JORDAN FISCAL REFORM PROJECT II

WATER PUBLIC EXPENDITURE PERSPECTIVES WORKING PAPER

October 2011

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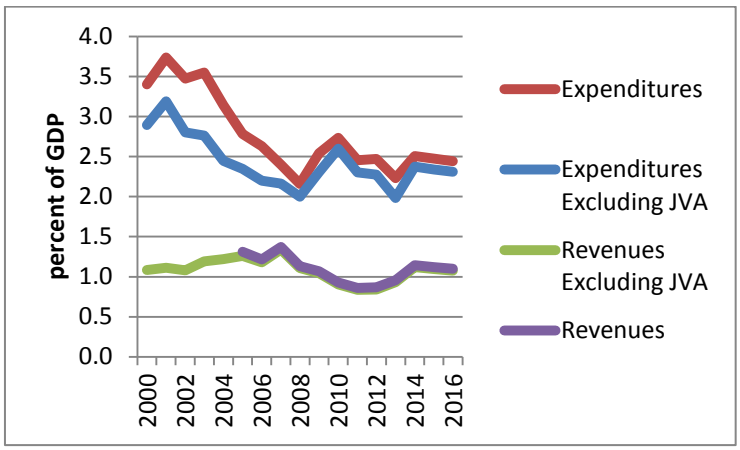
Abbreviations

BOT: Build-Operate-Transfer
CBJ: Central Bank of Jordan
DOS: Department of Statistics
EDP: National Executive Development Plan
GBL: General Budget Law
GDP: Gross Domestic Product
GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
Ha: Hectare
IBT: increasing block tariff
ISSP: Institutional Support and Strengthening Project
JICA: Japan International Cooperation Agency
JD: Jordanian Dinar
JRSP: Jordan Red Sea Project
JVA: Jordan Valley Authority
LEMA: a consortium of Suez Lyonnaise des Eaux- Montgomery Watson Arabtech Jardaneh
MCM: million cubic meters
MDG: Millennium Development Goal
MOA: Ministry of Agriculture
MOPIC: Ministry of Planning and International Cooperation
MWI: Ministry of Water and Irrigation
NRW: non-revenue water
NWMP: National Water Master Plan
O&M: Operations and Maintenance
OMS: Operations Management Support Project
PMU: Project Management Unit
UN: United Nations
USAID: United States Agency for International Development
WAJ: Water Authority of Jordan

Section 1: Overview

Public expenditure in Jordan on the water sector has been between 2 and 4% of GDP, within the range of between 1 and 5 percent of GDP in the MENA region (World Bank, 2010). While Jordan‟s level of expenditures is reasonable for a country with limited water resources, the gap between expenditures and revenues is significant and after narrowing from 2001 to 2007, has widened since then, but is projected to level off beginning in 2011 (see Figure 1).

Figure 1: Water Sector Expenditures and Revenues as Percent of GDP



Revenues are only from water services and are net of internal transfers. JVA data prior to 2005 was not available. GDP is market prices. Actual data through 2010, projections from 2011 onward. Projections are based on expenditure and revenue projections presented later in this report.
Sources: Revenue and expenditure data from MWI, WAJ, JVA, and Miyahuna and Aqaba Water Company via PMU. GDP actual data from CBJ; projections from the macroeconomic model presented in the main Public Expenditure Perspectives report.

Jordan is making excellent progress towards its UN Millennium Development Goals (MDGs) for access to water networks and sanitation services, and is on track to achieve its targets for 2015. The MDG performance demonstrates that Jordan provides excellent basic water and sanitation services, which may contribute to Jordan‟s strong performance in the health sector relative to its GDP. Jordan still has opportunities for improving performance in terms of providing continuous water supply, making groundwater withdrawals sustainable, reducing non-revenue water (NRW) (water that is produced but not billed, because of leaks in the system – "technical" losses – or illegal connections and meter errors – "administrative" losses), expanding sanitation services and wastewater treatment capacity, and agricultural productivity with respect to water.

Water Balance

Jordan has low water supply – among the lowest renewable water resources per capita of any country[1] – and moderate water demand – Jordan‟s economy uses an average amount of water per capita compared to other countries.[2] Jordan‟s water deficit is made up primarily through

[1] In 2008, Jordan ranked 12th lowest country in total renewable water resources per capita, at 153 m3/inhabitant/year (FAO AQUASTAT).
[2] In 2001, Jordan ranked 75th out of 145 countries in per capita water footprint (the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business), at 1,303 m3/capita/year (Water Footprint Network).

the "virtual" water in imported agricultural goods. With low supply and moderate demand, the economic cost of water in Jordan is very high, even if the government maintains a low price. Only through significant improvements in efficiency and reduced demand (allowing supply to be limited to lower cost sources) could Jordan reduce the economic cost of water.

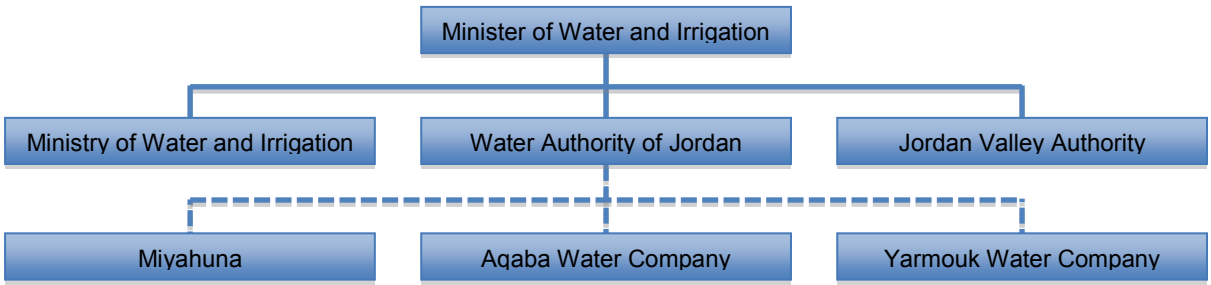
Jordan is already using essentially all its domestic renewable water resource. Groundwater is being withdrawn at approximately double the natural recharge rates (Chebaane, et. al., 2004). And, prospects are very limited for capturing more surface water through dams and water harvesting (small-scale water collection, which is expensive because of limited rainfall) (MWI, unpublished). Climate change is predicted to decrease annual precipitation by 4% to 27% of current levels, with other factors such as rainfall intensity, rainfall frequency, and soil moisture, further reducing naturally available and renewable water resource (MOPIC/UN Jordan, 2010; Christensen, et. al., 2007).

As groundwater resources decline, Jordan anticipates using more expensive sources of water, such as the Disi aquifer, treated wastewater, and desalination (GOJ, 2009). Absent improvements in how Jordan uses its water, projected population and economic growth will significantly increase water demand, potentially doubling to 1,550 MCM/yr by 2030 (MWI, unpublished), and push Jordan to access these costly water sources, creating a drag on the economy.

Institutional Organization

Figure 2 shows the institutional organization of the water sector.

Figure 2: Institutional Organization of the Water Sector



The Ministry of Water and Irrigation (MWI) is responsible for overall strategic direction and planning, in coordination with the Water Authority of Jordan (WAJ) and the Jordan Valley Authority (JVA). WAJ manages bulk water supply, and retail distribution in parts of the Kingdom where commercialization of distribution services has not occurred. WAJ is a government unit – meaning that it has some degree of autonomy compared to MWI and JVA, e.g., it issues government guaranteed debt and keeps its revenue rather than returning it to the Treasury. JVA is responsible for the socio-economic development of the Jordan Valley, primarily managing bulk water supply for irrigation, domestic, and industrial purposes, but also promoting land development. Miyahuna and Aqaba Water Company are government-owned utilities, operating as commercial entities to provide retail distribution and other functions such as water and wastewater treatment in Greater Amman and Aqaba, respectively. The Yarmouk Water Company begins operations in 2011 to service the Irbid area. WAJ manages the contracts with the water companies through its Project Management Unit (PMU),

and WAJ and JVA recommend water tariff changes and capital projects, but the Cabinet has ultimate regulatory authority, especially for tariffs.

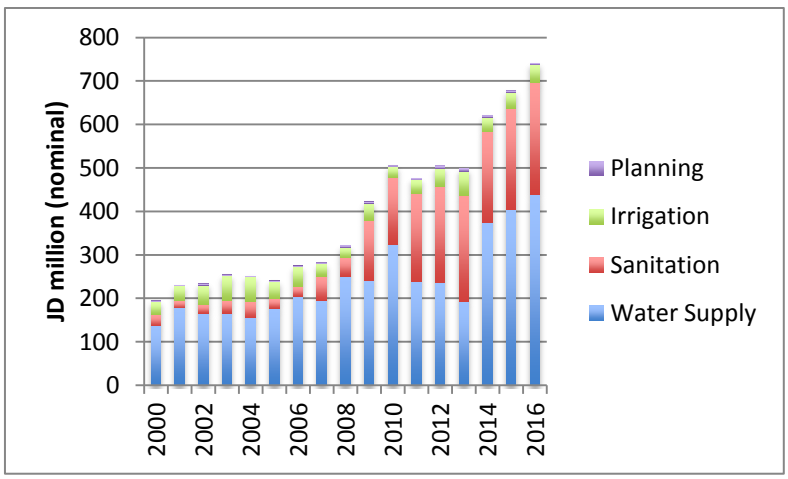
Section 2: Program and Expenditure Policies

The following sections examine the budget for the period 2000-2016 and then evaluate performance against previous and future goals and budgets. Appendix 1 presents a tabulation of the current services budget by program for the 2010-2016 period.

Expenditures

Water sector expenditures by the government – including MWI, WAJ, JVA, Aqaba Water Company, and Miyahuna – were approximately JD 500 million in 2010 and are expected to remain near that level for the next few years, before increasing again when the Disi project becomes operational in 2014 (see Figure 3). From 2006-2010, water sector expenditures increased 84% in nominal terms and 4% relative to GDP, with sanitation"s share increasing significantly. Water and wastewater has the largest share of any sector in the National Executive Development Program (EDP), totaling 16.6% of all investments included in the plan (MOPIC, 2010). The major expenditures (including domestic and international assistance funding sources) have been on increasing water production (e.g., Zara-Ma"in desalination plant, Disi groundwater abstraction and conveyance to Amman, Hofah-Zattary abstraction and conveyance to Irbid) and expanding the sewer system collections and treatment (e.g., the Al-Khirba As-Samra waste water treatment plant, the Greater Irbid Sewerage Project, and the Wadi Ash-Shelalah Wastewater Treatment Plant). Inflation in the price of materials, electricity, and wages has also contributed to the increase in nominal expenditures.

Figure 3: Water Sector Expenditures, Including Water Companies



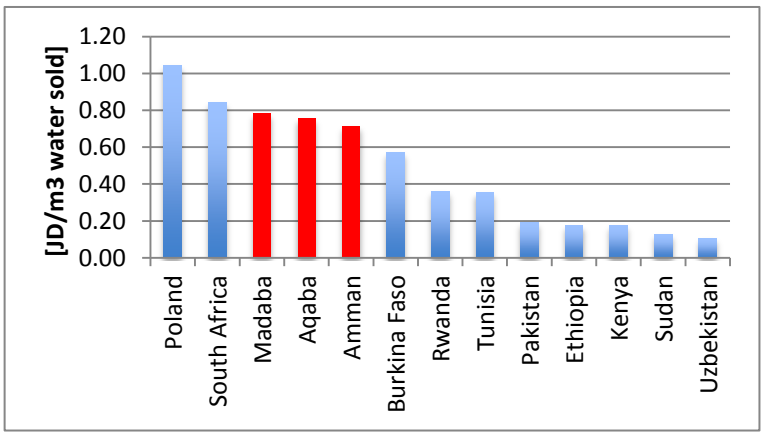
See Appendix 2: Supplemental Notes on Figures for assumptions and calculation methodology. Actual data through 2010, projections from 2011 onward.
Sources: MWI, WAJ, JVA, and Miyahuna and Aqaba Water Company via PMU.

Irrigation is a small portion of the total water sector expenditures, but projected to grow 2011-2013. The real cost of irrigation is in the opportunity cost of the water used (see Water Allocations section).

The 2011 budget continued the shift from expenditure on water supply to sanitation, made possible by a drop in expenditures on Disi from a peak of JD 120 million in 2010, which was primarily to buy down the unit price of produced water from the BOT project. Expenditure on Disi will return to approximately JD 85 million/year (2010 prices) in 2014 when Disi is expected to complete its first full year of operations.

The operational costs of water supply and sanitation systems in Jordan are relatively high when compared to other countries with low renewable water resources per capita (see Figure 4). The high cost per m3 of water sold is in part due to the high NRW. A lot of cost is expended on water that is not billed to the customer, which elevates the cost for water that does not reach the customer and demonstrates how important it is to reduce NRW. Aqaba has comparable costs to the rest of Jordan, but has much better service (water available continuously) and lower non-revenue water, demonstrating the value that can be obtained through investment in new and upgraded systems.

Figure 4: Comparison of Water Supply and Sanitation Operational Costs

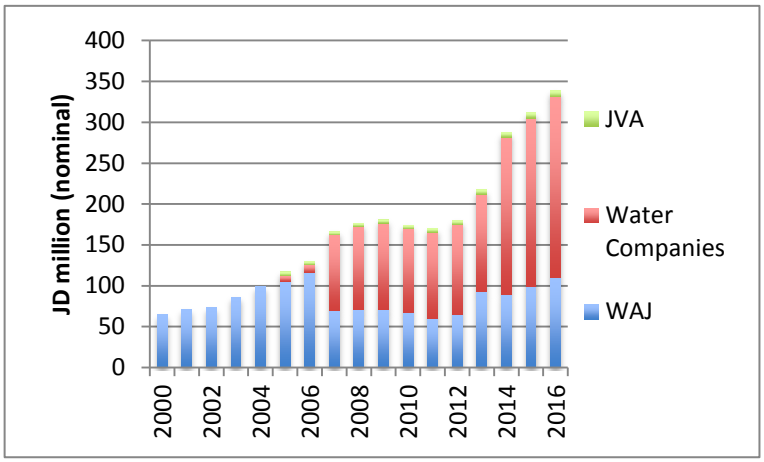


Countries were selected for comparison on the basis of low renewable water resources per capita. The data provide only a rough indication of comparative costs, and do not account for differences in level of service, water quality, physical factors, donor support, etc. Data for countries (except Jordan) are averaged across all reporting utilities; data are most recent available (2005-2009) in nominal prices. Jordan data are reported separately for selected systems.
Source for international data: World Bank/IB-NET. Sources for Jordan data: Aqaba: Aqaba Water Company, 2009. Amman: Segura/IP3, 2009a. Madaba: OMS, 2008. Source for ranking of countries by renewable water resources per capita: FAO AQUASTAT.

Revenues

Water sector revenues grew significantly from 2000-2007, due in part to reduced NRW and new connections added in 2006-2007 (see Figure 5). From 2007-2010, revenues increased 5% in nominal terms, but decreased 32% relative to GDP, pointing to a great opportunity to increase prices annually and keep up with Jordan‟s growing economy, without increasing the share of income going to water. Revenues are expected to increase when the Disi project comes on line, but increasing production is not a sufficient solution on its own, since the government loses money on every unit of water sold. Increasing prices and/or further reduction in NRW are needed to achieve revenue growth that keeps up with expenditure growth.

Figure 5: Revenues from Water Services, Including Water Companies



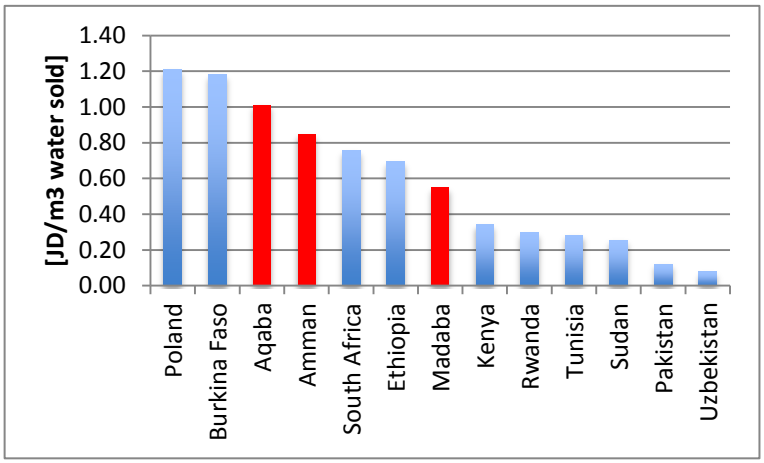
See Appendix 2: Supplemental Notes on Figures for assumptions and calculation methodology. Actual data through 2010, projections from 2011 onward. JVA data prior to 2005 was not available.
Sources: MWI, WAJ, JVA, and Miyahuna and Aqaba Water Company via PMU.

Better estimates of revenues are needed. In the 2010 Budget, the estimated WAJ revenues from sales of goods and services were JD 85 million, but the actual revenues were only JD 67 million, 21% less than planned. The reasons for this revenue shortfall should be considered when making future revenue estimates. For example, the 44% increase in WAJ revenues from sales of goods and services between 2012 and 2013 estimated in the 2011 Budget may be overly optimistic.

In Jordan, "the average urban water tariff … is now among the highest in the Middle East region. Conversely, levels of unaccounted-for-water… remain among the highest in the world" (Pitman, 2004). High NRW means that Jordan"s revenues per m3 of water sold by water supply and sanitation systems are not as high as they should be. Unit revenues are highest for Jordan in Aqaba, which has the lowest NRW. While revenues per m3 of water sold are relatively high in Jordan, tariffs could still be raised without exceeding normal international ranges for countries with little water (see Figure 6).[3] Increased revenues would allow for investment in NRW reduction, which would make it easier to provide continuous water supply.

[3] Al-Assa"d (2011) found that in Jordan, "the share of the average [houshold] expenditure on water and wastewater services to the total [houshold] expenditure… [is] 0.92%. In comparison to many other countries, this is considered at least 50% less than them."

Figure 6: Comparison of Water Supply and Sanitation Revenues



Countries were selected for comparison on the basis of low renewable water resources per capita. The data provide only a rough indication of comparative revenues, and do not account for differences in level of service, water quality, physical factors, donor support, etc. Data for countries (except Jordan) are averaged across all reporting utilities; data are most recent available (2005-2009) in nominal prices. Jordan data are reported separately for selected systems.
Source for international data: World Bank/IB-NET. Sources for Jordan data: Aqaba: Aqaba Water Company, 2009. Amman: Segura/IP3, 2009a. Madaba: OMS, 2008. Source for ranking of countries by renewable water resources per capita: FAO AQUASTAT.

JVA sells water to agriculture and industrial users and gives water to WAJ for free, resulting in very low total revenues. Although JVA sells much more water for agriculture than industrial applications, the revenues from each sector are about the same (approximately JD 2 million per year, for each) because the tariffs charged for agriculture are much lower than the tariffs charged for industry.

The revenues in the private sector for water supply services indicates a much higher willingness to pay for water than the current publicly regulated prices. For domestic water supply, the market shows "tanker water at a unit price of JD 3.8/m3" (ECO Consult, 2010a), compared with Miyahuna"s average tariff of JD 0.85/m3 (Segura/IP3, 2009a). In the agriculture sector, "Modern Jordan Farms, with large export markets, desalinates its own brackish water at a cost of JD 0.210/m3, plus the cost of pumping – demonstrating a willingness to pay 17 times more for water than the JD 0.012/m3 paid by small farmers to the JVA for irrigation water" (USAID, 2007). "Experience from the West Bank under identical agro-climatic conditions – but with well-developed export markets – suggests that farmers are willing to pay US$0.20/m3 for almost all crops" (Pitman, 2004).

Deficit, Cost Recovery, and Debt

Jordan has long struggled with low cost recovery in the water sector. In 1999, WAJ"s debt was unsustainable, and the MOF removed the debt from WAJ"s books and took responsibility for paying it directly, in effect providing a subsidy equal to the value of the debt. The continued high government subsidy to cover funding shortfalls, the expectation that new water sources will be significantly more expensive than current sources, and the likelihood that WAJ will again not be able to repay its debt, are significant strains on current and future government finances. Foreign assistance covers a significant portion of funding shortfalls, but dependence on it is a risk if assistance levels fluctuate.

Cost recovery rates are difficult to analyze because there is a wide range of ways cost recovery can be calculated. First, there is disagreement over whether revenues should cover only the cost of O&M, or also all (or some) capital investments. Second, the underpricing of water at every step of the supply chain from source to end-user (e.g., see hidden subsidies in the next paragraph) means that recovery of financial costs (reported on accounting statements) is not sufficient to recover economic costs. Third, O&M is significantly underfunded, as evidenced by the high rates of NRW, which again means that recovery of actual O&M costs is not sufficient to recover the costs of what should be spent on O&M. Fourth, the government accounts for some costs as capital expenditures that might typically be considered O&M expenditures, such as some salaries.

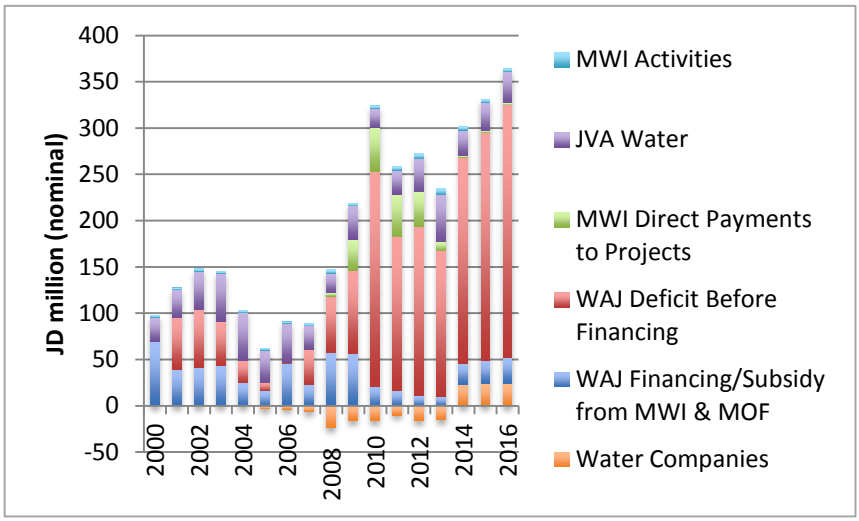
There are several forms of hidden subsidies to the water sector – and costs to the government – that are not taken quantitatively into consideration in the analysis of cost recovery and deficit. The electricity and fuel subsidy used in the production and distribution of water has been roughly estimated at JD 15 million/year (MWI, unpublished), and significantly higher when the water sector‟s rate is compared against the electricity rate that large industrial users pay. The government guarantee on domestic loans for WAJ provides a subsidy by reducing the interest rate WAJ would pay if it raised capital through the bond market (guaranteed by the utility‟s own revenue streams), as many water utilities in other countries do. Finally, international loans disbursed directly by MOF to Disi project contractors are not repaid by WAJ and represent another subsidy.

Rather than focus initially on cost recovery percentages, it is simpler to get the big picture of costs versus revenues by looking at the portion of the deficit due to the water sector. The results are clear: the water sector deficit is large and has been growing since 2007. The net cost of the water sector to the government in 2010 was approximately JD 300 million, equal to 20% of the combined deficit of ministries, departments, and government units.

The water sector deficit (see Figure 7) is a combination of:

- Appropriations for MWI‟s own activities
- Appropriation for JVA water activities net of the water revenues that JVA returns to MOF (including costs and revenues from water for industry, excluding JVA costs and revenues for non-water activities)
- Appropriation for MWI to pay WAJ contractors directly (rather than via WAJ)
- WAJ‟s deficit before financing (after revenues, which include MWI and MOF direct subsidy and international grants applied directly to the WAJ budget), which becomes WAJ debt.
- MWI and MOF subsidy to WAJ to finance capital projects
- Water company (utilities) profit or loss

Figure 7: Water Sector Deficit



In some years, water companies make a profit (negative deficit), which must be subtracted from the deficit in other areas to calculate the net deficit. See Appendix 2: Supplemental Notes on Figures for assumptions and calculation methodology. Actual data through 2010, projections from 2011 onward.
Sources: MWI, WAJ, JVA, Miyahuna and Aqaba Water Company via PMU, and GBD.

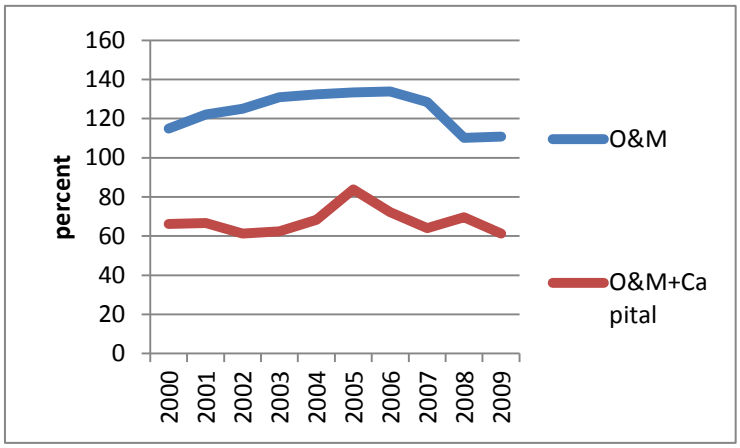
When the Disi supply comes on line in 2013 or 2014, the deficit is likely to be somewhat lower than it was in 2010, because the estimated JD 34 million/yr loss (2010 prices) on Disi water is less than the JD 120 million that the government spent on the Disi project in 2010. The estimate assumes the cost of Disi water (after deducting pre-operations government contribution) is equal to Miyahuna"s current price for water sales of JD 0.85/m3 (excluding connections, but including some non-variable revenues) (Segura/IP3, 2009a), NRW of 40%, and no increase to operating costs with the additional flow. Estimating Disi revenues based only on current variable revenues from water sales, which were JD 0.51/m3 for Miyahuna in 2010, would lead to projected losses on Disi operations of JD 54 million/yr. Adding increased operation costs and higher NRW due to higher flow would further increase the losses.

Water Supply and Sanitation Cost Recovery

Failure to recover the full costs (operations, maintenance, and capital) of water supply creates a vicious circle in which maintenance is underfunded, the system deteriorates, and NRW is high, which makes it even harder to recover costs.

According to their accounting division between O&M and capital, WAJ and the water companies (combined) achieve over 100% cost recovery for O&M, but only 60-70% when capital expenses are included. There has been a worrisome downward trend in cost recovery since 2005 (see Figure 8) due to inflation and large investments in water supply and wastewater treatment, which were not matched with tariff increases. Especially worrisome, "non-revenue water (NRW) stayed at very high levels with an average of almost 50%, despite substantial investment programs" (Rothenberger, Meuss, and Stoll, 2009). These investments have not yet created revenues to compensate for their high cost, nor has the service improvement provided by these investments been used to justify significant increases in water tariffs.

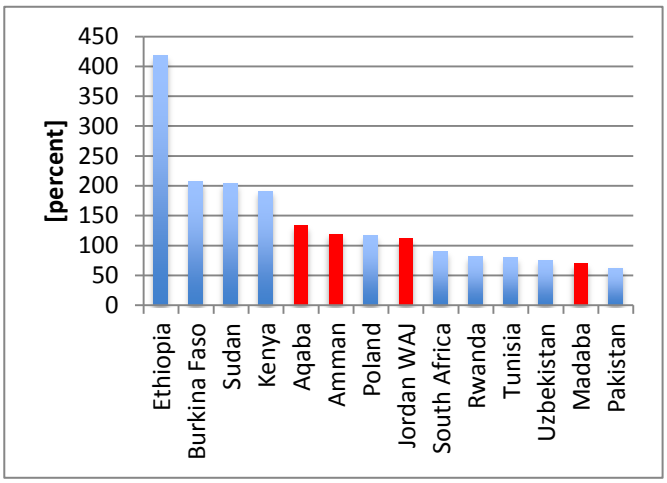
Figure 8: Cost Recovery Levels of Water Supply and Sanitation



Cost recovery calculation on an accrual basis, including WAJ and water companies. O&M and capital includes all costs (e.g., interest expenses).
Source: WAJ.

Amongst countries with low renewable water resources per capita, Jordan‟s operating cost recovery rate for utilities is in the middle (see Figure 9). The significant fraction of countries with cost recovery rates lower than the Jordan utilities‟ rates indicates that Jordan utilities are not alone in struggling to cover operating and maintenance costs, let alone capital costs. On the other hand, the high operating cost coverage ratio for utilities in some countries indicates that improved cost recovery is possible. A more detailed comparison correcting for differences in the accounting methodology, level of service, water quality, etc. might show that Jordan‟s revenues are not high when Jordan‟s water scarcity and cost of production due to physical constraints are considered.

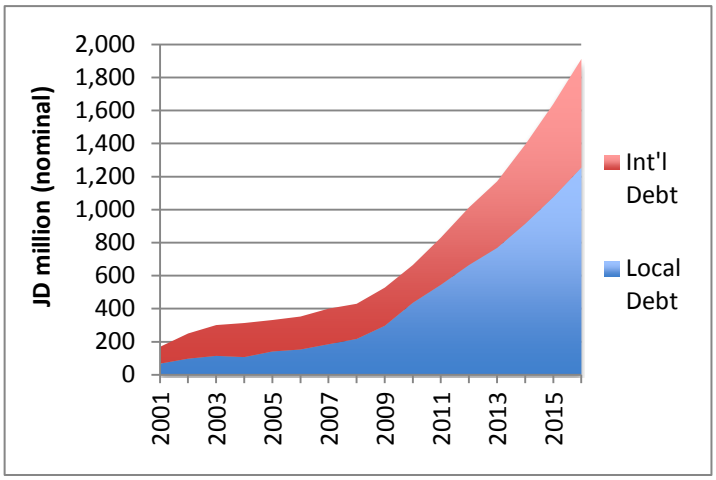
Figure 9: Comparison of Water Supply and Sanitation Operating Cost Recovery



Countries were selected for comparison on the basis of low renewable water resources per capita. The data provide only a rough indication of comparative cost recovery rates, and do not account for differences in level of service, water quality, physical factors, donor support, etc. Data for countries (except Jordan) are averaged across all reporting utilities; data are most recent available (2005-2009). Jordan data are reported separately for selected systems and for the whole Kingdom. Source for international data: World Bank/IB-NET. Sources for Jordan data: Aqaba: Aqaba Water Company, 2009. Amman: Segura/IP3, 2009a. Madaba: OMS, 2008. Jordan WAJ: WAJ Subscriber Department. Source for ranking of countries by renewable water resources per capita: FAO AQUASTAT.

The division of expenditures and revenues between WAJ and the water companies ensures that the companies are moderately profitable, while WAJ"s debt is rising at an alarming rate (see Figure 10). Debt levels are expected to rise from JD 0.7 billion in 2010 to JD 1.9 billion in 2016. In the absence of price increases or significant improvement in reducing NRW, it is likely that the Government of Jordan will have to assume WAJ"s debt as it did in 1999, making the deficit financing for WAJ a government subsidy, rather than an investment that will eventually be repaid through resulting increased revenues. The losses on WAJ"s balance sheet make it look less like a financially self-sufficient Government Unit and more like a ministry or department under the General Budget Law receiving annual funding.

Figure 10: WAJ Debt

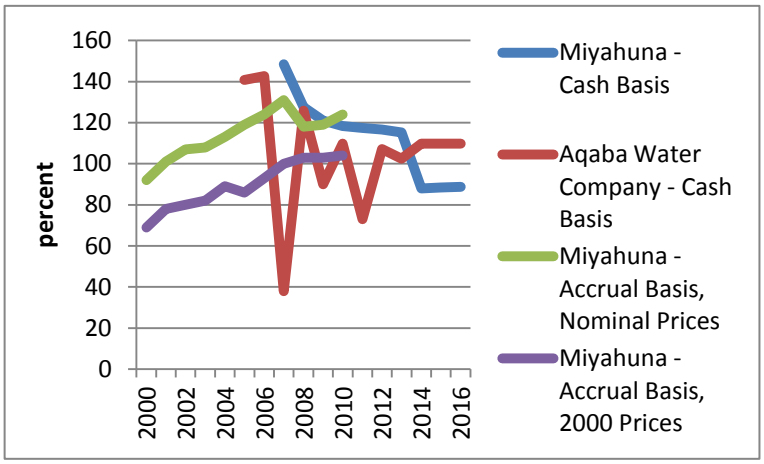


Source: WAJ actual data through 2010. Projections for 2011-2016 are based on expenditure and revenue projections presented earlier in this report, but also include WAJ"s non-water revenues (e.g., international assistance).

Figure 11 shows cost recovery for the water companies on cash and accrual bases. Their cost recovery is highly dependent on the subsidized prices of WAJ bulk water and electricity, and the fact that water companies are not responsible for major capital investments (WAJ is). If WAJ charged the utilities a price for water that covered WAJ"s capital costs, the utilities would not achieve O&M cost recovery.[4]

[4] "In 2008 Miyahuna"s total revenues were JD 76.5 million, including JD 9.3 million sewerage transfer from GAM tax and JD 12.2 million from connection fees. Only JD 50.0 million came from tariffs. These revenues barely cover its basic operating costs of JD 66.4 million. Moreover, Miyahuna"s business plan contemplates some JD 24.8 million in investments for expansion and critical improvements; however this plan is under funded which raises concerns about its viability. In addition Miyahuna receives substantial subsidies from WAJ for the supply of bulk water. Therefore pricing of services falls short on cost recovery grounds" (Segura, 2009).

Figure 11: Water Company Cost Recovery – Cash and Accrual Bases



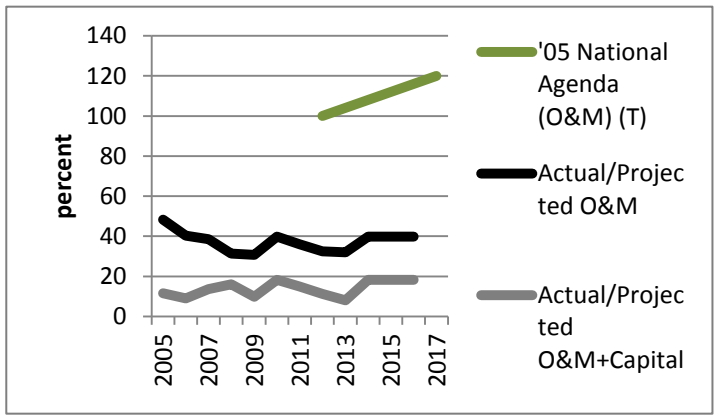
Actual data through 2010, projections from 2011 onward.
Source: Miyahuna (through 2010) and Aqaba Water Company (through 2013) via PMU. Projections for subsequent years are based on expenditure and revenue projections presented earlier in this report. Prior to 2007, the Miyahuna system was operated by LEMA.

Irrigation Cost Recovery

JVA achieves approximately 40% O&M cost recovery – and about 20% O&M and capital cost recovery – for its water supply to agricultural and industrial users. JVA would be able to achieve full cost recovery for O&M if it did not provide water for free to WAJ.[5] However, if JVA revenues from industrial water were excluded, the cost recovery would be lower, since revenues from industrial users are about 40 times more per m3 than agricultural users. The agricultural water tariffs are not high enough to achieve cost recovery on their own, even though NRW was only 14% in 2009. JVA is not on track to meet the National Agenda‟s targets for water cost recovery, largely because prices have not increased. See Figure 12.

[5] JVA‟s O&M costs for water services are estimated at JD 12 million/year. Water revenues were JD 5 million in 2010. JVA provided 100 MCM to WAJ in 2010, which at JD 0.10/m3 (a low estimate, which assumes none of the water is pumped; pumped water should be priced at JD 0.22/m3) is enough to cover JVA‟s O&M deficit.

Figure 12: Cost Recovery for JVA Irrigation and Industrial Water Supply – Targets (T) and Actual Performance



2005 National Agenda figures are targets. Actual data through 2010, projections from 2011 onward. Projections were made using 2011 General Budget Law estimates for 2011-2013, 2010 actual expenditures for 2014-2016, and 2010 actual revenues for 2011-2016.
Sources: GOJ, 2005; JVA.

Water Allocations and Consumer Surplus

The previous sections analyzed Jordan‟s water sector budget from the perspective of the net cost to the government (expenses minus revenues, i.e., subsidy), and found that the government is suffering from unsustainable losses. This section analyzes water allocations and tariffs set by the government from the perspective of consumer surplus (the value of the water to the user minus the cost, i.e., the net benefit to the user). The conclusion is that users can afford to pay more, while still profiting from water use.

While the allocations (quotas) for domestic and agricultural water may serve justifiable policy interests, the price charged by the government is much lower than what consumers would be willing to pay for that quantity in an otherwise free market. By lowering the price of water, the government is transferring a huge benefit to the consumers it selects to receive the underpriced water (through rationed domestic water supply and approval of each farmer‟s allowed water use), at the expense of the taxpayer and the economy. The taxpayer pays for the government losses in producing the water (i.e., the government subsidy). The economy suffers because a competitive market would allocate water (even within the quotas) more economically efficiently than any government can. The sad irony is that very little of the benefit is transferred to the poor, either in domestic water (see Social Equity Considerations chapter) or in agricultural water (since so much of the water goes to commercial farms).

A key policy question is how much (if any) government assistance should be provided to domestic water consumers and farmers, and if so, whether there is a better way for the government to provide the benefit than in the form of cheap water. For example, farmers might benefit more from subsidized irrigation equipment, or more consistent water supply, than subsidized water. Similarly, the Disi project requires decisions about who should receive the new supply, at what price, and thus what benefit. Water for industry and tourism is priced approximately at the market value and thus doesn‟t involve a significant transfer of benefits.

The benefit transferred by the government to the consumers, through the quotas and the artificially low prices, is equal to the value of the actual quantity of water at the marginal

value (or shadow price) for that quantity, minus the actual total expenditure by consumers. In 2009, the transferred benefit is estimated at JD 38 million for irrigation from surface water in the Jordan Valley and JD 213 million for domestic water. The value of the estimated benefit is in the same range as the net cost of the water sector to the Government of Jordan, indicating that consumers are willing to pay a price for water that would allow full cost recovery. Since the allocated water is worth more to the users than its total value at the marginal value, the consumer surplus is larger than the transferred benefit, ad consumers would still receive a net benefit from the water they purchased even if they paid the marginal value. Because it is difficult to calculate the price paid for water pumped from the highlands (since much of the cost is in terms of private purchase of pump equipment, electricity, etc., for which data are not easily available), this analysis for agriculture only considers irrigation from surface water in the Jordan Valley (representing 26% of all irrigation water).

Table 1 shows data, assumptions, and calculated values that were used for the estimate.

Table 1: Calculation of Estimated Government-Provided Benefit in Water Allocations

	JVA Agricultural Water[6]	Domestic Water
Quantity (2009)	76 MCM freshwater from King Abdullah Canal, 55 MCM blended treated wastewater	309 MCM
Unit Value (marginal value)	JD 0.389/m3 for freshwater, 0.240 JD/m3 for blended treated wastewater[7]	JD 0.9/m3[8]
Total Value (if all priced at marginal value)	JD 40 million	JD 278 million
Estimated Bulk Price	(not applicable)	JD 0.210/m3[9]
Bulk Revenue	JD 2 million (actual)	JD 65 million (estimated)
Estimated Government-Provided Benefit	JD 38 million	JD 213 million

Sources: Quantity from MWI. See footnotes for sources of other data.

The current water market is so different from what a competitive market would produce that it is difficult to predict what prices and quantities under those conditions would be (i.e., there are not good data on demand elasticity). The calculations in Table 1 assume that the demand for agriculture and domestic water would not change of the price were equal to the estimated marginal value. It is possible that some of the agricultural water demand has a marginal value lower than estimated here, and so the benefit may be overestimated. Different assumptions about the value of water would change the numbers somewhat, but the basic points would remain:

- The allocation of water at prices that are below the value of the water provides a very large benefit to the recipient.
- The Government of Jordan could raise significant revenue – possibly achieving full cost recovery – by increasing water tariffs to closer to their market value.

[6] The estimated benefit for all JVA water, including industrial water would be approximately the same as for agricultural water, since industrial water is sold much closer to the market price than agricultural water.
[7] The most recent data are from an unpublished MWI study. See the section on Revenues in the Budget Trends chapter for additional data on marginal value.
[8] Disi water at JD 0.90/m3 represents the marginal value of bulk domestic water (Segura/IP3, 2009a).
[9] Price for bulk water sold by WAJ to Miyahuna (MWI, unpublished).

Water Supply Allocation

Domestic water supply is the first priority for water allocation, but the allocation is only enough for one or two days of supply per week in much of the Kingdom. In case of water shortages, domestic supply is maintained by transferring water that normally would go to agricultural uses. There is enough water in Jordan to provide continuous domestic supply, but only through some combination of reduced allocation to agriculture, reduced NRW, and improved management of demand.

Irrigation Allocation

JVA sets the annual quota in the Jordan Valley on the basis of volume of water per hectare (ha) under cultivation, with different allowances for bananas (15,000 m3/ha year), citrus (10,100 m3/ha year), and vegetables (5,050 m3/ha year) (Molle, Venot, and Hassan, 2008). A farmer‟s water allocation is made based on how many hectares of crop JVA approves for water supply. Priority of water allocation for approved crop areas is citrus first, then bananas, and vegetables last. Taken together, these water allocation policies provide a great incentive for farmers to obtain approval for bananas and citrus, even though vegetables provide better economic returns when the full value of water is considered (see Water Productivity of Agriculture section).

In the highlands MWI allocates quotas for permitted wells, which could provide some degree of control on water abstraction. While there is a policy to reduce non-renewable withdrawals in the highlands (GOJ, 2009), quotas have not been used to implement that policy and have allowed "uncontrolled abstraction up to a limit of 150,000 m3/year/well, a volume much larger than the limits mentioned in the licenses" that the quotas replaced (Molle and Berkoff, 2007). Enforcement of highlands quotas in the highlands is also particularly challenging (Molle and Berkoff, 2007).

The allocation of water quotas in practice is based in part on current drought levels, costs of production, and political considerations. Practical opportunities to adjust quotas depend on these erratic factors more than on a systematic policy to improve economics of production and social safety nets. Enforcement of quotas is challenging, which makes it difficult to establish a competitive market for quota allocation (e.g., quota trading, buyouts, or even a gradual, systematic shift in water allocations). When farmers switch to crops with low water productivity (e.g., citrus and bananas), or expand cultivation into marginally arable land (e.g., olives in the eastern desert), the government has on occasion allowed them to use the water they need to continue operations (Molle, Venot, and Hassan, 2008).

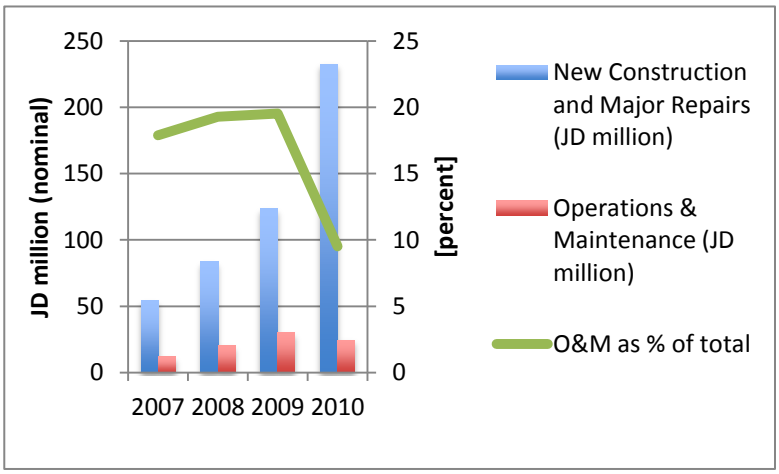
Cross-Cutting Investment Categories

New Construction vs. O&M

In the water sector, capital investments are expensive and extend over long periods. Proper budgeting of O&M, repair, and replacement for existing infrastructure is essential to optimizing its life and controlling the overall cost of providing the service. Furthermore, the water sector is a classic example of the need for considering the ability of the budget to support life-cycle costs before making new capital investments. Rough information is available on the expenditures on new projects vs. maintenance of existing assets (see Figure 13 and Figure 14), but targets for minimum O&M expenditures or O&M as a percentage of total expenditures have not been developed. Such targets would be very helpful in developing

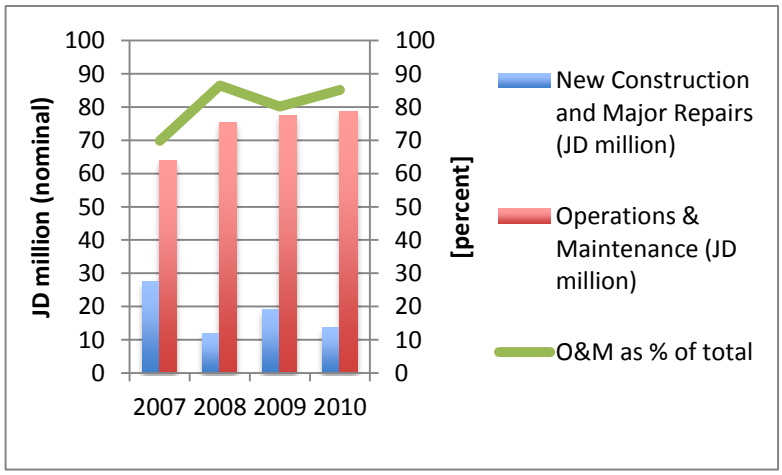
O&M budgets necessary to reduce technical NRW losses and ensure that sufficient budgetary resources will be available in the future to fund proper maintenance of new infrastructure.

Figure 13: WAJ Expenditures: New Construction vs. O&M



Source: Preliminary data from WAJ (not formalized).

Figure 14: Water Companies Expenditures: New Construction vs. O&M



Sources: Miyahuna and Aqaba Water Company via PMU.

Agricultural Loans

In the past, government-backed loans to farmers for investments in water-efficient technology have had problems. A 1994 World Bank Country Economic Memorandum "highlighted the difficulties of modernizing agriculture investments because of lack of financial discipline in sector-lending institutions and excessive government interference…. Agricultural land was generally unacceptable as collateral for borrowing…. The Agricultural Credit Corporation lent to farmers at 7-7.5 percent (on money borrowed by government at higher rates), debt forgiveness periodically occurred driven by political considerations, and as a result loan recovery averaged 65 percent" (Pitman, 2004). In particular, the small-scale

farmers that government policy aims to assist are often unable to pay back their loans" (Chebaane, 2004).

A current project to promote water-efficient technology, Irrigation Optimization in the Jordan Valley, provides a direct subsidy towards the price of upgrading irrigation systems, and appears to be more successful than subsidies in the form of loans.

Performance Trends

Jordan"s water sector plays a prominent role in national strategic planning. The following analysis is based on current progress of key performance indicators in the water sector identified in strategic planning documents.

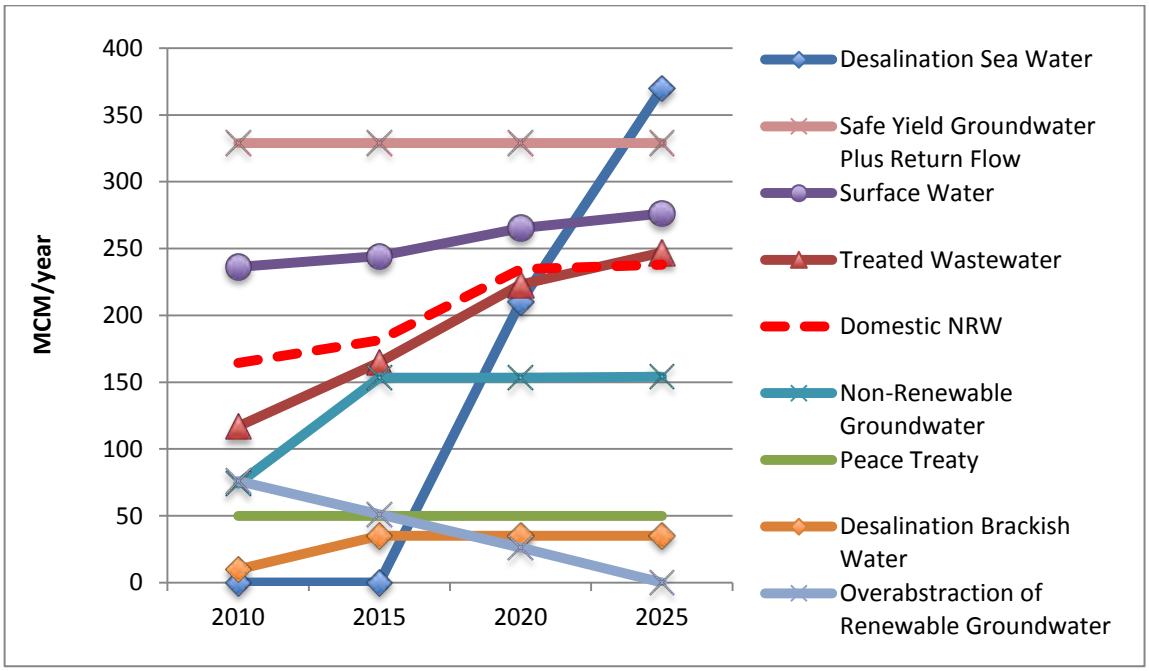
Water Supply

The main performance issues for water supply in Jordan are:

- Amount of water available
- Access to water supply
- Quality of the water

Amount of water available: In general, Jordan is doing a good job of maximizing water supply given the limited resources (see Water Balance section). Its main underexploited opportunity for increased water supply is NRW (see Non-Revenue Water section, Below). Figure 15 shows the main water resources with projected opportunities for increased supply, according to an upcoming profile of Jordan"s water sector (MWI, unpublished).

Figure 15: Water Supply Resources

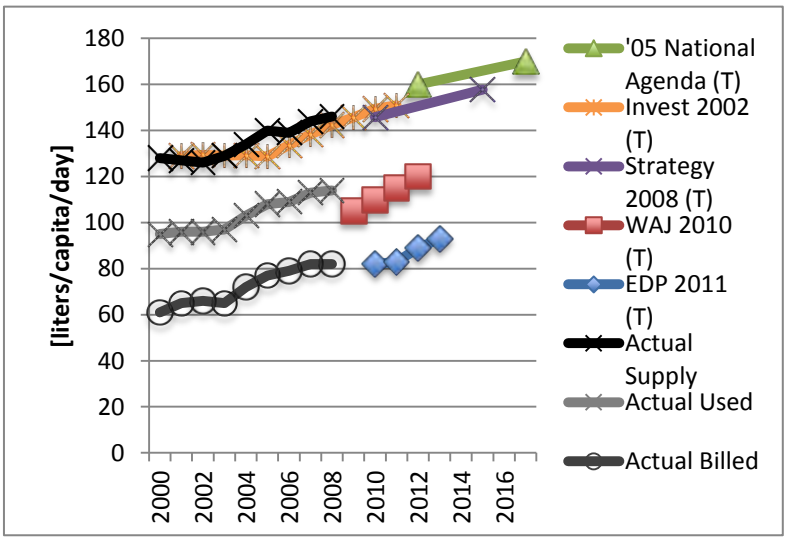


Administrative NRW is included because NRW that is consumed but not paid for represents an underutilized financial resource that could be used to expand other resources. Agricultural NRW is not included because of the difficulty in calculating it (e.g., due to variations in Jordan Valley vs. Highlands, bulk supply vs. on-farm losses).
Source: (MWI, unpublished).

The largest but most expensive sources of additional water supply are the Disi project and the Jordan Red Sea Project (JRSP). Smaller, but more cost-effective sources are reuse of treated wastewater, brackish water desalination, a few non-renewable groundwater opportunities, and dams (MWI, unpublished). Disi is scheduled to come on line in 2013-14, and will supply non-renewable groundwater for many years, but then diminish. The JRSP would desalinate seawater, but it will not be available in the near-term. Jordan continues to make good use of treated wastewater, increasing reuse from 90% of treated wastewater in 2002 to 93% in 2008, completed the As-Samra wastewater treatment plant, and is pursuing the MCC Zarqa project. By 2009, reused treated wastewater was 110 MCM (MOPIC, 2010), as large a source as the Disi project will be (though the quality and uses are different). A significant brackish desalination project – Zara Maʿīn – has been completed. The decreasing availability of surface water limits the opportunity for building new dam capacity, now that the 110 MCM Wahda Dam Project has been completed (MOPIC, 2010). Repair or replacement of dams that have lost capacity due to siltation may be worthwhile.

In addition to total water supply, another measure of water supply performance is water supply per capita (see Figure 16). This indicator can be measured in many different ways: pumped at the source, used, or billed; only domestic water, or including agricultural and industrial water. It is not clear from strategic planning documents how the performance indicators were intended to be measured, and thus it is difficult to evaluate actual performance against targets.

Figure 16: Domestic Water per Capita – Targets (T) and Actual Performance



"Supply" is measured at the source. "Used" is an estimate of the amount consumed, assuming that half of NRW is technical losses (leaks) and half is administrative losses (illegal connections and other unbilled use). "Billed" is measured at the meter. Note that water per capita targets may refer to supply, used, or billed. Actuals estimate water per capita based on water supplied by WAJ (i.e., the public water system) and the number of people connected to the WAJ system.
Sources of targets: EDP 2011: National Executive Development Program (MOPIC, 2010). WAJ 2010: WAJ 2010 Budget (GBD, 2010). 2005 2005 National Agenda (GOJ, 2005). Strategy 2008: Jordan Water Strategy (GOJ, 2009). Invest 2002: Water Sector Planning & Associated Investment Program (MWI, 2002). Source of actuals: WAJ Water Production and Transportation Sector.

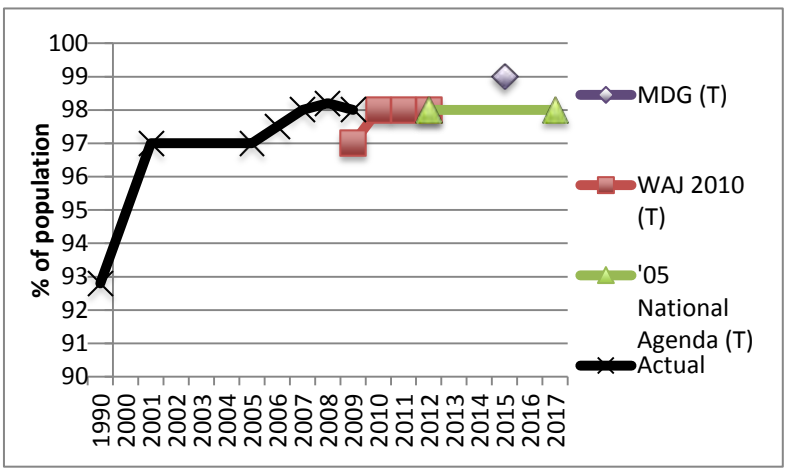
Jordan"s general trend in water supply per capita per day is impressive, considering that it faces many challenges that decrease performance: rapid population growth, dropping groundwater tables, increasingly expensive new sources of water, and political pressure to not shift water allocation from agriculture to domestic water. Jordan"s ability to meet its

targets for domestic water supplies per capita depends in large part on whether those who make the actual water allocation decisions follow the direction of those who develop strategic plans for water allocation between domestic and agricultural users. While additional total water supply could help, it is not an overriding factor for this indicator. There is enough water in Jordan for domestic consumption.

Reducing Jordan‟s significant non-renewable groundwater withdrawals is a policy objective that must be balanced against the need to increase water supply. Jordan‟s 2008-2022 Water Strategy sets targets for limiting growth in non-renewable withdrawals.

Access to water supply: Jordan performs well in making connections accessible and affordable for most of the population (see Figure 17). A connection to the water network – even if the service is non-continuous – provides great health and economic benefits compared to no access to the network. Access to improved water is lower in rural areas than Jordan overall (91% according to the World Bank/World Development Indicators), but is among the best in the region.

Figure 17: Water Connections/Access – Targets (T) and Actual Performance

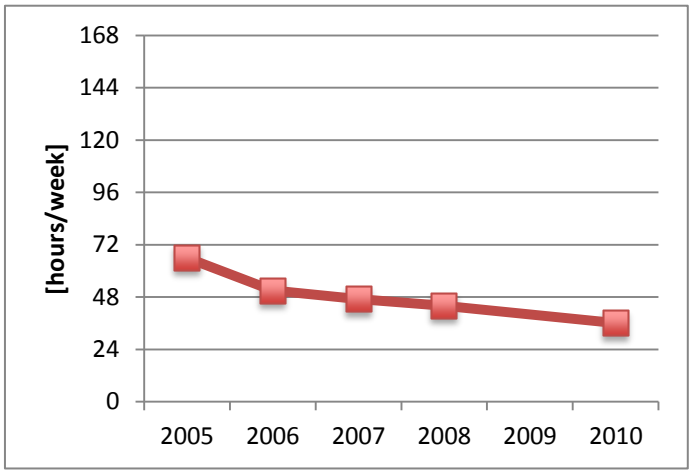


The performance indicator for the Jordan documents (WAJ 2010, 2005 National Agenda) measures connections to the water system, which is a slightly different measure than the MDG target of access to an improved water source.
Sources of targets: WAJ 2010: WAJ 2010 Budget (GBD, 2010). 2005 National Agenda (GOJ, 2005). Sources of actuals: MDG for 1990 and 2001 (MOPIC/UN Jordan, 2010), WAJ Subscriber Department for 2005-2009.

Continuity of supply (e.g., hours per week of service, or percent of connections with continuous supply) is a better overall performance indicator than total water supply. Measuring continuity of supply provides an incentive not only to pump more water, but also to reduce losses in transmission and distribution, and to use less water. Continuous supply reduces the risk of infiltration of contaminated water, improving water quality, reduces the cost of maintenance (less system damage from sudden changes in water flows), simplifies system operations (simpler distribution zone management, less staff to open and close valves), and makes it easier to detect and repair water leaks (Segura/IP3, 2009b). However, switching from intermittent supply often requires significant investment in the network first, because continuous supply increases the impact of leaks and requires a different approach to system operation. Continuous supply could also increase the total quantity of water consumed by households (ECO Consult, 2010a), though one study predicted only by 10-15% (Segura/IP3, 2006). Demand management policies (including pricing) can limit the increase. The impact of the 2011 tariff increase on water consumption should be evaluated.

Most parts of the Kingdom, with the exception of Aqaba, have intermittent water supply. "A consortium of donors recently invested $250 million to upgrade the Amman water system for continuous household deliveries. [As of 2008], 31 district of 330 were receiving continuous deliveries" (Hagan, 2008). However, Miyahuna"s "inability to reduce water losses and inadequate control of the water distribution system has resulted in a worrisome decline in the hours of service" (Segura/IP3, 2009b) (see Figure 18), though some of the decline is due to a conscious tradeoff to reduce NRW by pumping faster for shorter periods of time, at the expense on continuity of supply. "Evidence in other parts of the world… suggests that Miyahuna with the gross per capita water availability in Amman could provide continuous supply to customers" (Segura/IP3, 2009b). "Conakry, Guinea and Dakar, Senegal deliver 60 and 69 liters per person per day, respectively, in continuous supply" (Hagan, 2008).

Figure 18: Access to Water Service in Amman



168 hours/week equals continuous supply.
Sources: 2005-2009: Segura/IP3, 2009b. 2009: not available. 2010 (preliminary data): Miyahuna via PMU.

Quality of the Water Supply: The main indicator that WAJ uses to measure water quality is percentage of water samples in compliance with the Jordanian specifications. The value has been 98% since at least 2007 (GBD, 2011). However, according to the Department of Statistics (DOS) 2009 socio-economic survey, about 60% of the people are not satisfied of the water quality of the public system and buy bottled water at significant expense (ECO Consult, 2010b). WAJ believes that most of the complaints are associated with household storage conditions and people not cleaning their water tanks (ECO Consult, 2010b). The quality of water in the home and of public perception need to be addressed.

The most important factors for irrigation are not publicized or used in budget discussions:

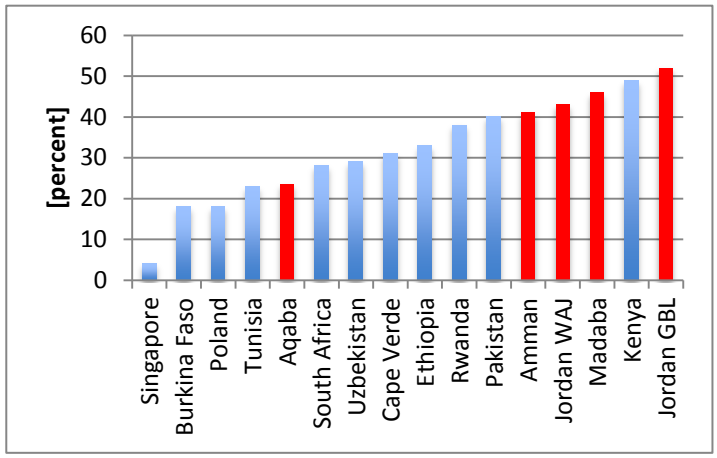
- Water pressure that is sufficiently high for efficient drip irrigation systems
- Salinity (for crop health) total suspended solids level (to prevent clogging of highly efficient irrigation systems)
- Adherence to scheduled water supply rotation between farmers

Non-Revenue Water (NRW)

In Jordan, the amount on non-revenue water (water that is produced but not billed, because of leaks in the system – "technical losses – or illegal connections and meter errors – "administrative" losses) as a percentage of total water produced is extremely high compared

to other countries with low water supply (see Figure 19). In part, this may be due to the non-continuous supply in much of Jordan‟s distribution network; the starting and stopping of water supply damages the system (see Water Supply section). However, some utilities in Kenya and Pakistan have non-continuous supply and are able to achieve better performance than Jordan overall. Aqaba has continuous supply, and much lower NRW than the Jordan average.

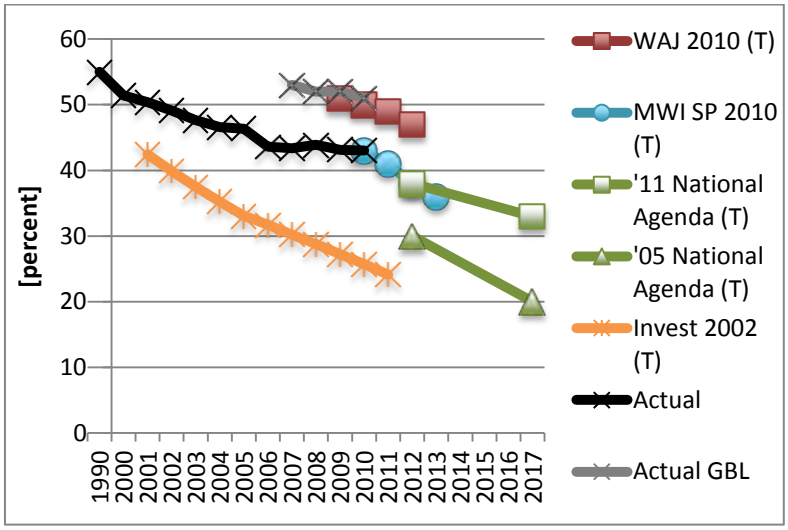
Figure 19: Comparison of Domestic NRW Rates



Countries were selected for comparison on the basis of low renewable water resources per capita. The data provide only a rough indication of comparative NRW, and do not account for differences in calculation methodologies, physical factors, etc. Data for countries (except Jordan) are averaged across all reporting utilities; data are most recent available (2005-2009). Jordan data are reported separately for selected systems and for the whole Kingdom.
Source for international data: World Bank/IB-NET. Sources for Jordan data: Aqaba: Aqaba Water Company, 2009. Amman: Segura/IP3, 2009a. Madaba: OMS, 2008. Jordan WAJ: WAJ Subscriber Department. Jordan GBL: WAJ 2010 Budget (GBD, 2010). Source for ranking of countries by renewable water resources per capita: FAO AQUASTAT.

Jordan is beginning to show progress in reducing NRW, but there is still an urgent need for improved performance, given the very high losses (Segura, 2009b). Data from the PMU show NRW have dropped from 52% in 2000 to 43% in 2009, a significant improvement. Data reported in the Government Units‟ Budget Law show NRW in the WAJ system have dropped from 53% in 2007 to 51% in 2010 (GBD, 2010; GBD, 2011). Under either methodology, there is a loss approximately equal to total WAJ and water company water revenues, JD 170 million in 2010, which is 60% of the JD 287 million deficit for water supply and sanitation in 2010. Jordan has not achieved its performance goals as quickly as planned (see Figure 20). NRW targets set in 2002 (MWI, 2002) were not met and those set for the National Agenda in 2005 (GOJ, 2005) are not likely to be met.

Figure 20: Non-Revenue Water for Domestic Use – Targets (T) and Actual Performance



Sources of targets: WAJ 2010: WAJ 2010 Budget (GBD, 2010). MWI SP 2010: MWI Strategic Plan 2010-2103 (MWI, 2010). 2011 National Agenda is draft (MWI, unpublished). 2005 National Agenda (GOJ, 2005). Invest 2002: Water Sector Planning & Associated Investment Program (MWI, 2002). Sources of actuals: Jordan Public Expenditure Review for 1990 (World Bank, 1991), PMU for 2000-2010 (2010 is preliminary data); Actual GBL: WAJ 2010 Budget (GBD, 2010) and WAJ 2011 Budget (GBD, 2011).

Some of the most encouraging performance is by Miyahuna, which has demonstrated that water delivered and billed to the user can be increased not only by increasing supply, but also by reducing leaks and illegal connections and improving collections (ECO Consult, 2010a). As part of a ten-year, JD 250 million restructuring of the Amman water utility, its NRW was reduced from 48% in 2000 to 38% in 2009 (MWI, unpublished). However, some of that improvement is due to pumping faster for shorter periods of time, rather than by fixing leaks, which puts the goal of continuous supply further out of reach (see Water Supply section and Figure 18). The Aqaba Water Company has reduced NRW from 60% to 31% (World Bank, 2004).

Even without commercialization of the water utility, it is possible to reduce NRW through focused efforts at improving operating processes. "A service contract for the billing and revenue collection processes of WAJ Madaba… was awarded to a Jordanian company… and shows considerable success in terms of improved services and revenues for WAJ" (Rothenberger, Meuss, and Stoll, 2009). Similarly, a Japan International Cooperation Agency (JICA) pilot project in the middle governorates found that NRW could be reduced 40-60% through a relatively simple set of interventions focusing on leak identification and repair, costing about JD 20 per subscriber (JICA, 2008).

NRW is relatively low at JVA, currently only 14% (JVA, unpublished), but there are problems with collections in the highlands. "The reason given for non-billing is that highland farmers already pay a high cost for well installation and pumping whereas those in the Jordan Valley have water delivered to the farm-gate by the JVA" (Pitman, 2004).

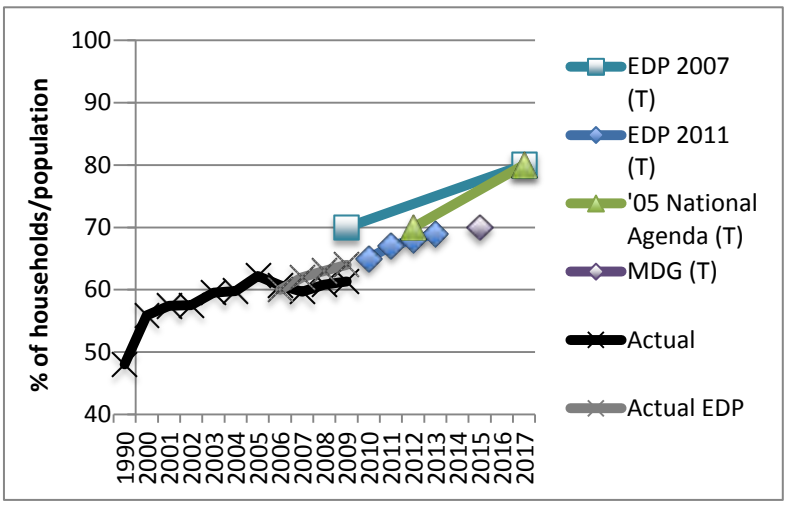
Sanitation

The main performance issues for sanitation in Jordan are:

- Access to the sewer system or other sanitation
- Capacity of the wastewater treatment plants relative to the demand for wastewater treatment (utilization rate)

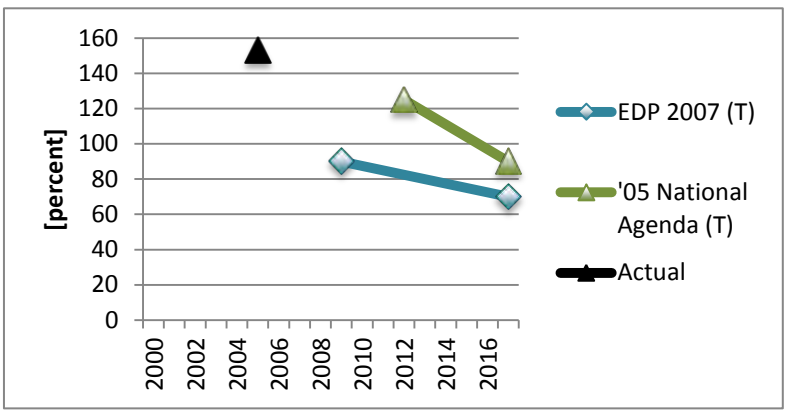
Jordan is making progress on improving access to sanitation, but still has a long way to go to meet its MDG (Figure 21). Significant expenditures on the As-Samra wastewater treatment plant (now completed), future expenditures on the MCC Zarqa, and planned increases for sanitation by WAJ in the 2011-2013 budget should all help. Continued tracking of wastewater treatment utilization rate (>80% generally means the plant is overloaded and treatment in impaired) would help plan budgeting for treatment plant construction (see Figure 22). Data on cost of and access to septic systems would help plan budgeting for sewer system extension to existing neighborhoods.

Figure 21: Sanitation Connections/Access – Targets (T) and Actual Performance



The performance indicator for the Jordan documents (WAJ 2010, 2005 National Agenda) measures connections to the water system, which is a slightly different measure than the MDG target of access to an improved sanitation facility.
Sources of targets: EDP 2011: National Executive Development Program (MOPIC, 2010). EDP 2007: National Executive Development Program (MOPIC, 2006). 2005 National Agenda (GOJ, 2005). Sources of actuals: MDG for 1990 (MOPIC/UN Jordan, 2010), WAJ Subscriber Department for 2000-2009. Actual EDP: 2011-2013 Executive Development Plan (MOPIC, 2010).

Figure 22: Wastewater Treatment Plant Utilization Rate – Targets (T) and Actual Performance

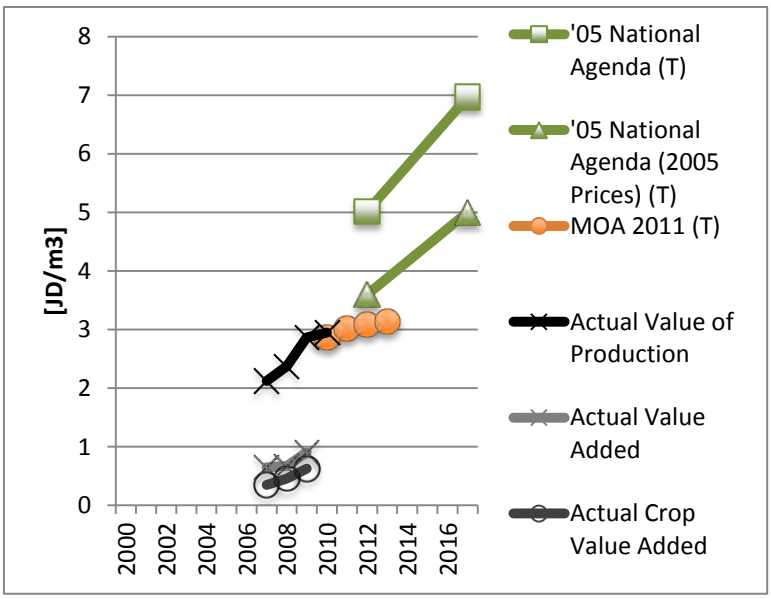


Sources of targets: EDP 2007: National Executive Development Program (MOPIC, 2006). 2005 National Agenda (GOJ, 2005). Source of actuals: 2005 National Agenda (GOJ, 2005).

Water Productivity of Agriculture

The Government of Jordan allocates a majority of its water to irrigated agriculture, 57% in 2009, so it is critically important that Jordan derive sufficient benefit to justify that large allocation. Jordan is falling short of its primary goal for agricultural use of water, set in the National Agenda in 2005: agricultural output per unit of water. If the goal for 2012 of JD 3.6/m3 is escalated from 2005 prices to 2009 prices, it becomes JD 5.0/m3. Even given the sharp increase in performance from 2007-2009 prices, the trajectory is not likely to reach the 2012 goal. Ideally, the objective of Jordan"s agricultural water policy should be to improve value added (i.e., profit plus wages), rather than value of production (i.e, gross revenue), because the water should be used to increase GDP, not merely to keep farms operating. In 2009, the value added for crops and livestock was JD 0.90/m3 of water, and for crops alone was JD 0.63/m3 of water. See Figure 23.

Figure 23: Agricultural Output per Cubic Meter of Water – Targets (T) and Actual Performance



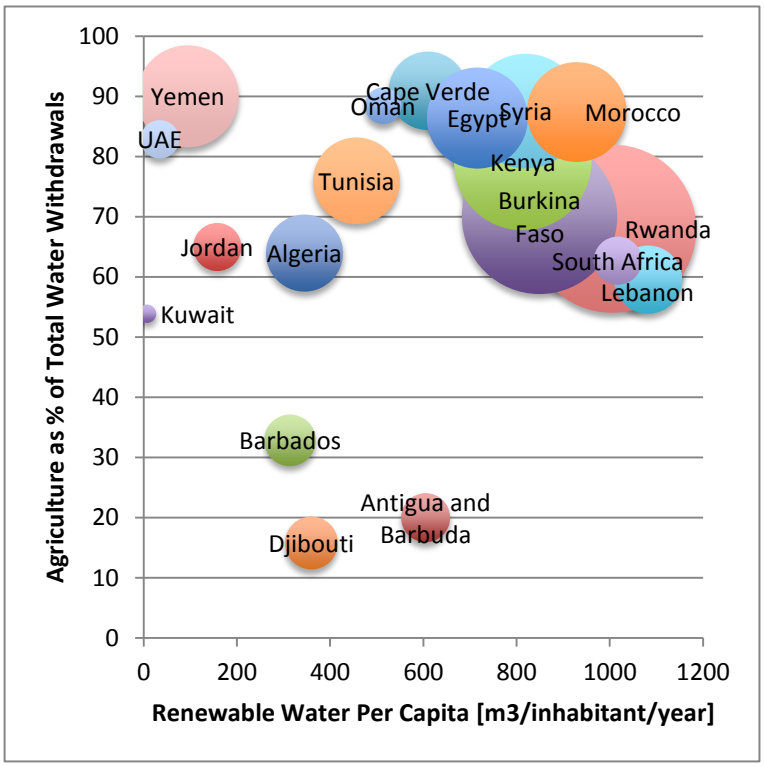
National Agenda targets are value of production. Data are for livestock and crops combined, unless noted as only for crops. 2009 real (constant) prices unless noted otherwise.
Sources of targets: Nat"l Agenda (GOJ, 2005), with price escalation data from DOS. MOA 2011: Ministry of Agriculture 2011 Budget (GBD, 2011). Sources of actuals: Ministry of Agriculture 2011 Budget (GBD, 2011) for Value of Production, except DOS for 2007; DOS for Value Added and Crop Value Added.

Many studies have suggested that in Jordan vegetables add more value per m3 of water than bananas or citrus, though there is significant variability in productivity for each crop under different conditions (Pitman, 2004; DAI, 2006; MWI, unpublished).

Amongst the countries with the lowest renewable water resources per capita, Jordan allocates a large percentage of its total water withdrawals to agriculture, but agriculture only contributes a small percentage of total GDP (see Figure 24). By contrast, Algeria and Tunisia allocate about the same percentage of water withdrawals to agriculture, but their agriculture sectors achieve double the share of GDP compared to Jordan. Furthermore, Barbados and Djibouti allocate a much smaller percentage of their water to agriculture, but their agriculture sectors achieve approximately the same share of GDP compared to Jordan. These differences depend in part on the composition of the economy, but they indicate that Jordan should

consider whether it has non-agricultural opportunities whose growth is limited by lack of water.

Figure 24: Agriculture as a Percent of GDP



Countries were selected for comparison on the basis of low renewable water resources per capita.
Source: FAO AQUASTAT.

Social Equity Considerations

The current domestic water tariff subsidizes many rich people, while charging higher water prices to many poor people. This is neither an effective nor efficient way to achieve the social equity (fairness) goal of ensuring that the poor have access to affordable water.

Currently, Jordan uses an increasing block tariff (IBT) to subsidize the price of water based on the amount consumed per month. In an IBT, the initial block or quantity of water consumed in a month is charged at a low unit price. Subsequent blocks are charged at increasingly high unit prices. The main problem with the IBT is that it assumes a correlation between water use per meter (not per person) and income, which is often not the case. It is possible that the poor use less water per person than the rich, but the poor are likely to have more people on a single meter than the rich (due to larger families and shared meters), thus increasing the consumption per meter. At least 20% of households in Jordan (Al-Assa‟d, 2011) and 39% of households in some neighborhoods in Zarqa (EcoConsult, 2010a) share the same meter. Furthermore, the IBT reduces the incentive to save water for people with low water use per meter (not per person) because they face an especially low marginal cost of water. The irony is that while developed countries have given up on the IBT as a way to assist the poor, it continues to be popular in developing countries (Boland and Whittington, 2000).

Studies in Jordan have shown at most limited correlation between water use and income (ECO Consult, 2010a), meaning that many people who do not need the subsidy receive it, and many who do need the subsidy do not receive it. Table 2 shows results from a study of water use in Amman by Segura/IP3. The study found that income correlates with the Greater Amman Municipality (GAM) land classification, and so was able to use land classification as a proxy for income. The study then found that there were actually more upper income people in the lowest price block than low-income people, indicating that the subsidy of the IBT was helping the rich as much as it was helping the poor. It also found many poor people in the highest price block, indicating that the IBT was actually imposing a high water price on many poor people (Segura, 2009a). A rough calculation found that only 30% of the subsidy in water tariffs went to Category D households with less than 60 m3/quarter consumption, a very inefficient targeting.

Table 2: Water Consumption vs. Land Use Category in Amman

Consumption per Quarter (m3/household)	Category A	Category B	Category C	Category D
0-20 m3	22%	29%	27%	18%
21-40 m3	26%	35%	33%	33%
41-60 m3	21%	22%	24%	29%
>60 m3	31%	15%	17%	21%

Land use category is a proxy for income, with Category A representing the highest income and Category D representing the lowest income.
Source: Segura/IP3, 2009a

Water may also be available more often in wealthy neighborhoods than in poor neighborhoods, causing the poor to obtain more water from expensive water tankers than the cheaper, publicly piped supply. Poorer deciles report a higher percentage of „rarely available" water compared to the richer deciles (World Bank, 2004).

There is also a potential problem in the distribution of subsidies for sanitation. Households connected to the sewer system receive a subsidy for their sanitation services, in the form of below cost water bill. However, households that are not connected to the sewer system must pay for the entire cost of septic systems. It is likely that the rural poor, lacking connections to the sewer system, are those who benefit least from the sanitation subsidy inherent in the subsidized water bill.

Section 3: Responding to Challenges

The following sections describe seven categories of responses that the Government of Jordan could take to respond to the key challenges identified in the previous discussion of sector background, budget, performance, and social equity. Table 3 maps the main challenges each of the responses addresses, through benefits may apply more broadly than indicated in the table. Some of these responses come at the expense of certain segments of society, who then have a strong incentive to oppose change. The key to implementing change is a combination of tailoring policies to reduce the negative impacts, providing compensation to some impacted groups, and marshaling the support of the majority who benefit.

Table 3: Challenges and Responses

Responses / Challenges	Limited Supply	Continuity of Supply	Groundwater Depletion	Non-Revenue Water	Sanitation	Water Productivity	Cost Recovery
Improving Economic Returns on Agricultural Water Use			X			X	X
Reducing Non-Revenue Water	X	X	X	X			X
Increasing Irrigation Efficiency			X			X	
Expanding Sanitation Services			X		X		
Increasing Revenues		X			X	X	X
Reforming Institutional Processes	X	X	X	X	X	X	X
Water Demand Management		X				X	

Improving Economic Returns on Agricultural Water Use

This section considers the connected issues of prices, quotas, and taxes and their impact on the agricultural economy. The underlying problem is that "by charging industry more than the full cost of delivery, to subsidize urban and agricultural water users, the government is currently deterring investors from developing certain types of industry in Jordan; industries that can add more economic returns and employ more workers than agriculture [can]." (USAID, 2007) Domestic use is the first priority for water allocation (though it could use the water more efficiently), so the question for it is largely one of raising prices, addressed in the Increasing Revenues section, below.

Growing crops in one of the driest countries in the world presents severe challenges. As a result, Jordan may not have a competitive advantage in the agriculture sector that justifies – on purely economic grounds – using about 60% of scarce water resources for agriculture. Nor is the subsidized price of agricultural water a particularly well-targeted strategy for generating employment for Jordanians, since nearly half of Jordan‟s agricultural work force is foreign workers (USAID, 2007). On the other hand, Jordan‟s agricultural sector has already faced a significant reduction in subsidies and removal of many protections against imports and some water price increases, through the World Bank Agriculture Sector Adjustment Loan and Agricultural Sector Technical Support Project (1994-2001). Jordan‟s agriculture remains good at producing some crops, and "has a significant comparative advantage by being able to harvest, and therefore export, fruit and vegetables at least two months before the growing season elsewhere in the Middle East and Europe" (USAID, 2007).

While it may make sense from the perspective of economic theory to reduce the allocation of water to the agriculture sector, there is also a significant opportunity to improve the economic productivity of water use within the agriculture sector (see Water Productivity of Agriculture section). Salman, Al-Karablieh, and Fisher developed a model that the government could use to guide more efficient allocation of water to agricultural users (2000), by adjusting quotas and/or prices. Simply increasing the price of water or stopping subsidies would encourage farmers to invest in more efficient technologies and switch to more efficient crops, but it may force some poor farmers out of business because their profit margins are small, and they do not have the capital needed to invest in new technologies. A politically acceptable policy to improve economic productivity of agriculture should use these price signals to discourage inefficient crops, but it must also provide assistance to overcome obstacles to transformation

of the agriculture sector, especially for small farmers (Molle, Venot, and Hassan, 2008). The GIZ Highland Water Forum is an example of a project that provides this assistance. It also promotes employment alternatives to agriculture in the rural economy, to help people who are willing to transition out of farming. Failure to provide this support limited the political acceptance and success of World Bank water price reforms in the 1990s (Pitman, 2004). Brazil‟s booming agriculture sector was built by increasing technology, commercialization, and the scale of farming operations, while maintaining productive small farmers (Economist, 2010). See also the incentives in the Increasing Irrigation Efficiency section.

Price of Irrigation Water: "Substantial increases in water prices can be expected to raise overall economic efficiency by motivating farmers to intensify cultivation, adopt higher-value crops, improve technology, or rent out their land to investors" (Molle, Venot, and Hassan, 2008). The price for freshwater should be higher than for treated wastewater (Pitman, 2004). With these policies, the agricultural sector would use the same amount of water, just use it more efficiently to create greater economic benefit (though some businesses‟ financial profits might decline a little). Furthermore, these changes wouldn‟t necessarily affect agricultural employment levels. At least in the Jordan Valley, "raising prices to recover O&M costs would not dramatically affect farmers" (Molle, Venot, and Hassan, 2008), since water "is not an important component in the cost structure of agricultural production in the Jordan Valley" (MWI/GTZ, 2004) (see Irrigation Allocation section). Salman, Al-Karablieh, and Fisher found that the elasticity of water demand with respect to the price of water was very low (-0.04) due to the very low actual price of water (2000).

It is important to implement price increases in a way that limits the impact on smaller, indebted farmers, or ones without collateral, who cannot easily access credit and, therefore, retain older, simpler production methods, or may be forced to rent out their land to commercial growers (Molle, Venot, and Hassan, 2008). Therefore, instead of raising prices on all farmers, the price for smaller farmers should remain subsidized (to achieve the important policy objective of protecting poor farmers). In contrast to the domestic water sector, an increasing block tariff (IBT) for irrigation water is a pro-poor policy because there appears to be a better correlation between volume of water consumption and wealth of the farmer, though there are some wealthy people with small farms used more for status than for profit (see Social Equity Considerations chapter for discussion of the IBT). The existing block tariffs could better target subsidies for the poor by reducing the volume threshold for the low-use, most subsidized block tariff, and increasing the tariff on the other blocks.

Another pro-poor policy that also incentivizes water efficiency would be to increase the price of water for crops that use large amounts of water. In the Jordan Valley, the pricing structure could be divided according to the type of water quota for that farmland. Land approved for bananas receives the highest water quota and could be charged the highest price, citrus next, and land for vegetables with the lowest quota could be charged the lowest price. Currently, there is a disincentive for farmers to shift from producing citrus and bananas to producing vegetables because of the consequent loss of their higher water quota (Molle, Venot, and Hassan, 2008). Pricing according to quota allocation could reduce the incentive to lobby for higher quotas and might encourage shifting to crops with lower water needs. While a switch to more water-efficient technologies favors large, commercial farms, a switch to more water-efficient crops could favor the vegetable crops grown by smaller family farms.

Quotas for Irrigation Water: Compensation for reducing or reallocating water quotas could be achieved by creating a market for trading quotas or simply buying out farmers‟ quotas, but it would only work through a long-term, consistent policy on quotas combined with improved

enforcement. While water markets have been created (e.g., in California), they are complicated and may require better monitoring and enforcement than currently exists in Jordan. It would, however, be worth trying on a pilot basis for the Government of Jordan to purchase water rights and test the market. "For example, farmers aged 60 years and older in the Mafraq region pump 36% of the groundwater for agriculture. The GOJ could buy their rights as a form of pension and thereby provide some incentive to retire" (USAID, 2007). A study in the highlands found that "approximately 50% of farmers surveyed have expressed their willingness to sell out their wells" (Chebaane, 2004). The study estimated a present value of $18.6 million costs versus $64.5 million benefits, and assumed a value of $0.60/m3 for water (Disi price estimate at the time), leading to a unit cost of the buyout at JD 0.12/m3, which when escalated to 2010 prices is JD 0.20/m3.

Even absent compensatory policies, "careful downward adjustments of quotas, as made in the valley since 1999, can motivate farm-level efforts to save water" (Molle, Venot, and Hassan, 2008). In any case, stopping the permitting of additional agricultural land and wells is essential to preventing increased use of water on marginally productive croplands (Pitman, 2004). Olive trees in the Azraq region are a very inefficient use of water, but they are often planted to establish property rights. In much of the region, land ownership is contested between various tribal claims and the government claims based on Agricultural Law Number 20 of 1973, which established state rangelands. The Department of Land and Survey will register land to an individual if the claimant can demonstrate sufficient investment, and the cheapest proof of investment remains agriculture (Highland Water Forum, forthcoming). Furthermore, Groundwater By-Law Number 85 of 2002, as amended by By-Law Number 76 of 2003 allows continued of illegal wells if the government determines there is social or economic need. If the government established that use of unpermitted wells disqualified a claimant from establishing property rights based on agricultural investments, it might reduce water use in certain areas of the highlands.

Agricultural Tax Policy: To provide compensation for Jordanian agriculture that could offset water price increases, USAID (2007) recommends "removal of municipal taxes and fees from produce not passing through wholesale markets, e.g., some export produce and produce sold directly to retailers." Ideally, taxes would only be reduced on the water-efficient crops, e.g., crops grown on the lower water quota (i.e., vegetables), while taxes on the crops with the higher quotas (i.e., bananas and citrus) would remain the same or increase.

Agricultural tariff reductions, led by the World Bank in the 1990"s, reduced inefficient use of water for irrigation because some crops were not longer profitable, while also benefiting the poor in general through cheaper food (Pitman, 2004). Continued reduction of tariffs on imported food, especially for crops that use a lot of water, would motivate Jordanian agriculture to focus more intensively on the crops where it has a competitive advantage, likely the more water-efficient crops.

Recommendation – Increase the agricultural water tariff for medium and higher use blocks and decrease the size of the lowest use block. In addition, add a tariff premium for farmers with banana and citrus quotas for irrigation water. Try buyouts of water rights on a pilot basis. Stop allocating land rights in the highlands to people with illegal wells. Reduce taxes on domestic agricultural products and reduce tariffs on agricultural imports.

Reducing Non-Revenue Water (NRW)

Jordan‟s NRW is extremely high and has a huge impact on expenditures and revenues (see sections on Expenditures, Revenues, and Deficit, Cost Recovery, and Debt). The challenge is made more difficult because the water supply is non-continuous (see Non-Revenue Water section under Performance Trends). On the positive side, NRW represents a large potential source of additional water. The estimated unit cost of JD 0.42-0.50/m3 of water that could be gained through a JD 200 – 500 million NRW reduction program is low compared with other options like the Disi project (MWI/GTZ, 2004; MWI, unpublished). For inspiration, the Government of Jordan could look to the Phnom Penh Water Supply Authority in Cambodia, which decreased NRW from 72% in 1993 to 6% in 2011 (Economist Magazine, 2011).

Identifying specific solutions to the NRW problem is made difficult by the lack of consistent reporting on the amount of NRW and the split between technical losses (physical leaks) and administrative losses (illegal connections to the water supply, under-billing because of metering problems, uncollected bills, etc.). As a first step, WAJ and the water companies should improve the quality and consistency of these data. In particular, it is hard to know how much to spend on system rehabilitation vs. collections and enforcement if the split between technical and administrative losses is not known. If administrative losses are due to a systematic under-registration of consumption at meters, it may be easier to simply increase the unit price of water than to replace the meters in order to get higher consumption readings per meter.

A detailed review of NRW, including the effectiveness of previous expenditures and the impact of successful projects on overall NRW figures, and an analysis of why the previous targets were not met, would help plan and budget for future investments (see Non-Revenue Water section under Performance Trends). Using data from previous studies (e.g., JICA, 2008), WAJ should include targets for NRW reduction and unit costs (e.g., JD/m3 saved) in its proposals for capital projects (see Project Prioritization and Use of Performance Indicators sections).

According to a recent report by the Asian Development Bank (ADB, 2010), some of the reasons why NRW is not adequately addressed are:

1. Asset management practices are not sufficiently linked to addressing the causes and effects of NRW.
2. NRW reduction is usually covered by an inadequate budget for O&M.
3. NRW does not show up explicitly in a utility‟s financial statements.
4. Highly subsidized price of wholesale water gives utilities distributing water little incentive to reduce leakage or improve tariff collection.

Possible solutions to these problems include accounting for the full cost of the price of water in financial transactions between WAJ, JVA, and the water companies and developing an asset management plan (see below).

Accounting for the Full Cost of Water

"Economic efficiency is not being achieved as large subsidies to Miyahuna and WAJ weaken the signals to operate more efficiently, and in particular reduce water losses" (Segura, 2009a). JVA should stop providing water for free to WAJ, and WAJ should stop providing its subsidy to water companies in the form of a below-cost wholesale water price. If the full cost of water is shown in accounting statements, then the financial value of the water saved by NRW

projects increases, making it easier to justify the investment. Managers with bonuses tied to profits would have a larger incentive to reduce NRW.

The subsidy to water companies could instead be provided, for example, on a per connection, per population, or per meter of pipe basis, with an agreement between WAJ and the utilities to decrease the subsidy by a certain percentage each year. The water company and the customer would initially experience no net financial impact if NRW stayed the same, but both could obtain significant gains if the company reduced NRW. In the developing contract for commercialization of the northern governorates water company, the subsidy was negotiated on a flat annual amount, rather than on a unit basis (connection, inhabitant, or meter of pipe). The advantages of a subsidy on a unit basis are that it is less arbitrary than a flat annual amount, and that it can adjust automatically to changing conditions if set properly. But even a flat annual subsidy would be better than the current subsidy distorting the value of wholesale water.

If the government policy is to subsidize the retail price of water, then the subsidy should be an explicit and transparent transfer to the utility, and not buried in a discounted price of wholesale water. Making the subsidy an explicit line in the WAJ budget would be analogous to Miyahuna‟s practice of showing the full cost of retail water on the bills it sends customers, even though it doesn‟t hold them responsible for paying that amount. WAJ and the water companies could also be required to present the value of NRW in financial statements, at least as a note. Setting the price of wholesale water based on WAJ‟s fair costs, instead of what the water company needs to be profitable, would also be a step towards full separation of the interests of WAJ and the utilities. WAJ and the utilities could negotiate the contractual terms directly or through an independent regulator (see Institutional Organization section).

The water companies might be concerned that they wouldn‟t actually receive the promised subsidy if it were no longer built into the price of the water. However, the contractual arrangement could provide the subsidy in the form of a deduction on the billed cost of water, so that there is never a risk that the government withholds the subsidy from the water companies.

Asset Management Plan

Asset management plans are good practice for ensuring that water systems are properly maintained and operate efficiently. "Under funding of maintenance of water and wastewater collection systems while not a subsidy to Miyahuna, affects the quality of the service and increases the final costs to users. Users have to pay for high levels of NRW and for indoor pumping stations and storage tanks in their premises to compensate for a deficient service" (Segura, 2009a). See the New Construction vs. O&M section in the Budget Trends chapter.

WAJ, JVA, and the water companies should use asset management plans to identify the condition of system assets and plan the O&M, repair, and replacement needed annually and over the long term. Targets should take into consideration the asset condition needed to achieve NRW targets, at least for technical losses. By improving the understanding of system performance, an asset management plan could also assist in identifying administrative losses, e.g., by differentiating between leaks and illegal connections.

The asset condition information can be summarized in the form of an asset condition or deferred maintenance index and used to justify funding requests for O&M, repair, and replacement. The asset management plan can also be used to identify the future O&M and

repair costs needed to properly maintain new construction, so that new investments do not exceed the government‟s financial resources to maintain them (MWI/GTZ, 2004).

According to Stone and Webster (2004), a good asset management plan would be expected to cover:

- A register of all the utilities‟ assets;
- Some assessment of the condition of the assets (or a sample thereof);
- Some measures of the serviceability of the assets (e.g., number of bursts, sewer collapses etc.), which again may be taken from a sample of assets;
- Some understanding of the long term maintenance needs of the assets (in terms of activities and expenditure); and
- An understanding of the impact of asset failure on services to customers (e.g., service interruptions)."

Jordan‟s water system faces serious "data limitations (network data and age, NRW, water and wastewater lengths, etc.)" (ECO Consult, 2010a), which means that it would take a major investment over a long period of time to fully develop the information needed for an asset management plan. Current preliminary efforts through the IT master plan should be expanded.

As a first step towards an asset management plan, target funding levels for investment in new projects vs. O&M and repair of existing systems could be developed to guide budgetary decisions (see New Construction vs. O&M section). For example, if the total asset value is JD 1 billion, and one assumes 4% depreciation, then there should be JD 40 million/year in the budget for maintenance and replacement of capital. Previous analysis found "under funding of maintenance costs [of] at least JD 12 million/year" in Amman (Segura, 2009a), and is a good starting point for a target.

Recommendation – Stop providing subsidies through below-cost bulk water. This recommendation applies both to water provided by JVA to WAJ, and by WAJ to the water companies. Instead, provide the subsidy on a per connection, per population, or per meter of pipe basis, or simply through a negotiated flat sum. Institute an asset management plan to guide O&M and capital expenditures.

Increasing Water Efficiency of Agriculture

Assistance to increase the water efficiency of agriculture can help overcome obstacles to change and should be pursued together with the increased prices, reduced quotas, and reduced import tariffs discussed in the Improving Economic Returns on Water Use section.

JVA should continue its efforts to improve water distribution system performance and subsidize water efficient irrigation technology, as in the Irrigation Optimization in the Jordan Valley project. JVA investment in improved distribution system performance will benefit all crops. However, any direct subsidies to farmers should be limited to crops that are water efficient or to lands that have the lower water use quota (for vegetables). Loans to farmers are not recommended (see Agricultural Loans section). It is estimated that using micro-irrigation would add net revenues of JD 300-1,000/ha/year for citrus, bananas, and vegetables in the Jordan Valley, which has 23,000 ha supplied by JVA‟s irrigation system (Molle, Venot, and Hassan, 2008). The resulting increased revenues from improved irrigation could be on the order of JD 10 million/year.

Lack of education may be one of the reasons hampering water efficiency in agriculture. Studies indicate that farmers are not taking full advantage of improvements in water infrastructure, such as drip irrigation, and that agricultural extension work is lacking in the highlands and the Jordan Valley. JVA"s territorial control of the Jordan Valley tempers the Ministry of Agriculture"s (MOA) willingness to work there (Chebaane, 2004; Pitman, 2004). Better coordination and reallocation of resources might allow MOA to do more work with farmers on utilizing infrastructure to improve water efficiency.

To encourage farmers to switch to more water-efficient crops, crop insurance should be provided only for water-efficient crops. It could be funded through the existing Agricultural Credit Corporation insurance program, with the main change being improved targeting of which crops are eligible for the insurance. Special funds for water efficiency investments have also been suggested (Chebaane, 2004), but they face significant bureaucratic and political challenges.

To help farmers maintain profits when water prices increase, the government could "provide incentives for farmers to grade agricultural produce by quality, sort by size and conformity, and practice proper post-harvest handling and transport, thereby increasing product quality and lengthening shelf life" (USAID, 2007). "Jordan"s agriculture is notably constrained by difficulties in identifying and adapting to changes in market demand" (Molle, Venot, and Hassan, 2008), which could be addressed through marketing programs and assistance in developing contract farming, where the sale is agreed upon before the crop is grown.

Recommendation – Link investments in the irrigation water distribution system to improvements in key performance indicators. Provide subsidies for investment in water efficient agricultural technologies and crop insurance only for water efficient crops. Increase the focus of agricultural extension work on water efficient technologies and crops.

Maximizing Health Benefits

A recent report listed the most beneficial interventions to improve Jordan"s water supply and sanitation system as those that (1) reduce the incidence of water-borne illness, (2) increase the potability of water from the public system, and (3) increase the hours of availability of public water (ECO Consult, 2010a). It is essential for Jordan to continue its efforts to expand the sewer network and increase wastewater treatment capacity to prevent the spread of disease. Increased wastewater treatment has the added benefit of providing an alternative source of water for agriculture. Jordan should also promote access to sanitation in areas outside of the sewer network.

Increasing sanitation coverage is expensive, and the proposed shift in water sector expenditures from water supply to sanitation in 2011-2013 should be implemented (see Expenditures section, Figure 1). Jordan will need to increase the revenues before Disi comes on line, in order to maintain the increased funding for the sanitation sector and not increase the water sector deficit.

As a second priority, WAJ and the water companies should increase people"s awareness of the importance of well-maintained systems within the home to water quality and potentially provide incentives to ensure proper maintenance. According to a recent study, "it is evident that people do not carry out a proper cleaning and maintenance program to their household facilities, and may not be aware of the household systems impact on water potability" (ECO

Consult, 2010a). Of course, providing continuous supply would make home tanks obsolete, and remove the risk of disease from standing water.

Recommendation – Continue the planned funding shift from water to wastewater, supported by increased revenues. Publicize maintenance needs of water systems in the home.

Increasing Revenues

Due to the positive externalities of water and sanitation for health, it may make economic sense to sell water below the market-clearing price. However, water sector subsidies were 20% of Jordan‟s deficit in 2010 (see Cost Recovery section), and cause market distortions that limit Jordan‟s economic growth. It makes sense to at least recover the cost of providing water service, in order to ensure that there are sufficient funds so that all have access to the benefits of water supply. Cross-subsidization – between rich and poor – of the price of water may be appropriate for ethical reasons. These principles are consistent with Islam (Faruqui, 2001). Jordan has been reluctant to increase tariffs (or improve collections) in a way that adequately finances the investments needed to meet water demand because such measures might impact the affordability of water, especially for the poor (Pitman, 2004).

A recent study recommended full recovery of the economic cost of water production (including variable and most fixed costs, but excluding connection fees) at Miyahuna, estimated at JD 1.65/m3, which would require doubling the water revenues of JD 0.85/m3 in 2008 (Segura/IP3, 2009a). A forthcoming study by USAID Institutional Support and Strengthening Program (ISSP) finds that full cost recovery at Miyahuna can be achieved by increasing variable water costs from JD 0.51/m3 (2010 data) to JD 1.16/m3. The National Water Master Plan (NWMP) recommended closing the cost recovery gap through a combination of operation efficiency improvements (30%), an improved integrated investment planning process (30%), and higher tariffs (40%) (MWI/GTZ, 2004). If long-term goals for cost recovery are to be meaningful, they must be accompanied by annual targets for implementation. Annual targets for cost recovery should be broken down into goals for revenues and expenditures. This section lists the political obstacles to increasing revenues (*in italics*) and provides recommendations for overcoming them.

The population opposes increased prices on the basis that service must improve first.
Make funds available in the budget if there is a commitment to raise revenues when the investment improves service (e.g., continuous domestic water supply when Disi water comes online, stable pressure regimes in irrigation systems), and institute price adjustments when service improves. This solution requires stronger budget procedures that provide budget for investment contingent on departments and units committing to achieving measurable service improvement, and then holding them accountable for achieving those performance goals.

People readily welcome the benefit of low water prices, but few grasp the less visible costs associated with subsidizing water supply.

a. The MOF needs to raise the profile of the deficit as a problem of national importance and communicate that all sectors receiving subsidies must share in the adjustment of reduced subsidies. Stronger budget procedures that set planning ceilings (and commodity subsidy targets) earlier in the cycle would help enforce those adjustments in the budget.
b. Change the terms of the political debate on water prices from the benefit of low water prices, to the benefit of low water prices for the poor. A clear policy on the percent of income the poor should spend on water (including network, tankers, and bottled water) would make this change possible. It would be politically easier to justify price increases

on the middle class and the rich as long as the price meets the policy target for the poor. One report recommends "that a poor family should not expend more than one percent of the poverty line income level (JD 347 per month per family) on water and wastewater services" (Segura/IP3, 2009a), but a broader evaluation of benchmarks is needed.

The Jordanian economy has developed around low-cost water, and there is a significant cost (including workforce adjustment) in transitioning to a more productive economy based on higher-cost water.

a. Recognize that water is so underpriced in Jordan that tariff increases can be achieved that reduce the deficit without significantly changing the structure of the economy. Crop changes wouldn"t necessarily affect employment levels.
b. Recognize that in the long term, much of any shift in agricultural employment resulting from increased water prices would be absorbed by foreign workers.

Some interest groups stand to lose significantly if water prices increase, and are willing to expend major political effort to prevent change.

a. Provide incentives to facilitate economic adjustments to increased water prices, coupled with stronger enforcement of the water-pricing regime. To provide incentives for change and then not enforce the agreed upon pricing structure that justifies the incentives is worse than not providing the incentive in the first place.
b. Provide representation for constituencies with broad interest in increasing water tariffs and decreasing taxes (e.g., business), to counterbalance constituencies that have a narrow interest in keeping water tariffs low (e.g., agriculture) (Hall, 2000). The representation could be on an independent regulatory Water Council, which approves water tariffs (see Institutional Roles section).

Water is a sector where the donor community has demonstrated a willingness to make significant expenditures. If Jordan increases cost recovery, the donor community might decrease its level of investment.

The donor community needs to be clear on its objectives and policies in the water sector, in order to demonstrate that improved cost recovery will not simply be offset by reduced donor expenditures in the water sector. The donor community could make its water sector expenditures contingent on increased revenues in the water sector, or offer additional funds if cost recovery improves. Signals from MOF that it will not assume water sector debt again (as it did in 1999) would also put pressure on the Cabinet to approve water sector tariff increases.

Any price reform must protect the poor from unaffordable tariff increases, but it is administratively challenging to target water subsidies.

a. Institute variable domestic water tariffs (or a flat rebate) based on the income level of the neighborhood, using the existing approach and neighborhood wealth maps for the variable property tax rate. Exemptions can be made for poor families in wealthy neighborhoods. See the Social Equity Considerations section for background and the report by Segura/IP3 (Segura/IP3, 2009a) for details.
b. Create a single block tariff for all but the highest use, since most of the poor – 62% in the Segura/IP3 study (2009a) – already pay the medium use block tariffs. Bills for lower consumption would increase because many of these customers are wealthy. The highest use is more wealthy people and excessive consumption and should pay more.
c. Link an increase in domestic water tariffs to a commensurate increase in support for the National Aid Fund (Jordan"s primary welfare program), or for a fund to increase access of the poor to affordable water, as was done for electricity. The National Aid Fund is better able to identify the needy than the water sector is.

d. Increase irrigation water tariffs for medium and high use blocks and land with banana and citrus quotas, which are unlikely to include poor farmers.

Changes in water policy in Jordan have often been driven by crisis, such as drought. Absent crisis, political inertia is strong.
Regularize discussion of water tariffs in political discourse, as an annual tariff review by an independent regulatory board, so that it is not an unusual issue that mobilizes strong political resistance (see Institutional Organization section). Enact legislation so that water tariffs are "automatically adjusted at least once a year to maintain the purchasing power" (Segura/IP3, 2009a), saving politicians from having to actively support increases.

Enforcement has not been effective at establishing the framework for a competitive water market. There is still a high incidence of damaged meters, illegal connections and wells, non-payment of bills, etc.
a. Continue efforts to empower water user associations to manage water rights, delegating responsibility for enforcement of usage compliance to the community.
b. Increase funding for enforcement actions and maintain them if they achieve improvements in performance indicators.
c. Increase the price of electricity, which is easier to enforce, in order to make pumping groundwater in the highlands less economically attractive.

Recommendation – Stop subsidizing the cost of water for middle and upper income families. Institute a flat tariff for all but the highest block water use. Support the poor either by targeting water subsidies based on real estate prices (land use categories in Amman), or through increased support from the National Aid Fund. Pass legislation to automatically increase water rates according to an inflation index. Increase tariffs for neighborhoods receiving continuous supply.

Reforming Institutional Processes

Project Prioritization

Tools for systematic cost-benefit analysis leading to prioritization of potential projects have been used successfully in the past in the water sector, and could be used now if someone (e.g., MOF, GBD, or MOPIC) requested the analysis. The analysis should include unit costs for achieving key performance goals (see Use of Performance Indicators section), description of the costs and benefits that are not captured in the summary unit cost data, and transparent documentation of the basis for project prioritization. The current prioritization of capital projects through the MOPIC National Executive Development Plan, the General Budget Law, and the Government Units" Budget Law does not quantify benefits. The NWMP estimated that 30% of the cost recovery gap could be closed through an improved integrated investment planning process (MWI/GTZ, 2004).

There are various examples of systematic, quantitative tools used to improve project prioritization in the water sector. In 2001, MWI conducted a systematic, quantitative analysis of all potential projects and published the results in "Water Sector Planning & Associated Investment Program 2002-2011." The analysis provided estimates of water produced or saved, and financial and economic returns on investment. In addition, MWI and GTZ jointly developed an Evaluation Tool for Investment Planning (ETIP), providing a systematic, Excel-based approach for documenting and weighing expert opinion about project value across a variety of different criteria. The criteria and weights were derived from the 2004

NWMP. The expert opinion can be derived from pre-feasibility studies or other sources. MWI has used ETIP to prioritize water sector projects for donor funding.

Taking the case of water supply projects as an example, the Disi project, at a cost of about JD 0.90/m3 (Segura/IP3, 2009a), sets a benchmark against which other proposed projects to increase supply should be compared, including projects that save water (see Reducing Non-Revenue Water and Water Demand Management sections). Also, to accommodate the new Disi supply, the government needs to prioritize the infrastructure improvements to support the increased supply in different areas, and set goals for reducing highland groundwater withdrawals by providing Disi water as an offset. The decision of the sequence of zones that receive the Disi water should be based in part on the cost per connection to make supply continuous.

Value engineering, in which design for a project is reviewed by an independent engineer to identify opportunities for cost-savings, could also help improve the project planning process.

Use of Performance Indicators

Jordan could make better use of performance indicators to guide investments in the water sector (see also Project Prioritization section). Program performance targets should be based on the sum of the benefits from the capital projects and current activities selected for funding in the budget. This type of analysis would help prioritize projects and evaluate progress, e.g., explaining why performance indicators were or were not achieved and justifying budget requests needed to meet policy objectives.

There should be less variation in the performance indicators tracked, and the way they are measured, in different strategic planning documents (e.g., General Budget Law, Executive Development Plan, strategic plans). At a minimum, each document should clarify the measurement approach when reporting targets and actual performance, so that the reader knows how to compare data. E.g., water supply per capita is reported sometimes measured at the source and sometimes at the meter; NRW for 2009 was reported in the 2011 Government Units" Budget Law at 52%, while the 2010-2013 Strategic Plan for MWI reported 44%.

Jordan should also focus its budget justifications on the performance indicators where the greatest progress is needed (e.g., sanitation connections, wastewater treatment plant utilization, agricultural production per m3 of water, continuity of water supply, rural water connections, water quality in the home, irrigation water pressure and total suspended solids, adherence to water distribution schedule, land using improved irrigation technology, long-term farmer income), rather than on ones that are largely achieved (e.g., drinking water connections, water samples in compliance with Jordanian specifications). As a positive sign, the Ministry of Agriculture has incorporated the goal for water productivity into its 2011 budget request. Making that a joint goal with JVA would help guide a coordinated effort.

Calculation and Presentation of Budget Subsidies

The presentation of public expenditures in the water sector has improved with the introduction of program-based budgets. For example, the Ministry of Water and Irrigation (MWI) has moved the budget presentation of its subsidy for WAJ out of the Administration and Support Services program and into a new "Supporting the Projects of the Water Authority" program, improving budget transparency. However, in the current presentation, it is still difficult to identify total expenditures by subsector (water, sanitation, irrigation, and planning) and total subsidies. Furthermore, below-market pricing of wholesale water makes it

difficult to form an accurate and complete assessment of public expenditures. The following issues should be resolved to improve budget transparency:

Funding for water and sanitation infrastructure should not pass from MWI or MOF to contractors without going through WAJ‟s budget. The total budgetary expenditure on water and sanitation infrastructure should be visible in the WAJ budget. Currently, MWI receives appropriations for infrastructure projects that are transferred to a contractor and not included in WAJ‟s budget (e.g., the Transferring Disi Water Project, #4105-004), which divides up the total water subsidy. Also, some international loans are held and repaid by MOF without entering WAJ‟s books, while most are transferred to WAJ and repaid by them. The MWI budget would be clearer if it only included funding for planning activities, and the WAJ subsidy went directly from the Treasury to WAJ. See also Accounting for the Full Cost of Water section.

There was some variation in the actual expenditure numbers reported by the line ministries – WAJ and JVA – and the actual expenditure numbers reported in the General Budget Law and the Government Units‟ Budget Law. GBD and the line ministries should work together to harmonize reporting of actual expenditures. Analysis to reduce the often large variances between planned and actual expenditures and revenues would also help budgeting (see Revenues section under Budget Trends).

Institutional Roles

Jordan has made progress involving the private sector and private sector management approaches in the water sector. The majority of local water distribution is now provided by commercialized (i.e., quasi-independent), government-owned entities, which are serving around 80% of the population (Rothenberger, 2009). JVA has begun decentralizing management of the irrigation distribution system to water user associations (MOPIC, 2010), and currently has contracts with 12 associations. WAJ has used (or is using) public-private partnerships (including Build-Operate-Transfer contracts) to provide water supply and wastewater treatment, including the Disi water supply project, the Al-Khirba As-Samra wastewater treatment plant, and the Al-Zara Ma‟in water desalination plant (MOPIC, 2010) (see sections on Water Supply and Sanitation Cost Recovery under Budget Trends and Non-Revenue Water under Performance Trends).

To continue the commercialization process, Jordan must increase the independence of the water companies from WAJ. “Separating economic regulation from other roles or functions, such as utility operation, ownership or policy making, has benefits in terms of setting clear objectives for each function, allowing trade-offs to be explicitly identified, and ensuring that institutional conflicts of interest are minimized and transparency and accountability are maximized” (Stone and Webster, 2004). Retail prices and bulk water costs for the utilities should be set by an independent regulator. The USAID ISSP has proposed that this role be fulfilled by a new Economic Regulator, with a new national Water Council to review and approve policy created by MWI (allocations, subsidy levels, strategy, etc.). See also Accounting for the Full Cost of Water section.

Jordan should also continue the decentralization of irrigation water management to local water user associations, both in the highlands and the Jordan Valley. “Significant budgetary savings could be accomplished by devolving irrigation and WS&S service functions to locally accountable institutions…. Decentralizing water management, including participatory irrigation management, has been identified as a key tool for achieving more efficient and equitable water management, especially in water-scarce regions” (World Bank, 2005). A

USAID report recommends "a law to permit the formation of groundwater basin water users associations. These associations could participate with the government in setting withdrawal limits, as well as allocating water rights among association members." (USAID, 2007) Similarly, "the JVA might adopt bulk water allocation and charging procedures, whereby water user associations would manage a yearly amount of water and recover charges. This approach, however, is hindered by extant cultural and social structures, and would require significant changes in the agency (JVA)–farmer relationship" (Molle, Venot, and Hassan, 2008).

Commercialization appears to have helped improve worker productivity, though rigorous, comparable, quantitative data are difficult to produce. The Operations Management Support project found that commercialization helped streamline long and bureaucratic procedures in procurement and other areas, provide performance incentives for staff and management, decentralize technical and financial planning, add a customer orientation, and reduce long response times (Rothenberger, Meuss, and Stoll, 2009).

Recommendation – Use systematic, quantitative cost-benefit analysis to inform selection of capital projects. Set performance targets based on the sum of the estimated benefits of selected projects, standardize the methodology for measuring each indicator, focus budget justifications on indicators that where progress is needed. Stop providing subsidies in the MWI budget and use a clearer presentation of subsidies in the WAJ budget. Establish an independent economic regulator to set retail and bulk prices for domestic water. Continue commercialization of domestic water supply, and decentralization of irrigation water management

Water Demand Management

The simplest way to increase efficiency and reduce demand for water use – Water Demand Management – is to increase prices, but there are complementary policies that can enhance the water saving benefits and reduce the cost impacts on consumers, including subsidies for water efficient technologies, water efficiency education to create a culture of conservation as has been done notably in parts of Australia and California, water efficient building codes, and water harvesting in homes (limited in scope at 20 MCM/yr and expensive at JD 1-2/m3 (MWI, unpublished), but more relevant in rural areas). The USAID Water Efficiency and Public Information for Action (WEPIA) program found "that the amount of potential water savings through installation of water saving devices (WSD) is… in the range of several million cubic meters annually. The cost of water saved through WSD ranges from JD 0.1-0.5/m3, showing that it is financially attractive for water consumers. The study points out that there are currently legal and policy barriers as well as shortcomings in the technical support to implement the widespread use of water saving devices in Jordan. Current water laws do not explicitly impose the use of water saving devices. Similarly, there are no nationally recognized standards for what constitutes a WSD." (MWI/GTZ, 2004)

Several projects are addressing these issues and improving the efficiency of water use, and these types of efforts should be continued: the USAID Reuse for Industry, Agriculture and Landscaping (RIAL) and Instituting Water Demand Management in Jordan (IDARA) projects (Chebaane, Tutundjian, and Al Zoubi, 2009; Chebaane, Chesnutt, and Qaqish, 2011), the MWI Water Demand Management Unit, the GIZ Highland Water Forum, and the Jordan Business Alliance on Water. Some of the most important policies include:

- The water companies should implement their Water Use Efficiency plans (developed with the IDARA project) with fully staffed Water Demand Management sections.

Jordan should also develop Water Use Efficiency plans for distribution areas not covered by the water companies, incorporating lessons learned from initial implementation efforts by the water companies.

- Subsidize the installation of water saving devices for domestic use. IDARA estimates that installation of 25,000 devices at JD 15 per device could generate nearly JD 10 million in savings over 20 years.
- Continue development of the Water Demand Management Unit to guide policy at the Ministry of Water and Irrigation.
- Develop and enforce a national standardized plumbing code and efficiency standards for water using products (plumbing products, appliances, etc.).
- Continue to expand the use of treated wastewater for agriculture in order to reduce agricultural demand for fresh water. The agricultural use of treated wastewater must be implemented in a sustainable way, in particular ensuring that the salinity of the treated wastewater does not cause long-term damage to the soil.

Many of the other policies discussed in the Responding to Challenges section would help reduce demand. One of the most important measures is improved enforcement of agricultural water allocations to limit illegal withdrawals, especially in the highlands (e.g., see Increasing Revenues section); enforcement of water efficient building codes and equipment standards; and enforcement of penalties for illegal connections to the domestic water supply. Another important measure is to make government accounting systems price water at its full value (even if the ultimate price for the consumer remains subsidized), and provide water subsidies on a non-volumetric basis (see Accounting for the Full Cost of Water section). The Improving Economic Returns on Agricultural Water Use and Improving Water Efficiency of Agriculture sections have several suggestions that could reduce demand, though in practice they would most likely help farmers use the same amount of water more efficiently, e.g., switching to more water efficient crops, subsidizing investments in irrigation technology, investments to improve the quality of the Jordan Valley Authority's irrigation water bulk supply, and improving agricultural extension efforts by Ministry of Agriculture and Jordan Valley Authority.

Recommendation – Continue programs that reduce water demand and promote water efficient technologies, especially implementation of the Water Use Efficiency plans at the water companies.

Appendix 1: Current Services Budget Projections

The current services budget was made using 2010 actual expenditures and revenues for 2014-2016 at MWI, WAJ, JVA (expenditures only), and Aqaba Water Company, and for 2011-2016 at Miyahuna and for JVA revenues. Projections of 2010 expenditures were adjusted for the impact of the Disi project (assuming 2014 is the first full year of Disi operations, 40% NRW for additional Disi supply, but no additional O&M or capital expenditures once operational). The projections assume that the water companies purchase Disi water directly from the operator, but total expenditures and revenues for the sector would be the same if the purchase went through WAJ. Budget estimates from MWI, WAJ, JVA (expenditures only), and Aqaba Water Company were used for 2011-2013. Projected expenditures and revenues are escalated proportionate to nominal GDP projections presented in the main Public Expenditure Perspectives report, with the exception of Disi expenditures and revenues, which are escalated based on price inflation projections presented in the main report.

	(in millions of JD)						
Ministry of Water and Irrigation Programs	**2010**	**2011 Budget**	**Current Services Projections**				
			2012	**2013**	**2014**	**2015**	**2016**
Expenditures							
Administration and Support Services	0.8	0.9	1.1	1.1	1.1	1.3	1.4
Water Sources	53.3	48.9	40.7	14.2	4.1	3.6	3.7
Developing and Enhancing Water Detection Network	0.2	0.4	0.7	1.0	0.3	0.3	0.3
Supporting the projects of Water Authority	17.2	16.2	11.5	10.2	23.0	25.5	28.2
Total Ministry of Water and Irrigation Expenditures	71.5	66.4	54.0	26.6	28.5	30.6	33.6

	(in millions of JD)						
Water Authority of Jordan Programs	**2010**	**2011 Budget**	**Current Services Projections**				
			2012	**2013**	**2014**	**2015**	**2016**
Expenditures							
Administration and Support Services	41.4	63.2	76.6	75.0	55.5	61.4	68.0
Water Program	137.3	71.9	83.6	77.5	90.1	99.8	110.5
Northern Water Program	46.0	14.9	8.5	1.0	61.6	68.2	75.5
Amman Water Program	2.5	10.4	6.5	2.5	3.3	3.7	4.1
Sewerage	41.2	59.8	69.1	71.3	55.2	61.1	67.6
Northern Sewerage Program	30.5	37.3	26.4	27.1	40.8	45.2	50.0
Amman Sewerage Program	44.9	42.9	55.9	68.4	60.1	66.5	73.7
Total Water Authority of Jordan Expenditures	343.7	300.3	326.5	322.7	366.7	405.8	449.4
Revenues							
Foreign Grants	22.9	56.9	67.5	61.6	30.7	34.0	37.6
Government Subsidy	21.3	16.2	11.5	10.2	23.0	25.5	28.2
Property Income	0.2	0.5	0.6	0.6	0.3	0.3	0.4
Revenues of Selling Goods and Services	67.0	59.7	64.3	92.7	89.8	99.3	110.0
Miscellaneous Revenues	0.4	0.7	0.0	0.0	0.6	0.6	0.7
Total Water Authority of Jordan Revenues	111.8	134.0	143.9	165.1	144.3	159.7	176.9

Jordan Valley Authority Programs	2010	2011 Budget	Current Services Projections 2012	2013	2014	2015	2016
	(in millions of JD)						
Expenditures							
Administration and Support Services	1.3	1.7	1.8	1.9	1.8	1.9	2.2
Lands and Rural Development	1.3	1.9	1.5	1.6	1.8	2.0	2.2
Irrigation	4.1	2.7	7.8	13.8	5.4	6.0	6.7
Dams	9.7	9.7	16.6	28.6	13.1	14.5	16.0
Operating, Maintenance, and Mechanics	8.5	8.9	9.5	9.5	11.4	12.7	14.0
Southern Ghor and Wadi Arabah	1.6	2.1	2.5	2.6	2.1	2.3	2.6
Comprehensive Development of Wadi Arabah Area	0.0	6.2	2.8	0.0	0.0	0.0	0.0
Total Jordan Valley Authority Expenditures	26.5	33.3	42.6	58.0	35.6	39.4	43.6
Revenues							
Agricultural Water	2.1	2.2	2.3	2.6	2.8	3.1	3.5
Industrial Water	2.4	2.6	2.7	3.0	3.3	3.6	4.0
Total Jordan Valley Authority Revenues	4.6	4.8	5.0	5.5	6.1	6.8	7.5

Miyahuna	2010	2011 Budget	Current Services Projections 2012	2013	2014	2015	2016
Water Supply	61.3	64.6	67.9	74.4	182.6	193.5	205.6
Sanitation	18.7	19.7	20.7	22.7	23.3	25.8	28.7
Total Miyahuna Expenditures	80.0	84.3	88.5	97.1	205.9	219.4	234.3
Total Miyahuna Revenues	94.7	99.0	103.3	111.9	181.2	193.9	208.0

Aqaba Water Company	2010	2011 Budget	Current Services Projections 2012	2013	2014	2015	2016
Water Supply	10.5	11.0	10.2	11.4	14.0	15.5	17.2
Sanitation	1.8	6.1	2.3	2.4	2.5	2.7	3.0
Total Aqaba Water Company Expenditures	12.3	17.1	12.5	13.8	16.5	18.2	20.2
Total Aqaba Water Company Revenues	13.5	12.5	13.3	14.1	18.1	20.0	22.2

Appendix 2: Supplemental Notes on Figures

Figure 3. Projections were made using 2010 actual expenditures for 2014-2016 at MWI, WAJ, JVA, and Aqaba Water Company, and for 2011-2016 at Miyahuna. Projections of 2010 expenditures were adjusted for the impact of the Disi project (assuming 2014 is the first full year of Disi operations, 40% NRW for additional Disi supply, but no additional O&M or capital expenditures once operational). Projected expenditures were escalated proportionate to nominal GDP projections presented in the main Public Expenditure Perspectives report, with the exception of Disi expenditures, which were escalated based on price inflation projections presented in the main report. The subtotal for expenditure on water supply does not include the water companies" purchase of bulk water from WAJ, because that is an internal transfer. The water supply figure includes a small double-counting of the cost of water purchase by WAJ from the companies, because the water company component is not easily separable from the total cost of water purchase by WAJ, which is less than JD 5 million/year.

Figure 5. Projections were made using 2010 actual revenues for 2014-2016 at MWI, WAJ, and Aqaba Water Company, and for 2011-2016 at JVA and Miyahuna. Projections of 2010 revenues were adjusted for the impact of the Disi project (assuming 2014 is the first full year of Disi operations, 40% NRW for additional Disi supply). Only revenues from water services are included; international assistance and miscellaneous revenues not related to water services (e.g., leasing of land) are not included. Projected revenues are escalated proportionate to nominal GDP projections presented in the main Public Expenditure Perspectives report, with the exception of Disi revenues, which are escalated based on price inflation projections presented in the main report. The projections assume that the water companies purchase Disi water directly from the operator, but total sector revenues would be the same if the purchase went through WAJ. The subtotal for water companies" revenues is net of cost of the water companies" purchase of bulk water from WAJ, because that is an internal transfer with the revenue included in the WAJ subtotal. The revenues include a small double-counting of the cost of water purchase by WAJ from the companies, because the water company component is not easily separable from the total cost of water purchase by WAJ, which is less than JD 5 million/year. JVA data prior to 2005 was not available. Note that only revenues from water and sewer services are included (e.g., international grants and property income are excluded).

Figure 7. JVA Water expenditures includes programs 4210 Irrigation, 4220 Dams, 4215 Operating, Maintenance, and Mechanics; excludes program 4205 Lands and Rural Development; and includes a pro-rated portion (based on the expenditure ratio of the fully included programs to the fully excluded program) of programs 4201 Administration and Support Services, 4225 Southern Ghor and Wadi Arabah, and 4230 Comprehensive Development of Wadi Arabah Area. Actual JVA revenues for 2000-2004 were not available, so the JVA Water figures for 2000-2004 use the actual JVA revenues for 2005 as an estimate (JD 4.5 million). MOF Direct Payments to Projects is estimated based on an annual average loan disbursement over the project duration. Negative value for water companies indicates a profit that must be deducted from the deficit.

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