country that shares the watersheds of the Euphrates and Tigris has common interests: prosperity, stability, and economic growth.

## 1.1 Obstacles

It is not enough to simply identify the institutional and policy changes that can address water and land management needs. It is also necessary to identify the barriers that may prevent the successful implementation of these changes. Barriers may be general, such as the high cost of technology, or they may be specific to a particular context, such as limited wind potential. But only through a comprehensive and integrated examination of options and barriers can a realistic path forward be established.

[114] For a complete description and analysis of water use in Türkiye, Syria, and Iran, see Appendix C.

The strategy was built on several assumptions: coordination would occur among the necessary parties; certain efficiencies would be achieved; and critical infrastructure would be built. Although we were as conservative as possible in making these assumptions, such as assuming 100% development in upstream countries, the strategy's success could still be jeopardized if certain conditions are not met. The most pressing issues are discussed below.

Coordination between Baghdad and Erbil on water resources issues is not an option. This strategy hinges on Iraq's ability to continue managing water resources jointly with the Kurdistan Region, as consistent and careful management of the largest reservoirs located in the north is the only way to ensure the required level of development for the entire country. Failure to maintain coordination in the future will almost certainly cause significant social and economic tension in the region, as well as a significant loss of opportunities for both sides.

In order to plan for an unknown future, the strategy makes a number of assumptions about future use of upstream water.[115]Some of these assumptions are pessimistic, for example, the assumption that 11% of Turkey's planned water control infrastructure projects will be implemented. However, some assumptions are optimistic. For example, we also assume that Turkey will achieve a degree of efficiency in agricultural water use and that the country will adopt a responsible cropping pattern. If upstream countries fail to meet the expected efficiency gains in agriculture over the next 20 years, further reductions in the quantity and quality of water reaching Iraq will likely cause, in addition to economic damage, concomitant social harm. Gaining a greater understanding of the actual plans and their evolution in Turkey and other riparian countries, and developing a comprehensive water negotiation strategy, should be a top priority for the Iraqi government.

An ambitious and achievable timetable has been designed to increase water use efficiency in Iraq's agricultural sector. If there is a delay in reaching the targeted efficiency, less water will be available for agriculture. If water use efficiency cannot be increased beyond 50%, for example, approximately 6.6 billion cubic meters of water will be lost annually, and 41%, or more than 2.7 million dunums, will not receive water, thus reducing agricultural production significantly.

If the drainage network is not rehabilitated and expanded as planned, agricultural backflows will continue to enter Iraq's rivers, severely degrading water quality. Salinity along the Euphrates River could increase5.1 mg/L in heat to more than 0.002 mg/L In Nasiriyah, salinity more than doubles throughout the length of the river. Similarly,

[115]For a full description of planned water use for upstream countries, see Appendix C.

Salinity along the Tigris River will increase.122 mg/L in Mosul Dam to 522 mg/L in The horn

Since the completion of the Great Mosul Dam, it has become clear that it poses a threat to Iraq. Plans to rehabilitate it are being actively explored, considering various technical solutions to provide a permanent solution. However, the scale of the work required and the technological challenges have significantly delayed the implementation phase. Failure to rehabilitate the Mosul Dam would significantly undermine the success of this strategy, as Iraq would lose its ability to protect itself from more severe floods and droughts, resulting in massive losses of life and property. In addition, Iraq would lose billions of dollars in agricultural and energy production. If the Mosul Dam is not rehabilitated, the next best option would be the construction of the Badush High Dam, which would be significantly less beneficial but is the least bad alternative. In this case, a detailed analysis of the Badush Dam would be necessary to ensure it is capable of holding a volume of water equal to that provided by the Mosul Dam.

The ecosystem services provided by the marshes to Iraq are significant and can be quantified in real financial losses if less water is delivered.14,321 billion cubic meters of water on average annually To the marshes. Similarly, failure to invest in protecting agricultural land and water quality will lead to countless consequences, such as further decline in water quality, affecting agricultural productivity and drinking water supplies; soil degradation, thus undermining agricultural sector productivity; land loss to desertification, threatening the livelihoods of millions of Iraqis and disrupting social stability. Protecting land, water resources, and other forms of environmental protection are often viewed as a luxury. They are not; they are a prerequisite for a healthy, secure, and prosperous country.

## 1.1 Updating and using tools created by the SWLRI study

One of the greatest tangible achievements of the project is thatIt is the creation of a number of SWLRI analytical tools.[116]These tools, including databases and various computer models, are enabled by data collection efforts.[117]Once delivered to the Ministry of Water Resources, these tools will serve as a cornerstone for future planning of water and land resources.

In order to serve this purpose, there must be a strong commitment to tool maintenance to ensure that the state of knowledge continues to grow throughout the plan implementation period and beyond. Tools that are considered priorities for continuous improvement include:12 databases prepared for SWLRI assessments as well About data that can be added to GIS tools, agro-ecological zoning, irrigation project mapping, and planning models. In addition, related measurements

[116]For a full description of these tools, see Appendix B.

[117]This effort is detailed in Appendix A and C.

Iraq's meteorological, hydrological, groundwater, and water quality data will facilitate efforts to track environmental changes.

Policies and protocols are expected to be developed to ensure that data collection efforts are updated regularly and implemented according to standards that adequately complement existing datasets. It is also essential to ensure that all relevant ministry staff are trained to update, operate, and maintain computer models as needed to describe conditions on the ground. Although these aspects will take time, they are essential for understanding and utilizing the primary data sources and computer models..SWLRI

## 1.1 A New Path to Decision-Making and Planning

The project has been introducedCurrent New Pattern of Planning and Decision-Making Regarding the Use of SWLRI Resources Water and land in Iraq, which must continue in the future. It is recommended that the third phase ofTo support the Ministry of Water Resources in implementing this strategy, the consultant SWLRI Working closely with the Ministry, it can help answer specific strategic questions related to national and international water-sharing agreements, review proposed designs for opportunities, organize and manage all aspects of the bidding process, facilitate the review process, define monitoring and data collection programs, further expand the scope and use of various digital tools to integrate them into the Ministry's daily management, and develop an advanced system for continuous monitoring and forecasting of flood and drought events. Because the current strategy is a long-term plan that provides more detail for project development during the first five years of the planning period,02 years old, Van The third stage ofIt will serve as a planning process for developing the strategy for the next years SWLRI. from0202 to 0201.

In order to implement the development goals of the strategyA number of reforms should be made, SWLRI Legal and institutional. But before strong recommendations can be made, a comprehensive review of existing laws and policies should be conducted. Then, when the review is conducted, the strategy for legal and institutional reform (You could write about the best ways to move forward with the changes (LIRS). The necessary structure for the country's future success.

To carry out this review and formulateWe suggest the two units below: LIRS

- Institutional Reform Unit
- Legal Reform Unit

The units will study current institutions and legislation, respectively, regarding water and related sectors. Their mission is to provide recommendations on the best ways to modify existing facilities or, if necessary, issue new policies or laws to implement strategic recommendations..SWLRI

As previously stated and established throughout the preparation of this strategy, Iraq faces a troubling future of water scarcity unless major reform of the water sector is achieved. Protecting lives and property, as well as meeting the country's development needs, requires a change in how water is used and allocated. This strategy provides the necessary tools for reform: a prioritized list of the most urgent actions; a detailed plan for the first five years of implementation, along with medium- and long-term objectives; a bottom-up approach that allows for ambitious targets for each sector; and data and models for planning and adaptation. The onus now falls on the Iraqi government to work with stakeholders to implement reform and, in turn, secure the conditions for a resilient and prosperous future for Iraq.

# ملحق- تفاصيل الإستثمارات

| SWLRI ID | PROJECT NAME | RANKING | % DEV | Area [th Du] | Water Demand [MCM/y] | REHABILITATION START | REHABILITATION END | REHABILITATION CAPEX REHA [M$] | RECLAMATION START | RECLAMATION END | RECLAMATION CAPEX RECL [M$] | TOTAL CAPEX [M$] | TOTAL OPEX [M$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IP-001 | Small farms from syrian border to hadeetha dam (watet al-rahbah-rehana-sagrah-alakhder-alkhasfe-alhasah) | 71 | 87% | 51.3 | 130.3 | 2018 | 2020 | 5.6 | 2019 | 2023 | 132.5 | 138.8 | 87.0 |
| IP-002 | Small farms from the hadeetha dam up to the boundary of the ramadi project (sekran)-left bank of euphrates river south of hadeetha dam- | 81 | 100% | 47.0 | 132.5 | 2018 | 2020 | 1.9 | 2019 | 2023 | 127.5 | 129.4 | 84.5 |
| IP-003 | Small farms at springs in the anbar muhafadha in the euphrates river | GW | 100% | 1.0 | 2.9 | | | | 2030 | 2032 | 2.7 | 2.7 | 0.6 |
| IP-004 | Ramadi-habaniyah | 73 | 97% | 131.4 | 326.8 | 2018 | 2022 | 262.6 | 2020 | 2022 | 109.0 | 380.4 | 331.0 |
| IP-005 | Faluja-amreah & (small farms from the ramadi-Faluja boundary up to the baghdad muhafadha boundary) | 75 | 90% | 50.4 | 134.0 | | | | 2025 | 2029 | 239.4 | 239.4 | 70.3 |
| IP-006 | Saqlawiyah | D | 100% | 140.0 | 367.7 | 2016 | 2023 | 308.7 | | | | 308.7 | 282.7 |
| IP-007 | Abu ghraib | D | 100% | 206.0 | 576.8 | 2017 | 2024 | 552.4 | | | | 552.4 | 374.0 |
| IP-008 | Radhwaniyah | D | 100% | 28.0 | 81.0 | 2016 | 2018 | 64.8 | | | | 64.8 | 105.2 |
| IP-009 | Yousifia | 45 | 100% | 125.0 | 360.0 | 2017 | 2021 | 153.8 | 2019 | 2023 | 329.3 | 483.1 | 325.2 |
| IP-010 | Latifia | 37 | 100% | 108.0 | 304.8 | 2016 | 2020 | 226.1 | 2019 | 2021 | 104.8 | 331.0 | 288.9 |
| IP-011 | Iskandariyah | 42 | 86% | 44.0 | 122.3 | 2018 | 2022 | 103.3 | | | | 122.8 | 96.1 |
| IP-012 | Faluja al-muahada | 62 | 100% | 54.0 | 152.2 | | | | 2026 | 2030 | 231.2 | 231.2 | 57.7 |
| IP-013 | Small farms from the boundary of the anbar muhafadha up to the Hindiyah barrage | 72 | 60% | 15.0 | 42.4 | | | | 2028 | 2030 | 54.0 | 54.0 | 13.7 |
| IP-014 | Jarf al sakhr & ruwaiyah | 69 | 100% | 38.0 | 107.8 | | | 0.0 | 2020 | 2022 | 179.7 | 179.7 | 113.7 |
| IP-015 | Greater mussaiyab | D | 100% | 310.0 | 836.1 | 2016 | 2023 | 656.2 | | | | 656.2 | 521.5 |
| IP-016 | Husainaia | 41 | 100% | 101.0 | 251.9 | 2015 | 2019 | 210.1 | 2019 | 2021 | 98.0 | 308.1 | 283.6 |
| IP-017 | Small farms; at spring irrigated in karbala muhafadha (ain al tamur) | GW | 100% | 10.0 | 29.7 | 2017 | 2019 | 18.8 | | | | 18.8 | 33.4 |
| IP-018 | Bani-hasan | 52 | 86% | 124.6 | 304.7 | 2016 | 2020 | 106.5 | 2017 | 2022 | 290.5 | 403.5 | 285.6 |
| IP-019 | Small farms from the Hindiyah barrage up to kifil | 64 | 90% | 3.6 | 8.7 | | | | 2028 | 2030 | 12.9 | 12.9 | 3.2 |
| IP-020 | Iskandariyah-mehaweel & gadwel al-nasiriya | 74 | 90% | 164.3 | 432.7 | 2018 | 2020 | 24.3 | 2019 | 2024 | 730.9 | 757.9 | 409.2 |
| IP-021 | Hilla-hashimiyah | 70 | 85% | 204.0 | 531.2 | | | | 2023 | 2029 | 956.6 | 956.6 | 277.9 |
| IP-022 | Huriyah-daghara | 12 | 100% | 635.0 | 1,702.5 | 2016 | 2023 | 713.1 | 2017 | 2027 | 2,620.1 | 3,333.2 | 1,517.9 |
| IP-023 | Hilla-diwaniyah | 55 | 97% | 273.8 | 643.6 | | | | 2020 | 2030 | 1,268.9 | 1,268.9 | 318.0 |
| IP-024 | Diwaniyah-shafiÆiyah | 19 | 100% | 380.0 | 1,031.9 | | | | 2022 | 2031 | 1,649.2 | 1,649.2 | 327.1 |
| IP-025 | Rumaitha | 40 | 100% | 144.0 | 426.6 | 2017 | 2019 | 85.4 | 2021 | 2025 | 485.0 | 570.4 | 349.3 |
| IP-026 | Hilla-kifil | D | 100% | 173.0 | 411.5 | 2017 | 2024 | 430.8 | | | 0.0 | 430.8 | 317.4 |
| IP-027 | Kifil-shnafiyah | 58 | 100% | 494.0 | 1,338.0 | 2020 | 2024 | 131.2 | 2020 | 2032 | 1,686.0 | 1,817.2 | 291.7 |

| SWLRI ID | PROJECT NAME | RANKING | % DEV | Area [th Du] | Water Demand [MCM/y] | REHABILITATION | | | RECLAMATION | | | TOTAL CAPEX [M$] | TOTAL OPEX [M$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | START | END | CAPEX REHA [M$] | START | END | CAPEX RECL [M$] | | |
| IP-028 | Muthanna | 27 | 100% | 41.0 | 123.0 | 2017 | 2019 | 75.5 | 2021 | 2023 | 122.1 | 197.6 | 116.1 |
| IP-029 | Shnafiyah-nasiriya | 43 | 100% | 260.0 | 790.8 | | | | 2023 | 2034 | 1,123.6 | 1,123.6 | 56.5 |
| IP-030 | Suq al shoyokh | 65 | 30% | 22.5 | 72.0 | | | | 2030 | 2032 | 109.3 | 109.3 | 16.4 |
| IP-031 | Small farms in the euphrates river mouth | 53 | 100% | 35.0 | 93.1 | | | | 2030 | 2032 | 167.5 | 167.5 | 24.6 |
| IP-032 | Zakho | 60 | 100% | 15.0 | 17.3 | | | | 2018 | 2020 | 64.8 | 64.8 | 52.0 |
| IP-033 | Small farms from the boundary up to mosul dam and salifaniya | 63 | 100% | 11.0 | 14.6 | | | | 2018 | 2020 | 56.7 | 56.7 | 39.2 |
| IP-034 | Small farms at springs in the dohuk muhafadha in the tigris river basin | GW | 100% | 4.0 | 5.7 | | | | 2021 | 2023 | 22.3 | 22.3 | 15.4 |
| IP-035 | Small farms at wells in the dohuk muhafadha in the tigris river basin | GW | 100% | 1.0 | 1.4 | | | | 2021 | 2023 | 14.1 | 14.1 | 8.3 |
| IP-036 | Dohuk | D | 100% | 2.0 | 2.6 | 2015 | 2017 | 5.9 | | | | 5.9 | 7.4 |
| IP-037 | North jazeera | D | 100% | 264.0 | 477.6 | 2015 | 2022 | 489.5 | | | | 489.5 | 444.7 |
| IP-038 | East jazeera | 26 | 100% | 215.0 | 403.0 | 2020 | 2022 | 21.1 | 2022 | 2029 | 752.7 | 773.9 | 222.9 |
| IP-039 | South jazeera | 8 | 100% | 344.0 | 670.3 | | | | 2021 | 2030 | 1,364.3 | 1,364.3 | 328.9 |
| IP-040 | Small farms from the mosul dam up to greater zab river | 33 | 100% | 46.0 | 86.1 | | | | 2018 | 2022 | 171.6 | 171.6 | 106.5 |
| IP-041 | Small farms at springs in the ninawa muhafadha in the tigris river basin | GW | 100% | 2.0 | 3.6 | | | | 2030 | 2032 | 8.6 | 8.6 | 1.5 |
| IP-042 | Small farms at wells in the ninawa muhafadha in the tigris river basin | GW | 100% | 1.0 | 2.0 | | | | 2030 | 2032 | 3.2 | 3.2 | 0.6 |
| IP-043 | Small farms at springs in the ninawa muhafadha in the greater zap river basin | GW | 100% | 3.0 | 5.3 | | | | 2022 | 2024 | 9.1 | 9.1 | 7.7 |
| IP-044 | Small farms at wells in the ninawa muhafadha in the greater zap river basin | GW | 100% | 4.0 | 7.4 | | | | 2030 | 2032 | 22.2 | 22.2 | 3.9 |
| IP-045 | Balandah | 83 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-046 | Khazir-gomel | 61 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-047 | Bela-rizan | 80 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-048 | Diyana-balikiyan | 87 | 15% | 0.9 | 1.5 | | | | 2022 | 2024 | 3.9 | 3.9 | 2.0 |
| IP-049 | Harir | 78 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-050 | Small farms at springs in the erbil muhafadha in the greater zap river basin | GW | 100% | 1.0 | 1.7 | | | | 2018 | 2020 | 4.0 | 4.0 | 4.3 |
| IP-051 | Markaz | 39 | 40% | 5.6 | 10.2 | | | | 2021 | 2023 | 16.9 | 16.9 | 10.0 |
| IP-052 | Shemamuk | 30 | 90% | 54.0 | 101.4 | | | | 2018 | 2020 | 226.2 | 226.2 | 162.7 |
| IP-053 | Eski-kalak | D | 100% | 42.0 | 81.4 | 2015 | 2019 | 66.7 | | | | 66.7 | 66.5 |
| IP-054 | Kashaf | 14 | 100% | 12.0 | 25.3 | | | | 2028 | 2030 | 44.9 | 44.9 | 11.0 |
| IP-055 | Sallamiyah | D | 100% | 9.0 | 17.2 | 2018 | 2020 | 30.0 | | | | 30.0 | 23.8 |
| IP-056 | Small farms at wells in the ninawa muhafadha in the greater zap river basin | GW | 100% | 1.0 | 1.9 | | | | 2030 | 2032 | 5.1 | 5.1 | 0.9 |
| IP-057 | Makhmur | 54 | 0% | | | | | | | | | 0.0 | 0.0 |

| SWLRI ID | PROJECT NAME | RANKING | % DEV | Area [th Du] | Water Demand [MCM/y] | REHABILITATION | | | RECLAMATION | | | TOTAL CAPEX [M$] | TOTAL OPEX [M$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | START | END | CAPEX REHA [M$] | START | END | CAPEX RECL [M$] | | |
| IP-058 | Small farms at well in the ninawa muhafadha in the tigris river basin | GW | 100% | 42.0 | 107.6 | | | | 2030 | 2034 | 105.2 | 105.2 | 6.0 |
| IP-059 | Penjween | 85 | 100% | 10.0 | 16.3 | | | | 2020 | 2022 | 31.1 | 31.1 | 19.6 |
| IP-060 | Small farms at siprins in the sulaymaniyah muhafadha in the lesser zab river basin from border to dam | GW | 100% | 2.0 | 3.6 | | | | 2023 | 2025 | 6.2 | 6.2 | 4.2 |
| IP-061 | Sangasar | 25 | 100% | 2.0 | 3.8 | | | | 2016 | 2018 | 6.4 | 6.4 | 5.3 |
| IP-062 | Raniya-sarujawa | 82 | 21% | 10.0 | 15.7 | 2015 | 2017 | 14.6 | | | | 21.0 | 24.7 |
| IP-063 | Sarsiyan | 79 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-064 | Small farms at springs in the erbil muhafadha in the lesser zab river basin | GW | 100% | 1.0 | 1.8 | | | | 2023 | 2025 | 3.4 | 3.4 | 2.5 |
| IP-065 | Small farms at wells in the kirkuk muhafadha , in the lesser zab river basin | GW | 100% | 1.0 | 1.9 | | | | 2030 | 2032 | 4.9 | 4.9 | 1.0 |
| IP-066 | Kirkuk | D | 100% | 662.0 | 1,298.4 | 2016 | 2024 | 1,598.5 | | | | 1,598.5 | 1,109.9 |
| IP-067 | Resasy-tereshiyah | 76 | 100% | 60.0 | 135.9 | | | | 2028 | 2032 | 239.2 | 239.2 | 35.6 |
| IP-068 | Al boajeel | D | 100% | 6.0 | 16.2 | 2017 | 2019 | 11.3 | | | | 11.3 | 17.2 |
| IP-069 | Small farms at springs in the salah ad din muhafadha in the udhaim river basin | GW | 100% | 20.0 | 47.2 | | | | 2030 | 2032 | 70.0 | 70.0 | 12.0 |
| IP-070 | Small farms at wells in the salah ad din muhafadha in the udhaim river basin | GW | 100% | 16.0 | 37.6 | | | | 2030 | 2032 | 49.7 | 49.7 | 8.5 |
| IP-071 | Haweeja | 23 | 100% | 192.0 | 398.7 | 2015 | 2022 | 214.2 | 2023 | 2027 | 307.2 | 521.4 | 247.3 |
| IP-072 | Small farms from lesser zab river mouth up to udhaim confluent | 56 | 100% | 102.0 | 240.9 | | | | 2018 | 2024 | 407.1 | 407.1 | 220.7 |
| IP-073 | Small farms at wells in the salah ad din muhafadha in the tigris river basin | GW | 100% | 7.0 | 15.2 | | | | 2030 | 2032 | 22.7 | 22.7 | 4.2 |
| IP-074 | Al-khalij, al aali | D | 100% | 18.0 | 47.0 | 2016 | 2018 | 26.0 | | | | 26.0 | 54.3 |
| IP-075 | Upper naifah | 48 | 100% | 59.0 | 150.3 | | | 0.0 | 2024 | 2028 | 241.2 | 241.2 | 83.7 |
| IP-076 | Dour | D | 100% | 8.0 | 20.4 | 2017 | 2019 | 12.3 | | | | 12.3 | 24.4 |
| IP-077 | Al-aoja & dujail | D | 100% | 24.0 | 63.4 | 2019 | 2021 | 48.4 | | | | 48.4 | 52.2 |
| IP-078 | Al-nai | D | 100% | 33.0 | 69.5 | 2015 | 2017 | 58.7 | | | | 58.7 | 70.5 |
| IP-079 | Ishaqi | D | 100% | 317.0 | 753.7 | 2015 | 2022 | 598.9 | | | | 598.9 | 592.3 |
| IP-080 | Shahrazoor | 84 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-081 | Kalar | 57 | 33% | 4.0 | 8.6 | 2015 | 2017 | 8.8 | | | | 14.1 | 14.3 |
| IP-082 | Kaolas | 86 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-083 | Small farms at springs in the sulaymaniyah muhafadha in the diyala river basin | GW | 100% | 1.0 | 1.6 | | | | 2023 | 2025 | 3.8 | 3.8 | 2.6 |
| IP-084 | Shekh-langar | 67 | 100% | 1.0 | 2.1 | | | | 2020 | 2022 | 5.3 | 5.3 | 3.2 |
| IP-085 | Balajo-khanaqeen-wind | 68 | 100% | 89.0 | 167.1 | | | | 2020 | 2024 | 381.5 | 381.5 | 210.4 |
| IP-086 | Qara teppe | 17 | 100% | 62.0 | 117.2 | | | | 2025 | 2029 | 280.1 | 280.1 | 80.1 |

| SWLRI ID | PROJECT NAME | RANKING | % DEV | Area [th Du] | Water Demand [MCM/y] | REHABILITATION | | | RECLAMATION | | | TOTAL CAPEX [M$] | TOTAL OPEX [M$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | START | END | CAPEX REHA [M$] | START | END | CAPEX RECL [M$] | | |
| IP-087 | Jalawlaa & al-saÆdiyah | 18 | 100% | 24.0 | 47.7 | | | 0.0 | 2025 | 2027 | 108.7 | 108.7 | 41.2 |
| IP-088 | Small farms at wells in the diyala muhafadha in the diyala river basin | GW | 100% | 4.0 | 7.6 | | | | 2030 | 2032 | 11.8 | 11.8 | 2.1 |
| IP-089 | Upper khalis | D | 100% | 216.0 | 467.1 | 2017 | 2024 | 583.8 | | | | 583.8 | 393.0 |
| IP-090 | Lower khalis | D | 100% | 230.0 | 587.7 | 2017 | 2024 | 417.4 | | | | 417.4 | 325.5 |
| IP-091 | Mandeli | 13 | 100% | 29.0 | 64.9 | 2018 | 2020 | 6.3 | 2019 | 2021 | 111.0 | 117.3 | 82.8 |
| IP-092 | Haruniyay+ combined head reach (sudour)+ muqdadiyah | 0 | 100% | 93.0 | 188.1 | 2017 | 2021 | 207.2 | 2022 | 2024 | 75.5 | 282.7 | 183.0 |
| IP-093 | Ruz | D | 100% | 230.0 | 541.7 | 2017 | 2024 | 394.6 | | | | 394.6 | 285.9 |
| IP-094 | Mahrut | 38 | 58% | 110.0 | 283.1 | 2016 | 2018 | 28.0 | 2017 | 2021 | 437.9 | 472.5 | 324.9 |
| IP-095 | Khoraisan (sareah) + tel asmar | 31 | 100% | 93.4 | 238.8 | | | | 2022 | 2026 | 389.9 | 389.9 | 176.6 |
| IP-096 | Small farms in the low course of diyala river along the right bank | 47 | 100% | 3.0 | 7.4 | | | | 2028 | 2030 | 13.8 | 13.8 | 3.4 |
| IP-097 | 9th april project (nehrawan) " previously 7th of april project" | D | 100% | 78.0 | 227.1 | 2017 | 2021 | 169.6 | | | | 169.6 | 161.2 |
| IP-098 | Small farms on left bank of the diyala and tigris river south of baghdad | 51 | 75% | 12.8 | 37.1 | | | | 2028 | 2030 | 56.3 | 56.3 | 14.0 |
| IP-099 | Wihda (nehrawan) | D | 100% | 85.0 | 251.5 | 2015 | 2019 | 205.9 | | | | 205.9 | 220.1 |
| IP-100 | Hour-rijab | D | 100% | 95.0 | 275.9 | 2019 | 2023 | 195.8 | | | | 195.8 | 169.2 |
| IP-101 | Suwairah ( hafria) | D | 100% | 148.0 | 398.9 | 2015 | 2022 | 328.0 | | | | 328.0 | 306.7 |
| IP-102 | Qusaiba | D | 100% | 55.0 | 141.1 | 2016 | 2020 | 114.8 | | | | 114.8 | 110.2 |
| IP-103 | Shihaimiyah | D | 100% | 72.0 | 185.7 | 2017 | 2021 | 144.5 | | | | 144.5 | 134.7 |
| IP-104 | Middle tigris | 35 | 100% | 528.2 | 1,442.5 | | | | 2019 | 2030 | 2,312.4 | 2,312.4 | 573.1 |
| IP-105 | Daboni (al-jut farms) | D | 100% | 68.0 | 196.5 | 2019 | 2023 | 121.0 | | | | 121.0 | 110.9 |
| IP-106 | Badra-jassan | 21 | 100% | 75.0 | 198.3 | 2017 | 2021 | 126.9 | 2020 | 2022 | 124.6 | 251.5 | 224.0 |
| IP-107 | Karmashiyah | 77 | 100% | 1.0 | 2.6 | | | | 2030 | 2032 | 11.1 | 11.1 | 1.5 |
| IP-108 | Dalmaj | D | 100% | 296.0 | 848.9 | 2016 | 2023 | 513.7 | | | | 513.7 | 445.8 |
| IP-109 | West gharraf | 15 | 100% | 337.0 | 999.3 | 2019 | 2023 | 143.9 | 2022 | 2031 | 958.5 | 1,102.4 | 231.1 |
| IP-110 | Al-mghashe "previously 17th july" | D | 100% | 56.0 | 167.2 | 2016 | 2020 | 128.4 | | | | 128.4 | 163.3 |
| IP-111 | East gharraf | 24 | 96% | 455.7 | 1,367.5 | 2016 | 2020 | 132.3 | 2019 | 2032 | 1,835.0 | 1,972.1 | 305.3 |
| IP-112 | Dawaiyah "previously 30th july" | 11 | 100% | 183.0 | 567.9 | 2015 | 2022 | 344.2 | 2024 | 2028 | 405.5 | 749.7 | 269.9 |
| IP-113 | Dujailah | D | 100% | 186.0 | 556.4 | 2016 | 2023 | 461.3 | | | | 461.3 | 369.7 |
| IP-114 | Kut-butaira | 20 | 100% | 133.0 | 393.3 | 2018 | 2020 | 41.9 | 2021 | 2027 | 562.9 | 604.8 | 249.8 |
| IP-115 | Abu-bshoot | D | 100% | 29.0 | 88.7 | 2017 | 2019 | 71.8 | | | | 71.8 | 73.4 |
| IP-116 | Taib | 2 | 100% | 1.0 | 2.8 | | | | 2018 | 2020 | 3.7 | 3.7 | 2.8 |
| IP-117 | Duwairij | 1 | 100% | 3.0 | 7.2 | | | | 2018 | 2020 | 14.3 | 14.3 | 10.3 |
| IP-118 | Nahar-saad | D | 100% | 75.0 | 215.7 | 2015 | 2019 | 196.0 | | | | 196.0 | 203.3 |
| IP-119 | Amara | 7 | 100% | 400.0 | 1,118.4 | | | | 2021 | 2034 | 1,802.5 | 1,802.5 | 107.9 |
| IP-120 | Shatt al-arab & swaib | 66 | 52% | 150.0 | 404.8 | 2015 | 2017 | 61.9 | 2017 | 2022 | 754.0 | 842.0 | 544.5 |
| IP-121 | Zubair (irrigated from wells) | GW | 100% | 35.0 | 99.5 | | | | 2030 | 2032 | 100.3 | 100.3 | 16.7 |

| | | | | | | REHABILITATION | | | RECLAMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWLRI ID | PROJECT NAME | RANKING | % DEV | Area [th Du] | Water Demand [MCM/y] | START | END | CAPEX REHA [M$] | START | END | CAPEX RECL [M$] | TOTAL CAPEX [M$] | TOTAL OPEX [M$] |
| IP-122 | Modern village 1 and 2 | 50 | 100% | 60.0 | 156.1 | | | | 2021 | 2025 | 266.3 | 266.3 | 131.1 |
| IP-123 | Basroukiya | 10 | 100% | 94.0 | 273.9 | | | | 2028 | 2032 | 462.1 | 462.1 | 68.3 |
| IP-124 | Mdalel, mrezeja and fao | 9 | 100% | 12.0 | 35.3 | | | | 2023 | 2025 | 62.6 | 62.6 | 30.3 |
| IP-125 | Abbasi | 34 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-126 | Sader | 28 | 13% | 20.0 | 44.0 | | | | 2020 | 2022 | 82.5 | 82.5 | 51.6 |
| IP-127 | Ali gharbi and ali sharqi | 3 | 100% | 137.0 | 403.4 | | | | 2020 | 2024 | 662.8 | 662.8 | 360.4 |
| IP-128 | Boghaylat | 6 | 100% | 30.0 | 93.4 | | | | 2022 | 2024 | 152.3 | 152.3 | 82.9 |
| IP-129 | Jazeera (island) sayed ahmad | 5 | 100% | 40.0 | 123.3 | | | | 2022 | 2026 | 198.4 | 198.4 | 88.5 |
| IP-130 | Southern ez river | 4 | 100% | 17.0 | 45.0 | | | | 2019 | 2021 | 83.0 | 83.0 | 56.7 |
| IP-131 | Khozaimiya | 29 | 40% | 2.0 | 4.9 | | | | 2020 | 2022 | 8.3 | 8.3 | 5.3 |
| IP-132 | Jazeera western samarra | 49 | 100% | 89.0 | 220.9 | | | | 2026 | 2030 | 354.6 | 354.6 | 87.9 |
| IP-133 | Upper resasy | 44 | 100% | 18.0 | 45.8 | | | | 2022 | 2024 | 72.8 | 72.8 | 39.8 |
| IP-134 | Southern haseeba al baghouz | 59 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-135 | Expanding hilla hashimiyah | 46 | 100% | 150.0 | 361.8 | | | | 2025 | 2032 | 731.4 | 731.4 | 104.9 |
| IP-136 | Extension sewaer | 16 | 100% | 43.0 | 129.3 | | | | 2030 | 2034 | 204.9 | 204.9 | 10.2 |
| IP-137 | Extension Middle Tigris-Suwaira | 36 | 100% | 137.0 | 374.1 | | | | 2026 | 2030 | 667.0 | 667.0 | 163.4 |
| IP-138 | Al Gharbia | 32 | 0% | | | | | | | | | 0.0 | 0.0 |
| IP-139 | Kirkuk Phase 3 | 22 | 100% | 160.0 | 313.8 | | | | 2018 | 2028 | 662.2 | 662.2 | 223.4 |
| IP-140 | Dhalouia | 22 | 100% | 32.0 | 62.8 | | | | 2021 | 2023 | 133.5 | 133.5 | 77.1 |
| IP-141 | Farms in the north of Saqlawiya from Euphrate river and in the left of Saqlawiya stream | | 100% | 26.0 | 68.3 | | | | 2020 | 2022 | 124.1 | 124.1 | 78.9 |
| IP-142 | Is'haqi farms from Balad up to the confluence with Tigris arm | | 100% | 62.0 | 147.4 | | | | 2028 | 2032 | 263.7 | 263.7 | 38.7 |
| **Grand Total** | | | | **12,920.4** | **33,080.6** | | | **12,475.2** | | | **33,068.3** | **45,631.1** | **20,344.1** |

# ملحق- تفاصيل مشاريع الري

| SWLRI ID | PROJECT NAME | GOVERNORATE | SOURCE | RANKING | Total Area MoWR [k donum] | Developed till 2013 [k donum] | To Be Developed in the Plan [k donum] | Final Development [k donum] | % DEV | REHAB [START YEAR] | REHAB [END YEAR] | RECLAM [START YEAR] | RECLAM [END YEAR] | TOTAL DEMAND [MCM/yr] | MAX MONTHLY DEMAND [MCM] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IP-001 | Small farms from syrian border to hadeetha dam (watet al-rahbah-rehana-sagrah-alakhder-alkhasfe-alhasah) | Anbar | Euphrates | 71 | 59.0 | 4.0 | 47.3 | 51.3 | 87% | 2018 | 2020 | 2019 | 2023 | 130.3 | 21.5 |
| IP-002 | Small farms from the hadeetha dam up to the boundary of the ramadi project (sekran)-left bank of euphrates river south of hadeetha dam- | Anbar | Euphrates | 81 | 47.0 | 1.0 | 46.0 | 47.0 | 100% | 2018 | 2020 | 2019 | 2023 | 132.5 | 21.0 |
| IP-003 | Small farms at springs in the anbar muhafadha in the euphrates river | Anbar | GW-springs | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2030 | 2032 | 2.9 | 0.5 |
| IP-004 | Ramadi-habaniyah | Anbar | Euphrates | 73 | 135.0 | 111.0 | 20.4 | 131.4 | 97% | 2018 | 2022 | 2020 | 2022 | 326.8 | 52.1 |
| IP-005 | Faluja-amreah & (small farms from the ramadi-Faluja boundary up to the baghdad muhafadha boundary) | Anbar/Baghdad | Euphrates | 75 | 56.0 | | 50.4 | 50.4 | 90% | | | 2025 | 2029 | 134.0 | 21.6 |
| IP-006 | Saqlawiyah | Anbar/Baghdad | Euphrates | D | 140.0 | 140.0 | 0.0 | 140.0 | 100% | 2016 | 2023 | | | 367.7 | 60.0 |
| IP-007 | Abu ghraib | Anbar/Baghdad | Euphrates | D | 206.0 | 206.0 | 0.0 | 206.0 | 100% | 2017 | 2024 | | | 576.8 | 93.0 |
| IP-008 | Radhwaniyah | Baghdad | Euphrates | D | 28.0 | 28.0 | 0.0 | 28.0 | 100% | 2016 | 2018 | | | 81.0 | 13.0 |
| IP-009 | Yousifia | Baghdad/Wasit | Euphrates | 45 | 125.0 | 57.0 | 68.0 | 125.0 | 100% | 2017 | 2021 | 2019 | 2023 | 360.0 | 57.8 |
| IP-010 | Latifia | Baghdad/Babil | Euphrates | 37 | 108.0 | 88.0 | 20.0 | 108.0 | 100% | 2016 | 2020 | 2019 | 2021 | 304.8 | 48.8 |
| IP-011 | Iskandariyah | Baghdad/Babil | Euphrates | 42 | 51.0 | 44.0 | 0.0 | 44.0 | 86% | 2018 | 2022 | | | 122.3 | 19.5 |
| IP-012 | Faluja al-muahada | Anbar/Baghdad/ Babil | Euphrates | 62 | 54.0 | | 54.0 | 54.0 | 100% | | | 2026 | 2030 | 152.2 | 24.4 |
| IP-013 | Small farms from the boundary of the anbar muhafadha up to the Hindiyah barrage | Babil | Euphrates | 72 | 25.0 | | 15.0 | 15.0 | 60% | | | 2028 | 2030 | 42.4 | 6.8 |
| IP-014 | Jarf al sakhr & ruwaiyah | Anbar/Baghdad/ Babil/Karbala | Euphrates | 69 | 38.0 | | 38.0 | 38.0 | 100% | | | 2020 | 2022 | 107.8 | 17.2 |
| IP-015 | Greater mussaiyab | Babil | Euphrates | D | 310.0 | 310.0 | 0.0 | 310.0 | 100% | 2016 | 2023 | | | 836.1 | 132.5 |
| IP-016 | Husainaia | Babil/Karbala | Euphrates | 41 | 101.0 | 80.0 | 21.0 | 101.0 | 100% | 2015 | 2019 | 2019 | 2021 | 251.9 | 36.9 |
| IP-017 | Small farms; at spring irrigated in karbala muhafadha (ain al tamur) | Anbar/Karbala | GW-springs | GW | 10.0 | 10.0 | 0.0 | 10.0 | 100% | 2017 | 2019 | | | 29.7 | 4.9 |
| IP-018 | Bani-hasan | Babil/Karbala/N ajaf | Euphrates | 52 | 145.0 | 43.0 | 81.6 | 124.6 | 86% | 2016 | 2020 | 2017 | 2022 | 304.7 | 44.3 |
| IP-019 | Small farms from the Hindiyah | Babil/Karbala/N | Euphrates | 64 | 4.0 | | 3.6 | 3.6 | 90% | | | 2028 | 2030 | 8.7 | 1.3 |

| SWLRI ID | PROJECT NAME | GOVERNORATE | SOURCE | RANKING | Total Area MoWR [k donum] | Developed till 2013 [k donum] | To Be Developed in the Plan [k donum] | Final Development [k donum] | % DEV | REHAB [START YEAR] | REHAB [END YEAR] | RECLAM [START YEAR] | RECLAM [END YEAR] | TOTAL DEMAND [MCM/yr] | MAX MONTHLY DEMAND [MCM] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | barrage up to kifil | ajaf | | | | | | | | | | | | | |
| IP-020 | Iskandariyah-mehaweel & gadwel al-nasiriya | Babil | Euphrates | 74 | 182.0 | 11.0 | 153.3 | 164.3 | 90% | 2018 | 2020 | 2019 | 2024 | 432.7 | 68.7 |
| IP-021 | Hilla-hashimiyah | Babil | Euphrates | 70 | 240.0 | | 204.0 | 204.0 | 85% | | | 2023 | 2029 | 531.2 | 84.2 |
| IP-022 | Huriyah-daghara | Babil/Diwaniyah | Euphrates | 12 | 635.0 | 207.0 | 428.0 | 635.0 | 100% | 2016 | 2023 | 2017 | 2027 | 1,702.5 | 243.1 |
| IP-023 | Hilla-diwaniyah | Babil/Diwaniyah /Najaf | Euphrates | 55 | 282.0 | | 273.8 | 273.8 | 97% | | | 2020 | 2030 | 643.6 | 100.0 |
| IP-024 | Diwaniyah-shafiÆiyah | Diwaniyah/Mut hanna | Euphrates | 19 | 380.0 | | 380.0 | 380.0 | 100% | | | 2022 | 2031 | 1,031.9 | 157.7 |
| IP-025 | Rumaitha | Muthanna | Euphrates | 40 | 144.0 | 30.0 | 114.0 | 144.0 | 100% | 2017 | 2019 | 2021 | 2025 | 426.6 | 58.4 |
| IP-026 | Hilla-kifil | Babil/Karbala/N ajaf | Euphrates | D | 173.0 | 173.0 | 0.0 | 173.0 | 100% | 2017 | 2024 | | | 411.5 | 59.7 |
| IP-027 | Kifil-shnafiyah | Babil/Diwaniyah /Najaf | Euphrates | 58 | 494.0 | 50.0 | 444.0 | 494.0 | 100% | 2020 | 2024 | 2020 | 2032 | 1,338.0 | 192.4 |
| IP-028 | Muthanna | Muthanna | Euphrates | 27 | 41.0 | 32.0 | 9.0 | 41.0 | 100% | 2017 | 2019 | 2021 | 2023 | 123.0 | 18.7 |
| IP-029 | Shnafiyah-nasiriya | Diwaniyah/Thi-Qar/Muthanna | Euphrates | 43 | 260.0 | | 260.0 | 260.0 | 100% | | | 2023 | 2034 | 790.8 | 118.9 |
| IP-030 | Suq al shoyokh | Thi-Qar | Euphrates | 65 | 75.0 | | 22.5 | 22.5 | 30% | | | 2030 | 2032 | 72.0 | 10.4 |
| IP-031 | Small farms in the euphrates river mouth | Basrah | Tigris | 53 | 35.0 | | 35.0 | 35.0 | 100% | | | 2030 | 2032 | 93.1 | 16.2 |
| IP-032 | Zakho | Dohuk | GW-wells | 60 | 15.0 | | 15.0 | 15.0 | 100% | | | 2018 | 2020 | 17.3 | 4.0 |
| IP-033 | Small farms from the boundary up to mosul dam and salifaniya | Dohuk/Ninawa | Tigris | 63 | 11.0 | | 11.0 | 11.0 | 100% | | | 2018 | 2020 | 14.6 | 3.2 |
| IP-034 | Small farms at springs in the dohuk muhafadha in the tigris river basin | Dohuk | GW-springs | GW | 4.0 | | 4.0 | 4.0 | 100% | | | 2021 | 2023 | 5.7 | 1.4 |
| IP-035 | Small farms at wells in the dohuk muhafadha in the tigris river basin | Dohuk | GW-wells | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2021 | 2023 | 1.4 | 0.4 |
| IP-036 | Dohuk | Dohuk | Tigris | D | 2.0 | 2.0 | 0.0 | 2.0 | 100% | 2015 | 2017 | | | 2.6 | 0.6 |
| IP-037 | North jazeera | Ninawa | Tigris | D | 264.0 | 264.0 | 0.0 | 264.0 | 100% | 2015 | 2022 | | | 477.6 | 98.8 |
| IP-038 | East jazeera | Ninawa | Tigris | 26 | 215.0 | 12.0 | 203.0 | 215.0 | 100% | 2020 | 2022 | 2022 | 2029 | 403.0 | 90.3 |
| IP-039 | South jazeera | Ninawa | Tigris | 8 | 344.0 | | 344.0 | 344.0 | 100% | | | 2021 | 2030 | 670.3 | 118.6 |
| IP-040 | Small farms from the mosul dam up to greater zab river | Ninawa | Tigris | 33 | 46.0 | | 46.0 | 46.0 | 100% | | | 2018 | 2022 | 86.1 | 19.3 |
| IP-041 | Small farms at springs in the ninawa muhafadha in the tigris river basin | Ninawa | GW-springs | GW | 2.0 | | 2.0 | 2.0 | 100% | | | 2030 | 2032 | 3.6 | 0.8 |
| IP-042 | Small farms at wells in the ninawa muhafadha in the tigris river basin | Ninawa | GW-wells | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2030 | 2032 | 2.0 | 0.4 |
| IP-043 | Small farms at springs in the | Ninawa | GW- | GW | 3.0 | | 3.0 | 3.0 | 100% | | | 2022 | 2024 | 5.3 | 1.0 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ninawa muhafadha in the greater zap river basin | | springs | | | | | | | | | | | | |
| IP-044 | Small farms at wells in the ninawa muhafadha in the greater zap river basin | Ninawa | GW-wells | GW | 4.0 | | 4.0 | 4.0 | 100% | | | 2030 | 2032 | 7.4 | 1.4 |
| IP-045 | Balandah | Dohuk | Greater Zab * | 83 | 1.0 | | rainfed | | | | | | | | |
| IP-046 | Khazir-gomel | Ninawa | Khazir * | 61 | 148.0 | | rainfed | | | | | | | | |
| IP-047 | Bela-rizan | Dohuk/Ninawa | Greater Zab * | 80 | 1.0 | | rainfed | | | | | | | | |
| IP-048 | Diyana-balikiyan | Erbil | Greater Zab | 87 | 6.0 | | 0.9 | 0.9 | 15% | | | 2022 | 2024 | 1.5 | 0.4 |
| IP-049 | Harir | Erbil | Greater Zab * | 78 | 25.0 | | rainfed | | | | | | | | |
| IP-050 | Small farms at springs in the erbil muhafadha in the greater zap river basin | Ninawa/Erbil | GW-springs | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2018 | 2020 | 1.7 | 0.4 |
| IP-051 | Markaz | Ninawa/Erbil | Greater Zab | 39 | 14.0 | | 5.6 | 5.6 | 40% | | | 2021 | 2023 | 10.2 | 1.9 |
| IP-052 | Shemamuk | Erbil | Greater Zab | 30 | 60.0 | | 54.0 | 54.0 | 90% | | | 2018 | 2020 | 101.4 | 18.8 |
| IP-053 | Eski-kalak | Ninawa/Erbil | Greater Zab | D | 42.0 | 42.0 | 0.0 | 42.0 | 100% | 2015 | 2019 | | | 81.4 | 14.5 |
| IP-054 | Kashaf | Ninawa/Erbil | Greater Zab | 14 | 12.0 | | 12.0 | 12.0 | 100% | | | 2028 | 2030 | 25.3 | 4.6 |
| IP-055 | Sallamiyah | Ninawa | Tigris | D | 9.0 | 9.0 | 0.0 | 9.0 | 100% | 2018 | 2020 | | | 17.2 | 3.2 |
| IP-056 | Small farms at wells in the ninawa muhafadha in the greater zap river basin | Ninawa | GW-wells | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2030 | 2032 | 1.9 | 0.4 |
| IP-057 | Makhmur | Erbil/Kirkuk | Greater Zab * | 54 | 140.0 | | rainfed | | | | | | | | |
| IP-058 | Small farms at well in the ninawa muhafadha in the tigris river basin | Ninawa/Salah-ad-din | GW-wells | GW | 42.0 | | 42.0 | 42.0 | 100% | | | 2030 | 2034 | 107.6 | 19.2 |
| IP-059 | Penjween | Sulaymaniyah | Lesser Zab | 85 | 10.0 | | 10.0 | 10.0 | 100% | | | 2020 | 2022 | 16.3 | 4.2 |
| IP-060 | Small farms at siprins in the sulaymaniyah muhafadha in the lesser zab river basin from border to dam | Sulaymaniyah | GW-springs | GW | 2.0 | | 2.0 | 2.0 | 100% | | | 2023 | 2025 | 3.6 | 0.9 |
| IP-061 | Sangasar | Sulaymaniyah | Lesser Zab | 25 | 2.0 | | 2.0 | 2.0 | 100% | | | 2016 | 2018 | 3.8 | 0.9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IP-062 | Raniya-sarujawa | Erbil/Sulaymaniyah | Lesser Zab | 82 | 48.0 | 10.0 | 0.0 | 10.0 | 21% | 2015 | 2017 | | | 15.7 | 3.4 |
| IP-063 | Sarsiyan | Sulaymaniyah | Lesser Zab * | 79 | 1.0 | | rainfed | | | | | | | | |
| IP-064 | Small farms at springs in the erbil muhafadha in the lesser zab river basin | Erbil | GW-springs | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2023 | 2025 | 1.8 | 0.4 |
| IP-065 | Small farms at wells in the kirkuk muhafadha , in the lesser zab river basin | Erbil/Kirkuk | GW-wells | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2030 | 2032 | 1.9 | 0.4 |
| IP-066 | Kirkuk | Kirkuk/Salah-ad-din/Diyala | Lesser Zab | D | 662.0 | 662.0 | 0.0 | 662.0 | 100% | 2016 | 2024 | | | 1,298.4 | 224.7 |
| IP-067 | Resasy-tereshiyah | Salah-ad-din | Tigris | 76 | 60.0 | | 60.0 | 60.0 | 100% | | | 2028 | 2032 | 135.9 | 23.5 |
| IP-068 | Al boajeel | Salah-ad-din | Tigris | D | 6.0 | 6.0 | 0.0 | 6.0 | 100% | 2017 | 2019 | | | 16.2 | 2.8 |
| IP-069 | Small farms at springs in the salah ad din muhafadha in the udhaim river basin | Salah-ad-din | GW-springs | GW | 20.0 | | 20.0 | 20.0 | 100% | | | 2030 | 2032 | 47.2 | 8.3 |
| IP-070 | Small farms at wells in the salah ad din muhafadha in the udhaim river basin | Salah-ad-din | GW-wells | GW | 16.0 | | 16.0 | 16.0 | 100% | | | 2030 | 2032 | 37.6 | 6.5 |
| IP-071 | Haweeja | Kirkuk | Lesser Zab | 23 | 192.0 | 100.0 | 92.0 | 192.0 | 100% | 2015 | 2022 | 2023 | 2027 | 398.7 | 68.4 |
| IP-072 | Small farms from lesser zab river mouth up to udhaim confluent | Salah-ad-din | Tigris | 56 | 102.0 | 0.0 | 102.0 | 102.0 | 100% | | | 2018 | 2024 | 240.9 | 41.6 |
| IP-073 | Small farms at wells in the salah ad din muhafadha in the tigris river basin | Salah-ad-din | GW-wells | GW | 7.0 | | 7.0 | 7.0 | 100% | | | 2030 | 2032 | 15.2 | 2.5 |
| IP-074 | Al-khalij, al aali | Salah-ad-din | Tigris | D | 18.0 | 18.0 | 0.0 | 18.0 | 100% | 2016 | 2018 | | | 47.0 | 8.1 |
| IP-075 | Upper naifah | Salah-ad-din | Tigris | 48 | 59.0 | | 59.0 | 59.0 | 100% | | | 2024 | 2028 | 150.3 | 25.8 |
| IP-076 | Dour | Salah-ad-din | Tigris | D | 8.0 | 8.0 | 0.0 | 8.0 | 100% | 2017 | 2019 | | | 20.4 | 3.5 |
| IP-077 | Al-aoja & dujail | Salah-ad-din | Tigris | D | 24.0 | 24.0 | 0.0 | 24.0 | 100% | 2019 | 2021 | | | 63.4 | 10.9 |
| IP-078 | Al-nai | Salah-ad-din/Diyala | Tigris | D | 33.0 | 33.0 | 0.0 | 33.0 | 100% | 2015 | 2017 | | | 69.5 | 11.2 |
| IP-079 | Ishaqi | Salah-ad-din/Baghdad | Tigris | D | 317.0 | 317.0 | 0.0 | 317.0 | 100% | 2015 | 2022 | | | 753.7 | 127.6 |
| IP-080 | Shahrazoor | Sulaymaniyah | Diyala * | 84 | 74.0 | | rainfed | | | | | | | | |
| IP-081 | Kalar | Sulaymaniyah | Diyala | 57 | 12.0 | 4.0 | 0.0 | 4.0 | 33% | 2015 | 2017 | | | 8.6 | 1.9 |
| IP-082 | Kaolas | Sulaymaniyah | Diyala * | 86 | 17.0 | | rainfed | | | | | | | | |
| IP-083 | Small farms at springs in the sulaymaniyah muhafadha in the | Sulaymaniyah | GW-springs | GW | 1.0 | | 1.0 | 1.0 | 100% | | | 2023 | 2025 | 1.6 | 0.4 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | diyala river basin | | | | | | | | | | | | | | |
| IP-084 | Shekh-langar | Sulaymaniyah | Diyala | 67 | 1.0 | | 1.0 | 1.0 | 100% | | | 2020 | 2022 | 2.1 | 0.5 |
| IP-085 | Balajo-khanaqeen-wind | Sulaymaniyah/Diyala | Diyala | 68 | 89.0 | | 89.0 | 89.0 | 100% | | | 2020 | 2024 | 167.1 | 29.9 |
| IP-086 | Qara teppe | Diyala | Diyala | 17 | 62.0 | | 62.0 | 62.0 | 100% | | | 2025 | 2029 | 117.2 | 20.0 |
| IP-087 | Jalawlaa & al-saÆdiyah | Diyala | Diyala | 18 | 24.0 | | 24.0 | 24.0 | 100% | | | 2025 | 2027 | 47.7 | 8.0 |
| IP-088 | Small farms at wells in the diyala muhafadha in the diyala river basin | Diyala | GW-wells | GW | 4.0 | | 4.0 | 4.0 | 100% | | | 2030 | 2032 | 7.6 | 1.3 |
| IP-089 | Upper khalis | Salah-ad-din/Diyala | Diyala | D | 216.0 | 216.0 | 0.0 | 216.0 | 100% | 2017 | 2024 | | | 467.1 | 74.9 |
| IP-090 | Lower khalis | Diyala/Baghdad | Tigris | D | 230.0 | 230.0 | 0.0 | 230.0 | 100% | 2017 | 2024 | | | 587.7 | 98.8 |
| IP-091 | Mandeli | Diyala | Diyala | 13 | 29.0 | 3.0 | 26.0 | 29.0 | 100% | 2018 | 2020 | 2019 | 2021 | 64.9 | 10.1 |
| IP-092 | Haruniyay+ combined head reach (sudour)+ muqdadiyah | Diyala | Diyala | D | 93.0 | 85.0 | 8.0 | 93.0 | 100% | 2017 | 2021 | 2022 | 2024 | 188.1 | 28.7 |
| IP-093 | Ruz | Diyala | Diyala | D | 230.0 | 230.0 | 0.0 | 230.0 | 100% | 2017 | 2024 | | | 541.7 | 82.6 |
| IP-094 | Mahrut | Diyala | Diyala | 38 | 190.0 | 10.0 | 100.0 | 110.0 | 58% | 2016 | 2018 | 2017 | 2021 | 283.1 | 48.1 |
| IP-095 | Khoraisan (sareah) + tel asmar | Diyala/Baghdad | Diyala | 31 | 93.4 | | 93.4 | 93.4 | 100% | | | 2022 | 2026 | 238.8 | 40.3 |
| IP-096 | Small farms in the low course of diyala river along the right bank | Baghdad | Diyala | 47 | 3.0 | | 3.0 | 3.0 | 100% | | | 2028 | 2030 | 7.4 | 1.2 |
| IP-097 | 9th april project (nehrawan) " previously 7th of april project" | Baghdad | Diyala | D | 78.0 | 78.0 | 0.0 | 78.0 | 100% | 2017 | 2021 | | | 227.1 | 37.4 |
| IP-098 | Small farms on left bank of the diyala and tigris river south of baghdad | Baghdad | Tigris | 51 | 17.0 | 0.0 | 12.8 | 12.8 | 75% | | | 2028 | 2030 | 37.1 | 6.0 |
| IP-099 | Wihda (nehrawan) | Baghdad/Wasit | Tigris | D | 85.0 | 85.0 | 0.0 | 85.0 | 100% | 2015 | 2019 | | | 251.5 | 40.8 |
| IP-100 | Hour-rijab | Baghdad/Wasit | Tigris | D | 95.0 | 95.0 | 0.0 | 95.0 | 100% | 2019 | 2023 | | | 275.9 | 44.4 |
| IP-101 | Suwairah ( hafria) | Diyala/Baghdad/Wasit | Tigris | D | 148.0 | 148.0 | 0.0 | 148.0 | 100% | 2015 | 2022 | | | 398.9 | 59.3 |
| IP-102 | Qusaiba | Wasit/Babil | Tigris | D | 55.0 | 55.0 | 0.0 | 55.0 | 100% | 2016 | 2020 | | | 141.1 | 20.5 |
| IP-103 | Shihaimiyah | Wasit/Babil | Tigris | D | 72.0 | 72.0 | 0.0 | 72.0 | 100% | 2017 | 2021 | | | 185.7 | 25.9 |
| IP-104 | Middle tigris | Baghdad/Wasit/Babil/Diwaniyah | Tigris | 35 | 528.2 | | 528.2 | 528.2 | 100% | | | 2019 | 2030 | 1,442.5 | 196.6 |
| IP-105 | Daboni (al-jut farms) | Wasit | Tigris | D | 68.0 | 68.0 | 0.0 | 68.0 | 100% | 2019 | 2023 | | | 196.5 | 27.0 |
| IP-106 | Badra-jassan | Wasit | Tigris | 21 | 75.0 | 47.0 | 28.0 | 75.0 | 100% | 2017 | 2021 | 2020 | 2022 | 198.3 | 30.3 |
| IP-107 | Karmashiyah | Wasit | Eastern Tributaries | 77 | 1.0 | | 1.0 | 1.0 | 100% | | | 2030 | 2032 | 2.6 | 0.4 |
| IP-108 | Dalmaj | Wasit | Tigris | D | 296.0 | 296.0 | 0.0 | 296.0 | 100% | 2016 | 2023 | | | 848.9 | 114.5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IP-109 | West gharraf | Wasit/Thi-Qar | Tigris | 15 | 337.0 | 60.0 | 277.0 | 337.0 | 100% | 2019 | 2023 | 2022 | 2031 | 999.3 | 138.6 |
| IP-110 | Al-mghashe "previously 17th july" | Diwaniyah/Thi-Qar | Tigris | D | 56.0 | 56.0 | 0.0 | 56.0 | 100% | 2016 | 2020 | | | 167.2 | 23.2 |
| IP-111 | East gharraf | Wasit/Thi-Qar | Tigris | 24 | 475.0 | 55.0 | 400.7 | 455.7 | 96% | 2016 | 2020 | 2019 | 2032 | 1,367.5 | 193.0 |
| IP-112 | Dawaiyah "previously 30th july" | Missan/Thi-Qar | Tigris | 11 | 183.0 | 123.0 | 60.0 | 183.0 | 100% | 2015 | 2022 | 2024 | 2028 | 567.9 | 79.9 |
| IP-113 | Dujailah | Wasit | Tigris | D | 186.0 | 186.0 | 0.0 | 186.0 | 100% | 2016 | 2023 | | | 556.4 | 81.7 |
| IP-114 | Kut-butaira | Wasit/Missan | Tigris | 20 | 133.0 | 16.0 | 117.0 | 133.0 | 100% | 2018 | 2020 | 2021 | 2027 | 393.3 | 60.1 |
| IP-115 | Abu-bshoot | Missan | Tigris | D | 29.0 | 29.0 | 0.0 | 29.0 | 100% | 2017 | 2019 | 0 | | 88.7 | 12.9 |
| IP-116 | Taib | Missan | Eastern Tributaries | 2 | 1.0 | | 1.0 | 1.0 | 100% | | | 2018 | 2020 | 2.8 | 0.4 |
| IP-117 | Duwairij | Missan | Eastern Tributaries | 1 | 3.0 | | 3.0 | 3.0 | 100% | | | 2018 | 2020 | 7.2 | 1.1 |
| IP-118 | Nahar-saad | Missan | Tigris | D | 75.0 | 75.0 | 0.0 | 75.0 | 100% | 2015 | 2019 | | | 215.7 | 31.1 |
| IP-119 | Amara | Missan | Tigris | 7 | 400.0 | | 400.0 | 400.0 | 100% | | | 2021 | 2034 | 1,118.4 | 159.3 |
| IP-120 | Shatt al-arab & swaib | Basrah | Tigris | 66 | 290.0 | 20.0 | 130.0 | 150.0 | 52% | 2015 | 2017 | 2017 | 2022 | 404.8 | 70.3 |
| IP-121 | Zubair (irrigated from wells) | Basrah | GW-wells | GW | 35.0 | | 35.0 | 35.0 | 100% | | | 2030 | 2032 | 99.5 | 18.4 |
| IP-122 | Modern village 1 and 2 | Baghdad | Tigris | 50 | 60.0 | | 60.0 | 60.0 | 100% | | | 2021 | 2025 | 156.1 | 23.3 |
| IP-123 | Basroukiya | Diwaniyah/Muthanna | Tigris | 10 | 94.0 | | 94.0 | 94.0 | 100% | | | 2028 | 2032 | 273.9 | 38.4 |
| IP-124 | Mdalel, mrezeja and fao | Wasit/Diwaniyah/Thi-Qar | Tigris | 9 | 12.0 | | 12.0 | 12.0 | 100% | | | 2023 | 2025 | 35.3 | 4.9 |
| IP-125 | Abbasi | Kirkuk/Salah-ad-din | Tigris * | 34 | 60.0 | | rainfed | | | | | | | | |
| IP-126 | Sader | Erbil/Kirkuk/Salah-ad-din | Tigris | 28 | 150.0 | | 20.0 | 20.0 | 13% | | | 2020 | 2022 | 44.0 | 7.6 |
| IP-127 | Ali gharbi and ali sharqi | Missan | Tigris | 3 | 137.0 | | 137.0 | 137.0 | 100% | | | 2020 | 2024 | 403.4 | 62.7 |
| IP-128 | Boghaylat | Missan/Thi-Qar | Tigris | 6 | 30.0 | | 30.0 | 30.0 | 100% | | | 2022 | 2024 | 93.4 | 13.2 |
| IP-129 | Jazeera (island) sayed ahmad | Missan/Thi-Qar | Tigris | 5 | 40.0 | | 40.0 | 40.0 | 100% | | | 2022 | 2026 | 123.3 | 17.4 |
| IP-130 | Southern ez river | Missan | Tigris | 4 | 17.0 | | 17.0 | 17.0 | 100% | | | 2019 | 2021 | 45.0 | 7.7 |
| IP-131 | Khozaimiya | Salah-ad-din | Tigris | 29 | 5.0 | | 2.0 | 2.0 | 40% | | | 2020 | 2022 | 4.9 | 0.8 |
| IP-132 | Jazeera western samarra | Salah-ad-din | Tigris | 49 | 89.0 | | 89.0 | 89.0 | 100% | | | 2026 | 2030 | 220.9 | 37.5 |
| IP-133 | Upper resasy | Salah-ad-din | Tigris | 44 | 18.0 | | 18.0 | 18.0 | 100% | | | 2022 | 2024 | 45.8 | 7.8 |
| IP-134 | Southern haseeba al baghouz | Anbar | Euphrates * | 59 | 4.0 | | rainfed | | | | | | | | |
| IP-135 | Expanding hilla hashimiyah | Babil/Diwaniyah | Euphrates | 46 | 150.0 | | 150.0 | 150.0 | 100% | | | 2025 | 2032 | 361.8 | 50.5 |
| IP-136 | Extension sewaer | Muthanna | Euphrates | 16 | 43.0 | | 43.0 | 43.0 | 100% | | | 2030 | 2034 | 129.3 | 18.8 |
| IP-137 | Extension Middle Tigris-Suwaira | Wasit | Tigris | 36 | 137.0 | | 137.0 | 137.0 | 100% | | | 2026 | 2030 | 374.1 | 51.0 |

| SWLRI ID | PROJECT NAME | GOVERNORATE | SOURCE | RANKING | Total Area MoWR [k donum] | Developed till 2013 [k donum] | To Be Developed in the Plan [k donum] | Final Development [k donum] | % DEV | REHAB [START YEAR] | REHAB [END YEAR] | RECLAM [START YEAR] | RECLAM [END YEAR] | TOTAL DEMAND [MCM/yr] | MAX MONTHLY DEMAND [MCM] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IP-138 | Al Gharbia | Wasit | Tigris * | 32 | 40.0 | | rainfed | | | | | | | | |
| IP-139 | Kirkuk Phase 3 | Salah-ad-din/Diyala | Udhaim | 22 | 160.0 | | 160.0 | 160.0 | 100% | | | 2018 | 2028 | 313.8 | 54.3 |
| IP-140 | Dhalouia | Salah-ad-din/Diyala/ | Tigris | 22 | 32.0 | | 32.0 | 32.0 | 100% | | | 2021 | 2023 | 62.8 | 10.9 |
| IP-141 | Farms in the north of Saqlawiya from Euphrate river and in the left of Saqlawiya stream | Anbar | Euphrates | | 26.0 | | 26.0 | 26.0 | 100% | | | 2020 | 2022 | 68.3 | 11.2 |
| IP-142 | Is'haqi farms from Balad up to the confluence with Tigris arm | Salah-ad-din/Baghdad | Tigris | | 62.0 | | 62.0 | 62.0 | 100% | | | 2028 | 2032 | 147.4 | 25.0 |