A report for JCCME prepared by Dunia, LLC

Water and Sewage Sectors in Iraq: Sector Report — February 2013

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Executive Summary and Introduction

Over the past 5 weeks, Dunia Frontier Consultants (DFC) conducted extensive field research in Iraq, supplemented by desktop research of publically available documentation of Iraqi government documentation and statistics in an effort to provide a clear overview of Iraq's current water and sewage sectors.

Field research involved a ten-day trip by a DFC international staff member to Basra Province. This trip resulted in approximately twenty meetings and interviews with Basra Provincial Council officials, advisors at the governor's office, officials at the Ministry of Municipalities and Public Works, district council members, scientists, academics, engineers and civil society activists. In addition to spending time in Basra City, the international staff member made trips to Um Qasr, Khor al-Zubair, Zubair, Safwan, Siba and al-Faw.

Meanwhile, Dunia Iraqi staff met with officials and obtained data from the Ministry of Environment, the Ministry of Municipalities and Public Works, the Ministry of Water Resources and the Ministry of Planning. Additionally, an Iraqi law firm, Dler Law Office, provided insights and analysis into the legal aspects of the water and sewage sectors.

Desktop research focused on reports by Iraq's Ministry of Water Resources, Ministry of Planning and Ministry of Municipalities and Public Works, as well as on materials made available by provincial governments and Iraqi academic institutions.

Key findings of the report include:

- While Iraq has two major rivers, and more fresh water per capita than most countries in the region, upstream withdrawal increases in Turkey and Syria, coupled with the lack of enforcement of a quota system in Iraq have led to a growing water crisis in southern Iraq, particularly in Basra province.
- Iraq's existing water and sewage infrastructure, including treatment plants and pipe networks, is largely in disrepair. Insufficient operating budgets are exacerbated by poorly trained personnel, unreliable electricity, and a tendency to look for quick fixes rather than long-term solutions to problems.
- Access to sewage and water networks is marginal in urban areas, and exceedingly poor in many rural areas. This is particularly true of access to sewage treatment plants.
- Despite water shortages in Basra, leading to costly damage to the agriculture sector, there is no effective widespread plan currently underway to reuse treated water for irrigation.

- Iraqi officials increasingly recognize that the broader involvement of international companies is needed to address the underlying problems in both the water and sewage sectors.
- Key Iraqi government agencies in the water and sewage sector include the Ministry of Municipalities and Public Works and its provincial level directorates, the Ministry of Water Resources, the Provincial Council's and the Provincial Governor's Offices.
- Iraqi officials widely feel they lack access to true experts in creating a comprehensive strategy for addressing water and sewage problems. This creates an advantage for Japanese companies, because, along with North American and Western European companies, Japanese companies are seen as being staffed with technical experts.
- Several officials noted to Dunia the need for not only increased reverse osmosis technologies in Basra due to elevated salinity levels in the Shatt al-Arab, but also the need to explore desalinization of seawater.

DFC is confident that this report will help JCCME and Japanese companies to better understand the current landscape of Iraq's, and in particular Basra's, water and sewage sectors. This report will also facilitate Japanese efforts to engage with Iraq's government in identifying areas where Japanese companies can work on developing Iraq's water and sewage infrastructure and provide an initial business development roadmap.

Kyle Stelma
Managing Director
Emerging Markets

Nationwide Overview

Population Indicators

Province[i]	Capital City	Population (million)	% Urban	% Below Poverty Line ($2.20/day)
Baghdad	Baghdad	7.145	87	13
Ninewa	Mosul	2.811	61	23
Basra	Basra	1.913	78	32
Babil	Hilla	1.652	53	41
Dhi Qar	Naseriya	1.616	58	32
Anbar	Ramadi	1.486	52	21
Salahaddin	Tikrit	1.191	46	40
Diyala	Baquba	1.561	41	33
Wassit	Kut	1.065	52	35
Qadisiya	Diwaniya	.990	52	35
Tamim	Kirkuk	.902	69	10
Karbala	Karbala	.888	65	37
Maysan	Amara	.824	65	25
Najaf	Najaf	.615	68	24
Muthanna	Samawa	.615	44	49

Economic Indicators

Critical Economic Data	
Total Land Mass	441,839 SQ KM
Nominal GDP (2012 est)	USD 160.7 billion
GDP Growth (2012 est)	12.57%
GDP Per Capita	USD 4,899
Inflation	6.1%
Oil Production	3.3 million
Labor Force	8.175 million
Unemployment	18%
Imports/GDP	54.5%
Exports/GDP	95%
Govt. Budget (2012)	USD 100.5 billion
Currency	New Iraqi Dinar (USD 1=IQD 1,163)

Overview of Challenges in the Water Sector

Iraq's potable water sector faces myriad challenges. The presence of these challenges offers inherent opportunities for international companies to become increasingly active in Iraq's water sector. Indeed, in conversations with a multitude of Iraqi government officials, one overarching theme of these conversations was a widespread awareness of the need for Iraq's government to enlist international companies not only in constructing new water infrastructure, but also in consulting on preliminary studies, strategic planning, tendering processes and project oversight.

Major challenges identified in Dunia's research included:

- A lack of strategic coordination between the disparate government entities tasked with developing Iraq's potable water infrastructure. The Ministry of Water Resources, Ministry of Municipalities and Public Works, Provincial Councils, Governors Offices and District Councils all have inputs into the development of water infrastructure. However, Dunia interviews suggest that often these bodies do not coordinate effectively, to the point that their respective plans are often contradictory[ii].
- Attempts at quick solutions rather than long term planning. Government entities often feel pressure to quickly spend the money in their annual budgetary allocations. Additionally, national and provincial political figures see the quick provision of services as a way to shore up constituent support prior to elections. Both of these factors lead to wasteful spending of money on poorly conceived projects[iii].
- Absence of reliable data. Multiple interviews with Iraqi officials suggested that the absence of reliable data hampers efforts to effectively develop Iraq's water infrastructure. Two examples of this include: First, a provincial official noting that the Water Directorate had no idea what water demand currently is in any given city, because they could not accurately estimate the size of the population. Second, an official recounting that an international company signed a contract to build a purification plant based on a specific set of data on total dissolved solids (TDS) levels, however when the company arrived, they discovered TDS levels three times the previously understood amount, rendering their plans impossible to implement.
- Depletion of resources. This problem is particularly pervasive in central and southern Iraq. The Tigris and Euphrates Rivers both originate in Turkey, with the Euphrates (and very briefly the Tigris) passing through Syria as well before entering Iraq. Turkey and Syria's rate of usage of the Tigris and Euphrates has increased and Iraq has failed to successfully implement a rationing system along its stretch of the two rivers, resulting in a significantly diminished flow rate in southern Iraq. The same phenomenon has occurred with the Qaroon River, which originates in Iran.
- Increased pollution and salinity. Several factors have combined to cause a significant deterioration in water quality in much of Iraq, particularly in southern Iraq. These

factors include increased salinization due to decreased flow rate of the Tigris, Euphrates and Qaroon in southern Iraq, industrial pollution from Iraq and Iran, urban population growth leading to dumping of raw sewage in rivers, and increased oil production without significant regulatory oversight.

Figure 1 A factory in the Iranian industrial city of Abadan sits on the Shatt al-Arab, less than 1KM from Iraq[iv]

Figure 2 Water in the Shatt al-Arab, the source for much of Basra's water network, shimmers with fuel pollution[v]

- Lack of services and maintenance. Irregular electricity provision is exacerbated by a lack of budgetary allocation for generators, generator fuel and preventative maintenance. All of these factors reduce the effectiveness of existent water treatment plants.

Overview of Challenges in the Sewage Sector

Iraq's sewage sector faces similar challenges to the water sector. Again, there seems to be a broad understanding amongst the Iraqi government institutions that deal with the sewage sector that they must increase the involvement of international companies if they are to overcome the challenges inherent in the sector.

Major challenges identified in Dunia's research included:

- Electricity shortages. A study by Iraq's Ministry of Planning suggested that unstable electricity provision had a significant negative impact on the effectiveness of Iraq's sewage treatment plants.[vi]
- Population growth. Urbanization coupled with general population growth have overwhelmed Iraq's urban sewage treatment plants. This has led to an increase in raw sewage being dumped directly into waterways.
- Uneducated public. An already poor pipeline network is exacerbated by a public not well educated on the proper use of drainage networks according to Iraqi officials interviewed by Dunia.
- Poor understanding of the scope of the problem due to inaccurate statistics. For example, a 2012 report provided to Dunia by the Ministry of Water Resources focusing on the country's sewage network contained statistics from 2002.
- Poor central planning leading to delays in project implementation. An employee of an Iraqi company that has worked on sewage infrastructure noted that a contract was signed with an international company to build a large plant two years ago. However, the international company has yet to begin work, because the government has not yet provided the blueprint and specifications for the facility, something that was supposed to be accomplished over a year ago.

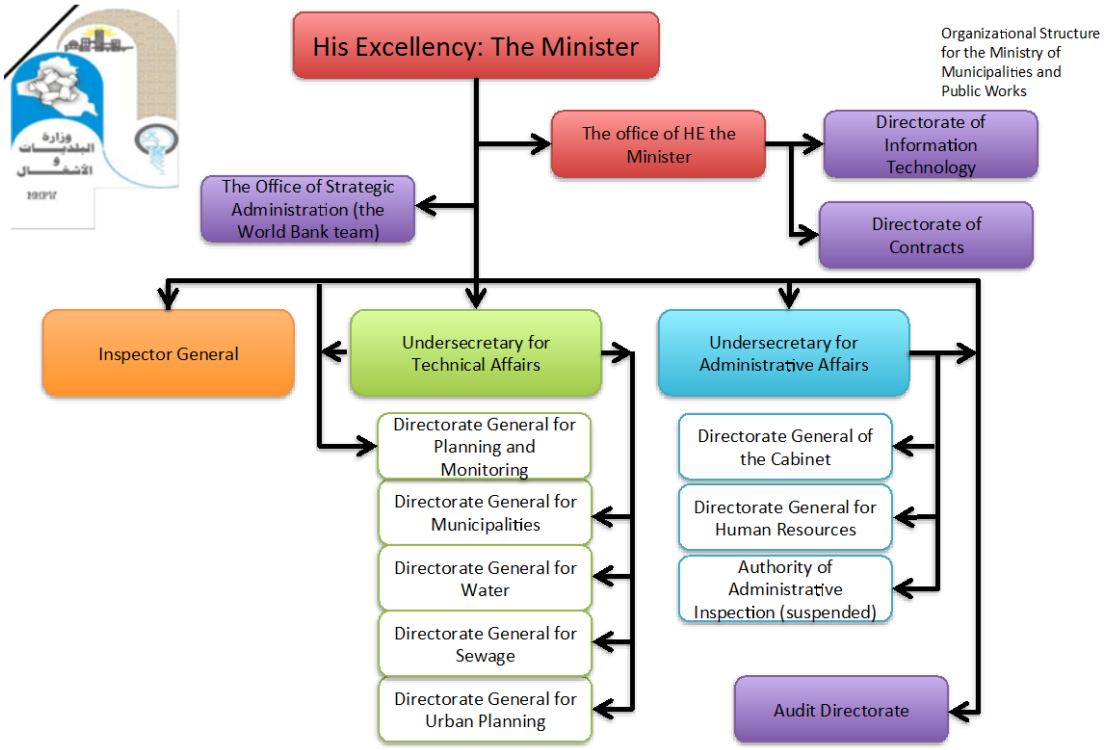
Water Sector Organization and Structure

Government Ministries and Agencies

There are a number of Iraqi government institutions and bodies involved in Iraq's drinking water and sewage sectors. This includes headquarters of central government entities in Baghdad, branches of these central government entities at the provincial level, and the provincial governments themselves. The following is a breakdown of the government entities involved in the water and sewage sectors:

- Central Government HQs in Baghdad
    1. Ministry of Municipalities and Public Works. The MoMPW is the central government authority tasked with strategizing, budgeting and implementing centrally funded projects in Iraq's water and sewage sectors. It is the single

most important entity in Iraq's water and sewage sectors, and its organizational structure is outlined below (it should be noted that there are separate directorates under the Undersecretary for Technical Affairs for water and sewage):



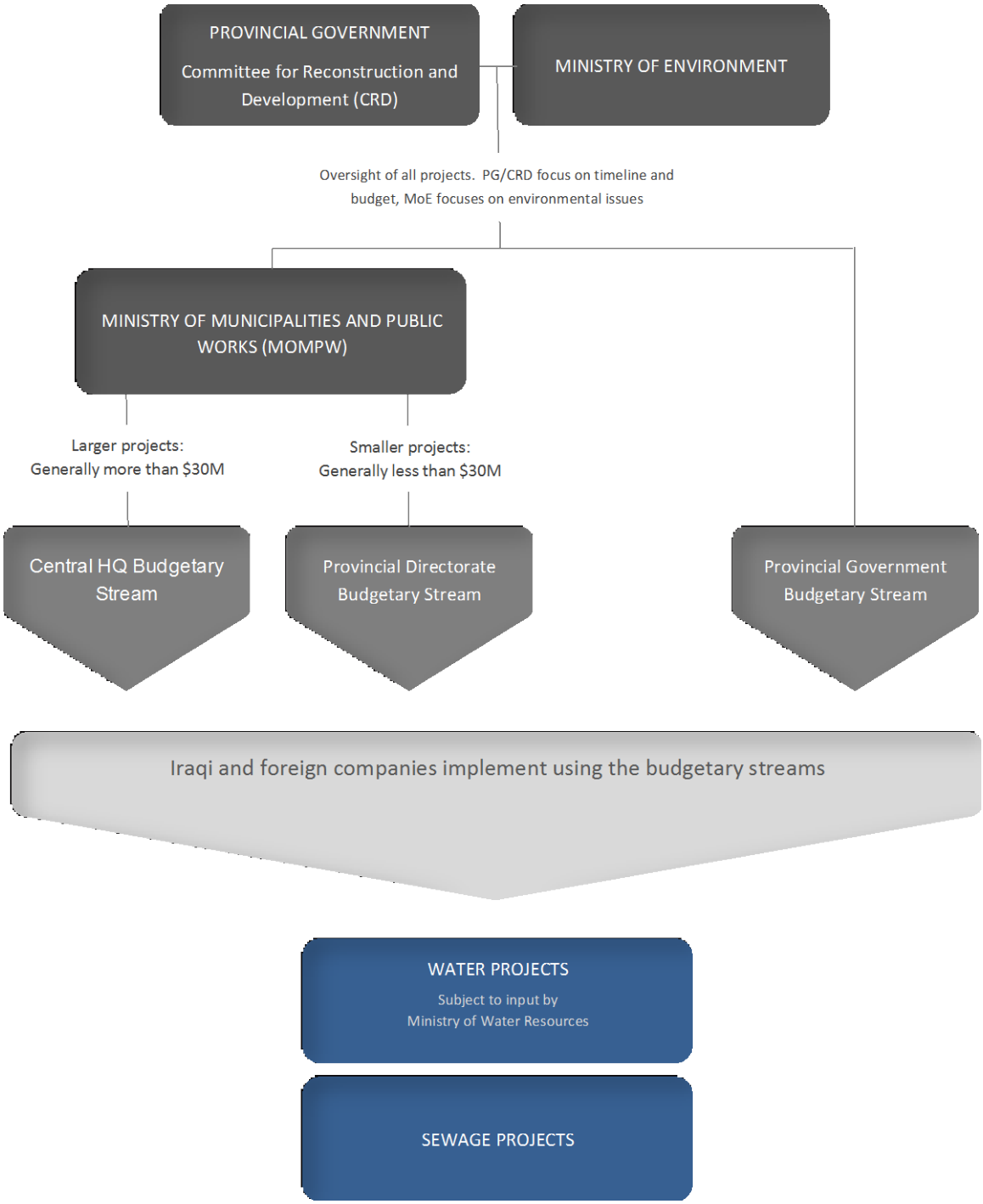
2. Ministry of Water Resources. The MoWR is of secondary importance to the MoMPW, primarily because water and sewage projects go through the latter, and not the former. The MoWR is relevant because it makes strategic decisions about Iraq's waterways that have a direct impact on the feasibility of specific water projects.
3. Ministry of Planning. The MoP is relevant to the water and sewage sectors in so far as its statistical wing COSIT undertakes studies on water and sewage issues that in turn help to direct the strategic thinking of the MoMPW.
4. Ministry of Environment. The MoE plays a role in conducting environmental studies of Iraq's waterways, and has the ability to advise on a project if it feels the project could negatively impact Iraq's environment.

5. Ministry of Health. The MoH plays a role similar to the MoE in assessing environmental impacts of projects involving Iraq's waterways. Specifically, the MoH looks at the health impact of given projects on Iraq's citizenry.
6. The Prime Minister's Office. While in theory the PMO should not be directly involved in project implementation, anecdotally, the office will order the implementation of a specific project by decree, essentially overriding the MoMPW.[vii]

- Central Government Branches at the Provincial Level
    1. Directorate of Sewage. Every governorate outside of Kurdistan has a DoS office in its provincial capital. The DoS is the provincial level arm of the Sewage Directorate of the MoMPW. The provincial directorates are also responsible for operating sewage plants in the provinces.
    2. Directorate of Water. Every governorate outside of Kurdistan has a DoW office in its provincial capital. The DoW is the provincial level arm of the Water Directorate of the MoMPW. The provincial directorates are also responsible for operating water treatment plants in the provinces.
    3. Ministry of Water Resources Provincial HQ. Iraq's governorates typically have a provincial level director general for the MoWR located in each provincial capital.
- Provincial Government (it should be noted that the PG controls a budgetary stream totally separate from that of the MoMPW)
    1. Office of the Governor. The governor's office is in charge of strategic planning for the water and sewage sectors, and also for making the final decision on the issuing of tenders.
    2. Provincial Council. The PC works with the governor's office to come up with specific projects that are then tendered. The PC will typically have significant input in making recommendations to the governor's office on awarding tenders. The PC also plays an oversight role, ensuring that projects are completed on time and at budget.
    3. Committee for Reconstruction and Development. The CRD is a sub-unit of the PC. In many provinces the CRD is essentially delegated the role of oversight and tender recommendations by the PC.

The above-mentioned entities all play a role in the water and sewage sectors. However, on a practical level, a company implementing a water or sewage project will primarily interface with the MoMPW and relevant provincial directorate if they are implementing a project via the MoMPW's budget, or, they will primarily interface with the office of the governor and the provincial council if they are implementing a project using the provincial government's budget stream.

The below graphic demonstrates in visual form the how projects are implemented.



Water Resource Management

The MoWR oversees the management of water resources. In practical terms, this means that MoWR decision-making has a direct impact on drinking water projects implemented by the MoMPW and the provincial governments. Dunia's interviews suggested that there is insufficient communication between the MoWR and both the MoMPW and the provincial governments. Specifically, some decisions taken by the MoWR work counter to the strategic planning of the provincial governments, and/or the MoMPW.

As such, it is recommended that any Japanese company signing a contract with either the provincial government or the MoMPW in the drinking water sector meet with senior officials in the relevant province at the MoWR to get the viewpoint of the MoWR on the feasibility of the project.

Permits and Monitoring

In addition to the oversight of water resources executed by the MoWR, the Ministry of Health and the Ministry of Environment also play an official role, codified by law, in issuing permits and monitoring Iraq's waterways. For example, the MoH is the body tasked with issuing a permit to any company or individual seeking drain any water into any Iraqi waterway (expanded on in the Environmental Criteria section). Similarly, the Department of Protecting and Improving the Environment, which answers to the MoE, also must issue a license to anyone seeking to dump or drain water into Iraq's waterways.

Tariffs

The water tariff in Iraq is currently set at approximately IQD 3.5/cubic meter ($.0035/cubic meter). This tariff, assuming it is regularly paid, is estimated to cover a maximum of 5% of Iraq's operations and maintenance costs for the drinking water sector[viii]. However, according to Iraqi officials, most individuals and many businesses don't pay the water tariff, so in actuality the percentage of costs covered by the tariff is far less than 5%.[ix]

Companies

The majority of water and sewage projects in Iraq have been awarded to Iraqi construction and contracting companies[x]. However, it should be noted that this is changing, as there has been a clear trend of projects implemented by Iraqi companies either not being finished, going way over budget, exceeding deadline, or in some cases the contracting company simply stealing the money and leaving[xi]. However, the following Iraqi companies have been linked to recent projects in the water and sewage sector:

Company	Province
Al-Mabruk Company	Diyala
Al-Nibras al-Abiyadh	Anbar
Jana al-Falah	Anbar
Al-Rahef	Anbar
Al-Iraq al-Hur Company	Anbar
Al-Khaleej al-Kabeer	Karbala
Deefaf al-Rafidayn	Wassit
Al-Iqbal Company	Maysan
Al-Rabat Company	Muthanna
Al-Yamama	NA
Al-Faruuq State Company	Qadisiya

In addition to the companies listed above, in response to a specific information request, Dunia has identified several companies in Basra that interested Japanese companies should consider meeting in Basra to discuss potential collaboration on future water and sewage projects.

Company	Notes	Contact
Al-Madar al-Hur	Worked on implementing water pump sewage project in al-Qibla, Basra. Previously worked for US Military on construction contracts.	**Basrah Address:** Manawi Basha Hotel, Khora Street. **Contact Person:** Mr. Uday Jasim Abood **Local Telephone**: +964(0) 7808 539 888
Al-Dayer United Company	Worked on water project in Garma, Basra province. Contracted on water injection project at West Qurna.	**Basrah Address:** HQ1 Basrah – Khor-Al-Zubair , Um Qasser St. **Contact Person in Basrah:** Issam Abdulbari **Title:** Deputy General Manager **Local Telephone:** +964(0)7801 019 847 or +964(0)7703 194 231 **E-mail Address:** manager@aldayerunited.com, factory@aldayerunited.com or essam@aldayerunited.com
Dar Ibn Khaldun for General Contracting	Pipe laying project for Basra Water Directorate. Water treatment plant in	**Basrah Address:** Al Gazaeir St. – Near Yard Aviation **Contact Person in Basrah:**

	Qurna, Basra province.	Abdul-Ameer Abbas Jaber **Title:** Deputy General Manager **Local Telephone:** +964(0)7801 084 453 **E-mail Address:** horus_iraq@yahoo.com
ABR al-Sharq Company	NA	**Basra Address:** Al-Kornish Street, near Central Bank of Iraq. **Contact info:** +964 780 100 9710 qussay@abrsharq.almoosawigroup.com

Supply and Demand Details

Water Supply

The vast majority of Iraq's fresh water comes from the Tigris and Euphrates Rivers. In 2009 the Tigris River discharged 49.2 billion cubic meters into Iraq, and the Euphrates 19.34[xii].

However, even within the Ministry of Water Resources, there are conflicting statistics as to the exact supply of water to Iraq. A 2012 study published by Iraq's Ministry of Water Resources regarding renewable water resources gave the below figures, which are lower than the numbers above, also provided by the same Ministry:

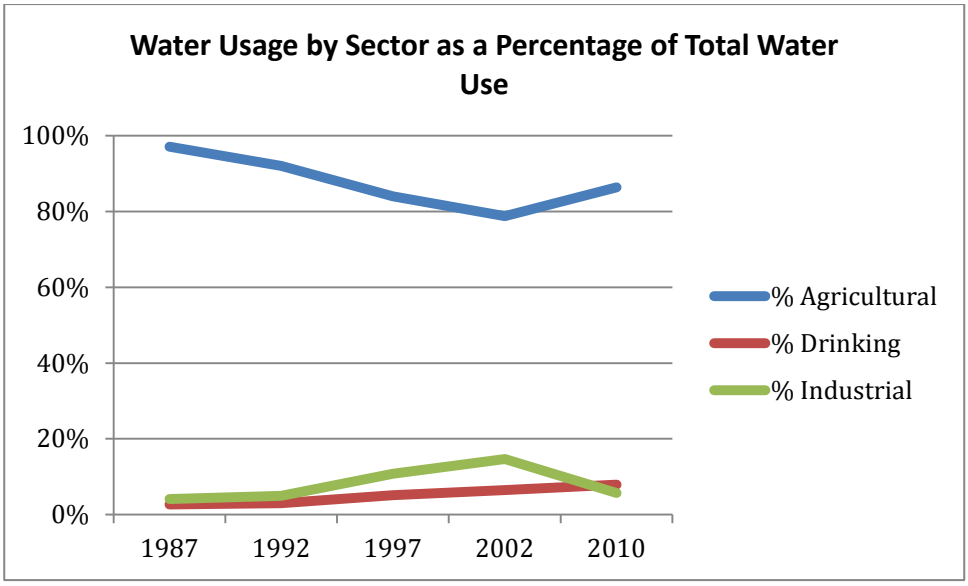
Annual Renewable Water Resources Statistics (2010 data)[xiii]		
	Cubic Meters/Year	Cubic Meters Per Capita
Surface Water	50,045,000,000	1528
Ground Water	4,228,000,000	140

Sectoral Water Use

Historically, agriculture has made up by far the largest portion of Iraq's water demand. Unfortunately, monitoring sectoral demand effectively ceased in Iraq following the US invasion and subsequent civil war. However, an analysis of data compiled prior to the 2003 war, and beginning again in 2009, when data collection began to reemerge, demonstrates the use of water for agricultural reasons as a percentage of total water usage dropped dramatically from the late 1980s until the eve of the overthrow of Saddam Hussein. The demolition of Iraq's industrial sector between 2003 and 2007 caused a reversal of this phenomenon as the majority of Iraq's state owned factories lay dormant. However, the trend of an increase in industrial

water usage at the expense of agricultural usage witnessed between 1987-2002 is anticipated to commence again with the development of Iraq's energy and industrial infrastructure.

Total Water Withdrawal and Sources



[xiv]

Total water demand by sector, as determined by the Ministry of Water Resources for 2010 is outlined below.

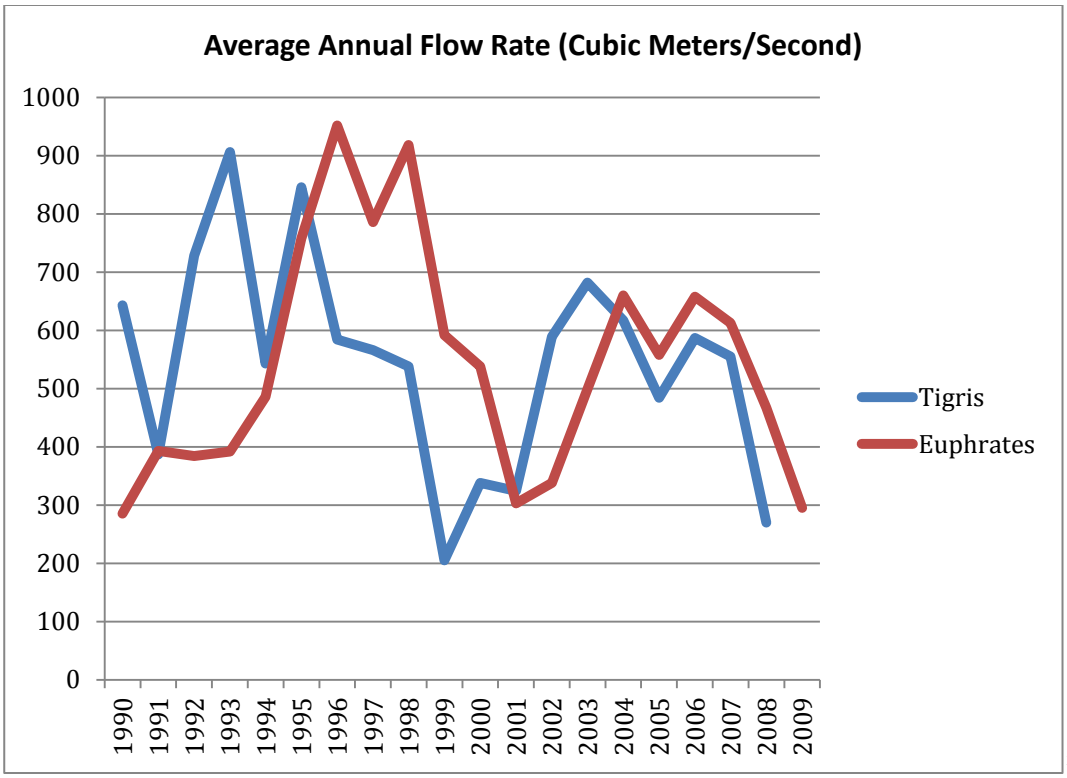
2010 Water Demand by Sector[xv]

Sector	Demand cubic meters/year
Drinking water	3,780,000,000
Industrial Usage	2,720,000,000
Agricultural/irrigation	42,000,000,000
Marsh renewal	19,600,000,000
Evaporation	8,400,000,000
Total	76,500,000,000

Municipal Water and Wastewater Infrastructure

Water Supply Indicators

The water volumes in the Tigris and Euphrates Rivers entering Iraq have decreased since the 1990s. This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria.



[xvi]

The reduction in water flow in southern Iraq has been particularly devastating. According to an Iraqi marine scientist interviewed by Dunia, water flow to the Shatt al-Arab in the early 1980s from the Qaroon River ranged from 300-700 cubic meters/second. That figure has since been reduced to near zero. Additionally, the Tigris and Euphrates combined to provide another approximately 700 cubic meters/second to the Shatt al-Arab, and that number is now around 50 cubic meters/second. In short, the volume of water entering Iraq via the Tigris and Euphrates is greatly reduced, and, use of that limited water has increased in Iraq's upstream areas meaning that downstream areas are doubly affected.

Figure 3 A stretch of the Euphrates River runs through Ramadi, the capital of Anbar Province.

Wastewater Indicators

Iraq is currently believed to generate a total of 580 million cubic meters of wastewater annually, and is faced with an annual total of 7 billion cubic meters of drainage water[xvii].

Iraq currently only has proper wastewater treatment facilities for urban areas, typically only for the provincial capitals. Even in the serviced provincial capitals, a significant percentage of the population does not have their waste sent to a treatment plant; rather, it is piped directly into a waterway, or into predetermined dumping areas. Rural areas are almost without exception not linked to sewage treatment plants. For example, in Basra, an estimated 45% of the inhabitants of Basra City are linked to a network that sends their waste to a treatment plant, while less than 2% of people outside of Basra City have their waste processed.[xviii]

The below table shows a breakdown by province of the amount of waste sent to sewage treatment facilities by province in 2010.[xix]

Waste Treated by Province in 2010	
Province	Cubic Meters/Day
Baghdad	1,200,000
Dhi Qar	93,600
Basra	70,000
Maysan	70,000
Karbala	67,000

Anbar	77,006
Qadisiya	40,405
Najaf	25,100
Ninewa	15,150
Babil	12,000
Salahaddin	8,125
Tamim	1,284
Diyala	0
Wassit	0
Muthanna	0

Wastewater Treatment Plants

Currently Operational Large-scale Plants[xx]			
Province	**Number of Plants**	**Design Capacity (Cubic Meters/Day)**	**Actual Capacity (Cubic Meters/Day)**
Anbar	3	73,600	6624
Baghdad	3	680,000	1,200,000
Babil	1	12,000	12,000
Karbala	1	50,000	48,000
Salahaddin	4	48,500	11,000
Najaf	1	35,000	25,000
Qadisiya	2	15,750	9,705
Dhi Qar	3	35,000	25,000
Maysan	2	45,000	45,000
Basra	1	286,000	70,000
Muthana	0	0	0
Wassit	0	0	0
Diyala	0	0	0
Tamim	0	0	0
Total	21	1,280,850	1,482,329

Many of the plants listed above are in various stages of disrepair. Indeed, the three major Baghdad sewage treatment plants were constructed in the 1940s and 1950s. Other central plants are newer than these, but are still decades old. In the cases where actual capacity exceeds design capacity, the plants are either simply overburdened, thus having a negative impact on their effectiveness, or there have been piecemeal attempts to increase the plant capacity. The plants in the above table will in the near future be joined by a multitude of new

sewage plants. These new plants are covered in more detail in the Ongoing and Planned Projects section.

The large-scale central plants are complemented in many areas by secondary small capacity plants.

Appendix Two has a plant by plant breakdown with available information on plant specifics for those plants where information was available.[xxi]

Currently Operational Small-scale Plants[xxii]

Province	Number of Plants	Design Capacity (Cubic Meters/Day)	Actual Capacity Cubic Meters/Day)
Ninewa	7	23,000	15,150
Tamim	9	8,180	46
Karbala	2	25,000	25,000
Najaf	2	200	100
Qadisiya	3	814	700
Muthanna	1	500	500
Dhi Qar	3	10,100	3500
Diyala	0	0	0
Anbar	0	0	0
Baghdad	0	0	0
Babil	1	Na	0
Wassit	0	0	0
Salahaddin	0	0	0
Maysan	0	0	0
Basra	0	0	0
Total	29	72,494	44,996

Water Treatment Plants

Iraq's water treatment plants largely extract water from the Tigris and Euphrates Rivers, and their various tributaries. Indeed, one of the problems currently facing Iraq is its relative lack of urban reservoirs.

According to Dunia interviews with Iraqi officials at the Ministry of Water Resources, most urban areas (provincial capitals, district capitals and sometimes sub-district capitals) have one or more large water treatment plants operated by the provincial branch of the Water Directorate belonging to the Ministry of Municipalities and Public Works. A large web of much smaller

treatment plants complements these large water treatment plants, also operated by the Water Directorate. However, in many cases the output of the large and small plants is not suitable for drinking, particularly in southern Iraq. Residents of Basra City interviewed by Dunia noted that they use tap water for showering and household cleaning, but uniformly use either bottled water, or privately treated water delivered via tanker trucks for drinking.

This has led to the creation of an undetermined number of private owners of water purification technology who obtain water from one of the smaller plants, purify it, and then sell it to citizenry.

Details on specific water treatment plants are provided as Appendix One. The table below details the allocation of water treatment facilities across Iraq's governorates.

Large and Small Water Stations in Iraq's Provinces[xxiii]

Province	Number of Large Plants	Output of Large plants (cubic meter/day)	Number of Small Plants	Output of Small plants (cubic meter/day)	Total Output (cubic meters/day)
Nenawa	41	727,591	75	97,997	825,588
Kirkuk	16	393,876	215	265,936	659,812
Baghdad	10	226,080	137	252,067	478,147
Dyala	25	237,043	147	219,366	456,409
Salah Al-Din	20	336,200	177	282,410	618,610
Babel	18	245,920	264	391,741	637,661
Najaf	13	258,960	118	233,270	482,230
Karbala	7	242,620	124	215,283	457,903
Wassit	21	185,500	202	247,350	432,850
Anbar	21	372,418	155	177,003	549,421
Messan	13	68,600	230	383,222	451,822
Muthana	8	157,017	62	115,738	272,755
Dewanyia	15	198,773	175	188,531	387,304
Thi-Qar	18	109,140	141	270,182	379,322
Basra	15	237,000	214	652,960	889,960

Desalinization

Iraq's only coastline is along the Persian Gulf in Basra Province. Currently, according to officials at the provincial government and the Basra Water Directorate (belonging to the Ministry of Water Resources), water from the Gulf is not used for drinking water or agriculture/irrigation, and as such there are no desalinization plants doing seawater reverse osmosis of water from the

Persian Gulf.[xxiv] However in Basra, multiple Iraqi officials, including a district council chief and deputy director of the Basra Water Directorate, noted that they believe large-scale desalinization plants utilizing water from the Persian Gulf are the only sustainable answer to Basra's drinking water and irrigation needs.

As such, the current extent of desalinization occurs with reverse osmosis systems in existent water plants using the brackish Shatt al-Arab water or polluted river water, particularly in Basra Province where salinity levels are significantly higher than the rest of Iraq.

Water Reuse

Currently, Iraq fails to reuse its treated wastewater in an efficient way, according to officials interviewed by Dunia. Treated wastewater is sometimes dumped back into freshwater sources, according to officials, but despite much discussion of the subject, there are yet to be successful efforts to efficiently reuse water on a local level.

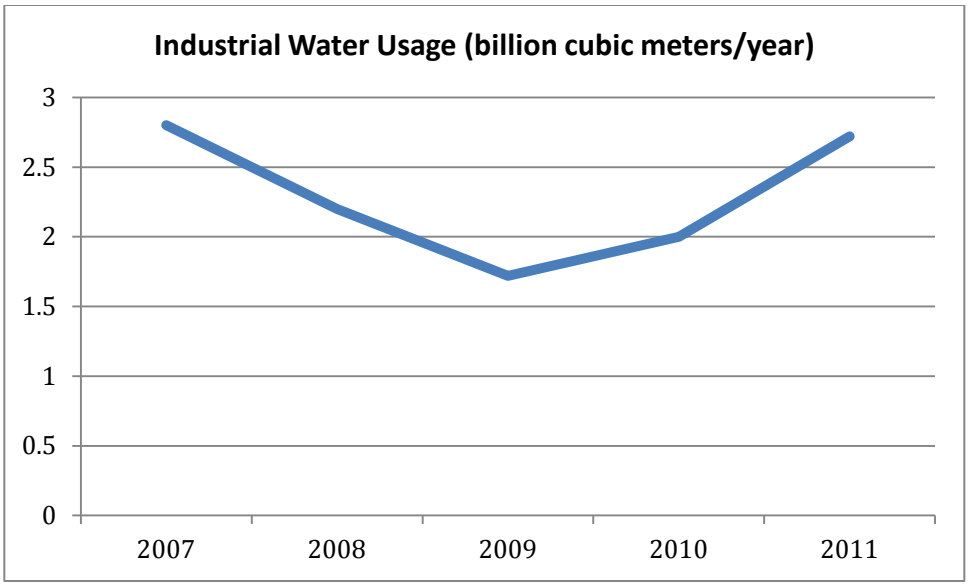
According to a provincial government official interviewed by Dunia, *"what we want to do going forward is make sewage treatment more localized. We need to divide the city, and the province as a whole, up into zones. Sewage water treated in these zones needs to be recycled locally and used for agricultural purposes. For gardens, and local farming. Right now, there isn't really a localized system for reuse of water."*[xxv]

Corroborating the provincial official's narrative, a report commissioned by the Ministry for Water Resources noted, *"on a practical level, the Baghdad municipality is the first to utilize waste water for agricultural purposes. This has been done in the 1030 hectare green belt in the north west of Baghdad. The project uses 15,000 cubic meters per day to water 125,000 trees."*[xxvi]

Water Industry

Industrial Water Usage 2007-2011

The most recent Ministry of Water Resources estimates put Iraq's annual industrial water usage at 2.72 billion cubic meters per year. According to statistics from the Ministry of Water Resources, total industrial water usage is currently on the rebound after falling year on year between 2007 and 2009.



Total Industrial and Wastewater Treatment and Discharge

Iraq's currently operational wastewater treatment plants (central and small-scale plants) process 1,527,325 cubic meters per day, or 557,473,625 cubic meters per year, according to the latest estimates from the Ministry of Water Resources. Meanwhile, Iraq's industrial water consumption is currently estimated at 2,720,000,000 cubic meters per year.[xxvii]

There are currently no accurate statistics for small-scale industrial wastewater treatment plants or their discharge. Many large industrial plants, such as Iraq's oil refineries, have dedicated treatment plants. For example, Iraq's Dora Refinery in Baghdad has a dedicated treatment plant that processes 750 cubic meters per hour. This water is discharged into the Tigris River in Baghdad, with an Iraqi scientist noting that the water is not adequately treated and leads to *"a harmful environmental impact on the Tigris River."*[xxviii]

Corroborating this narrative, an Iraqi biologist interviewed by Dunia noted that Iraq's industrial enterprises, notably oil refineries and cement factories, routinely dump heavily polluted, insufficiently treated wastewater into Iraq's waterways, or into adjacent empty land. The scientist noted, *"the Ministry of Environment notices this….but they are unable to do anything about it because they are poorly trained, poorly staffed and underfunded."*[xxix]

Similarly, Iraq's treated and untreated waste is routinely dumped back into Iraq's waterways. Another Iraqi scientist interviewed by Dunia noted, *"we have seen increased biological pollution on the floor of the Arab (Persian) Gulf at the mouth of the Shatt al-Arab. Our hypothesis is that*

this is due to the increase in the dumping of raw sewage into the Shatt al-Arab, which has resulted from the increase of population in Basra City, and the overwhelming of the Hamdani sewage treatment plant."[xxx]

The takeaway from the above is that despite the absence of precise statistics, Iraq's government is aware that it is facing an increasingly severe problem of water pollution due to untreated or poorly treated industrial and sewage being dumped into its waterways.

Water Finance

Tariffs

As noted previously in this report, Iraq has imposed a tariff of approximately $.003/cubic meter of water. Were everyone to pay this tariff, this would at best cover 5% of Iraq's water costs. However, the illegal tapping of Iraq's water lines is a common practice. During field visits to al-Faw and Siba in southern Basra Province, Dunia employees witnessed ample evidence of citizens tapping into the local water network in plain view of police. In other words, not only is Iraq's citizenry widely tapping illegally into the water network, but it is doing so with full knowledge of Iraq's government suggesting that the government is not only unable, but also unwilling to enforce water tariffs.

Ministry of Finance data suggests that in 2011, the MoMPW brought in IQD 98 million in taxes, or just over $84,000.[xxxi]

Operating Expenditure and Capital Expenditure

For the year 2011, the last year in which the Ministry of Finance was able to provide a detailed breakdown of spending by the Ministry of Municipalities and Public Works, the MoMPW had a total budget of $1,797,000,000. Of this $1.063 billion was dedicated to capital expenditure[xxxii]. $727 million was designated for operating expenditures[xxxiii]. It should be noted however that many of the MoMPW projects are multi-year projects, meaning that their budgets are drawn from up to five or more successive annual budgets. While a provincial level breakdown was not made available, Dunia estimates that the capital budget for Basra for 2011 from the MoMPW was $85,040,000[xxxiv].

Initial figures for the 2012 budget show that the MoMPW's total budget for 2012 increased to $2,032,000,000 in 2012 with a capital budget of $1,307,000,000 and an operating budget of $724,000,000

However, despite the absence of clear statistics, officials interviewed by Dunia suggested that chronic underfunding for operating expenses, preventative maintenance and spare parts is a serious and ongoing problem for water and sewage projects alike.[xxxv]

Similarly, a Basra provincial government official noted in an interview that he believed the disparate provincial governments combined had approximately $13 billion to spend on all rehabilitation and development projects in 2012. He added that his provincial government had a $1.5 billion budget for projects in 2012, and a $1.6 billion budget for 2013. The official noted that in 2010 60% of the province's development budget was spent on water and sewage projects, while that number was closer to 45% in 2012 and was expected to be 30% in 2013[xxxvi]. The official noted that, "the large majority" of this budget was dedicated to capital expenditure, rather than operational costs, although he was unable to provide a precise figure.

In addition to spending by Iraq's government on water and sewage projects, several development agencies have also funded projects. Preeminent among these are USAID and JICA according to an official of the MoMPW's Water Directorate.[xxxvii]

Government's Water and Sewage Strategy

Water

Iraq's government has issued a five year development plan which aims to[xxxviii]:

- Address the shortage of drinking water to the rural population, deemed to be at least 35%
- Implement 92 water projects using funds delegated to the provincial governments
- Address current operational shortcomings by providing fuel, electricity and engineering as well as requisite equipment
- Implement water quotas
- Increasing citizen awareness of water use and water preservation methods
- Reassess current tariff rates on water to mitigate overconsumption
- Construct desalinization plants in southern provinces
- Train staff

Sewage

Iraq's government has issued a "five year strategic plan" which aims to:

- Increase the percentage of its citizens served by the sewage network to 40%.
- Enhance the efficiency of the government's treatment of waste water
- Develop a system for the effective reuse of collected rain water and treated sewage water[xxxix]
- Ensure that treated water which is reintroduced into waterways conforms to international standards[xl]
- Implementing 48 new projects [xli]
- Rehabilitating old projects [xlii]

- Expanding drainage networks [xliii]
- Implementing projects in cities based on population and groundwater levels [xliv]
- Transitioning to vertical housing to mitigate flooding [xlv]

It should be noted that Iraqi officials interviewed by Dunia were very skeptical of all announced water and sewage strategies. A district level official noted that, *"strategic planning is done in Baghdad, and is often totally removed from the reality on the ground at the district level. I would say national planning has been a hindrance, not a help."*[xlvi] Similarly, officials both at a provincial branch of the MoMPW and at a provincial council noted the absence of strategic planning, suggesting that the official plans that do exist are, *"just words"* as one of them put it, with the other stating that, *"the people making these plans are often not experts. They just speak in very general terms, but don't provide realistic solutions to serious problems."*

Similarly, many of the points in the water and sewage development plans are simply unfeasible, because they rely on data and studies that do not exist. Specifically, in an interview with a Provincial Water Directorate senior engineer, Dunia inquired as to plans to develop water infrastructure based off of understandings of population densities, and topographical studies. The official responded by saying, *"we actually need to commission a consultant to do a topographic study, as we are not sure of the water levels ourselves. Additionally, we don't know what true water demand is, because we have no idea how many people live in the provincial capital, or the province as a whole."*

Private Sector Participation

Private sector participation in Iraq's water and sewage development has been limited to Iraqi and foreign companies implementing service projects funded by Iraqi government budgetary streams, or in some cases, international aid and development money. The exception to this is Iraqi citizens, in areas that do not have potable drinking water, who run their own small purification plants.

In addition to the Iraqi companies participating in the water and sewage sectors listed in the Water Section and Organization Structure section, the following international companies are currently active in the sector:

Company	Country	Province
Master Water	Lebanon	Baghdad
Metito	UAE	Anbar
F&B	Lebanon	Anbar
Drake and Scull	UK	Karbala

CGC	China	Maysan
Concord	Jordan	Muthanna
CNEEC	China	Babil
Genzouba Company Ltd	China	Babil
Intash	Turkey	Salahaddin
Alcom	Turkey	Salahaddin
ICG	Iran	Tamim
Dow Chemicals Kuwait	Kuwait	Basra
Hill International	USA	Baghdad
Pell Frischman	UK	Anbar
Ho Hup	Malaysia	Baghdad
Passavant Roediger	UAE	Karbala
Shriram EPC	India	Basra
Mokul	India	Basra

In response to a specific follow up request from JCCME, Dunia would like to specifically call attention to Shriram EPC (India), Mokul (India), Metito (Turkey) and Hill International (USA). Shriram EPC and Mokul were both mentioned by Basra provincial government officials as currently being active in sewage projects in Basra province, and were held up as examples of international companies that had successfully won large sewage contracts. Meanwhile Metito was also mentioned by a Basra official as being active in the southern part of the province. It should be noted that the Basra officially incorrectly described Metito as Turkish. The company is actually headquartered in the UAE. Metito is also active in Anbar province. Finally, Hill International has been active in the sewage sector in Baghdad, and has also been linked to a huge residential development in Basra in a project management capacity. Undoubtedly, should the project management project go forward, Hill International will be involved in selecting contractors to implement water and sewage networks for the new development.

Current and Future Projects

Water

The following table represents ongoing water projects being implemented by the MoMPW:

Province	Location	Project Details	Company
Wassit	Mawafaqiya	Implementation of Neighborhood Water Project	Balad al-Salam for Trade and General Contracting (Iraq)
Dhi Qar	Al-Rafa-i	Providing materials for 2000 cubic	Al-Watan al-Khair LTD (Iraq)

		meters/hour Al-Rifa'I Water Project	
Babil	Abi Gharaq	Design and implementation of pipe network capable of processing 4000 SQM/hour	Jiangsu Lingzhi Environmental Protection Company (China)
Wassit	Badr	Design and implementation of 2000 cubic meters/second Badr water project to include installation of pipes and equipment	Gorkem (Turkey)
Anbar	Baghdadi	Providing equipment and implementing electromechanical equipment and pipes for 3000 cubic meter/hour water project	al-Faw State Company (belongs to Iraq's Ministry of Construction and Housing)

Sewage

The following table represents ongoing sewage projects being implemented by the MoMPW:

Province	City	Project Name	Capacity cm/day	Project Cost $	Company Name
Diyala	Kana'an	Waste Water treatment plant - East Diyala	48,000	46,000,000	Al-Mabruk Company
Anbar	Falluja	Falluja Waste Water treatment Network	NA	67,000,000	Al-Nibras Al-abydh , Jana Al-Falah and Al-Rahef Companies - Iraq
Anbar	Ramadi	Ramadi Waste Water treatment plant and Network	100,000	109,000,000	Al-Iraq Al-Hur Company - Iraq
Al-Najaf	Al-	Al-Baraq'ya	50,000	22,000,000	Design MITITO - Turkey

	Baraq'ya	Waste Water treatment plant			/Construction F&B - Lebanon
Karbala	Karbala	Karbala Waste Water Treatment	40,800	23,400,000	Drake & Scull - UK
Karbala	Al-Hindyia	Al-Hindyia Waste Water Treatment	131,000	27,000,000	AL-Khaleej Al-Kaber Company - Iraq
Wassit	Kut	Al-Numanyia Waste Water Treatment	34,000	28,000,000	Dhefaf Al-Rafidin company - Iraq
Maysan	Amara	Maysan Waste Water Treatment	60,000	58,000,000	Al-Eqbal Company - Iraq
Maysan	Al-Azer	Al-Azer Waste Water Treatment	60,000	150,000,000	CGC - China
Maysan	Al-Majar	Al-Majar Waste Water Treatment	32,400	24,000,000	Al-Jahraa Company - Iraq / the work suspended because the company not qualified
Dhi-Qar	Nasryia	Nasryia Waste Water Network	NA	250,000,000	Al-Mamura Company - Iraq / Work suspended cause of corruption
Dhi Qar	Al-Shamyia	Al-Shamyia Waste Water Network	110,000	108,000,000	AL-Khaleej Al-Kaber Company - Iraq
Muthanna	Samawa	Samawa Waste Water Treatment	37,800	55,000,000	Concord - Jordan / Al-Rabat Company - Iraq
Babel	Hela	Hela Waste Water network	NA	38,000,000	Al-Helo & Emirates - Iraq
Babel	Hela	Hela Waste Water network	NA	90,000,000	CNEEC - China
Babel	Al-Sue'ra	Al-Sue'ra Waste Water Network	NA	123,000,000	China genzhouba company limited- China
Salahaddin	Al-Dur	Al-Dur Waste Water Network	NA	42,500,000	Al-Yamama Company - Iraq

Salahaddin	Tuz	Tuz Waste Water Network	NA	90,000,000	Intash - Turkey
Salahaddin	Balad	Balad Waste Water Network	NA	46,000,000	Alcom – Turkey / Al-Naour Company - Iraq
Qadisiya	Dewanyia	Dewanyia Waste Water Network	NA	182,000,000	Al-Faroq State company for construction - Iraq

The following table represents planned projects, and their anticipated budget by year. Those projects highlighted in red ink are believed to already be underway, and are also represented on the above table[xlvii].

Project	Governorate	Estimated Cost	Years	2010	2011	2012	2013	2014
Mosul sewage / 1st stage	Ninawa	$644,883,920	4	$257,953,568	$128,976,784	$128,976,784	$128,976,784	-
Kirkuk sewage project / 1st stage	Kirkuk	$631,986,243	4	$202,063,629	$171,969,046	$128,976,784	$128,976,784	-
Hawijah sewage project	Kirkuk	$45,571,797	3	$21,496,131	$12,037,833	$12,037,833	-	-
Daquk sewage project	Kirkuk	$10,318,143	3	-	-	$3,439,381	$3,439,381	$3,439,381
Baiji sewage project	Salah al-Din	$63,628,548	3	$29,234,738	$17,196,905	$17,196,905	-	-
Tuz sewage project	Salah al-Din	$90,283,749	3	-	$38,693,035	$25,795,357	$25,795,357	-
Shirqat sewage project	Salah al-Din	$35,253,654	3	-	-	$18,056,750	$8,598,452	$8,598,452
Dour sewage project	Salah al-Din	$15,337,214	3	-	-	$6,878,762	$4,299,226	$4,299,226
Hit	Al-	$63,628	3	-	$29,234	$17,196	$17,196	-

sewage project	Anbar	,548			,738	,905	,905	
Haditha sewage project	Al-Anbar	$51,590 ,714	3	-	$21,496 ,131	$21,496 ,131	$8,598, 452	-
Rawa sewage project	Al-Anbar	$12,037 ,833	3	-	$3,439, 381	$4,299, 226	$4,299, 226	-
Al-Khalis sewage project	Diyala	$63,628 ,548	3	-	$29,234 ,738	$17,196 ,905	$17,196 ,905	-
Mugdadiyah sewage project	Diyala	$51,590 ,713	3	-	$25,795 ,357	$12,897 ,678	$12,897 ,678	-
Khan Beni Saad sewage project	Diyala	$21,496 ,131	3	-	$8,598, 452	$6,018, 917	$6,878, 762	-
Kanaan sewage project	Diyala	$12,897 ,678	3	-	$4,299, 226	$4,299, 226	$4,299, 226	-
Al-Medayn sewage project	Baghdad	$20,636 ,285	3	-	$12,037 ,833	$4,299, 226	$4,299, 226	-
Al-Tarmiya sewage project	Baghdad	$17,196 ,904	3	-	$4,299, 226	$8,598, 452	$4,299, 226	-
Al-Hai sewage project	Wasit	$75,666 ,381	3	$41,272 ,571	$17,196 ,905	$17,196 ,905	-	-
Al-Zubaidiya sewage project	Wasit	$9,458, 298	3	-	-	$4,299, 226	$3,439, 381	-
Al-Hilla sewage project	Babil	$361,13 4,996	3	$171,96 9,046	$94,582 ,975	$94,582 ,975	-	-
Al-Mussaib sewage	Babil	$65,348 ,238	3	$30,954 ,428	$17,196 ,905	$17,196 ,905	-	-

project								
Al-Kasim sewage project	Babil	$45,571,797	3	-	-	-	$19,776,440	$12,897,678
Iskandariya sewage project	Babil	$73,086,844	3	-	-	-	$30,094,583	$21,496,131
Mahaweel sewage project	Babil	$22,355,976	3	-	-	-	$13,757,524	$4,299,226
Al-Hussainiya sewage project	Najaf	$13,757,523	3	$5,159,071	$4,299.226	$4,299.226	-	-
Al-Mishkhab sewage project	Najaf	$41,272,572	3	$20,636,286	$10,318,143	$10,318,143	-	-
Manathira sewage project	Najaf	$41,272,572	3	$20,636,286	$10,318,143	$10,318,143	-	-
Al-Abassiya sewage project	Qadisiya	$4,299,226	2	-	-	-	$2,579,536	$1,719,690
Al-Hamza sewage project	Qadisiya	$51,590,714	3	$21,496,131	$17,196,905	$12,897,678	-	-
Ifach sewage project	Qadisiya	$26,655,202	3	$9,458,298	$8,598,452	$8,598,452	-	-
Dagharra sewage project	Qadisiya	$9,458,298	3	-	-	-	$5,159,071	$2,579,536
Ghammas	Qadisiya	$18,916,595	3	-	-	-	$10,318,143	$5,159,071

sewage project								
Al-Khidhir sewage project	Muthana	$29,234,738	3	$12,037,833	$8,598,452	$8,598,452	-	-
Ali Al-Gharbi sewage project	Maysan	$8,598,452	3	$4,299,226	$2,149,613	$2,149,613	-	-
Qalat Salih sewage project	Maysan	$8,598,452	3	$4,299,226	$2,149,613	$2,149,613	-	-
Kumait sewage project	Maysan	$5,159,071	3	-	-	-	$2,579,536	$1,719,690
Ali Al-Sharqi sewage project	Maysan	$4,299,226	2	-	-	-	$2,579,536	$1,719,690
Al-Kahlaa sewage project	Maysan	$12,037,833	3	-	-	-	$6,878,762	$2,579,536
Al-Shatra sewage project	Dhi Qar	$144,453,997	3	$58,469,475	$42,992,261	$42,992,261	-	-
Suq Al-Shuyukh sewage project	Dhi Qar	$93,723,130	3	$42,132,416	$25,795,357	$25,795,357	-	-
Al-Chibayish sewage project	Dhi Qar	$20,636,285	3	-	-	-	$12,037,833	$4.299,226
Al-Basra sewage project	Muthana	$523,645,742	4	$201,203,783	$107,480,653	$107,480,653	$107,480,653	-
Al-Qurna sewage project	Basra	$63,638,547	3	$21,496,131	$21,496,131	$21,496,131	-	-

Al-Midaina sewage project	Basra	$29,234,738	3	-	$10,318,143	$10,318,143	$8,598,452	-
Abu Al-Khasib sewage project	Basra	$146,173,688	3	-	$42,992,261	$42,992,261	$60,189,166	-
Shatt Al-Arab sewage project	Basra	$74,806,535	3	-	$25,795,357	$25,795,357	$23,215,821	-
All	All	$3,822,871,883	5	$1,175,408,426	$976,784,179	$902,837,489	$689,595,873	$78,245,916

Market Forecast

Market Forecast Breakdown 2012

In 2012 the Ministry of Municipalities and Public Works had a capital investment budget of $1,307,000,000 for water and sewage projects. How that money was spent is not publically available information. Indeed, Iraq's body in charge of auditing the country's public institutions, the Supreme Audit Board, has continually complained that Iraq's disparate ministries roundly fail to account for their spending. As such, it is reasonable to assume that there is no documentation anywhere that accurately breaks down annual spending by the MoMPW.

An analysis of the MoMPW's planned spending for 2012 as spelled out in their five year strategic plan suggests they designated $903 million for sewage development projects, which would leave $404 million for drinking water projects.

Similarly, an employee of the Basra Provincial Council noted to Dunia that the provincial government had a 2012 budget of $1.5 billion for development projects, 45% of which, or $675 million, was spend on water and sewage projects.

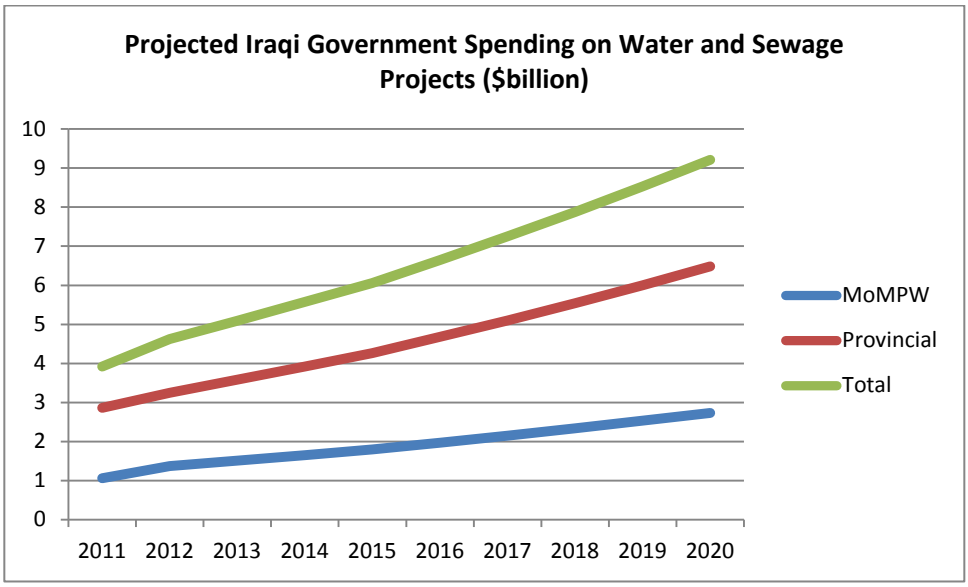
Another official suggested that the total budget at the provincial level for development projects nationwide (excluding Kurdistan) was $13 million (this figure would include money designated in the national budget for provincial governments, as well as petrodollars in oil producing provinces and point of entry customs revenues in provinces with border crossings). Dunia's assumption is that because of the salinization crisis in the Shatt al-Arab, and the rapid growth of Basra City due to an influx of non locals seeking jobs, the water and sewage problems in Basra

are substantially worse, and therefore demand a greater share of the provincial development budget than in other provinces. Assuming that other provinces spend their resources at half the rate of Basra on water and sewage projects, the total expenditure for provincial governments (including Basra) would be $3.25 billion for water and sewage projects in 2012.

This would mean that in 2012, a combined $4.557 billion was spent by Iraq's national and provincial government on water and sewage projects.

However, it is important to note that it is highly unlikely that this total amount of money was actually spent on water and sewage projects. Iraq routinely ranks in the top ten of Transparency International's corruption index. The reality is, a significant percentage of this $4.557 billion does not end up being spent on its intended purpose.

Market Forecast between 2011 and 2020



To arrive at this projection, we took the known 2012 data of the MoMPW's capital investment budget. We also took the provincial spending data described above in the Market Forecast Breakdown 2012 section above. We then applied Dunia's anticipated growth rates for Iraq[xlviii] to these 2012 base numbers to anticipate increases in spending. The 2011 MoMPW numbers are based on Ministry of Finance data detailing MoMPW capital investment, while the 2011 provincial numbers are based off the assumed growth rate for 2012.

Our assumption is that Iraq's spending on water and sewage will continue to grow into the second half of the coming decade, because according to Dunia's understanding, even in a best case scenario, Iraq's 2010-2014 sewage development plans will still see a significant majority of the population not in areas covered by sewage treatment plants, particularly in rural areas. Additionally, increased upstream activity by Turkey and Syria will force Iraq to continue to seek new solutions to provide its citizens with potable water, and irrigation water, particularly in southern and southeastern Iraq.

Market Forecast Data Between 2011 and 2020

Year	MoMPW	Provincial	Total
2011	1.06	2.86	3.92
2012	1.37	3.25	4.62
2013	1.51	3.58	5.09
2014	1.65	3.92	5.57
2015	1.8	4.26	6.06
2016	1.97	4.68	6.65
2017	2.15	5.1	7.25
2018	2.34	5.54	7.88
2019	2.53	6	8.53
2020	2.73	6.48	9.21

Environmental Criteria

Water Quality Standards for Rivers, Lakes and Groundwater

The following table represents Iraqi standards for "source water" including all fresh water sources:[xlix]

Property	Concentration Level **(mg/L unless stated otherwise)**
Color	Normal
PH	6.5-6.8
Dissolved Oxygen	More than 5
B.O.D.5	Less than 3
C.O.D	Na
Cyanide	.02
Fluoride	.02 or more as naturally present
Free Chlorine	Trace

Chloride	200 or more as naturally present
Phenol	.005
Sulfate	200 or more as naturally present
Nitrate	15
Phosphate	.4
Ammonium	1
DDT	N.L
Lead	.05
Arsenic	.05
Copper	.05
Nickel	.1
Selenium	.01
Mercury	.001
Cadmium	.005
Zinc	.5
Chromium	.05
Aluminum	.1
Barium	1
Boron	1
Cobalt	.05
Iron	.3
Manganese	.1
Silver	.01

Potable Water Quality Standards[I]

The following table represents Iraq's potable water standards:

Component	Iraqi Standard (law 417-1974)
TDS	500-1500 mg/l
K	250 mg/l
Na	200 mg/l
Ca	75-200 mg/l
Mg	50-150 mg/l
Cl	200-250 mg/l
HCO-3	125/200 mg/l
T.H.	100-500 mg/l
PH	6.5-8.2

Wastewater Treatment Standards[li]

The following table represents Iraq's treated wastewater standards:

Component	Unit	Standard
Color	Mg/L	Normal
Temperature	Mg/L	-
Suspended solid	Mg/L	-
PH	Mg/L	6.5 – 6.8
Dissolved Oxygen	Mg/L	More than 5
B.O.D.5	Mg/L	Less than 3
C.O.D. (Cr207method)	Mg/L	-
Cyanide CN -	Mg/L	0.02
Fluoride F -	Mg/L	0.02 or more as naturally present
Free chlorine	Mg/L	Trace
Chloride	Mg/L	200 or more as naturally present
Phenol	Mg/L	0.005
Sulfate	Mg/L	200 or more as naturally present
Nitrate (No3)	Mg/L	15
Phosphate (Po4)	Mg/L	0.4
Ammonium (NH4)	Mg/L	1
DDT	Mg/L	N.L.
Lead (pb)	Mg/L	0.05
Arsenic AS	Mg/L	0.05
Copper Cu	Mg/L	0.05
Nickel Ni	Mg/L	0.1
Selenium Se	Mg/L	0.01
Mercury Hg	Mg/L	0.001
Cadmium Cd	Mg/L	0.005
Zine Zn	Mg/L	0.5
Chromium Cr	Mg/L	0.05
Aluminum AL	Mg/L	0.1
Barium Ba	Mg/L	1
Boron B	Mg/L	1
Cobalt Co	Mg/L	0.05
Iron Fe	Mg/L	0.3
Manganese Mn	Mg/L	0.1
Silver Ag	Mg/L	0.01

Environmental Criteria for Agriculture, Industry and Public Service Projects

Environmental criteria for projects is determined by the legislation outlined below. Specifically, companies implementing projects that result in any dumping in public waterways (and all waterways are considered to belong to the state) must obtain permits from the Ministry of Health pursuant to Law # 25 of 1967, and the Department of Protecting and Improving the Environment pursuant to law #2 of 2001. The specifications of these laws are outlined in the below subsections dealing with each of these laws.

However, it should be noted that Iraqi officials repeatedly stressed to Dunia that Iraq's government does a poor job of enforcing environmental regulations. As such, any company planning on implementing a drinking water project should be cognizant that of the likelihood that any agricultural or industrial projects upstream of their water project are highly likely not to be effectively regulated, meaning that potential pollution levels in water being treated by the water project in question could rapidly change in levels of pollution with little recourse.

Law Related to River and Water Resources

An important issue which foreign companies should consider when exploring water infrastructure projects in Iraq is that according to Article 15 of Law No. 40 of 1951, any dispute arising out of these laws discussed below will be governed by Iraqi law.

Law #25 of 1967

Law No. 25 states that in Iraq, all the rivers, water pools, marshes, swamps, and underground water, is all public water. No one can dump or drain anything into these bodies of water without a license from the Ministry of Health (MoH). To obtain a license, one has to apply to the MoH; along with the application, the person or company should attach two maps showing the area where the company wants to dump or allow drainage to enter the water. The MoH should respond to the application within 60 days. The MoH has the authority to approve the application, deny the application, and specify exactly what and how much can be drained into the public water.

The MoH has the right to deny a license when the drainage would occur in a sensitive area; for instance, where fish are growing, where people are swimming, or where drinking water is sourced. The MoH has the right to enforce these rules and to confirm that people and companies are adhering to the rules. The MoH's water analysis data will be used in any investigation, and not the data provided by the person or company draining substances into the public water.

The MoH presents conditions upon what may be drained or dumped into the water, even with a license; for instance:

1) the concentration of the contents of the water cannot exceed certain thresholds, which are specified- for instance, not more than 60 parts per million;
2) the drainage may not contain hydrogen sulfates, other toxic substances, or any chemicals that may react with substances that are already in the public water;
3) the ion concentration of the drainage cannot be less than 6, or greater than 10;
4) the drainage cannot exceed temperatures that would affect the public water;
5) the drainage may not violate any other conditions imposed by the MoH.

Animal carcasses, sewage and other pollutants cannot be dumped into the public water, nor can animals or contaminated clothing be washed in the public water.

If a person or company dumps or drains substances into the public water in violation of the conditions or limits set by the MoH, then the company should inform the health authorities, begin constructing a water filtration/treatment facility within three months, and bring the facility into operation within 12 months. If they continue violating the MoH rules and regulations, then the MoH has the right to stop the person or company from releasing drainage into the public water.

If the MoH finds out about improper drainage which puts the public's health at risk, then the MoH will inform the violator in writing. The MoH will order them to immediately stop the drainage, and work with the MoH to put together a long term solution.

If anybody violates these rules, they will be punished by Law No. 45 of 1958.

Law #2 of 2001

This law is very similar to Law No. 25 of 1967, except that this law refers to the Department of Protecting and Improving the Environment (the DPIE), and not the MoH. Also, this law also states that the license required for drainage into public waters must be obtained by the DPIE, rather than the MoH. The law states that the license is only valid for one year, and must be renewed on an annual basis. The DPIE should respond to an application for a license within 30 days. If the DPIE fails to respond to an application, or rejects the application, then the applicant has 15 days to appeal; the appeal should be placed with the head of the Department.

The Department can cancel or revoke a license under the following conditions:

1) if the drainage or waste damages the environment or threatens the public's health;
2) if the terms of the license are violated, or if the license is used for any other purpose other than those stated in the license.

This law states that the person or company draining substances into the public waters must use the best equipment available to filter the drainage- and that they must provide a report of their

drainage activities to the DPIE. No volatile, explosive or chemically reactive chemicals may be drained into the water.

Law #89 of 1982

This law is a very broad law concerning public health, and it covers many issues. The section of this law which relates to drinking water and sanitation states the following points. The law states that any project that carries out water treatment for drinking water must have a complete laboratory with all of the equipment and staff required for the work. The laboratory must be capable of conducting chemical and physical tests to determine the quality of the water, determine its pH level, and guarantee that it meets the country's requirements for drinking water. The water treatment facility must allow government laboratory experts to visit the water treatment facility, to determine if the water meets the government's requirements.

The water treatment facility must obtain approval from the MoH when the water treatment facility chooses the chemicals and processes it plans to use to treat the water.

Basra Overview

Supply and Demand of Water

Potable Water Supply and Demand

Basra province's drinking water is drawn from two primary sources: the al-Badaa Canal emanating from nearby Dhi Qar Province, and the Shatt al-Arab.

An official at the Basra Water Directorate said that by his estimates drinking water demand for Basra City alone is 1,296,000 cubic meters per day with province wide demand closer to 1,900,000 cubic meters per day. However, the official cautioned that neither he nor anyone else had a firm understanding of how many people live in Basra City, or Basra Province, and that he does not believe any reliable statistics on drinking water demand currently exist[lii].

Total supply of potable water in Basra province has been listed by recent Ministry of Water Resources statistics as 890,000 cubic meters per day including central and small-scale water treatment plants. Inquiries by a Dunia employee suggested that actual supply of water is significantly less than that, at approximately 570,000 cubic meters per day. However, the discrepancy is largely academic in nature, as there is broad agreement that much of the water produced by Basra's water treatment plants is undrinkable. This is particularly true for those plants that draw water from the Shatt al-Arab.

According to the same official at the Basra Water Directorate, there is an increasing sense that Basra is heading towards an even more significant water shortage. The official noted that he believes that by as soon as the end of 2014 rising salinity levels in the Shatt al-Arab, coupled with increased pollution will render the water unusable, at least given the current capabilities of water treatment plants. The official added that at this time, the only usable water source will be the Badaa Canal, which is capable of providing less than half of the water demands of Basra City, assuming none of the water is diverted to the rest of the province. The official noted that in his opinion, *"the only long term solution is to figure out a way to utilize sea water."*[liii]

A Broader Problem with the Water Supply

In addition to the problem of insufficient and poor quality drinking water, Basra is faced with a more general water problem, namely the rising salinity of the Shatt al-Arab and surrounding soil. Indeed, provincial and district officials noted that in many parts of southern Basra livestock is dying and people are leaving due to the absence of sufficient water to sustain an agricultural lifestyle. According to a marine biologist at the University of Basra, *"to address the problem of*

rising salinity levels in the Shatt al-Arab, particularly in southern Basra near al-Faw, the province needs a combined 75 cubic meters per second of water flow into the Shatt al-Arab from the Tigris and Euphrates Rivers. Right now, depending on the season, we get between 10 and 50 cubic meters per second. Coupled with other environmental factors, the result is rapidly increasing salinity levels. Currently salinity levels in the Shatt al-Arab near Basra City are around approximately two parts per thousand, in al-Faw they are above ten, and can get up to over twenty in the summer. However, the reaction by the Ministry of Water Resources and the Provincial Government is to divert water to the south to address the salinity issue there. Not only will that not work, but it may well bring the salinity levels in the Shatt al-Arab in Basra City up to twelve parts per thousand." [liv]

A second scientist at Basra University noted to Dunia that his assessment of the current water strategy was that the government had, *"given up on the Shatt al-Arab"* because by his estimation the current allocation of water from the Tigris and Euphrates is clearly not enough to sustain the Shatt al-Arab and stave off rising salinity levels. He added that, *"there is a perception that Basra is an industrial province and an oil and gas province. The government feels that Maysan, Wassit, and other provinces upstream are reliant on agriculture, so they allow these provinces to take more than their quota of water. Basra, as you know, is at the end of the line. In the absence of effective regulations on how much water the other provinces take, there is not much we can do."* [lv]

Possible Solution

Indeed, a recurring theme when speaking with Basrawi officials and scientists was that no plan exists to reverse the salinity problem in the Shatt al-Arab. Increased upstream activity and withdrawal not only in other Iraqi provinces, but also in Syria and Turkey are irreversible. The only officials who offered a solution to this problem were an official at the Water Directorate (the local branch of the MoMPW) and a district level official in al-Faw. Both of these officials saw the answer to this growing problem as commencing large-scale desalinization of sea water from the Persian (Arab) Gulf.

Ratio of Water Leakage in Water Supply Line

Estimates of water leakage rates range from 10% to 50%. According to interviews with water engineers, the two primary causes of water leaks are pipe networks in a state of disrepair, and the illegal tapping of pipe networks by Basra's citizenry. According to an official interviewed by Dunia, there is not a firm understanding of exactly how much water is lost to either of these two causes.[lvi]

A JICA study in 2006 estimated water leakage at 30%[lvii], while a Dunia interview with a Basra official put this number at 50%. These two figures seem to take into account both leaky pipes, and illegal tapping of the network. However, the 10% figure provided in MoWR documentation appears to refer only to pipe network malfunction. Dunia assesses that the overall leakage from pipes is most likely in the range of 25% not including water illegally syphoned from the network.

Saturation Ratio of Sewage Pipeline

A Basra provincial official stated that 45% of Basra City residents, and 2% of Basra province residents outside the capital city are connected to sewage pipelines that lead to sewage treatment plants[lviii]. Meanwhile, a MoWR report suggests that 38% of all Basra province residents including Basra City are served by the sewage network.

According to interviews with provincial and district officials, most Basra City residents, as well as residents of Um Qasr, Zubair, al-Faw, Siba, Qurna and Abi al-Khasib that are not connected to the sewage treatment network are connected to a pipe network that drains raw sewage either into the Shatt al-Arab, or into empty areas. The exception to this are what a local official referred to as "squatter camps" and other slum areas on the outskirts of Basra City, as well as rural areas in Zubair and al-Faw Districts. The official said that while accurate statistics did not exist, he suspected that approximately 15% of the province's total population (including internally displaced squatters from other provinces living in semi-permanent or abandoned dwellings) are not connected to any sewage pipelines. However, a report provided by the Ministry of Planning puts this number at 27.4% in 2010[lix].

Situation of Water Purification Plants

According to research done by a local Dunia employee, there are currently 16 functional central water treatment plants in Basra province. An additional two plants are under construction, with plans to begin construction on a large third plant. These plants are operated by the MoMPW. The below table identifies these plants:

Location and Source	Project Name	Cost of Project	Year	Method of Purification	Design Capacity (cm /Year)	Actual Capacity (cm /Year)
Basra (Badaa canal)	Basra Water Project	N/A	1978	Chlorine Gas	96000	70000
AL-Jubela (Shatt al-	Al-Jubela Water	N/A	1936	Chlorine Gas	24000	20000

Arab)	Project					
Al-Bradhyia (Shatt al-Arab)	Al-Bradhyia Water Project 1	N/A	1957	Chlorine Gas	24000	20000
Al-Bradhyia (Shatt al-Arab)	Al-Bradhyia Water Project 2	N/A	1957	Chlorine Gas	24000	20000
Basra (Shatt al-Arab)	Al-Labani Water project	N/A	1968	Chlorine Gas	14400	10000
Khor Al-Zubair (Shatt al-Arab)	Khor Al-Zubair Water Project	N/A	1988	Chlorine Gas	36000	10000
Al-Sh'eba (Shatt al-Arab)	Al-Sh'eba Water Project	N/A	1948	Chlorine Gas	19200	14400
Shatt Al-Arab (Shatt al-Arab)	Shatt Al-Arab Water project	N/A	1973	Chlorine Gas	24000	10000
Al-Nashwa (Shatt al-Arab)	AL-Nashwa Water Project	N/A	1985	Chlorine Gas	4000	1200
Al-Deer (Shatt al-Arab)	Al-Deer Water project	N/A	1968	Chlorine Gas	4800	4000
Qurna (Euphrates)	Qurna Water Project	N/A	1980	Chlorine Gas	24000	17000
Basra (Shatt al-Arab)	Old city Water Project	N/A	1983	Chlorine Gas	4800	2700
Al-Su'eeb (Shatt al-Arab)	Al-Su'eeb Water Project	N/A	1980	Chlorine Gas	4800	2500
Al-Fao (Shatt al-Arab)	Al-Fao Water Project	N/A	1982	Chlorine Gas	24000	22000
Um Qaser (NA)	Um Qaser Water Project 1	$ 20,800,000.00	2007	Chlorine Gas	13200	13000
Basra (NA)	Great Basra Water	$ 623,000,000.00	2013	Chlorine Gas	250000	

		Project	**				
Um (NA)	Qaser	Um Qaser Water Project 2	$ 14,000,000.00	2011	Chlorine Gas	4000	4000

In addition to chemical treatment of water, some of these plants offer a degree of reverse osmosis treatment according a Basra official. However, these plants were universally described as doing an insufficient job of removing saline and other particles from the water. An official at the Water Directorate noted, *"The plant using the Badaa water is the best, by far. Then there is a plant at the Basra University Garma Campus that is also ok, but all the others do not produce drinkable water. Even the Badaa and the Garma plants fluctuate in quality day to day, and are not reliably drinkable.* [lx]*"*

This account was confirmed by an engineer in the governor's office, who noted that "everybody" either buys bottled water, or buys water from private suppliers who run their own small-scale reverse osmosis or chemical purifying operations[lxi].

Sources indicated the water treatment plants suffer from a standard array of problems, namely[lxii]:

- Poorly trained personnel
- Irregular power supplies
- Insufficient operating budget
- Lack of spare parts on hand

Situation of Sewage Treatment Plants

The Hamdani sewage treatment plant in Basra is the province's only major sewage treatment plant. Construction was started in the 80s, and it was intended to have seven stages. To date, two stages have been completed, and the plant is estimated to process 70,000 cubic meters daily. According to an engineer working in the governor's office, *"the population of Basra has roughly doubled since construction began on the plant. Additionally, the plant has never been finished as per its initial design."*[lxiii]

Other than the Hamdani plant, a project titled the Basra Heavy Water Treatment Unit in Basra City was recently completed for a cost of $24 million, and has a capacity of 6,000 cubic meters per day. This plant is reportedly in good working order.

Rehabilitation and New Projects for Water Pipelines

The Basra Provincial Government has announced that it is tendering several new water pipeline projects throughout Basra province in 2013. According to the government's plans, bids for these projects must be submitted by February 17, however companies interested in bidding on a tender can request a one month extension. It remains likely that some or most of these projects will not be awarded in the initial bidding round, and will be retendered either later this year, or in next year's budgetary cycle. Regardless, the description of these projects is indicative of the type of water pipeline projects tendered by the provincial government, and a similar set of projects are anticipated to be tendered annually in the coming years.

Figure 4 Aging pipes lead into a polluted canal in downtown Basra City

(Note- interested parties in the following tenders should contact both the Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766) and the Governor's Assistant for Districts and Subdistricts Yousif Abu Yehya at +964 770 260 8912.)

Tender Number and Name	Project Description
1-Water/Conservation	Supply and installation of a 200 cubic meters/hour capacity bulk water unit with transmission pipeline network in the Hayader tribal area in al-Sidda, Al-Midaina District
2/Water/ Conservation	Supply and installation of a 200 cubic meters/hour capacity bulk water unit with transmission pipeline network in the Al-Adhimiya tribal area in Al-Haritha Subdistrict
1/Water/ Development	Installing ductile pipes of different diameters for the directorate's stockpile and maintenance parts for projects and networks
16/Water/ Development	Supply and installation of a 200 cubic meters/hour capacity bulk water unit with transmission pipeline network in the Khamisa area; 400 cubic meters/hour capacity bulk water unit with transmission pipeline network in Shilhat al-Hijaj; and a 200 cubic meters/hour unit in al-Fathiya
17/Water/ Development	Supply and installation of a 200 cubic meters/hour capacity bulk water units with transmission pipeline networks in the Siddat al-Ilm, Al-Harith, and Al-Salboukh areas
26/Water/ Development	Implementation of the first phase of the project to contruct a pumping station and laying trasmission pipes with different diameters to deliver water to the Ezzeddin Salim Subdistrict in the Qurna District
17/46/Water/ Imports	Preparation and installation of a water treatment unit with a capacity of 800 cubic meters/hour with transmission pipeline for the old Qurna water project
8/Water	Transportation and installation of two bulk water units with a capacity of 200 cubic meters/hour and transmission pipelines for the areas of Miyah Al-Soor and Al-Salaam
26/16/Water	Installation of primary and secondary water transmission pipelines for Khor Al-Zubair
7/62/Water	Installation of a bulk water unit with a capacity

	of 400 cubic meters/hour and transmission pipeline for Al-Salihiya in the Shatt Al-Arab District
10/8/Water	Installation of primary and secondary pure water transmission pipelines in Imam Al-Sadeq Subdistrict
16/51/Water	Maintenance and rehabilitation of the bulk water units and installation of pumps in the Abbas water project
22/26/Water	Installation of primary and secondary pure water transmission pipelines in Al-Midaina District
1/47/Water	Refurbishing the cathodic protection stations for steel pipes transmitting raw water for the two project of "25 Million" and "United Basra," including replacing defective parts
7/62/Water	Installation of a bulk water unit with a capacity of 400 cubic meters/hour with transmission pipeline in Al-Salihiya in Shatt Al-Arab District
26/16/Water	Installation of primary and secondary water transmission pipelines for buildings in Khor Al-Zubair
Water	Installation of two bulk water units with a capacity of 200 cubic meters/hour with transmission pipelines in Al-Nahran and Beit Shawi

Rehabilitation and New Projects for Sewage Pipelines

The Basra Provincial Government has announced that it is tendering several new sewage pipeline projects throughout Basra province in 2013. According to the government's plans, bids for these projects must be submitted by February 17, however companies interested in bidding on a tender can request a one month extension. It also remains likely that some or most of these projects will not be awarded in the initial bidding round, and will be retendered either later this year, or in next year's budgetary cycle. Regardless, the description of these projects is indicative of the type of sewage pipeline projects tendered by the provincial government, and a similar set of projects are anticipated to be tendered annually in the coming years.

(Note- interested parties in the following tenders should contact both the Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766) and the Governor's Assistant for Districts and Subdistricts Yousif Abu Yehya at +964 770 260 8912.)

Tender Number and Name	Project Description
1/Sewage/ Development	Preparation of studies and designs, and supplying and installing heavy stormwater water networks and stations in the provincial center (Al-Kaziza)
3/Sewage/ Development	Preparation of studies and designs, and supplying and installing stormwater networks on Baghdad Street (the area between Al-Kaziza intersection and Saad Square intersection)
5/Sewage/ Development	Preparation of studies and designs, and supplying and installing heavy stormwater sewage networks and stations for Al-Najibiya and a trunk line from Al-Najibiya to al-Kaziza that serves the neighborhoods of Al-Najibiya, Al-Ma'qal, Al-Dawudiya, Hayy Tariq, Al-Sadiq, Al-Kanadi, Al-Jamaa, Five Mile, and the pump stations along it
15/Sewage/ Development	Preparation of studies and investigations, designing, and completing the installation of heavy stormwater networks and stations in Al-Sadouniya
2/15/Sewage	Preparation of studies and investigations of the capacity of heavy sewage networks, stations, transmission pipelines, and the treatment center and designing plans for additional pipelines and upgrades to accommodate for current and future demographic expansion, in cooperation with the appropriate directorates. The work includes finding solutions to drainage problems caused by excess water accumulation from rain in domestic houses in central Basra.

In addition to the above projects being tendered by the Basra Provincial Government, the MoMPW has reportedly entered into an agreement with India's Shriram EPC and Mokul Group for a $238 million project to build a sewage pipeline network over a three year timeline in al-Qibla District, Basra province.

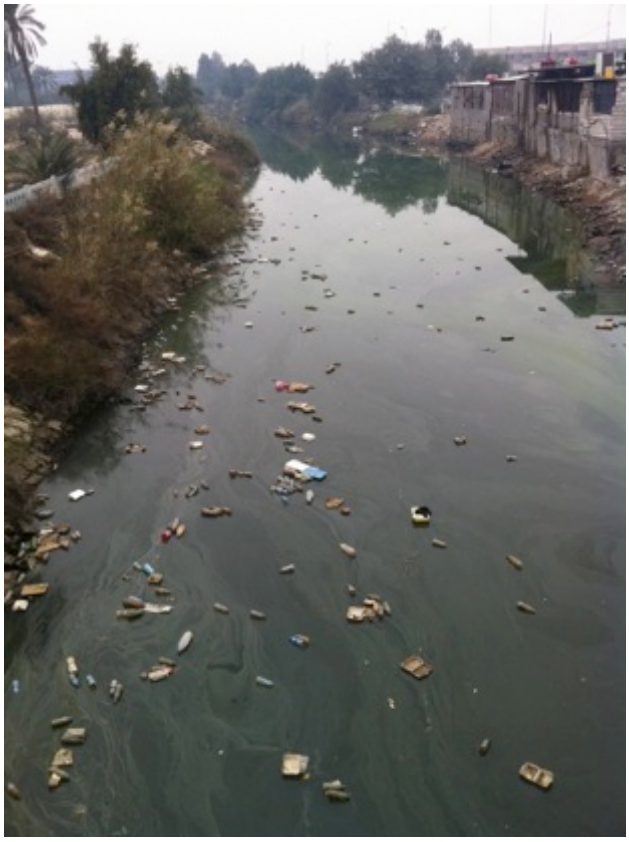


Figure 5 Raw sewage is now pumped into canals, like this one in Basra city, due to an increasing population, according to local officials

Rehabilitation and New Projects of Water Purification Plants

The Basra Provincial Government announced several tenders regarding work on water purification systems as well. As noted above, the stated deadline for submitting a bid on one of these tenders is 17 February, however companies interested in bidding on a tender can request a one-month extension. It remains likely that a significant number of these projects will be awarded either in a subsequent tendering round later this year, or rolled to 2014. It should be noted as well that many of the tenders in the Rehabilitation and New Projects for Water Pipelines section also include work on water purification plants, and any companies interested solely in water purification plants are encouraged to read that list as well. The following tenders are exclusively for rehabilitation or development of purification plants, and do not involve pipeline work.

(Note- interested parties in the following tenders should contact both the Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766) and the Governor's Assistant for Districts and Subdistrics Yousif Abu Yehya at +964 770 260 8912.)

Tender Number and Name	Project Description
7/Water/ Development	Installing systems to fix chlorine gas leaks in Abu Khaseeb, Shatt al-Arab, and Al-Barad'iya (5 systems)
9/Water/ Development	Install critical electricity lines for the water units in Imam Sadiq Subdistrict
19/Water/ Development	Installation of a 1,000 cubic meters/hour capacity water treatment unit in the Al-Shuwaiba water project instead of Aqua water units
21/Water/ Development	Repairing bulk water units in Dayr
22/Water/ Development	Installing two bulk water units with 200 cubic meters/hour capacity in Al-Bawawy and Al-Shinana
25/Water/ Development	Maintenance and rehabilitation of projects and bulk water units in the provincial center
2/20/Water/ Imports	Providing six filtration and disinfecting units with a capacity of 400 cubic meters/hour with all the proper accessories
6/20/Water/ Imports	Preparation of studies and designs to implement the new consolidated Qurna water project
23/63/Water/ Imports	Rehabilitation to increase the production capacity for the pure water Qurna project
28/Water	Providing specialized machinery for the directorate
23/Water/ Development	Installation of an integrated water network in the housing project for displaced families from Hour Saleen
19/57/Water	Maintenance and rehabilitation of bulk water units and stations in central Basra

13/59/Water	Maintenance and rehabilitation of bulk water units and projects in Abu Khaseeb, Balad, and Jaikoor
14/48/Water	Installing a central laboratory
25/17/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Haritha Subdistrict
21/29/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Qurna Subdistrict
4/52/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Shaheed ("Martyr") Ezzadeen Saleem Subdistrict
3/41/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Midaina District
8/40/Water	Providing laboratory equipment for directorate projects and water units
12/44/Water	Providing materials and equipment to elongate the suction and pulling systems for the directorate's projects and water units
15/37/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Dayr Subdistrict
16/51/Water	Maintenance and rehabilitation of the bulk water units and installation of pumps in the Abbas water project
24/64/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Nishwa Subdistrict
27/31/Water	Maintenance and rehabilitation of bulk water units and projects in Al-Imam Al-Qa'im Subdistrict
11/53/Water	Istallation of buildings for water network maintenance in Al-Ashar, Al-Basra, and Al-Jumhuriya
20/30/Water	Providing electrical adaptors and materials of various types and capacities across Basra Province
Water	Installation of two bulk water units with a capacity of 400 cubic meters/hour in Al-Qurna
Water	Installation of four bulk water units with a capacity of 200 cubic meters/hour in Nahr Al-Izz Al-Gharbi ("West Izz River")—in Beit Oufy,

	Beit Fareej, Al-Shaghanba, and Beit Muajal/Beit Washeeh

In addition to the above projects, an official in Baghdad noted that there are plans for a "Great Basra Water Project" with joint funding from the Japanese (JICA) and Iraqi governments. The project is reportedly being designed by a company called NJS Consultants Ltd. According to a press release from NJS Consultants Ltd, the project will entail[lxiv]:

- *Construction of new 35 km transmission and distribution system ring main of 2,000 mm diameter, transmission reservoir with a capacity of 50,000 cu m, and a 6,450 L/s transmission pumping station of 60 m head;*
- *Strengthening of 27 km of 200 mm to 700 mm distribution mains in 13 distribution zones;*
- *Rehabilitation of 290 km transmission and distribution network of 110 mm to 1,200 mm;*
- *Construction of new 250 MLD water treatment plant, 2,375 L/s pumping station of 40 m head, and R.O. plant with a capacity of 150 MLD including related works;*
- *Institutional development and preparation of project management plan, management and information system development;*
- *Management reform, GIS mapping, establishment of distribution network zoning and leak detection team in each zone, formulation of tariff scheme for water charges, and capacity development for the operation and maintenance of water supply infrastructure.*

Rehabilitation and New Projects of Sewage Treatment Plants

The Basra Provincial Government announced several tenders regarding work on sewage treatment plants. As noted above, the stated deadline for submitting a bid on one of these tenders is 17 February, however companies interested in bidding on a tender can request a one month extension. It remains likely that a significant number of these projects will be awarded either in a subsequent tendering round later this year, or rolled to 2014.

(Note- interested parties in the following tenders should contact both the Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766) and the Governor's Assistant for Districts and Subdistricts Yousif Abu Yehya at +964 770 260 8912.)

Tender Number and Name	Project Description
6/Sewage/ Development	Preparation of studies and designs, and supplying and installing maintenance part

	centers in central Basra and districts and subdistricts of Hayy al-Hussein, Al-Ma'qal, Al-Rabat, Al-Muwaffaqiya, Al-Ashar (1,2,3), Al-Qibla, Al-Jumhuriya, Al-Nishwa
9/Sewage/ Development	Maintenance and rehabilitation of units at the treatment facility in Hamdan
11/Sewage/ Development	Preparation of study, designing and installing central laboratory in Hamdan
3/3/Sewage	Purchasing diesel pumps and plungers and generators and transformers

In addition to the above projects being tendered by the Basra Provincial Government, the Ministry of Municipalities and Public Works is implementing or planning to implement the following projects over the next three years:

Location	Planned Allocation for 2013
Qurna	NA
Abi al-Khasib	$60,000,000
Madaina	$9,000,000
Shatt al-Arab	$21,000,000

Organizations Executing New Projects

The two organizations executing new projects in the water and sewage sectors are the Basra Provincial Government, and the Ministry of Municipalities and Public Works.

For projects executed by the provincial government, the two primary stakeholders are the governor's office and the provincial council. The governor's office ultimately had the final say on the awarding of tenders, while the provincial council and its affiliated CRD offer advice on shortlisted companies.

For projects executed by the MoMPW, these projects, depending on size, either go through the Provincial Water and Sewage Directorates, or the Ministry HQ in Baghdad.

Likelihood of Hiring of Foreign Consultants

Officials at the Provincial Council, the Basra Governor's Office and the Basra Water Directorate all explicitly stated that they intend to increase their hiring of foreign contractors to work on

water and sewage projects. Several reasons were given, but officials at all three offices agreed that greater involvement of foreign companies was needed for the following reasons:

- Failure of projects implemented by Iraqi companies to be finished in a timely fashion
- Poor project management
- Mismanagement of tendering for large projects
- Absence of reliable statistical data from Iraqi sources to underpin the creation of a viable long-term strategy
- Insufficient number of properly trained Iraqi personnel to execute large-scale projects.

The head of the Basra Provincial Council Committee for Reconstruction and Development explicitly noted, *"both the provincial government and the water and sewage directorates want to increasingly hire foreign companies not only to implement projects, but also to consult on project management and to manage the tendering process for large projects. We don't want to only do this for large projects, but also for projects in the $20 million range, and even on projects smaller than that."*[lxv] The same official noted that many of the projects inside Basra City are being worked on by Iraqi companies, but that going forward he expects most sizable projects outside of the provincial capital to be awarded to international companies. He stated that this was because, in some cases, the provincial government is locked into contracts in Basra City with Iraqi companies, and in other cases, that current projects are simply extensions of existing projects, and are therefore awarded to the company that built the initial project. However, outside Basra City many projects are starting from the ground up, and foreign companies have an easier time being awarded these projects.

Similarly, an advisor at the governor's office noted that his office is *"very interested in speaking with foreign companies on all water and sewage projects in the coming years."*[lxvi] Meanwhile, a senior engineer at the Basra Water Directorate noted that in addition to hiring international companies to implement projects, his directorate was actively looking to hire international companies to execute a variety of studies and survey work (details are provided in the subsequent Japanese Advantage and Opportunities section).

In sum, all of the relevant authorities in Basra that oversee water and sewage projects made it explicitly clear to Dunia that they hope to hire international companies to assist on all facets of water and sewage projects going forward. Additionally, the poor track record of Iraqi companies in addressing the increasingly dire conditions of Basra's water sector, and a still limited sewage network, appear have made an impact on Iraqi officials views on whether to award projects to Iraqi versus international companies.

Restrictions of Foreign Contractors

There are no defined restrictions on foreign contractors in the Basra water and sewage sectors. Officials widely said that international companies would be considered for any project they showed interest in, and no examples were provided of projects that foreign firms are officially barred from. Interviews with expat staff at international companies suggested that foreign contractors implementing large-scale infrastructure projects are "encouraged" to hire local labor, and to provide training to Iraqi engineers as part of the project implementation, but this is not codified into law.

Other unofficial restrictions on operations of foreign companies do exist. Dunia's interviews revealed the following restrictions or obstacles, which should be considered by Japanese companies considering undertaking a major project in Basra.

- Difficulty moving heavy equipment in and out of Basra. Basra's Um Qasr Port is a notoriously difficult port of entry to navigate. It is also the only port in Iraq capable of handling heavy equipment shipments. Additionally, once equipment has gone through customs and entered Iraq, it is difficult, and expensive, to send the equipment out of the country.
- Competing with Turkish and Iranian companies. As an official at the Basra Provincial Council noted, *"Turkish and Iranian companies are already here. They have a continual presence on the ground. We are in a rush, so if we want to move quickly on something, it is much easier for us to just deal directly with the companies that are already here."*[lxvii] This does not mean that it is impossible, or even difficult for a Japanese company to win business in a competitive bidding process against an Iranian or Turkish company, however, it is important for any international company to emphasize that they have a quality advantage over "quick fix" solutions often favored by Iraq's and Basra's government.
- Security. Basra is a much safer environment than most of the rest of Iraq, however most large foreign companies still use private security companies to move around the province. Clients of these security companies have the option of traveling in armored SUV convoys, in one armored car, or in regular civilian vehicles. Depending on which option a company chooses, costs can be very high. Information can be provided upon request on security company options in Basra, as well as recommendations for the level of security required for travel in different parts of Basra province.
- Lodging. For companies sending expat personnel to Basra City, currently the only options for housing are two semi-secure hotel options, as well as villas operated by security companies. If expat personnel is being sent to one of the other areas of Basra province, outside of Basra City, there are a multitude of life support camps operated by

both foreign and Iraqi companies that service MNCs. Information and recommendations can be provided upon request.

Japanese Advantage and Opportunities

Japanese Advantages as Perceived by the Iraqi and Basra Government

Iraqi officials repeatedly lamented to Dunia that Iraq's government, both historically prior to the 2003 overthrow of Saddam Hussein, and continuing through today, ignores sub terrain infrastructure at the expense of impressive looking above ground projects. Several officials interviewed by Dunia perceive North American, Western European, South Korean and Japanese companies as having a more nuanced and effective understanding of infrastructure development; not only more nuanced than other Iraqis, but more nuanced than Iranian, Turkish and south Asian companies. As one official put it*, "I would rather see a company from a country with top quality water and sewage infrastructure building our infrastructure. These Turkish, Lebanese and Iranian companies should go fix their own countries. Basra is a rich province. We should be paying the best companies to come here to develop this province. Why do we have better companies overseeing the construction of our sports city than we do building our sewage network?"* [lxviii]

Additionally, both an official at the MoMPW, and an Iraqi marine scientist noted that, to solve Iraq's water problems, they need to work with, as the MoMPW official said, *"companies that base their work on studies and data."* (for details on the type of studies the Water Directorate is hoping to commission, see Specific Requests by Iraqi Officials).

Meanwhile the marine scientist recounted an anecdote about how the absence of data had cost Basra province a water project in Abi al-Khasib. The scientist recounted how an international company had agreed to implement a water treatment plant with one understanding of what the salinity level of the water was. However, once they arrived at the work site and tested the water, they discovered a salinity level three times higher than what they were expecting, rendering their plans untenable. The scientist noted, *"if this were an Iraqi company, they would have gone ahead with the project anyway, knowing that the project wouldn't work."*

Another engineer at the Basra Governor's noted that a new entity had just been formed named the Project Planning Section (PPS). When pressed on the function of the new entity, the engineer noted that the PPS aimed to emulate North American, Western European and Japanese/South Korean models of strategic planning for projects. The engineer lamented that, *"everything feels rushed now, like there is no plan. There's never enough time, or enough money. The members of this new section were trained in Beirut, and we hope to work with good international companies so we can replicate their project planning models."*

Similarly, several interviewees referenced an ongoing water diversion channel, which is sending water from the Badaa Canal to al-Faw as an example of the need for collaboration with Japanese or other international companies. One official at the provincial government noted, *"the project is being built by Iraqi companies, but it needs oversight. It needs control systems and dams to be effective, but the companies implementing the project now lack the technical knowledge to do this. This means the implementers cannot be part of the planning process. If we had a good international company here with well-trained engineers experienced in this type of project, we would attain a better result."*[lxix]

Speaking of the same channel project, an Iraqi marine scientist said that the current implementation strategy highlighted the need for international companies. *"Look, there are big problems. One is that most of the channel us uncovered, so evaporation is going to be a big problem and will reduce effectiveness. There are others as well. The government needs to start bringing in successful international companies to work on these projects, not just in implementation, but in the initial planning phases, and the project management."*[lxx]

Bottom Line

Many Iraqi officials associate Japanese companies with a higher level of service, provided only by companies from first world countries. Many Iraqi officials, particularly those with engineering backgrounds, realize that Iraq suffers from a lack of reliable data and statistics. There is a growing recognition that some of the regional companies, not to mention Iraqi companies, which are offering quick fixes are not part of a long term solution to Iraq's water and sewage problems. Japanese companies can leverage this sentiment to their advantage by contrasting their approach to that of regional and Iraqi companies.

Specific Requests by Iraqi Officials

Over the course of Dunia's research, we interviewed a number of Iraqi officials involved in the water and sewage sector, most of them in Basra province. Several very specific requests directed at foreign companies came out of these conversations. These requests are typically forward looking, and have not yet been offered for tender. However, they represent projects that Iraqi officials interviewed by Dunia see as either likely or inevitable to be pursued in coming years.

Desalinization of Sea Water

Currently, Iraq does not use seawater from the Persian (Arab) Gulf for agricultural or drinking purposes. However, multiple officials interviewed by Dunia in Basra province stated that given the trajectory of the increased salinization of the Shatt al-Arab and the interrelated decrease in

flow into Basra of the Tigris and Euphrates Rivers that major desalinization plants were inevitable.

A MoMPW official in Basra City noted, *"we need to shift our focus away from the Shatt al-Arab, and towards figuring out a way to use sea water (from the Persian Gulf). There is no other long term solution. The flow from the Badaa River is not enough to sustain the city, let alone the province, and within two years the salinization level of the Shatt al-Arab is going to be even high than it is now. Our need for a desalinization plant making use of sea water is inevitable, and we need to start looking at this now, not later."*[lxxi]

Similarly, an official in al-Faw district, which is on the Persian Gulf noted that, *"when officials from the Ministry (MoMPW) in Baghdad talk about addressing southern Basra's water problems, they only talk about drinking water. It's the same thing with the provincial government. Drinking water is a problem, but it's not our biggest problem. Our biggest problem is that the agricultural way of life in al-Faw is dying. People are leaving. Digging a channel to bring some drinking water isn't going to bring people back. The only way to bring people back is if we can build a large desalinization plant that not only provides drinking water, but also can provide water for agricultural irrigation and livestock."*

Contact

Parties interested in pursuing a conversation on opportunities involving desalinization plants are recommended to reach out to the Deputy Director General of the Basra Water Directorate Hamed al-Masoudy at enghamid66@yahoo.com or+964 770 319 5125. Additionally, parties are recommended to reach out to the Director of the al-Faw Municipality Ahmed al-Mubader at engineer_mubarak@yahoo.com or +964 0780 140 4041.

Bottom Line

The water quality in the Shatt al-Arab is deteriorating. This fact appears to be widely accepted. Some provincial council and governor's office officials seem to be wedded to the idea of continuing to rely on the Shatt al-Arab indefinitely, but there appears to be a growing feeling within the water directorate and at the district level in the most hard hit areas of Basra that utilizing sea water is the only way to address the large scale of Basra's agricultural and drinking water needs. By being early engagers in this conversation, Japanese companies have the opportunity to get in at the ground floor of what is still a developing idea.

Anticipated increase in need for Reverse Osmosis Due to Shatt al-Arab Salinization

Provincial officials as well as marine scientists and MoMPW personnel noted that salt levels in the Shatt al-Arab are expected to rise more than they already have in the coming years.

Already, officials in Basra lament the poor quality of water that comes from treatment plants utilizing Shatt al-Arab water. These problems are only going to increase, with a marine scientist speculating that salt levels could hit 12-14 parts per thousand in the area of Basra City by 2014.

Should these levels continue to rise, it is widely agreed upon that treatment plants throughout the province, including in Basra City, will need significantly improved reverse osmosis and other treatment and purification technologies to cope with rising salinity levels.

Contact

Parties interested in pursuing a conversation on opportunities involving desalinization plants are recommended to reach out to the Deputy Director General of the Basra Water Directorate Hamed al-Masoudy at enghamid66@yahoo.com or+964 770 319 5125.

Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766

The Governor's Assistant for Districts and Sub-districts Yousif Abu Yehya at +964 770 260 8912.

Bottom Line

Officials, particularly those at the Water Directorate (rather than the provincial government) seem to believe that rising salinity levels along the length of the Shatt al-Arab are inevitable. Companies offering world class technologies in removing salt and other contaminants can leverage concerns over fears of increased salinization levels exacerbated by the current poor performance of Basra's treatment plants.

Bio-Lagoons and Organic Wastewater Treatment

Throughout Iraq, there is an extreme shortage of access to sewage treatment plants for rural citizens. A marine scientist noted that, *"the climate and landscape of southern Iraq, particularly Dhi Qar, Maysan and Basra Provinces is a good fit for the construction of bio lagoons and other forms of organic wastewater treatment that leverage existing plant life. The ecosystem is southern Iraq, and the types of plants such as marsh reeds, is exactly what you look for in building a bio-lagoon. Many of the areas with the requisite conditions also happen to be areas that do not currently have access to sewage treatment plants."*[lxxii]

Contacts

Parties interested in pursuing bio-lagoons and other organic waste treatment are recommended to reach out to Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766

The Governor's Assistant for Districts and Sub-districts Yousif Abu Yehya at +964 770 260 8912.

Bottom Line

Many of the areas of southeastern Iraq currently not being serviced by central sewage treatment plants happen to be in areas that are well suited for bio lagoons. USAID successfully implemented a bio lagoon project in Anbar province[lxxiii], and any Japanese companies with expertise in bio lagoons or other organic

Localized Reuse of Waste Water

Officials in the Basra governor's office stated explicitly that they are looking for a company to help them determine a way to effectively use treated wastewater for irrigation and agricultural purposes. The governor's advisor on water issues noted that he would like to see a movement towards having more localized wastewater treatment plants, and a network capable of utilizing treated water in localized zones rather than simply dumping treated or untreated water back into the Shatt al-Arab.

The idea of localized reuse of treated sewage is appealing in all areas of Basra province but particularly in areas south of Basra City where increased salinization has rendered the Shatt al-Arab water unusable for irrigation.

Contact

The Governor's Assistant for Districts and Sub-districts Yousif Abu Yehya at +964 770 260 8912.

Bottom Line

Japanese companies have the potential to promote two projects in one by proposing small scale rural sewage treatment plants with a plan for localized reuse of treated sewage for agricultural use. This idea would be particularly resonant in al-Faw, Safwan and western Zubair district, all of which suffer from either high levels of salinization or a general shortage of water (in western Zubair's case).

Studies

Officials in the governor's office, the provincial council and the water directorate all noted that they are actively seeking foreign consultants to work on a number of water and sewage related studies. The following studies were specifically mentioned as actively being sought from foreign companies:

- A topographical study of Basra Province
- A study of the precise chemical composition of The Tigris, Euphrates, Shatt al-Arab and Persian Gulf

- A broad general study that identifies the problems facing Basra in the water sector, and then proposes solutions
- Training for the staff of the Water Directorate
- A study on how to best provide water and sewage services to planned new developments in Basra province
- A study focusing on how to utilize sea water from the Persian Gulf for agriculture and drinking

Contact

Parties interested in pursuing a conversation on opportunities involving water studies are recommended to reach out to the Deputy Director General of the Basra Water Directorate Hamed al-Masoudy at enghamid66@yahoo.com or+964 770 319 5125.

Basra Provincial Council Committee for Reconstruction and Development Director Abbas Maher at abbassmeer@yahoo.com or +964 780 913 5766

Bottom Line

Japanese companies will find that all of the government agencies involved in the water and sewage sectors are interested in commissioning studies from international companies. Additionally, with the exception of the desalinization study, all of the above bullets are applicable to all of Iraq's provinces.

Specific Opportunities for Japanese companies and Technologies

Following a specific request by JCCME, Dunia has cross referenced the specific technologies offered by Mitsubishi Heavy Industries (MHI), Hitachi Plant Technology (HPT), Toray, Yokogawa, and Kubota with needs identified by the Basra government and the Water and Sewage Directorates.

Mitsubishi Heavy Industries

Dunia assesses that there is a significant opportunity for MHI to engage the Basra Water Directorate on seawater desalinization. As noted previously in this section, a high-ranking official at the Basra Water Directorate explicitly noted to Dunia that the Directorate is hoping to commission a study regarding the potential for using seawater for drinking and agricultural usage. MHI has a documented track record of success both in conducting studies of how to use Sea Water Reverse Osmosis (SWRO) technology to provide drinking water, and of implementing plant projects. Dunia believes that there is the potential for MHI to develop a relationship with the Water Directorate by being commissioned to conduct a study on how to use the companies SWRO technology to help solve Basra's water needs. This may open the door for MHI to win a contract to build a SWRO plant on the Persian (Arab) Gulf in the future.

Hitachi Plant Technologies

Following our conversations with Iraqi officials, Dunia believes that there is a distinct need for HPT's High Filter Rapid Filtration Device. Dunia believes that HPT can successfully market this technology to Iraq's government, and the Basra provincial government and Basra Water Directorate in particular, because of the technology's low operating costs and low maintenance requirements. Several Iraqi officials, including those in Basra, noted that insufficient operating budgets and especially poor systems for ensuring proper maintenance were both major problems hampering the effectiveness of existing water treatment plants. Therefore, we believe that HPT can play up the low maintenance needs and low operating costs of this technology as ways to solve existing problems that Iraqi officials are well aware of.

Similarly, HPT can market to Iraq's government its membrane type drinking water treatment device. This technology will be appealing to both the Basra provincial government and the Basra Water Directorate because much of the water being utilized for the city's drinking water comes from the Shatt al-Arab, which is heavily polluted with raw sewage. Additionally, officials cited poor electricity provision as a major impediment for water and sewage treatment plants, and the membrane type drinking water treatment device uses limited power, making it suitable for the Iraqi environment.

Toray

Following our conversations with Iraqi and Basra officials, Dunia believes that Toray has an opportunity to successfully market its reverse osmosis membrane technology (ROMT) to the Basra provincial government and the Basra Water Directorate. Officials at both entities noted that the TDS level of the Shatt al-Arab is expected to continue to rise, rendering current plants even less effective than they currently are. Toray can emphasize that their ROMT is of a higher quality than many of the aging existing technologies being used by current water treatment plants. Additionally, Toray officials should note to their Iraqi counterparts that as long as Basra is attempting to utilize water from the Shatt al-Arab, they are going to have to upgrade their RO capabilities or water will become increasingly undrinkable.

Additionally, Toray should market its irrigation technologies. These technologies are specifically needed in southern areas of Basra province, such as al-Faw and Safwan. Toray can emphasize to Basra officials that their various membrane technologies can help to desalinate water from the southern part of the Shatt al-Arab that is so brackish currently that it is of limited or no use for irrigation purposes.

Yokogawa

In discussing the various opportunities throughout Southern Iraq with both Iraqi governmental officials and with local end-users, we believe that there are a number of specific and general opportunities available for the Yokogawa Electric Corporation; especially given their extensive in-region experience (Kuwait, Oman, Qatar, Saudi Arabia) and quite significant installed base in Iraq as well (Basrah Refinery, Baiji Refinery, Garraf/Majnoon/East Baghdad fields) underpinned by an Iraqi Headquarters in Basrah.

Specifically, the production control systems (Stardom and Fast/Tools) that Yokogawa offers would find a natural marketplace among the impending desalinization plants, reverse-osmosis locations, and the 3 province-wide wastewater treatment plants that are being planned and/or constructed within the province—as well as during impending refurbishments of the existing 16 plants. Furthermore, on the back of increased numbers of actual plants themselves throughout the province (and within Southern Iraq as well), field instruments ranging from chlorine analyzers to differential pressure transmitters to magnetic flowmeters should find increasing utilization throughout a number of projects and directorates. Specifically, natural client bases can be found within the Water Directorate and the MoMPW itself as both act as operational and planning arms of the wastewater needs throughout the province.

Kubota

Following Dunia's interviews with Iraqi and Basra officials, and an assessment of tenders released by the Basra provincial government, we believe that Kubota can market their ductile iron pipes as a solution to Basra's problem of high leakage levels in the water pipe networks. Basra's pipe networks have been damaged by both the Iran-Iraq war in the 1980s, and the fighting that followed the 2003 US invasion. As a result, in addition to needing pipes for newly developed residential areas, Basra's government also periodically replaces existing pipes. Kubota should emphasize that their pipes are of a superior quality to those produced in neighboring countries, such as Iran and Turkey.

Similarly, there is also a market for Kubota's chlorinated polyethylene membrane technology. Dunia believes that this technology could be particularly appealing to the Basra government to address the increasingly polluted water from the Shatt al-Arab that is fed through water treatment plants intended for drinking purposes in Basra City and other areas in Basra province. Kubota should emphasize that the presence of raw sewage in the Shatt al-Arab means that its membrane technology is a good solution as it is capable of addressing water contaminated with bacteria.

Additionally, the tenders released by the Basra provincial government suggest that there is still a high demand in Basra for various pumps, both for drinking water and sewage networks. Dunia recommends that Kubota emphasize to the Basra provincial government the different types of pumps that they provide as a solution to sewage pumping needs in parts of Basra city that are plagued by overburdened sewage pipes and existing pumping systems such as Hayaniya.

Recommendations on Engagement and Communications Points

Specifically in Basra province, there are several key communication points that Japanese companies can seize on to gain an advantage in negotiating for water and sewage infrastructure projects in the province.

- An understanding of underserved areas in Basra City. A prominent civil society activist in Basra noted that the following areas are the poorest and most deprived in Basra City: Hayanaiya, al-Hussein, Jamhuriya and Khamsmeel. By specifically bringing up these areas as in need of improved services, Japanese companies can demonstrate that they have an understanding of the operating environment[lxxiv].
- An understanding of underserved areas outside of Basra City. The same civil society activist noted that al-Faw District and parts of Zubair District, notably Abeed, are in need of water and sewage services. Again, an awareness of specific areas of need in Basra province will provide an advantage to Japanese companies.
- Recognizing Basra City citizens pride in their city's past. Government officials and private citizens alike noted that Basra City used to be prettier and cleaner than it is today. Specifically, canals in Basra City that are now polluted and filled with sewage used to be suitable for swimming. Government officials voiced to Dunia their desire to see the following areas returned to their previous condition: Rabat, Khandaq. Understanding this pride and desire of Basra officials to see their city returned to a better condition it previously enjoyed will help facilitate positive communication between Japanese companies and local officials[lxxv].
- Understanding the fear that deteriorating land and water quality has destroyed a way of life. Multiple officials lamented that the increased salinization of the Shatt al-Arab and surrounding land, particularly in al-Faw, but also further north along the Shatt al-Arab, is destroying an agricultural way of life that has existed for centuries. Suggesting strategies for addressing this fear will create a good rapport with local officials.

[i] UN-IAU 2010 Report
[ii] Dunia Interview
[iii] Dunia Interview
[iv] Photo taken by Dunia
[v] Photo taken by Dunia
[vi] COSIT: Environment Survey in Iraq 2010
[vii] Dunia interview with district level official
[viii] Action Fiche for Iraq, European Union
[ix] Dunia interview with provincial officials
[x] Dunia interview with MoMPW official
[xi] Dunia interviews with Iraqi engineers
[xii] Ministry of Water Resources
[xiii] Waste Water Production and Treatment Use in Iraq Country Report, Ministry of Water Resources
[xiv] Aquastat and the Ministry of Water Resources
[xv] Ministry of Water Resources
[xvi] Data obtained from the Ministry of Water Resources
[xvii] Ministry of Water Resources
[xviii] Dunia interview with provincial official
[xix] Ministry of Municipalities and Public Works
[xx] Documentation obtained from Iraq Ministry of Planning Survey
[xxi] Ministry of Municipalities and Public Works
[xxii] Ministry of Municipalities and Public Works
[xxiii] Ministry of Municipalities and Public Works
[xxiv] Dunia interview with Ministry of Water Resources official
[xxv] Dunia interview with a governor's advisor in southern Iraq
[xxvi] Report by the Ministry of Water Resources
[xxvii] Ministry of Water Resources
[xxviii] RAfa Suhaili, Evaulation of the Performance of the Dora Refinery Wastewater Treatment Plant
[xxix] Dunia interview with Iraqi PhD
[xxx] Dunia interview with Iraqi scientist in Basra
[xxxi] Ministry of Finance, 2011 Breakdown of State Institutions
[xxxii] Ministry of Finance
[xxxiii] US Inspector General for Iraq Reconstruction
[xxxiv] This estimate is based off the assumption that ministerial provincial allocations are approximately based on commensurate population.
[xxxv] Dunia interview with provincial and MoMPW employees

[xxxvi] Dunia interview with the head of a provincial reconstruction and development committee
[xxxvii] Dunia interview
[xxxviii] Ministry of Planning, 2010-2014 Development Plan
[xxxix] Report by Ministry of Water Resources
[xl] Ministry of Planning, 2010-2014 Development Plan
[xli] Ministry of Planning, 2010-2014 Development Plan
[xlii] Ministry of Planning, 2010-2014 Development Plan
[xliii] Ministry of Planning, 2010-2014 Development Plan
[xliv] Ministry of Planning, 2010-2014 Development Plan
[xlv] Ministry of Planning, 2010-2014 Development Plan
[xlvi] Dunia interview with a district council member
[xlvii] Ministry of Municipalities and Public Works
[xlviii] Growth rates combine IMF and World Bank projections with Dunia's assessment of likely increases in hydrocarbon exports
[xlix] Report by Iraq Ministry of Water Resources. MoWR report cites "regulation 25"
[l] Order 417/1974
[li] Ministry of Water Resources Report
[lii] Dunia interview
[liii] Dunia interview
[liv] Dunia interview
[lv] Dunia interview
[lvi] Dunia interview with engineer working for provincial government on water issues
[lvii] Basra Water Supply from View Point of its Water Sources, Tokyo Engineering Consultants
[lviii] Dunia interview with CRD member
[lix] Environmental Survey of Iraq, COSIT
[lx] Dunia interview
[lxi] Dunia interview
[lxii] Dunia interview
[lxiii] Dunia interview
[lxiv] www.njsconsultants.com
[lxv] Dunia interview
[lxvi] Dunia interview
[lxvii] Dunia interview
[lxviii] Dunia interview
[lxix] Dunia interview
[lxx] Dunia interview
[lxxi] Dunia interview
[lxxii] Dunia interview

[lxxiii] Dunia interview
[lxxiv] Dunia interview with local NGO director
[lxxvlxxv] Dunia interview

Appendix One

Province	City	Project Name	Project Capacity cm/day	Year	Construction Company	Project Cost $
Baghdad						
1	Al-Khadhumyia	Khadhumyia	112,500.00	2010	Water Master - Lebanon	$95,833,333.33
2	Al-Zafranyia	Al-Rasheed Water Project	90,000.00	2012	Al-Ghadeq & Abdul Razaq Al-Aousi / Invirotic co.	$58,018,287.37
3	Al-Karkh	Al-Qadisyia Water Project	90,000.00	2012	Water Master - Lebanon	$31,666,666.67
4	East Baghdad	Al-Baldyiat Water Project	225,000.00	2011	Water Master - Lebanon	$48,895,833.33
5	Al-Rashdyia	Al-Rashdyia Water Project	68,000.00	1994		0.00
6	Al-Rashdyia	Shek Hamad Water Project	1,100.00	1972		0.00
7	Al-Tarmyia	Al-Tarmyia Central Water Project	1,200.00	1962		0.00
8	Al-Abayji	Al-Abayji Water Project	1,200.00	1970		0.00

9	Al-Maden	Al-Maden Old Water Project	22,000.00	1981		0.00
10	Al-Maden	Al-Maden New Water Project	68,000.00	1995		0.00
11	Abu Ghareb	Zidan Water Project	22,000.00	2002	Ministry of Municipal	$6,666,666.67
12	Al-Mahmoudyia	Al-Mahmoudyia Water Project	60,000.00	1984		0.00
13	Al-Yousfyia	Al-Yousfyia Central Water Project	13,200.00	1984		0.00
14	Al-Yousfyia	Al-Yousfyia - Village Water Project	11,000.00	1985		
Diyala						
1	Baquba	Baquba Cental Water Project	70,400.00	1985		
2	Baquba	Al-Tahrer Water Project	8,800.00	1999		
3	Al-Huryia	Al-Huryia Water Project	8,800.00	2004		
4	Al-Kanan	Al-Kanan Water Project	8,800.00	1986		
5	Bani Saad	Bani Saad Water Project	8,800.00	1991		

6	Bani Saad	Abdul Hameed Water Project	8,800.00	1977		
7	Al-Khales	Al-Khales New Water Project	70,400.00	1992		
8	Al-Khales	Al-Khales Old Water Project	8,800.00	1966		
9	Al-Khales	Al-Hoyish Water Project	8,800.00	1977		
10	Al-Mansoryia	Al-Mansoryia New Water Project	17,160.00	1984		
11	Al-Mansoryia	Al-Mansoryia Old Water Project	3,850.00	1958		
12	Baladroz	Baladroz New Water Project	10,890.00	1958		
13	Baladroz	Baladroz Old Water Project	2,310.00	1978		
14	Baladroz	Ghazi Naji Water Project	44,000.00	2007		
15	Mandli	Mandli Water Project	15,015.00	1978		
16	Al-Maqdadyia	Al-Maqdadyia New Water Project	70,400.00	1997		

17	Al-Maqdadyia	Al-Maqdadyia Old Water Project	8,800.00	1959		
18	Al-Maqdadyia	Barawna Water Project	5,280.00	1972		
19	Al-Maqdadyia	Al-Wajihyia Water Project	2,310.00	1967		
20	Abi Seda	Abi Seda Water Project	13,200.00	1983		
21	Khanaqen	Khanaqen Water Project	17,600.00	1971		
22	Khanaqen	Qarah Tabah	5,280.00	1985		
23	Jalolaa	Lalolaa New Water Project	10,560.00	1982		
24	Jalolaa	Lalolaa Old Water Project	3,960.00	1959		
25	Al-Sadyia	Al-Sadyia Water Project	21,120.00	1987		
Al-Anbar						
1	Al-Ramadi	Al-Ramadi Water Project	144,000.00	1984		
2	Al-Ramadi	Al-Ramadi New Water Project	12,000.00	1975		
3	Al-Karma	Al-Karma Water Project	36,000.00	1985		

4	Faluja	Faluja New Water Project	44,000.00	1985		
5	Faluja	Faluja Old Water Project	12,000.00	1964		
6	Faluja	Al-Naymia Water project	24,000.00	1986		
7	Al-Habanyia	Al-Khaldyia Water project	4,320.00	1975		
8	Al-Habanyia	Al-Habanyia Village Water Project	3,960.00	1983		
9	Al-Khaldyia	Al-Husyba Water Project	8,000.00	1996		
10	Heet	Kubysa - Heet Water Project	24,000.00	1989		
11	Heet	Heet Village Water Project	7,200.00	1979		
12	Heet	Heet Old Water Project	4,300.00	1957		
13	Heet	Al-Baker Water Project	3,600.00	1957		
14	Haditha	Haditha - Haqlanyia Water Project	36,000.00	1990		
15	Haditha	Barwana Water Project	3,000.00	1974		

16	Ana	Ana Water Project	23,000.00	1986		
17	Qaem	Qaem Water Project	4,000.00	1964		
18	Qaem	Al-Ubydi Water Project	20,000.00	2007		
19	Qaem	Al-Rmana Water Project	1,320.00	1981		
Al-Najaf						
1	Al-Najaf	Al-Najaf Central Water project	200,000.00	1997		
2	Al-Najaf	Al-Shabaka Water Project	870.00	1975		
3	Al-Najaf	Al-Haydaria Water project	6,200.00	1972		
4	Al-Kufa	Al-Kufa Water Project	72,000.00	1970		
5	Al-Kufa	Al-Manthira Water Project	10,500.00	1976		
6	Al-Kufa	Al-Huryia Water Project	3,840.00	2000		
7	Al-Kufa	Al-Abasyia Water Project	6,000.00	1981		
8	Al-Manathira	Al-Mishkhab Water Project	11,000.00	1977		

9	Al-Manathira	Al-Hera Water project	3,840.00	2000		
10	Al-Manathira	Al-Hera New Water project	3,840.00	2007		
11	Al-Manathira	Al-Qadisyia Water Project	10,500.00	1974		
12	Al-Manathira	Al-Manathera New Water project	36,000.00	2010		
13	Al-Manathira	Al-Mishkhab New Water Project	48,000.00	2010		
Karbala						
1	Karbala	Al-Hussain City Water Project	176,000.00	1986		
2	Karbala	Al-Hussain Water Project	59,400.00	1973		
3	Karbala	Al-Safi Old Water project	22,000.00	1959		
4	Al-Hindyia	Al-Hindyia Water Project	44,000.00	1987		
5	Al-Hindyia	West Jadwal Wter project	2,640.00	1980		
6	Al-Hindyia	Al-Hindyia Old Water Project	4,400.00	1967		

7	Al-Hindyia	Al-Kherat Water project	2,640.00	1982		
Wasit						
1	Kut	Kut Water Project	40,000.00	1980		
2	Kut	Al-Kardhyia Water Project	4,800.00	2003		
3	Kut	Waset Water Project	1,200.00	1973		
4	Kut	Shekh Saad Water Project	11,500.00	1984		
5	Al-Numania	Al-Numania New Water Project	2,800.00	1982		
6	Al-Numania	Al-Numania Old Water Project	1,000.00	1980		
7	Al-Numania	Al-Ahrar Water Project	4,300.00	1982		
8	Al-Hay	Al-Hay Water Project	31,000.00	1986		
9	Al-Hay	Al-Mwfaqia Water Project	1,200.00	1962		
10	Al-Hay	Al-Basher Water Project	1,200.00	1981		
11	Al-Swera	Al-Swera Water Project	40,000.00	1981		

12	Al-Swera	Al-Swera Old Water Project	4,800.00	1960		
13	Al-Swera	Al-Azizia Water Project	54,000.00	1989		
14	Al-Swera	Al-AZizia Old Water Project	4,100.00	1973		
15	Al-Swera	Al-Zubydia Water Project	1,200.00	1964		
16	Al-Swera	Um Sunim Water Project	1,200.00	1982		
17	Al-Swera	Al-Mazra Water Project	1,200.00	1981		
18	Al-Badra	Al-Badra Water Project	9,400.00	1983		
19	Al-Badra	Al-Daboni Water Project	1,200.00	1982		
20	Al-Badra	Al-Samden Water Project	2,880.00	1990		
21	Al-Badra	Al-Jasan Water Project	2,400.00	1999		
Missan						
1	Amara	Amara Water Project	30,000.00	1975		
2	Amara	Al-Rafden Water Project	10,000.00	1957		

3	Al-Majar	Al-Majar Water Project	3,000.00	1968		
4	Qala Salah	Qala Salah Water Project	2,000.00	1962		
5	Al-Maymona	Al-Maymona Water Project	2,400.00	1962		
6	Ali Al-Gharbi	Ali Al-Gharbi Water Project	7,000.00	1980		
7	Ali Al-Sharqi	Ali Al-Sharqi Water Project	2,000.00	1962		
8	Kamet	Kamet Water Project	2,000.00	1975		
9	Al-Mashrah	Al-Mashrah Water Project	2,000.00	1975		
10	Al-Kahlaa	Al-Kahlaa Water Project	2,000.00	1973		
11	Al-Azeer	Al-Azeer Water Project	2,400.00	1975		
12	Al-Salam	Al-Salam Water Project	2,000.00	1970		
13	Al-Qadha	Al-Adel Water Project	7,000.00	1981		
Thi- Qar						
1	Nasryia	Nasryia Water Project	57,000.00	1979		

2	Nasryia	Nasryia Water Project	8,000.00	1957		
3	Nasryia	Al-Bat'ha Water Project	1,000.00	1961		
4	Nasryia	Sa'eed Dakheel Water Project	12,000.00	1982		
5	Nasryia	Nasryia New Water Project	220,000.00	2009		
6	Al-Jabaysh	Al-Eslah Water Project	1,000.00	1957		
7	Al-Jabaysh	Al-Fahood Water Project	10,000.00	1972		
8	Al-Jabaysh	Al-Jabaysh Water Project	2,200.00	1962		
9	Souq Al-Sheukh	Souq Al-Sheukh Water Project	3,000.00	1957		
10	Souq Al-Sheukh	Karma Bani Sa'eed Water Project	1,000.00	1963		
11	Souq Al-Sheukh	Al-Tar Water Project	1,000.00	1979		
12	Al-Refa'ee	Al-Refa'ee Water Project	5,700.00	1968		

13	Al-Refa'ee	Al-Refa'ee/ Village Water Project	2,000.00	1979		
14	Al-Refa'ee	Al-Fajar Water Project	1,000.00	1967		
15	Al-Refa'ee	Qalat Sukar Water Project	12,660.00	1984		
16	Al-Shatra	Al-Shatra Water Project	25,000.00	1963		
17	Al-Shatra	Al-Dawayia Water Project	1,250.00	1984		
18	Al-Shatra	Al-Gharaf Water Project	8,000.00	1996		
Basra						
1	Basra	Basra Water Project	96,000.00	1978		
2	Basra	Al-Labani Water Project	14,400.00	1968		
3	Al-Jubila	Al-Jubila Water Project	24,000.00	1936		
4	Al-Bardhyia	Al-Bardhyia Water project 1	24,000.00	1957		
5	Al-Bardhyia	Al-Bardhyia Water project 2	24,000.00	1957		

6	Khour Al-Zubair	Khour Al-Zubair Water Project	36,000.00	1988		
7	Al-Shueba	Al-Shueba Water Project	19,200.00	1948		
8	Shatt Al-Arab	Shatt Al-Arab Water Project	24,000.00	1973		
9	Al-Nashwa	Al-Nashwa Water Project	4,000.00	1985		
10	Al-Deer	Al-Deer Water Project	4,800.00	1968		
11	Al-Qurna	Al-Qurna Water Project	24,000.00	1980		
12	Al-Madena	Al-Madena Water Project	4,800.00	1983		
13	Al-Sueeb	Al-Sueeb Water Project	4,800.00	1985		
14	Al-Fao	Al-Fao Water Project	24,000.00	1982		
15	Um Qasser	Um Qasser Water Project	13,200.00	2007		
16	Basra	Basra Great Water Project	250,000.00	2012		
Muthana						
1	Al-Rumetha	Al-Rumetha New Water project	88,000.00	1982		

2	Al-Rumetha	Al-Rumetha Old Water project	36,000.00	1971		
3	Al-Rumetha	Al-Warkaa Water Project	22,400.00	1982		
4	Al-Salman	Al-Salman Water Project	750.00	1982		
5	Al-Salman	Besa Water project	190.00	1985		
6	Al-Khudher	Al-Darajee Water Project	2,200.00	1999		
7	Al-Semawa	Al-Semawa Water Project	44,000.00	2010		
8	Al-Salman	Al-Salman Purification unit	200.00	2010		
Babel						
1	Hela	Hela New Water Project	120,000.00	1991		
2	Hela	Al-Tayara Old Water project	24,000.00	1975		
3	Hela	Hela Old Water Project	22,800.00	1954		
4	Hela	Al-Kafel Water Project	3,600.00	1978		
5	Al-Hashmyia	Al-Mat'hatyia Water Project	4,800.00	1964		

6	Al-Hashmyia	Al-Hashmyia Water Project	7,600.00	1963		
7	Al-Hashmyia	Al-Shomali Water Project	2,400.00	1965		
8	Al-Mahaweel	Al-Mahaweel New Water Project	4,800.00	1978		
9	Al-Mahaweel	Al-Mahaweel Old Water Project	1,200.00	1975		
10	Al-Mahaweel	Al-Hssen Water Project	12,600.00	1976		
11	Al-Mahaweel	Al-Mu'asker Water Project	10,000.00	1984		
12	Al-Mahaweel	Al-Mashroh Water Project	2,400.00	1975		
13	Al-Museb	Al-Museb New Water Project	43,200.00	1982		
14	Al-Museb	Al-Museb Old Water Project	6,800.00	1975		
15	Al-Museb	Hateen Water project	8,000.00	1984		
16	Al-Museb	Hateen / Eskandaryia Water Project	10,000.00	1987		
17	Al-Museb	AL-Me'aden Water Project	3,200.00	1982		

18	Sada Al-Hindyia	Sada Al-Hindyia Water Project	20,000.00	1982		
Salah Al-Din						
1	Tekret	Tekret Old Water Project	9,900.00	1993		
2	Tekret	Tekret Water Project 1	15,400.00	1981		
3	Tekret	Tekret Water Project 2	33,000.00	1985		
4	Tekret	Al-Oja Water Project	22,000.00	2001		
5	Baiji	Baiji Water Project	66,000.00	1988		
6	Balad	Balad Old Water Project	5,500.00	1952		
7	Balad	Balad New Water Project	11,800.00	1978		
8	Al-Es'haqi	Yathrab Water Project	22,000.00	1983		
9	Al-Dhlu'eh	Al-Dhlu'eh Water Project	3,300.00	1986		
10	Samara	Samara Water Project	45,000.00	1983		
11	Al-Dur	Al-Dur New Water Project	5,900.00	1982		

12	Al-Dur	Al-Dur Old Water Project	3,300.00	1960		
13	Al-Tuz	Braw'Jli Water Project	10,200.00	1976		
14	Al-Tuz	Tuz Water Project	3,600.00	1960		
15	Al-Tuz	Tuz Kafri Water Project	88,000.00	2005		
16	Al-Shrqat	Al-Shrqat Water Project	2,200.00	1974		
17	Al-Shrqat	Al-Shrqat Old Water Project 1	1,500.00	1963		
18	Al-Shrqat	Al-Shrqat Old Water Project 2	9,000.00	1986		
19	Al-Shrqat	Al-Shrqat Old Water Project 3	66,000.00	2010		
20	Al-Dejel	Al-Dejel Water Project	4,800.00	1957		
Ninawa						
1	Mosul	Al-Aysar Old Water Project 1	44,000.00	1966		
2	Mosul	Al-Aysar Expansion Water Project 1	44,000.00	1981		

3	Mosul	Al-Aysar New Water Project	236,000.00	1993		
4	Al-Rashdyia	Al-Rashdyia Water Project	3,960.00	1965		
5	Mosul	Al-Ayman Water Project	182,160.00	1980		
6	Al-Dandan	Al-Dandan Water Project	8,800.00	2001		
7	Mosul	Al-Aysar OLd Water Project 2	17,600.00	1973		
8	Mosul	Al-Aysar Expansion Water Project 2	6,050.00	1979		
9	Telkef	Telkef Water Project	3,300.00	1994		
10	Al-Rashdyia	Al-Rashdyia Expansion Water Project	4,400.00	1998		
11	Hamam Al-Alel	Hamam Al-Alel Water Project	8,800.00	1964		
12	Al-Qyara	Al-Qyara Water Project	11,000.00	1973		
13	Al-Shora	Al-Shora Water project	11,600.00	1979		
14	Al-Sulamyia	Al-Sulamyia Water Project	39,249.00	1985		

15	Sanhareb	Sanhareb Water Project	39,249.00	6160		
16	Al-Qush	Al-Qosh Water Project	6,600.00	1985		
17	Al-Saad	Al-Saad Water Project	4,000.00	1990		
18	Sinjar	Sinjar Water Project	16,500.00	1955		
19	Sinjar	North Water Project	4,200.00	2004		
20	Sinjar	Sharaf Al-Din Water Project	1,800.00	2001		
21	Al-Qirawan	Al-Qirawan Water Project	1,080.00	2002		
22	Telafer	Telafer Old Water Project	11,000.00	1965		
23	Telafer	Telafer New Water Project	61,600.00	1985		
24	Domiz	Zamar Water Project	4,400.00	2004		
25	Rabe'a	Rabe'a Water Project	2,970.00	1962		
26	Shekhan	Shekhan / Ayon Water project	4,840.00	1989		
27	Shekhan	South Shekhan Water Project	1,320.00	1994		

28	Shekhan	Shekhan / Al-Mahad Water project	1,800.00	2004		
29	Shekhan	Al-Faroq Water project	280.00	1999		
30	Al-Ba'aj	Al-Ba'aj Water Project	1,320.00	1980		
31	Al-Hadher	Al-Hadhar Water Project	6,050.00	1982		
32	Makhmor	Makhmor Old Water Project	1,100.00	1963		
33	Makhmor	Makhmor New Water Project	4,400.00	1984		
34	Al-Kwer	Al-Kwer Water Project	11,880.00	1986		
35	Al-Qarj	Al-Qarj Water Project	11,000.00	1984		
36	Al-De'aka	Al-De'aka Water Project	700.00	1997		
37	Faida	Faida Water Project	3,300.00	1975		
38	Faida	Faida / Domiz Water Project	800.00	1987		
39	Al-Qahtanyia	Al-Qahtanyia Water Project	3,000.00	1980		

40	Al-Qahtanyia	Al-Sumod Water Project	1,000.00	1975		
41	Wana	Wana Water Project	2,000.00	1987		
Dewanyia						
1	Dewanyia	Dewanyia New Expansion Water Project	30,000.00	2008		
2	Dewanyia	Dewanyia Old Water Project	15,600.00	1972		
3	Al-Shamyia	Al-Shamyia New Expansion Water Project	16,000.00	2009		
4	Al-Shamyia	Al-Shamyia old Water Project	4,800.00	1973		
5	Al-Shamyia	Ghamas New Water Project	3,166.00	1980		
6	Al-Shamyia	Ghamas old Water Project	2,400.00	1958		
7	Dewanyia	Al-Daghara Water Project	5,516.00	1975		
8	Dewanyia	Al-Daghara / Village Water Project	6,688.00	1984		
9	Afak	Afak Water Project	4,316.00	1972		

10	Afak	Al-Bader Old Water Project	4,344.00	1970		
11	Al-Hamza	Al-Hamza Old ater Project	6,083.00	1975		
12	Al-Hamza	Al-Ein Water project	1,022.00	1970		
13	Al-Hamza	Al-Mansor Expansion Water Project	22,000.00	2009		
14	Afak	Al-Bader New Water Project	44,000.00	2009		
15	Al-Shanafyia	Al-Shanafyia Water Project	44,000.00	2010		
Kirkuk						
1	Kirkuk	Kirkuk Water Project	302,400.00	1993		
2	Yayji	Yayji Water Project	3,520.00	2005		
3	Laylan	Laylan Water Project	6,600.00	1957		
4	Terjel	Terjel Water Project	8,800.00	2005		
5	Debas	Debas old Water project	79,920.00	1975		
6	Debas	Debas New Water project	26,640.00	1978		
7	Hawja	Hawja Old Water Project	13,200.00	1982		

8	Hawja	Hawja New Water Project	44,000.00	2007		
9	Hawja	Tel Ali Water Project	7,200.00	1982		
10	Hawja	Kasaba Water Project	4,400.00	1968		
11	Hawja	Riadh Village Water Project	8,000.00	1984		
12	Al-Zab	Al-Zab Water Project	8,250.00	1975		
13	Al-Zab	Al-Zab / Village Water Project	8,800.00	1979		
14	Daquq	Daquq Water project	9,000.00	1952		
15	Alton Kubri	Alton Kubri Water Project	6,600.00	1971		
16	Taza	Taza Water Project	4,400.00	2000		

Appendix Two

Location	**Plant Name**	**Design Capacity (cubic meters/day)**	**Actual Capacity (cubic meters/day)**	**Year of Construction**	**Method**
Baghdad	Rusafa	175,000	300,000	1942	Vixiaoip and Biological
Baghdad	Rustamiya North	300,000	250,000	1959	Vixiaoip and Biological
Baghdad	Rustamiya South	300,000	250,000	1959	Vixiaoip and Biological
Basra	Hamdani	286,000	70,000	1979	Vixiaoip

Qadisiya	Khairi Plant	NA	NA	1983	Biological
Karbala	Firiha	75,000	25,000	1990	Biological
Salahaddin	Dibai	16,000	20,000	Na	Biological
Salahaddin	Samara	9,000	5,000	Na	Biological
Salahaddin	Dajil	12,500	3,000	Na	Biological
Salahaddin	Shirqat	8,000	3,000	na	Biological