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# Human Rights Risk Assessment: Disi Water Conveyance Project Financial Sector Perspective



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## **ABOUT THIS DOCUMENT**

NomoGaia is a nonprofit think tank that develops, pilots and publishes tools for corporate human rights due diligence. Since 2008, NomoGaia has focused on sector-specific human rights impact assessment (HRIA), examining the positive and negative, direct and indirect impacts of corporate capital projects on human rights. However, companies implementing operations and capital projects are not the only businesses with human rights responsibilities; the financial institutions that enable such investments to move forward are also expected to carry out human rights due diligence.

This document represents an initial pilot of a beta-version tool for evaluating the human rights risks of the financial institutions that back such capital projects. It is designed to be quicker and more nimble than NomoGaia's full HRIA, in recognition that financing timelines can be tight, and financial institutions often need to understand the biggest risks early in investment discussions.

It is supplemented here with a monitoring component, examining the investment retroactively with an aim to guiding future decision-making, for foreign investments in general and for investments in Jordan's water sector in particular. This will allow impacts to be evaluated both as the project was planned and as it was implemented. Monitoring was completed with the support of the American University School of International Service, through a practicum in Fall Semester 2014.

A second pilot of this finance-sector HRIA is underway in Myanmar, on a gas-fired power plant funded by the World Bank. For more information on this tool, please visit [www.nomogaia.org](http://www.nomogaia.org) or contact the project lead, Kendyl Salcito, at [Salcito@nomogaia.org](mailto:Salcito@nomogaia.org).

## **EXECUTIVE SUMMARY**

NomoGaia's impact assessment of the Disi Water Conveyance Project on the Human Right to Water and Sanitation commenced in 2011 with evaluations of the water sector in general and the Disi pipeline in particular. Initial field investigation (conducted May 2011, while the pipeline was under construction) scoped the project and identified Amman, rather than the pipeline corridor or Mudawarra well-field in southern Jordan, as the center-point of most significant human rights impacts. As such, the follow-up assessment in October and November 2014 focused on the human rights impacts of Disi to water users of Amman. Future research should consider impacts on users of aquifers located in northern Jordan, as Disi was designed to relieve pressure on these over-extended resources. Additional justification for such research has arisen recently, as proposals have been advanced to extend the Disi pipeline to the northern governorates.

Evaluating the human rights impacts of Disi was complicated by significant geopolitical instability in the region during the years of assessment. Violent conflicts in Iraq, Syria, Israel/Palestine and Egypt caused significant population movements, including a refugee influx into Jordan, which further strained an already over-stressed water system. In this context, Disi's shortcomings have been broadly set aside by politicians, media and the public, who suggest that without Disi, Jordan's water crisis might have been insurmountable.

Our research does not fully substantiate that conclusion. Although water availability in impoverished East Amman has increased temporarily (experts suggest that Disi water supply will be exhausted decades before the project's planning documents suggested), the Disi water project has not had a positive effect on the Right to Water as holistically understood. Compromises made in Disi's implementation and the insufficient maintenance of Amman's water infrastructure undermine its benefits and prevent it from contributing to a systemic shift in Jordan's water management strategy while generating negative impacts on human rights. Specifically:

### **Right to Water: Quality, Sustainability**

Disi is not relieving northern aquifers. These over-extracted and salinated water resources, which Amman traditional relied upon, are being diverted to other areas within Jordan. The government has not released extraction rates. Therefore, the Disi project is not preserving the Right to Water for future generations.

### **Right to Water: Governance, Transparency**

The implementation of Disi was not, as committed, preceded by a finalization of Amman's water districts. As a result, water continues to be dumped into the soil and siphoned off in water theft, affecting both the state's ability to generate revenues from water (which would enable sustainable maintenance of water infrastructure and fulfill a component of the Right to Water) and Disi aquifer's ability to supply water to Amman efficiently, as it is a rapidly depleting, non-recharging water resource.

### **Right to Water: Governance, Transparency, Non-Discrimination**

The government did not, as committed, halt southern Jordan's most water-intensive agricultural enterprises, which draw water from Disi. Many of these farms are run by large corporations, which flood-irrigate water-intensive crops like citrus for export to Europe. This does not respect the right to an adequate standard of living for poor Jordanians (who farm more efficiently and were supposed to be allocated small plots in the breakup of large conglomerates), while it continues to support the interests of elites, further entrenching inequalities.

**Right to Health; Right to Water: Quality**

Disi is not improving water quality, having been found to contain radionuclide levels that far exceed WHO standards and Jordan's own Gross Alpha and Gross Beta (as well as Ra-226 and Ra-228) environmental limits. Disi water quality only meets Jordanian health standards when blended with additional water resources, and only then because the Government of Jordan revised its water law to increase the acceptable levels of radionuclides 5-fold in 2008, after initial Disi water quality tests found radionuclide exceeding national standards. Furthermore, the rapid rate of pumping (resulting from the immediate ramp-up to full production for Amman in 2014), as well as the failure to close farms near the well-field, will expedite degradation of water quality, further affecting the right to health for water consumers. Researchers in Saudi Arabia have already recorded increasing salinity and radiation in the Disi/Saq aquifer at locations where pumping has been most intense.<sup>1</sup> These right to health concerns are particularly pertinent for children, who are more susceptible to radiation risks and water quality impacts than adults, and citizens of East Amman, who are more likely to drink water from the tap.

**Right to Public and Political Participation; Right to Water: Transparency**

The government has withheld water quality and quantity monitoring data from the press and contributed to publication delays on hydrogeological studies demonstrating that recoverable water from Disi was a fraction the volume previously reported. This undermines free expression in the country. At 2.4 billion cubic meters (BCM), as opposed to the assumed 4-10 BCM, Disi is not large enough to fulfill the right to an adequate supply of water, as promised, to the residents of Amman. The corollary negative associated with this diminished quantity is the high cost of extraction. The \$1.1 billion USD (780 million JD) cost of construction is compounded by increasing operational costs, as fuel subsidies to the Ministry of Water are being curtailed. Disi water costs over 1JD per cubic meter to extract, far exceeding Jordanian citizens' capacity to pay. The Government of Jordan, as a result, is in a deeply unstable financial position with regard to Disi water. Leaders within Jordanian ministries acknowledge that maintaining the pipeline's functionality will require additional donor inputs. These challenges were foreseeable – Jordan has planned fuel subsidy reductions for several years, and the research indicating low recoverability rates from the Disi aquifer was conducted prior to the pipeline's construction, though it was made public. It is conceivable that investment in Disi will have the long-term effect of requiring major increases in water tariffs, which the population did not foresee or approve through any participatory processes. Furthermore, the Disi aquifer will not fulfill the needs of Amman as promised, which will require the government to secure other sources of water, which will necessitate additional investment in the water sector.

**Non-Discrimination**

Disi has been presented as an essential emergency supply of water in the face of population influx. This claim is undermined by the realities of Jordan's water sector, including leakage and usage data. Jordan's domestic water usage is dominated by the agricultural sector, which uses over 60% of the country's water and only generates an estimated 3% of GDP.<sup>2</sup> Meanwhile, leakage rates from water systems in the northern governorates where Syrian refugees are concentrated reach up to 75%. Addressing leakage and distribution shortcomings would more than compensate for population influx.

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<sup>1</sup> Becker, M. Contaminated aquifers: radioactive water threatens Middle East. Der Spiegel. November 2012. <http://www.spiegel.de/international/world/contaminated-aquifers-radioactive-water-threatens-middle-east-a-865290.html>

<sup>2</sup> "Water for Life" p. 5-2.

State pronouncements that blame Syrians for the failure of Disi to meet water allocation expectations have contributed to tension and resentment in communities, which have reportedly resulted in conflicts in some areas, potentially affecting security of person.

There are, however, certain rightsholder groups that have benefitted from dimensions of the Disi project. Among them are agricultural workers and owners as well as residents of East Amman. Agricultural workers and owners may have faced water restrictions in the absence of Disi, as increasing domestic water needs may have necessitated a reallocation of water from farmers to families. Because Disi water is supplying domestic users, farmers have not experienced water restrictions.<sup>3</sup> Residents of East Amman have seen their water allocation rates rise significantly with the initiation of the Disi pipeline. Improved water schedules for these areas have been well received, but it is essential to emphasize the importance of adequate water quality alongside adequate quantity. As East Amman has a higher concentration of water users that drink tap water than West Amman (West Amman residents predominantly buy drinking water, or filtration systems that treat municipal water before drinking, and use municipal water for other household uses), the increased allocation to this population may also be increasing their health risks as radiation exposure is increased.

Right	Project as Planned	Project Implemented
<b>Right to Water/Sanitation</b>	1.47	-3.59

Right	Project as Planned	Project Implemented
<b>Freedom of Expression</b>	-	-5.00
<b>Right to Health</b>	-1.33	-8.80
<b>Right to an Adequate Standard of Living</b>	3.33	-4.00
<b>Rights of Children</b>	-	-
<b>Right to Public and Political Participation</b>	-1.57	-9.00
<b>Right to a Clean Environment (Right to Water and Environmental Sustainability)</b>	5.00	0.00

These findings were borne out in a detailed analysis of over 180 indicators pertinent to contextual conditions and project design and implementation, which are available at the link below.

[http://nomogaia.org/?attachment\\_id=1063](http://nomogaia.org/?attachment_id=1063)

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<sup>3</sup> Namrouqa, H. Irrigation water for winter crops secured. 31 March 2015. Jordan Times. <http://jordantimes.com/article/irrigation-water-for-winter-crops-secured>

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## 1. INTRODUCTION

This is an assessment of the impacts of the Disi Water Conveyance Project (“Disi” or “the project”) on the Human Right to Water and Sanitation (Right to Water) and other associated rights. Because the HRIA was commenced before the pipeline began functioning, it considers the impacts of the project as it was designed, as well as the actual impacts resulting from its implementation. As such, it considers the design and contextual changes that occurred after loans were made, and it evaluates their human rights implications for future water sector financing.

### 1.1. Human rights and financial institutions

Although international agreements have endowed governments with the express duty to protect human rights, globalization has placed significant power in the hands of corporations and investment institutions that operate worldwide. Financial institutions can influence human rights outcomes when funding projects on behalf of or in partnership with a state, and capital development has implications well beyond the project fence line. Large transnational banks and corporations have acquired responsibilities to respect human rights. With the 2011 release of United Nations Special Rapporteur on Human Rights and Business John Ruggie’s *Guiding Principles on Business and Human Rights*, the duties of business to respect human rights have been laid out. Governments have a duty to respect, protect, promote and fulfill human rights; businesses have a duty to respect human rights. Financial institutions operate as corporations, occasionally drawing mandates for development from governments. As a result, at a minimum they are held to the standard of ‘respect’ for human rights.

Respect is defined as a three-step process, involving a statement of commitment, a process of “human rights due diligence” and a mechanism for receiving and redressing the complaints of rightsholders regarding human rights abuses. The Equator Principles, encompassing 79 financial institutions and covering over 70% of international project finance debt in emerging markets, includes human rights due diligence in lending evaluations. Multilateral development banks such as the European Investment Bank, have also begun producing human rights policies.

Respecting human rights poses particular challenges for financial institutions, partly because their leverage over a project is limited to the lifespan of a loan. While human rights due diligence for project operators lasts for the duration of a project and into its closure, banks can only reasonably be expected to conduct due diligence on the front end of project development. Once a loan is repaid or an installation is erected, the financing body loses the authority to dictate terms.

This assessment and its recommendations are targeted to the financial institutions that supported the project. Without their investment, the Disi project was non-viable, owing to the lack of capital on the part of both the Government of Jordan and the implementing company, GAMA Enerji A.S., a joint venture between Gama Holdings, a Turkish corporation, and GE Energy Financial Services.

### 1.2. Single-right HRIAs

Like other publicly available operations-level human rights impact assessments (HRIAs), this assessment evaluates the ways an investment project interacts with human rights. Unlike those HRIAs, however, it focuses on the human right to water and sanitation and other rights associated with water, because the affected rightsholder group is too large to be canvassed for the full suite of rights.

Single-right HRIAs are not, in practicality, assessments of impacts on a single right. This is because human rights interact and intersect; no right exists in a vacuum.<sup>4</sup> As a result, investigation of impacts on the Right to Water necessarily also evaluate impacts on other human rights, both economic and social rights as well as political and civil rights. The Right to Water involves the former set of rights including the right to health, the right to a clean environment, and the right to an adequate standard of living. The latter set of rights are implicated with issues involving equitable access to water, which evokes the right to political participation, nondiscrimination and freedom of expression when the Right to Water is not adequately protected and promoted by states or respected by corporate enterprises.

### **1.3. Rightsholders**

Human rights are held by individuals referred to as “rightsholders.” HRIAs necessarily employ this term, which is not used in other assessments, because rights analysis starts with the individuals whose human rights could be at risk. Traditional impact assessment, in contrast, focuses on groups that have a “stake” in the project – be it financial, social, environmental or otherwise. Most impact assessments categorize stakeholders by proximity, dividing them into host community, host country and “wider community”. The rightsholder to an HRIA are more exclusive – a subset of the stakeholder group.

Rightsholders generally live within the project vicinity (although there are exceptions, as described below). They are integral to a HRIA, particularly if they are not well represented by government, trade unions, NGOs, or any other organization. Community leaders, traditional government leaders and NGO leaders may have positions and opinions reflective of rightsholder concerns, and so should be heard, but more vital are the voices of the “voiceless” – those whose interest are rarely taken into consideration, sometimes to the detriment of all. The goal of rightsholder analysis is to determine, as accurately as possible, the effect of the Project on rights, whether or not the rightsholders are in power.

While rightsholders are often directly affected by a project, such as workers or community members that are directly adjacent to a project, there are times when the affected rightsholders are more removed from the project fence line. This is particularly true when a financial institution is funding a project that involves duties and activities that are traditionally undertaken by states (for example, power lines and sewage treatment plants). Thus, when conducting human rights due diligence, financial institutions that are partnering with states to finance large infrastructure projects must ensure that they evaluate not just the human rights impacts within the project fence line, but also the impacts that occur beyond the project fence line.

## **2. METHODOLOGY**

HRIA, like all impact assessments, are carried out in phases. The UN Guiding Principles present a framework for the content and process of assessment, beginning with scoping to identify the most significant human rights impacts (Principle 17), followed by a data-gathering and analysis process involving direct engagement with rightsholders (Principle 18), followed by a prioritization of interventions, to address the most severe, intense and irremediable impacts first (Principle 18), followed by the implementation and monitoring of those interventions and ongoing human rights challenges (Principles 19 and 20). These phases are described here as: scoping, cataloging, ratings, mitigation and monitoring.

These components are depicted visually in Figure 1.

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<sup>4</sup> G. MacNaughton and P. Hunt, 'Health Impact Assessment: The Contribution of the Right to the Highest Attainable Standard of Health', *Public Health* 123, no. 4 (2009): 302-5, <http://www.ncbi.nlm.nih.gov/pubmed/19386335> (accessed Apr).

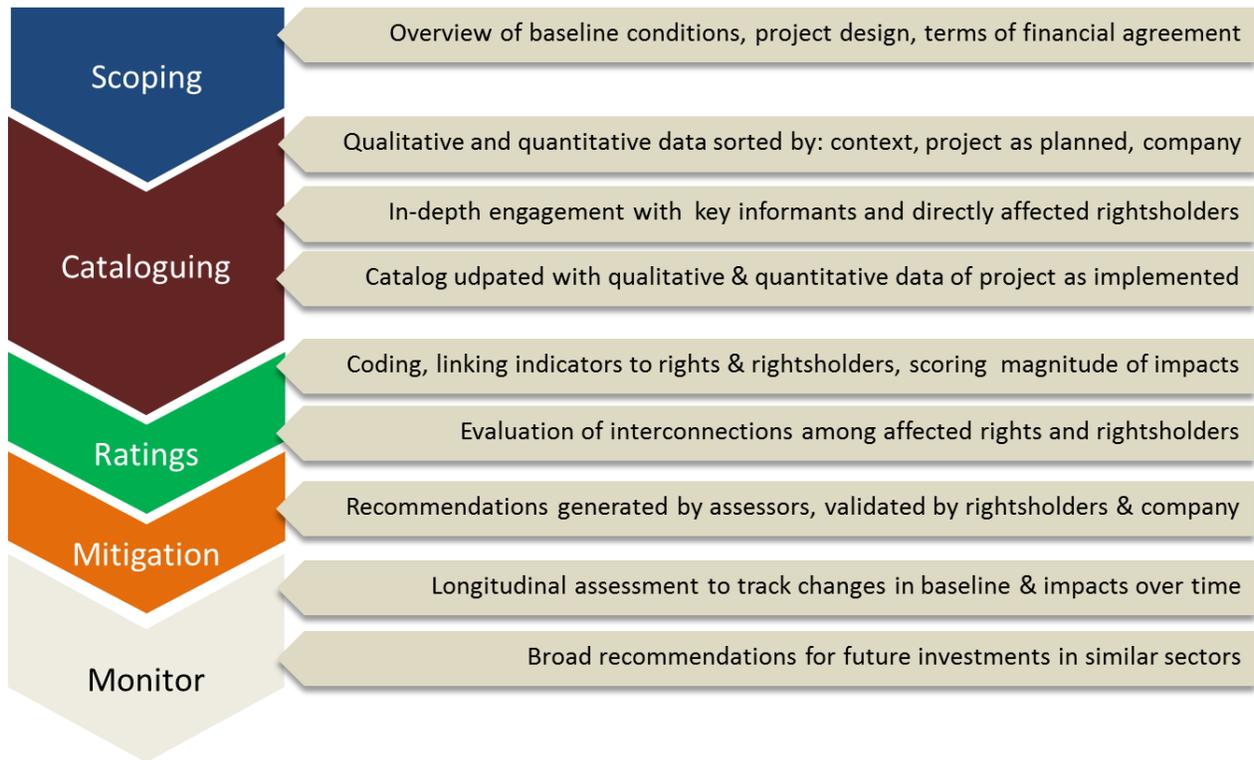


Figure 1. Phases of human rights impact assessment

### 3. SCOPING

The purpose of scoping within the HRIA framework is to identify the most affected individuals and the most affected human rights. A project potentially affects numerous groups of rightsholders and affecting the full spectrum of human rights.

Depending on the size of a project’s footprint or scope of the operation, the affected rightsholders and affected rights considered may need to be tailored and focused in order to produce an HRIA which is both comprehensible and useful to financial decision-makers. The broad geographic footprint of the pipeline and the interconnectedness of all water users in Jordan required this assessment to narrow its focus to the Right to Water as pertinent to water users in Amman.

#### 3.1. Affected Rightsholders

The Disi pipeline draws water from the Mudawarra well-fields in southern Jordan through Ma’an, Tafila, Karak, Madaba and Muntazah, depositing roughly 100 million cubic meters (MCM) per year into two separate reservoirs in the greater Amman area. This geographical footprint extends through several of Jordan’s governorates and affects a significant proportion of its populations.

NomoGaia scoped the Disi project in 2011, visiting the well fields in Mudawarra, traveling along significant portions of the pipeline, and speaking with stakeholders in Amman. The initial scoping of the project identified several rightsholders, including: the recipients of Disi water in Amman, the residents of the areas where aquifers were previously designated to Amman, and the population in southern Amman where the Disi water is being extracted from the Mudawarra well-fields.

Parsing Disi's impacts is complicated by the fact that there are several affected rightholders beyond the operational components of pumps, pipeline and reservoirs. For instance, Disi is one of several inputs into the Amman's municipal water system. Additionally, rightholders in southern Jordan include local municipalities that have utilized Disi water for decades. Also, Amman has traditionally relied on water sources located in northern and western Amman, and this use is supposed to subside now that Disi water is being delivered to Amman. These populations are faced water sources that were not previously available. Furthermore, citizens in Amman were promised improved quality and quantity of water with Disi's delivery via the pipeline. Scoping this assessment required identifying the most affected individuals and rights.

This assessment was scoped to address the most intense and immediate impacts, which are experienced by residents of Amman whose water supply is directly changed. This population includes at least 2.5 million individuals.<sup>5</sup> Indirect impacts in Mudawarra, where the well fields are located, and in the lands supported by aquifers previously used by Amman, are an important topic for future research.

### **3.2. Affected rights pertinent to the right to water**

In addition to focusing on a specific population, this assessment necessitated narrowing in of a particular group of rights. Conducting NomoGaia's full-scale human rights impact assessment, with over 320 indicators, on the entire population of Amman without focusing on particular rights would obscure Disi's specific human right impacts. Thus, this assessment focuses on the Right to Water and rights that are associated with and affected by the Right to water.

The Right to Water has historically been analyzed within the International Covenant on Economic Social and Cultural Rights, subsumed under the Right to an Adequate Standard of Living (Article 12), but it was detailed more thoroughly in 2003 in the UN Committee on Economic, Social and Cultural Rights' General Comment No. 15 (General Comment 15). General Comment 15 highlights that water must be *sufficient, safe, acceptable, physically accessible, and affordable* for personal and domestic uses.<sup>6</sup> In addition, the Right to Water should be attained through overarching human rights principles of: non-discrimination, participation, accountability, and sustainability.<sup>7</sup> Together, these qualifications account for both freedoms and entitlements. Freedoms include freedom from state interference in access to water or information about water. Entitlements include access to a minimum amount of safe drinking water to sustain life and health and participation in water related decision-making at the national and community levels.<sup>8</sup>

General Comment 15 is a useful framework for analyzing the Right to Water, because it enables the Right to Water to be understood in terms of its relationship to other human rights codified in the International Bill of Human Rights. Table 1 displays these links while also drawing from current literature on business, human rights and the Right to Water.<sup>9</sup> Because the human rights framework is self-reinforcing, there are overlaps among the elements of the Right to Water and the fundamental human rights principles.

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<sup>5</sup> <http://www.geohive.com/cntry/jordan.aspx>. Government officials in Jordan claim that Amman's population is as much as 4 million. <http://www.jordantimes.com/news/local/amman-s-population-rises-around-4-million---biltaji>

<sup>6</sup> U.N. Committee on Economic, Social and Cultural Rights. General Comment No. 15: The rights to water (2002). U.N. Doc. E/C.12/2002/11.

<sup>7</sup> de Albuquerque, C (2012). On the Right Track: Good Practices in Realising the Rights to Water and Sanitation. U.N. Special Rapporteur on the human right to safe drinking water and sanitation.

<sup>8</sup> de Albuquerque, C (2012).

<sup>9</sup> <http://ceowatermandate.org/files/business-hrws-guidance.pdf>;  
[http://www.ihrb.org/pdf/More\\_than\\_a\\_resource\\_Water\\_business\\_and\\_human\\_rights.pdf](http://www.ihrb.org/pdf/More_than_a_resource_Water_business_and_human_rights.pdf); ON THE RIGHT TRACK,

**Table 1 Human Rights Standards and Principles within the Right to Water**

Explanation of Human Rights Principle	Human Rights & Source Articles
<b>Sufficient</b>	
<p>Sufficiency pertains to the quantity of water available to sustain healthy life. Sufficient water should be available continuously for personal and domestic uses. It includes sufficiency for drinking, bathing, cleaning and livelihoods. Infrastructure development projects can affect stream flows and water tables through their operations and corporations and financiers should monitor these impacts to ensure human welfare is not affected.</p>	<p>Right to Health Right to an Adequate Standard of Living Right to Food (ESC 12, UD 11)</p>
<b>Safe</b>	
<p>Safety encompasses quality parameters for microbes, parasites, chemical substances and radiological hazards. Corporations are responsible for ensuring that business activities do not negatively affect quality, which requires them to know such parameters at baseline. Because children are more susceptible to health risks associated with poor quality water, the rights of children are of concern alongside the economic, social and cultural rights of adults.</p>	<p>Right to Health Right to a Clean Environment Rights of Children (ESC 12, CP 24)</p>
<b>Acceptable</b>	
<p>Water itself must be acceptable (in taste, odor, color) to ensure perceived security, often based on religious and cultural norms and practices. Likewise, water distribution mechanisms must be acceptable. Populations that have historic ties to particular water bodies may perceive negative impacts on their water security if corporate activities divert, reroute or relocate water sources. This can have religious and cultural implications in some communities.</p>	<p>Right to Political Participation Right to a Clean Environment Right to Culture (CP 17, ESC 12 &amp; 15, UD 27)</p>
<b>Accessible</b>	
<p>The UN estimates that water can be considered accessible within 1km of a household. Additional considerations are necessary for persons with disabilities, women, children and the elderly. Impacts on the distance or time involved for rightsholders to gather water – including modification of access routes, rerouting of watersheds, lowering of water tables, or restrictions on distribution schedules to households –require mitigation.</p>	<p>Freedom from Discrimination Right to an Adequate Standard of Living (ESC 2, 7 &amp; 12; CP various)</p>
<b>Affordable</b>	
<p>The UN estimates that 3% of household income is the maximum rights-respectful expenditure on water. Affordability also applies to the prices paid by the state to provide water. Affordability poses dilemmas in water-scarce nations, where low availability affects quality, creating tiered markets for higher quality water that is unaffordable for the poor. Ensuring ongoing affordability requires states and companies supplying, distributing and conveying water to exploit resources in ways</p>	<p>Right to an Adequate Standard of Living Freedom from Discrimination (ESC 2,7 &amp; 12; CP various)</p>

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*supra* note 15, at 34; *Rep. of the Special Rapporteur*, *supra* note 24, ¶¶ 11, 16, 22, 29, 36, 38, 44; FACT SHEET NO. 35, *supra* note 13, at 9.

<p>that prioritize human rights over other (often financial) interests and protects resources over time.</p>	
<p><b>Non-discriminatory</b></p>	
<p>The majority of those who do not have or cannot attain access to adequate water are marginalized, such as women and children, and poor populations. These populations often must make choices between water and other human rights such as food, shelter, or health care.</p> <p>Companies are expected to identify where their water usage and impacts will have disparate impacts on particular (vulnerable) subpopulations. Disparate impacts can result from a state's water allocation policies, tariff structures or quality differentiations that privilege the populations of particular regions or industries. In municipal water supplies, where corporate inputs or outputs could affect both municipal users and downstream users, scoping of a broad network of rightsholders is needed to identify all likely-affected rightsholder groups.</p>	<p>Right to Political Participation Freedom from Discrimination (ESC 2 &amp; 7, CP 17)</p>
<p><b>Participatory</b></p>	
<p>A state's effort to achieve universal access to water is expected to be participatory, egalitarian and democratic. The majority of those who do not have or cannot attain access to adequate water are marginalized and vulnerable populations. These populations often lack political representation and decision-making powers that hampers their knowledge of their rights and ability to bring about changes. If a company's water usage aligns with the interests of one subpopulation but not another, it may undermine the participatory nature of Right to Water achievement, giving strength to certain voices over others. Further, if water is at risk of being impacted, citizens have a right to voice concerns and seek feedback. State interference in public discourse about corporate changes to water infrastructure constitute business complicity in violation of freedom of expression.</p>	<p>Right to Political Participation Freedom from Discrimination Freedom from Interference in Private Life Freedom of Expression Right to Information (ESC 2 &amp; 7, CP 17, 19, 25)</p>
<p><b>Accountable</b></p>	
<p>Under General Comment 15, states are expected to provide "a framework for monitoring, complaint mechanisms, and redress for [s]tate violations or failures to deliver services." When states are not accountable to citizens for failures to fulfill the Right to Water, companies entering that context face a rights disrespectful baseline, which increases the risk of corporate complicity in state failures.</p>	<p>Right to Information (CP 19)</p>
<p><b>Sustainable</b></p>	
<p>State water programs, institutions, and infrastructure must be sustainable: economically, environmentally, and socially. Tariff structures need to be implemented so that it is both affordable for everyone, including those in poverty, but also allows for revenue for the continued delivery of water. This requires adequate regulation mechanisms, oversight, and a remedial framework. The systems delivering water must be planned strategically to ensure the risks over the lifetime of the infrastructure are taken into consideration to ensure they are financed for their full life cycle, particularly when relying on financing from donor countries or business entities. Furthermore, water must be provided in way that does not overexploit natural resources, as states human rights obligations are intergenerational and never expire.</p>	<p>Right of Self Determination and Subsistence (UD 1, CP 1)</p>

## 4. CATALOGING

Cataloging starts with an evaluation of the context in which the project is being implemented in order to establish a baseline. Then, the project is assessed against this established baseline. The detailed cataloging process characteristic of NomoGaia HRIAs was pared down to focus on the human rights pertinent to the Right to Water. Simultaneously, it was augmented with water-specific topics of investigation. The full suite of human rights topics evaluated and coded are available in the excel sheet linked here:

[http://nomogaia.org/?attachment\\_id=1063](http://nomogaia.org/?attachment_id=1063)

The content of these catalogs is summarized in narrative form below.

### 4.1. Context

#### 4.1.1. Political and Economic

Jordan is the world's fourth most water-poor country.<sup>10</sup> Jordan's water sector is overseen by the Minister of Water and Irrigation, who is one of 25 cabinet members that report to the Prime Minister. The Minister is responsible for the Ministry of Water and Irrigation (Ministry), which oversees overall strategic direction and planning, the Jordan Valley Authority, which is responsible for supplying water in the Jordan Valley for socio-economic development, and the Water Authority of Jordan (WAJ), which manages bulk water and distributes water to areas of the country that is not served by a separate water distribution entity, which WAJ has the power to create.<sup>11</sup>

In the late 1980s, Jordan began experiencing increasing water deficits that threatened the viability of Jordan's water resources. In 1991, the government of Jordan started exploring the possibility of utilizing water from the Disi aquifer for domestic use. A feasibility study and preliminary plans were presented in 1996 followed by a detailed design and tender documents in 1997. The aquifer, which is part of the Rum aquifer system, sits between Jordan and Saudi Arabia. The transboundary nature has caused diplomatic concerns, which may have deterred the World Bank from financing the project (the World Bank dropped the project from its portfolio in 2004).<sup>12</sup> Initial ESAs were presented in 2004 with GAMA Holdings winning the bid to build the pipeline in 2007.

Prior to transporting Disi water to Amman for domestic uses, Jordan extracted a total of 1.7 billion cubic meters from the Disi aquifer. Corporate farming operations have used water from the aquifer for irrigation since the early 1980s, escalating extraction to 70-80 MCM per year by 2008. Since 2008, extraction has dropped to 60 MCM per year, dominated by center-pivot crop irrigation (40 MCM of that usage). An additional 15 MCM is designated for domestic use while 5 MCM supports Jordan's phosphate industry. Agricultural companies that irrigate with Disi water include the Rum Company, WAFA Farm, ARICAT Farm, Jordan Financing House Co., and GRAMCO Farm, all large enterprises owned by wealthy businesspeople. Local industries planned to use recycled water while agricultural users were expected to lose access,

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<sup>10</sup> Promoting water education in the fourth most water scarce country in the world. UNESCO Office in Amman. 1 February 2013. [http://www.unesco.org/new/en/amman/about-this-office/single-view/news/promoting\\_water\\_education\\_in\\_the\\_fourth\\_most\\_water\\_scarce\\_country\\_in\\_the\\_world/#.VM03iC5ry74](http://www.unesco.org/new/en/amman/about-this-office/single-view/news/promoting_water_education_in_the_fourth_most_water_scarce_country_in_the_world/#.VM03iC5ry74); The Jordan Times has reported the country to be second poorest: Namrouqa, H. 22 October 2014. <http://jordantimes.com/jordan-worlds-second-water-poorest-country>

<sup>11</sup> <http://www.frp2.org/english/Portals/0/Water%20PEP%20Working%20Paper-Eng.pdf>

<sup>12</sup> <http://www.worldbank.org/projects/P077750/disi-water-project?lang=en>. See also <http://www.oecd.org/countries/jordan/36489193.pdf> p. 36; [http://www.academia.edu/1556719/The\\_Disi\\_project\\_an\\_internal\\_external\\_analysis](http://www.academia.edu/1556719/The_Disi_project_an_internal_external_analysis) pp.453-54

however aerial photo evidence indicates that many of these farms were still operating as of January 2015.<sup>13</sup>

Jordan's water policies perpetuate Jordan's water scarcity issues. The majority of Jordan's water resources (an estimated 60-85%) are allocated to the agriculture sector, which used 529 MCM of water in 2011. Although agriculture contributes only 3% to Jordan's GDP, it is managed by powerful individuals in Jordanian society, and the Government of Jordan has been reluctant to curtail agricultural water use. As a result, alternative water resources for domestic purposes have been sought, often at high expense. The Disi water conveyance project was one such alternative, costing over \$1 billion in capital costs alone.

Jordan's water sector is also hampered by ineffective water infrastructure. While an estimated 330 MCM of water was allocated for residential use in 2011, roughly 40% of that water lost to leakage. Households accessed, on average, under 30 cubic meters per person per year, or 82 liters per day (US citizens use closer to 600 liters per day). Actual access and usage rates vary significantly, dropping below 20 liters per person per day in households with limited storage capacity. This is because water is not accessible to most Amman residents on a daily basis; limited supplies only permit for weekly or semi-weekly water provision.

Today, Amman's water delivery and collection services are provided by Miyahuna, a limited liability national company established in 2007 under WAJ's authority. It replaced LEMA, which had a management contract with WAJ to manage water and wastewater services in Amman beginning in 1999. Miyahuna is run by a general assembly that includes 7 members representing the Ministry, WAJ and other government entities. Miyahuna acts as a retail distributor of water in Amman selling water to citizens, private business and government buildings. It is also responsible for wastewater collection and managing Amman's municipal water grid and infrastructure.

#### **4.1.2. Environmental and Health**

A primary barrier to using the Disi water for domestic consumption is its high radionuclide levels resulting from the natural occurrence of uranium and thorium deposits within the sandstone aquifer. A study from Duke University published in 2009 highlighted the elevated levels in Disi water<sup>14</sup>. The government and Ministry denounced this study referring to it as "baseless". The Minister added that the tested water was not from government owned wells and the Disi water is "100 per cent safe".<sup>15</sup>

While the government publically questioned the Duke study, in 2008 the Government of Jordan changed its drinking water standards, increasing allowable radionuclide levels 5-fold above WHO guidelines. Jordan's previous water standards matched the WHO guidelines. This revision increased the allowable exposure to radioactive material in drinking water from 0.1 to 0.5 millisvert per year. While the WHO states the 0.1 mSv/year is conservative, exposure to higher levels does increase health risks.<sup>16</sup>

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<sup>13</sup><http://waterinventory.org/sites/waterinventory.org/files/chapters/Chapter-10-Saq-Ram-Aquifer-System-web.pdf>; little data is available after 2013. The Jordan Times reports that contracts were canceled for southern farms in May of 2013 <http://www.jordantimes.com/news/local/cabinet-ends-southern-farm-companies-contracts>

75 ESIA.p.B92

<sup>14</sup> Vengosh et al. (2009 & 2014).

<sup>15</sup> <http://www.jordantimes.com/news/local/disi-project-will-go-ahead-despite-radiation-allegations>' (mentions change to .5)

<sup>16</sup> WHO Guidelines, pp. 197-98.

Meanwhile, Jordan's other resources supplying water to Amman are at risk of exceeding national salinity limits. Prior to Disi, Amman's water was supplied by six primary sources<sup>17</sup>:

- The **Zai Water Treatment Plant**, which draws water from the King Abdullah Canal (supplied by the Yarmouk River, Zarqa River, Lake Tiberias and Al-Mukheebah Wells), 6-10 small Wadis in the Jordan Valley and the Abu Zighan Desalination Plant (capacity 90 MCM/yr, actual 60-70 MCM/yr)
- The **Zara Ma'in Water Treatment Plant**, which draws water from Zara Ma'in Wadi, Zara Springs and the Mujib Dam (capacity 48 MCM/yr, actual 36 MCM/yr)
- Local springs and wells within the Greater Amman Area – Ras al' ein, Wadi es-sir, Qatrana, Suwaga, Muqaqqar, Taj, and Ruseifa (actual 35-40 MCM/yr)
- The **Khaw transmission pipeline** drawing from Zarqa (Azraq Basin) (actual 4-8 MCM)
- The **Wala transmission pipeline** drawing water from Madaba (actual 4-5 MCM/yr )
- The **Lajjoun wells** drawing water from Karak (actual 1-6 MCM/yr )

#### **4.1.3. Social**

Jordan's water scarcity forced Amman to implement a water-rationing program in 1988, which remains in place today. Since then water has been delivered to Amman residents, now Miyahuna customers, periodically. This rationing system has required citizens to invest in water tanks that collect water when it is delivered, usually on a weekly basis. These tanks allow families to collect water for use until subsequent water delivery, which had, at times, been unreliable.

Jordan has created an unsustainability expectation of significant subsidies, including access to cheap water. Jordanians have a history of protesting when these subsidies are cut. This occurred both in 1989 and 1996 due to recession and IMF structural adjustment agreements. Prior to the Arab Spring in 2010, worsening socio-economic conditions, including rising food prices, fueled protests throughout Jordan. While the Monarchy survived the Arab Spring, there were significant protest movements and civil disturbances. Protests, usually held on Fridays during prayer for about two years between 2011 and 2013, were led by the Muslim Brotherhood and Jordan Youth Movement and were mostly non-violent.<sup>18</sup> Tensions did rise and became violent on occasion. These outbursts were credited to the reductions in gasoline subsidies in November 2012.<sup>19</sup> Early that summer, tires were burned and streets blocked in response to the lack of available water.<sup>20</sup>

#### **4.2. Project as Planned (includes contributions from by AU SIS students D'Ambrisi, Overton and Rosen)**

The Disi Water Conveyance Project comprises 64 wells (46 operational, 9 standby and 9 piezometric), a 325 kilometer pipeline from the Disi aquifer to Amman, and five emergency turnouts in Ma'an, Tafila, Karak, Madaba, and Muntazah. Water is deposited in two reservoirs in Amman, one in Dabuk and one, newly constructed, in Abu Alanda. The pipeline was built and is operated by Gama Holding A.S., through a 25-year BOT agreement.

##### **4.2.1. Political and Economic**

While physically the process of conveying water from the Disi aquifer to Amman's municipal grid is fairly straight forward, it involves a number of different organizational bodies, including government agencies,

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<sup>17</sup> [http://www.acwua.org/sites/default/files/handout\\_oct.pdf](http://www.acwua.org/sites/default/files/handout_oct.pdf)

<sup>18</sup> Zawafri 269, 270 271

<sup>19</sup> <http://www.bbc.com/news/world-12482679>

<sup>20</sup> <http://www.nytimes.com/2012/11/29/world/middleeast/a-parched-jordan-places-hopes-in-reservoir.html>

private contractors and public utility companies. The pipeline was built and is operated by a project company GAMA Enerji A.S., which is a joint venture between GAMA Holding A.S. and GE Energy Financial Services. It was reported that GE was planning to sell its 50% stake in GAMA Enerji A.S back to GAMA Holding A.S. GE reported that this was a to portfolio-based decisions. GAMA Enerji A.S. built and operates the pipeline under a build, operate and transfer (BOT) agreement, meaning GAMA Enerji A.S. will own and operate the pipeline for 25 years after which the pipeline will transfer to the Jordan government.<sup>21</sup> While Miyahuna is not involved in the construction of the pipeline or management of the extraction and transportation of the water, it is the entity that distributes blended Disi water to Amman.<sup>22</sup>

The pipeline cost over \$1 billion to build. To cover this cost, there were contributions from a number of different parties. GAMA Holding A.S. contributed \$192 million in equity. The Ministry and WAJ will contribute \$300 million. Of this amount, \$50 million came from the French Development Agency and another \$50 million from the European Investment Bank. Jordan’s remaining \$200 million was a contribution from the Ministry and WAJ and is guaranteed by the Jordan Treasury Ministry. PROPARCO (\$92 million), the European Investment Bank (\$125 million) and OPIC (\$250 million) complete the financing for the pipeline.<sup>23</sup>

#### 4.2.2. Environmental and Health



Figure 2. Disi project design (image: Gama.com.tr)

The expected supply rates fluctuated over the years of planning. In the June 2004 ESIA, the expected discharge rate was 150 MCM/year, but by 2008 a new estimate suggested a range between 100-120 MCM/year. No reasons were given for the lower withdrawal rates, but hydrogeologists interviewed by assessors indicated that the 150 MCM withdrawal rate was found to be too rapid to maintain an adequate standard of quality in the aquifer – faster pumping results in faster quality deterioration.<sup>24</sup> To protect the aquifer, the Jordan government announced it would not renew the agricultural licenses once they expired in 2012.<sup>25</sup> These private agriculture operations signed contracts with the government in the 1980s that permitted free water

<sup>21</sup> ESIA3, exec p.2; [http://geenergyfinancialservices.com/press\\_releases/view/338](http://geenergyfinancialservices.com/press_releases/view/338); <http://www.hurriyetdailynews.com/general-electric-to-quit-energy-partnership-in-turkey.aspx?pageID=%20238&nID=63183&NewsCatID=345>; <http://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=39528082>

<sup>22</sup> <http://static1.squarespace.com/static/506f165ae4b072c9aeb650ec/t/52938991e4b023ca7561a17e/1385400721404/englishannualreport-121105192406-phpapp02.pdf>; <http://www.seguraconsulting.net/amman-water>

<sup>23</sup> FrenchDevAgencyReport

<sup>24</sup> Interviews, October-November 2014

<sup>25</sup> Ministry of Water and Irrigation. Environmental and Social Assessment: Disi-Mudawarra to Amman Water Conveyance System. June 2004; Gama Energy Inc. 2008; Greenwood, R. (2011). Social, political, economic and health effects of the Disi aquifer on Jordanian society. Independent Study Project (ISP) Collection. Paper 1104; Namrouqa, H. Farmers should seal illegal agricultural wells by year end—Water Ministry. 9 July 2014. Jordan

extraction, which was upheld in a government decision in 2005.<sup>26</sup>

A 2008 ESIA produced by GAMA Enerji A.S., the project engineer, found that, “With the exception of naturally occurring radionuclides, the Disi water quality will comply with the drinking water standards established by Jordanian regulation.” This claim is only valid after Jordan revised its drinking water standards in 2008 and once Disi water is blended with an approximate 1 to 1 ratio with non-Disi water (a blending schedule was included in the aforementioned ESIA).<sup>27</sup> Therefore, Disi water by itself would not meet Jordan’s revised water schedule, and blended water only meets the standard because it was revised.

One benefit, and subsequent selling point, of the project as planned was reducing reliance on over-extracted water resources, particularly the Azraq and Amman-Zaraq basins in northern Jordan. As designed, the influx of Disi water was expected to eliminate the need for Khaw, Wala and Lajjoun sources in Amman. Local springs were to continue to supplement Amman water until they are scheduled to be reduced in 2017. EIB and AFD required Jordan to implement a Ground Water Reduction plan that provided relief to vulnerable aquifers. This plan was presented in Environmental and Social Management Plan 2.

#### **4.2.3. Social**

The primary purpose of the Disi project was to provide a reliable, safe source of domestic water for Amman where citizens have been living under a rationing program since 1988. Supporters and government stakeholders of the Disi project promoted it with emphasis on increasing the frequency of water delivery in Amman to 3-4 days weekly, if not continuous supply, for residents. Increasing water supply in Amman would help Jordan protect the Right to Water for citizens of Amman and potentially stave off potential unrest in Amman due to the lack of water availability.

### **4.3. Project as Implemented**

The Disi project reached full production levels of 105-110 MCM/yr in January 2014, a full year ahead of the planned schedule for a slow and measured ramp-up. Yet, the production spike did not result in the full scale of increased access predicted by the environmental impact assessment (EIA).

#### **4.3.1. Political and Economic**

Extracting water from the Disi aquifer to the citizens of Amman involves GAMA Enerji A.S., WAJ and Miyahuna. GAMA Enerji A.S. operates the wells in Mudawarra where water is extracted and the pipeline that ships water to the Dabuk and Abu Alanda reservoirs. Once in these reservoirs, Miyahuna blends the Disi water with water from Zai treatment plant in the Dabuk reservoir and water from Zara Ma'en treatment plant in the Abu Alanda reservoir. From here, the water is distributed to Miyahuna customers in Amman, which serves 98% of citizens in the Amman governorate, organized into 44 distribution zones that consist of 325 sub-zones, although 40% of these zones and sub-zones are not completely established.

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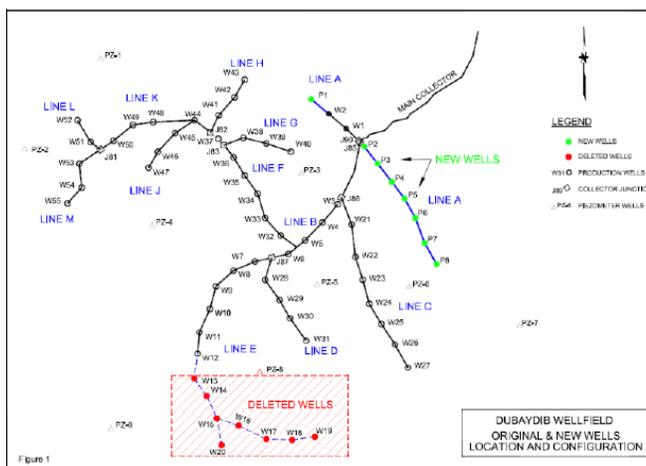
Times. <http://jordantimes.com/farmers-should-seal-illegal-agricultural-wells-by-year-end---water-ministry>; Omari, R. ‘Gov’t has no intention to reconsider decision on Disi farming investors’. 2 August 2011. Jordan Times. <http://jordantimes.com/govt-has-no-intention-to-reconsider-decision-on-disi-farming-investors>

<sup>26</sup> Daoud, R., Naber, H., Tarbush, M.A., Zuossous, R., Salman, A. and Karableih, E. (2006). Environmental issues of water resources. In *Water Resources in Jordan: Evolving Policies for Development, the Environment, and Conflict Resolution*. Ed. Haddadin, M. RFF Press. p. 100; Haddadin, M., Daoud, R. and Naber, H (2006). *Water and wastewater management: governance and policy framework*. In *Water Resources in Jordan*. RFF Press. p. 197.

<sup>27</sup> ESIA3 p. & ESIA4 p.

In return for GAMA’s investment in the pipeline, WAJ pays GAMA Enerji A.S. 0.92 JD (\$1.30 USD) per cubic meter of Disi water, even though the real cost of the Disi water is between 1-1.1 JD (\$1.41-1.55 USD) per cubic meter. Then WAJ sells the Disi water to Miyahuna for 0.45 JD (\$0.64) per cubic meter.

Miyahuna officers, who actively monitor water usage throughout greater Amman, cite the inadequacy of existing infrastructure as the primary factor limiting the effectiveness of the additional water supply from Disi. Roughly 40% of Amman’s water districts have not been established, meaning that revenues cannot be monitored<sup>28</sup>, cross-collection (people receiving double their allocated water by being set up on two different distribution lines) is persistent, and abandoned pipes drain water into soil. While continuous water supply was deemed a goal in implementing the Disi project, in reality, it would essentially deplete resources, depress revenues, and only temporarily improve access. Miyahuna has opted to maintain periodic supply, although at an increased rate, to reduce the flow of municipal water into illegal reservoirs and out of broken or unfinished pipes.



While Miyahuna saw an increase in water customers in 2014, this was because barriers to acquiring water meters were eliminated, including a major price cut for new meters. This increase in ‘customers’ does not necessarily correlate to an increase in users. This local government policy shift is a step towards protecting the Right to Water and is a positive human rights development. Previously, poorer families were priced out from acquiring individual water meters. This required several housing units to share a single water meter, which forced these families into the higher blocks of the graduated water tariff. Thus, these families were paying artificially high water tariffs, a problem that had been identified by foreign and international donors.<sup>29</sup> Reducing the barriers to acquiring individual water meters allows families to pay for their water use at the appropriate level of the graduated water tariff. Therefore, the primary increase in Miyahuna customers is from positive policy shifts and not from refugees residing in Amman.

#### 4.3.2. Environmental and Health

Although Disi began supplying water to Amman at an accelerated pace, no comparable acceleration was apparent in the decommissioning of corporate agriculture in southern Jordan. Farms that were to cease pumping Disi water in 2012 remained functional as recently as January 2015. This is concerning, because over-extraction of the Disi aquifer has been demonstrated to increase salinization rates, rapidly diminishing the quality of the water. While the salinity of water in Amman has dropped with the mixing of Disi water, it is expected to rise as the Disi aquifer is pumped at a rate of 100 MCM to Amman.<sup>30</sup> Furthermore, with the corporate farms continuing to operate, in addition to the water utilized in Aqaba city, as well as the proposed extension of the Disi pipeline that will transport an additional 30 MCM to northern governorates,<sup>31</sup> the pumping rate of Disi will triple over the coming years.

<sup>28</sup> Current meters monitor storage tank volume, which would not drop if continuous flow were supplied.

<sup>29</sup> <http://www.frp2.org/english/Portals/0/Water%20PEP%20Working%20Paper-Eng.pdf> p.31-32

<sup>30</sup> Note to previous use – see Hind’s paper below

<sup>31</sup> Jasem, A.H. et al. The fate of Disi aquifer as strategic groundwater reserve for shared countries (Jordan and Saudi Arabia). In Journal of Water Resources and Protection. October 2011.



Figure 3. Nov 9, 2009



Figure 4. Dec 30, 2014

(Sources: Landsat Look 8; Google Earth)

The elevated levels of radiation of the Disi water is of concern, even though it is being reduced with blending from other water sources. Jordan was aware of these elevated levels and passed revised water standards so that with necessary blending, the water delivered through Miyahuna would meet these standards. The increased allowable radionuclide exposure does increase citizens of Amman to greater risks of cancer, in particular bone cancer and Leukemia. What is equally disconcerting is that Disi water is being promoting by government and water sector officials as a “clean” water source, but have failed to disclose the information about the elevated radionuclides.

Jordan has not successively relieved vulnerable water resources with the implementation of the Disi aquifer. Only the Azraq basin has seen declines in abstraction rates. The Zai and Zara Ma’en water treatment plants continue to supply the same quantities to Amman as before, in order to provide blending water to dilute Disi’s radionuclide count. While Amman’s reliance on its traditional water resources may have been cut, these resources are still being pumped at the same rate, with water reallocated to local populations, Khaw to Zarqa, Wala to Madaba, and Lajjoun to Karak respectively. Therefore, Disi is not meeting one of its major goals in providing relief to vulnerable water resources and was required by EIB and AFD

The decision not to restrict pumping has been attributed to the influx of Syrians, but ESIA’s for the project have been citing “rapid population increase in Amman, Zarqa and Irbid” as a concern since 2004, and few actions have been taken to address municipal water needs in that time. Other solutions such as completing and repairing water infrastructure throughout Amman and other needed regions and instituting agricultural water use reform that prioritizes domestic water have not been implemented. Government estimates of refugee populations (1.4 million Syrians and 3 million total refugees) far exceed globally accepted population estimates (620,000 registered Syrian refugees; 100,000-200,000 unregistered Syrian refugees; 43,000 Iraqis; very small numbers of Palestinians, as they have not been permitted entry). Overinflating estimated refugee numbers has provided umbrage for continued pumping of overstressed aquifers while overlooking the sectors using the highest quantities of water and ignoring the non-pumping solutions that do not require additional water sources.

#### 4.3.3. Social

Since coming online, the Disi project has increased the amount of water provided to citizens of Amman and improved the consistency of delivery. According to data from Miyahuna, water delivery in October 2014 on average is up 10 to 11 hours as compared with 2012, depending on the area (11 hours in the East and 10 hours in the South and West). This increase was also confirmed through interviews with citizens

of Amman. According to data from Miyahuna, average water delivery in Amman is approximately 49 hours a week (51 hours in the East, 48 in the West, and 43 in the South).

While the increases in hours of available water delivery were raised about the same for the entire city, and while the average per week is fairly even, these increases have more impact on East Amman, which is traditionally poorer than other areas of the city. Therefore, this area relies heavier on municipality supplied water than the more affluent West Amman, where resident can afford to buy bottled and filtered water, especially for drinking. Thus, the increase in water delivery in East Amman may provide positive impacts that are not felt in the West.

These positive impacts may however be countered by increased risk. The increase in flow rates may lead to increased exposure to radionuclides, due to the elevated levels found in Disi water and delivered to citizens of Amman. This is particularly concerning in East Amman, as this community drinks water directly from the tap at a significantly higher rate. Furthermore, health risks to Amman residents derived from the absence of continuous flow, which resulted in waterborne illnesses deriving from intake of contaminated soils when pipes were empty, and bacterial accumulation in rooftop water tanks that sometimes run dry, persist. An additional health concern derives from the recent discovery that the Disi pipe linings have begun to peel away, leaving steel pipes exposed.<sup>32</sup>

The reliability of the increased supply has come into question for two primary reasons. First, the aquifer has been found to be two to five times less capacious than previously thought and the corporate farms in the south continue operating, limiting the aquifer's lifespan to an estimated 16 years. Second, because it requires blending to be drinkable, it relies on the availability of secondary sources, which remain questionable as they are drawn from depleted aquifers and from canals that supply water too turbid for treatment in the rainy season.

#### **4.4. Financial Backers**

The primary financial institutions backing the Disi Project are the European Investment Bank (EIB), French Development Agency (ADF), and US Overseas Private Investment Corporation (OPIC). EIB is committed to respecting human rights in its investments, but it only adopted this commitment in 2012, several years after Disi was commissioned. Since 2009 AFD has committed to carrying out human rights due diligence on its investments.<sup>33</sup> Again, this commitment is predated by the investment in Disi. OPIC has been upgrading its due diligence processes, but it does not have any human rights commitments or any established protocols for vetting the human rights impacts of its investments.

## **5. RATINGS**

This assessment is being completed during the operational phase of the Disi project. The project, both as it was planned and as it was implemented, is evaluated for human rights impacts. Evaluating the potential human rights impacts of the project as planned enables assessors to note where diversions from planned development resulted in negative impacts that may have been prevented had plans been followed. Both the planned (hypothetical) and implemented (actual) project are contrasted against a contextual examination of Jordan's water sector and its adequacy with regards to human rights standards. Looking at the impacts at different stages of the project provides insights into how context can change and how financial institutions should plan and anticipate these changes through proper human rights scoping and

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<sup>32</sup> Anti-corruption alerted the government about the steel lining pipes Disi. 4 September 2014. AmmanNews.net. <http://www.ammonnews.net/article.aspx?articleno=204834>

<sup>33</sup> <http://www.afd.fr/home/AFD/developpement-durable/DD-et-operations/droits-humains-developpement>

cataloging. This process is beneficial for both future projects within Jordan, and for other large-scale infrastructure projects, with the ultimate goal of mitigating negative human rights impacts and maximizing positive ones.

Since this was a retroactive assessment, the project is evaluated as it was planned and as it was actually implemented. This process allows for evaluating whether the planning process adequately considered the contextual situation in which the project was being implemented and whether modifications to project design affected the project’s ultimate human rights impacts.

In human rights terms, these unmet project goals pose supplementary risks to human welfare and dignity. The overall impact on the Right to Water is found to be negative (score -3.59) as the project has been implemented, while even as planned it was expected to have only a marginally positive impact (score 1.47).

Right	Project as Planned	Project Implemented
<b>Right to Adequate Supply of Water/Sanitation</b>	<b>1.47</b>	<b>-3.59</b>

The Right to Water itself is comprised of specific water components and general human rights principles across different segments of the identified rights holders. Below is how these components, principles, and rightsholders combined to determine that the Disi project as a whole has a negative effect on the Right to Water for the identified rightsholders.

This is not to indicate that no one has experienced human rights improvements in the implementation of the Disi projects, however. When disaggregated by rightsholder, agricultural producers have seen rights protected, and residents of East Amman have seen sufficient improvements in access to water to register as positive. However, these positives are overwhelmed by risks, as outlined in Table 2.

Table 2 Right to Water Impacts of Disi

Right to Water Element/ Principle, Explanation	Affected Human Rights	Impact Rating
<b>Sufficient</b>		
Residents of Amman did not have access to sufficient water prior to the Disi project, with a per capita average of 83m <sup>3</sup> per capita per day (dipping below 20m <sup>3</sup> per capita per day in low income households). A major aim of Disi was to increase sufficiency.	Right to Water - Quantity	Green
East Amman Residents – are now receiving water 51 hours per week, eliminating shortages that predated the project.	Right to Water – Quantity (may need to change this to green)	Yellow
West Amman Residents – have also seen an increase improvements in supply but the impacts are not as significant because this population does not rely on municipally supplied water for drinking.	Right to Food; Right to an Adequate Standard of Living	Green
Agricultural water users – who were expected to decrease water usage, have not seen decreases in water allocations to agriculture		

<b>Safe</b>		
<p>Biota – No change from baseline</p> <p>Chemical substances – salinity is lower in Disi water than other water sources for Amman, however salinity is expected to increase rapidly due to overpumping.</p>	Right to Health	
<p>Radiological elements – naturally occurring uranium and thorium in the sandstone aquifer have leached into Disi water, elevating Ra-226 and Ra-228 levels above WHO and Jordan safe drinking water standards. Mixing brings water to revised Jordanian standards but not WHO standards. There are no mixing options for any turnouts prior to Amman. One to one mixing is not always possible during rainy season because turbidity makes treatment of surface water infeasible. Additionally, existing resources are overtaxed and may not be available in perpetuity.</p>	Right to Health Right to a Clean Environment	
<p>Because children are more susceptible to health risks associated with radiation, they are particularly affected.</p>	Rights of Children	
<b>Acceptable</b>		
<p>Water taste has reportedly improved, however 60 percent of Jordan residents do not trust municipal water sources. Those who can buy bottled water elect not to drink water supplied through the municipal system. Others purchase systems to filter the tap water before drinking it. This mitigates health risks for them but does not improve the acceptability of water or protect poor water users from health risks associated with water quality.</p>	Right to Water - Acceptability (Should this be green)	
<p>Additionally, water users may not find the cost of Disi water acceptable. Current users pay roughly 10% of the actual cost of municipal water. Disi is among the most expensive water resources ever tapped in Jordan, and costs are slated to rise as fuel subsidies are phased out. The operating cost of Disi increased 30% when energy tariffs increased in 2014. They are slated to continue increasing until 2017 (Interviews).</p>	Right to Political Participation Right to Water - Acceptability	
<b>Accessible</b>		
<p>Accessibility is high throughout Amman, where an estimated 98% of households have piped water. Refugees represent an exception, as many of them are in temporary housing. However, this is not an effect of Disi but rather of contextual challenges in Jordan. The Government of Jordan was expected to finish the establishment of Amman’s water districts before Disi came online, which was not done.</p>	Right to Water - Accessibility	
<b>Affordable</b>		

<p>The UN estimates that 3% of household income is the maximum rights-respectful expenditure on water. This is not currently exceeded by Jordanian water tariffs. However, pumping Disi water is highly energy intensive, and the cost per cubic meter is expected to rise as fuel tariffs are eliminated. Disi water is already unaffordable for Miyahuna – the company states that if it does not receive additional subsidies from the government it will cease to be solvent (the company is not permitted to change tariffs charged to customers).</p>	<p>Right to an Adequate Standard of Living</p>	
<p>If tariffs to customers do increase, Jordan’s poor, as well as refugee communities, will not be able to afford water. Refugees currently spend an average of 4% of their monthly income on utilities. Any increase in water or fuel tariffs would significantly exceed the maximum rights-respectful expenditure on water. Ensuring ongoing affordability requires states and supply, distribution and conveyance companies to exploit resources in ways that prioritize human rights over other (often financial) interests and over time. This is not in evidence in Jordan’s agriculture sector.</p>	<p>Freedom from Discrimination – the Poor</p>	
<p><b>Non-discriminatory</b></p>		
<p>The majority of those who do not have or cannot attain access to adequate water are poor and must make choices between water and other human rights such as food, shelter, or health care. In Amman, the poor are drinking low-quality Disi-blended water because it is the only option they can afford. The wealthier households access alternative water sources of higher quality.</p>	<p>Freedom from Discrimination – the Poor</p>	
<p>That Disi has been presented as an essential emergency supply of water in the face of population influx is undermined by the realities of Jordan’s water sector, including leakage and usage data. Jordan’s water usage is dominated by the agricultural sector, which generates an estimated 3% of GDP while using over 60% of the country’s water. Meanwhile, leakage rates from water systems in the northern governorates where Syrian refugees are concentrated reach up to 75% and in Amman the non-revenue water rate is over 35%. Addressing leakage and distribution shortcomings would more than compensate for population influx. State pronouncements that blame Syrians for the failure of Disi to meet water allocation expectations have contributed to tension and resentment in communities, which have reportedly resulted in conflicts in some areas, potentially affecting security of person.</p>	<p>Freedom from Discrimination – Syrians in Jordan</p>	
<p><b>Participatory</b></p>		
<p>Amman’s poor lack political representation and decision-making powers, which hampers their knowledge of their rights and ability to bring about changes.</p>	<p>Right to Political Participation, Freedom from Discrimination</p>	

<p>Achievement of universal access to water is to be participatory, egalitarian and democratic. The country's water allocation strategy, which continues to prioritize agriculture over domestic uses, undermines the participatory nature of Right to Water attainment, giving strength to certain voices over others.</p> <p>Citizens have a right to voice concerns and seek information from the proponents of water projects. Information about the quality of Disi water and the capacity of the aquifer were withheld from the public.</p>	<p>Freedom from State Interference in Private Life</p> <p>Freedom of Expression, Right to Information</p>	
<p><b>Accountable</b></p>		
<p>The absence of water quality data in Amman (European Investment Bank is the only current source of quality data, available on request) reflects a lack of accountability on the part of Disi project proponents to Disi water users. The absence of public discourse about planned fuel and water tariff increasingly compounds an accountability failure in approving the Disi project without clearly stating the projects costs and benefits, as well as potential risks, to the Amman public and soliciting feedback.</p>	<p>Right to Information</p>	
<p><b>Sustainable</b></p>		
<p>Disi is not economically, environmentally or socially sustainable.</p> <p>Tariffs cover less than 10% of the cost of Disi water, threatening the viability of the state water company. Additionally, pumping water into an incomplete municipal network, where broken pipes, incomplete lines, water theft and overlapping distribution mechanism cause an estimated 35% of revenue-generating water to be lost affects both the environmental and economic sustainability of the project.</p> <p>The tapping of a non-recharging aquifer is inherently unsustainable environmentally; elevating pumping rates above planned levels further threatens environmental sustainability. Agro-industry was to be halted in the south, and satellite imagery from January 2015 demonstrates that this has not been done. Human rights obligations are ongoing and do not expire – the rapid depletion of Disi may violate the rights of Amman's children by exhausting a resource in such a brief time. The rapid pumping of Disi water is likely to accelerate salinization, mitigating the positive effect of reduced salinity of wastewater reused on crops after treatment at As Samra Water Treatment plant.</p> <p>The social sustainability of Disi hinges on its contribution to a national water plan that ensures access to water for everyone. Currently Amman's water allocation system prioritizes areas that have seen social upheaval in recent years. It is unclear how long Disi water and other sources supplying Amman can be pumped at current rates, calling into question the water allocation regime's social sustainability.</p>	<p>Right to Water</p> <p>Economic Sustainability</p> <p>Environmental Sustainability / Right to a Clean Environment</p> <p>Social Sustainability</p>	

The human right to water, as all human rights, interacts and intersects with other human rights. This assessment also evaluated the impacts of these associated rights. Positive impacts foreseen for these associated rights have not been achieved in implementation.

Right	Project as Planned	Project Implemented
Freedom of Expression	-	-5.00
Right to Health	-1.33	-8.80
Right to an Adequate Standard of Living	3.33	-4.00
Rights of Children	-	-
Right to Public and Political Participation	-1.57	-9.00
Right to a Clean Environment (Right to Water and Environmental Sustainability)	5.00	0.00

## 6. MITIGATION AND MONITORING

The project has been built and loans have been disbursed, significantly limiting the leverage that international investors have over the project. However, as demonstrated through the impact assessment, the project as implemented is having a negative rights impact. Investors, as well as donor countries that are highly involved in Jordan’s water sector, can encourage and assist the government in maximizing the potential benefits while mitigating the risks.

NomoGaia is not the first organization to evaluate aspects of Jordan’s water sector; however it is the first to conduct a human rights impacts assessment that focuses on rightsholders and their human rights.<sup>34</sup> Our recommendations for ensuring that the Disi project is a rights respectful project are drawn in part from previous studies and reports on Jordan’s water sector from both Academics and donor states.<sup>35</sup> Steps to accomplish this include holding the Jordanian government accountable for terms within the lending agreements while also pushing for and assisting in reforms that will improve the efficiency of Jordan’s water sector.

The recommendations listed below are directed toward EIB and ADF, because they included key stipulations in loan documents requiring actions of the Government of Jordan. However, OPIC has a responsibility to carry out due diligence on its investments and loans, to modify loan terms to ensure that investments respect human rights, and to follow up on those loan terms. It is not reasonable to retroactively assign responsibilities to OPIC for this project, but OPIC should recognize such responsibilities in the future.

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<sup>34</sup> For instance there have been numerous reports that focus on water tariffs, water resource management, agricultural management, refugee water availability, etc.

<sup>35</sup> OCED, Jordan: Overcoming the governance challenges to private sector participation in the water sector; Molle, Irrigation in the Jordan Valley: Are water pricing policies overly optimistic?; Venot, Groundwater Depletion in the Jordan Highlands: Can Pricing Policies Regulate Irrigation Water Use? USAID, Audit of USAID/Jordan’s water and wastewater infrastructure project (Jan. 2015); USAID, Jordan Fiscal Reform: Project II: Water Public Expenditure Perspectives Working Paper (Oct. 2011).

## **6.1. Recommendations to EIB and ADF**

### **6.1.1. Transparently monitor water quality**

Per loan agreements, water quality monitoring is ongoing. The European Investment Bank (EIB) provided data on elevated radionuclide levels on request.

- Lenders should make Disi water quality publicly available, which is inline with the human rights principle of transparency, potentially in collaboration with the Ministry of Water and Irrigation, on the government website.
- Publicly conducted monitoring should ensure that the water delivered by Miyahuna is of quality to meet the human rights standard of adequacy.
- To this end, lenders may be encouraged to assist the Government of Jordan in revising drinking water standards.

### **6.1.2. Use Disi compliance to preserve renewable water resources**

One of the primary justifications for the high-cost Disi water project was that renewable water resources in Jordan, in particular the Amman-Zarqa and Azraq basins, would be given time to recovery from decades of over-extraction. While Amman has reduced its reliance on these water sources, other municipalities are now pumping them at comparable rates, depriving the basins of needed relief. In the Environmental and Social Management Plan (Part 2), the AFD and the EIB obligated the Ministry of Water and Irrigation, to institute “a Groundwater Reduction Plan”, discontinuing extraction from the Azraq basin and reducing extraction from the Amman-Zarqa basin once the Disi pipeline was operational. The plan calls for quarterly and annual reporting on the extractions from both basins.

- Lenders should require that these reports are delivered. This information should be provided to the public so that it easily accessible, potentially posted on the Ministry’s website.
- If the reports provided by the Ministry demonstrate that Amman is still receiving water from the Azraq and/or water abstraction from the Amman-Zarqa basin have not been sufficiently reduced, then lenders should publicly investigate why the plan was not carried out.
- Lenders should then work with the Jordanian government to produce subsequent plans to meet the goals of aquifer protection.

### **6.1.3. Close large-scale farms using the Disi aquifer**

The Disi aquifer is a non-renewable aquifer, thus it is an inherently unsustainable solution to Amman’s and Jordan’s water issues. It is also under stress, as agricultural users slated to lose their water licenses in 2012 have continued to operate, even as the Disi project has increased extraction. Photo evidence from January 2015 shows that several of these farms continue to operate. The longer these farms extract water from the Disi aquifer the less effective the project will be for Amman, both in terms of water quantity and quality.

- Lenders should push for the closure of these corporate agricultural operations as it was presented in the ESIA’s.

## **6.2. Recommendations to donor states**

### **6.2.1. Increase collaboration and communication among national**

The EIB, AFD and OPIC, each providing financing for the Disi project, are all agencies that were created by States with the goal of advancing these States’ interests through development. Supplying Jordan with an expensive source of water without adequately addressing other deficiencies within Jordan’s water sector

not only undermines the Disi project, but it also undermines the efforts these same States are taking in correcting these aforementioned deficiencies.

For example, USAID has stated that Jordan has enough water “to provide continuous domestic supply, but only through some combination of reduced allocation to agriculture, reduced NRW, and improved management of demand.”<sup>36</sup> Continuous domestic supply would go a long way in protecting Jordanians’ human right to water. USAID has worked to assist Jordan in these areas that will allow for continuous domestic water supply. However, when OPIC, another US governmental agent, provides unconditional financial support to the Disi project it relieves pressure on the Jordanian government to implement necessary water sector reforms, reducing the leverage for implementing these reforms. In short, one US entity is appears to be undermining the other in achieving the goal of a Jordan that protects the human rights to water. This applies to the EIB and AFD as they have also funded other projects within Jordan’s water sector.

### **6.2.2. Repair (and complete) urban water infrastructure**

Tapping the Disi aquifer, as well as planning for the Red-Dead project, highlight that Jordan lacks adequate water resources, but significant water is lost between the source and the individuals that rely on the water. This is due infrastructure failures throughout the country and particularly in Amman. Jordan has set goals for reducing non-revenue water in its National Water Strategy. Miyahuna officials said that as much of 40% of Amman’s water districts have not been completed. This means that water usage cannot be measured, there is incomplete infrastructure that results in water being delivered to broken and damaged pipes, and proper tariffs cannot be collected to ensure the sustainability of the system as a whole. This results in over 35% non-revenue water.

There is an ongoing collaboration between the Jordan water sector and international donors (EIB, the Italian government, the German Development Bank (KfW), USAID, and the World Bank) to restructure and rehabilitate the entire water infrastructure in the Greater Amman area.<sup>37</sup> Officials in Jordan’s water sector admitted that some of these projects have faltered due to funding issues, particularly in southern Amman. Therefore, the same States that are funding the Disi projects also know that this water is being sent into a water infrastructure that has seriously deviancies.

Lenders and donor countries, in particular the United States, Germany, France, and Italy, have interests both in the infrastructure projects and the Disi pipeline.

- These lenders and donor states should ensure that these infrastructure projects are being effectively implemented and that this water infrastructure program completely establishes Amman’s 44 distribution zones and 325 sub-zones.

### **6.2.3. Reform the agriculture sector**

Jordan allocates between 60 to 85 percent of it total water for agriculture. This significant use of water only contributes 3% to Jordan’s GDP. The inefficient use of water resources for agriculture strains Jordan’s water supply for all the country’s uses, including domestic and industrial. Jordan’s National Water Strategy calls for agricultural reforms, as well as USAID, which will ensure the most efficient use of the Disi pipeline. International donors should provide technical and financial support for reforming Jordan’s agricultural water use.

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<sup>36</sup> USAID, Jordan Fiscal Reform: Project II: Water Public Expenditure Perspectives Working Paper (Oct. 2011). P. 37

<sup>37</sup> El-Naser, Hazim K., Management of Scarce Water Resources: A Middle Eastern Experience (Wit Press, 2009). P.

- Reform agricultural tariffs and water allocation policies, particularly in the Jordan Valley region, that incentivize harvesting of water efficient crops over water inefficient ones.
  - Change agricultural water tariffs so that treated water is more cost effective than freshwater.
  - Institute increasing block tariffs (IBT) on agricultural water users, which unlike domestic water IBT is a policy that encourages efficiency while protecting poorer farmers.
  - Implement water policies that increase the price of water for more water intensive crops and lower prices for more water efficient crops.<sup>38</sup>
- Support the Ministry in enforcing By-Law Number 85 that authorizes the halting of illegal water extraction in the Highland region.
  - Provide support to ensure that all meters are protected and operational.
  - Provide funding so that WAJ can develop and maintain an effective enforcement regime.
  - Assess whether the lowering the threshold for free water, currently set at 150,000 meters cubed, is adequate to protect these vulnerable aquifers.
  - Investigate the effectiveness of potential well buy-out programs.
- Implement an insurance system that enables farmers to transition to water efficient crops to eliminate the threat of lost revenues due to new crops and techniques.

#### **6.2.4. Revise Project Vetting Procedures**

Environmental and social impact assessments completed for this project did not consider impacts on the end-users of the water that the project delivered. This highlights the need for international financiers to understand the Guiding Principles and how to effectively implement them into their lending processes.

At a minimum, organizations such as OPIC, AFD, and EIB, are on level with commercial banks and lenders and have a responsibility to respect human rights. However, as institutions that are either agencies of particular states, or its membership is composed of states, these institutions should understand what states' responsibility to protect entails, both home and host states, and ensure that they are not preventing these states from accomplishing their duties.

Furthermore, as part of the lending process, international financiers, including AFD, EIB, and OPIC, should ensure that states and corporations receiving funds have policies in place in order to fulfill their responsibilities as laid out in the Guiding Principles. In this case, financing that was provided to GAMA Enerji A.S. should have been conditioned on its ability and commitment to respect human rights and financing provided to the government of Jordan should be conditioned on Jordan's ability and commitment to protecting human rights in regards to the Disi pipeline.

OPIC includes its human rights responsibilities within its Environmental and Social Policy Statement. OPIC should create a human rights policy statement in line with Principle 16 of the Guiding Principles that is independent of OPIC's Environmental and Social policies. Multiple and expansive environmental and social assessments were conducted on the Disi project and failed to evaluate the comprehensive human rights impacts. This highlights the importance of independent human rights policies and processes.

Also, OPIC's Procedural Manual states that human rights screening is based upon the statutory requirements of the Foreign Assistance Act. OPIC should adapt human rights policy and procedures that encompass the full spectrum of human rights as outlined in Principle 12 of the Guiding Principles.

EIB, as an EU agent, is uniquely bound by European human rights standards. EIB has reviewed its existing social performance in light of the Guiding Principles and reported of the development of the Guiding

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<sup>38</sup> All three above sub-recommendations are drawn from USAID (2011), p. 34

Principles in practice. EIB should develop a publicly available policy statement that articulates its commitment to respecting human rights as presented in Principle 16 of the Guiding Principles. Also, it should ensure that its social performance standards ensure that all investments enable governments to protect human rights and companies that receive funding to respect human rights with effective human rights policies and procedures.

AFD has used the International Bill of Human Rights to develop its CSR framework. Within this framework, human rights risks are assessed and used to determine whether a project is funded. In addition to the International Bill of Human Rights, the AFD should also commit to the UN Guiding Principles and explain how its current framework upholds the principles found within them.

## 7. CONCLUSION

The sentiments of the Arab Spring resonated with some in Jordan, while the power structures remained intact. Protests in Jordan were driven by commodity prices, in particular oil and water. Water availability has the potential to instigate instability in a country that has managed to remain stable despite chaos around it. However, Jordan's current water policies are not sustainable.

Jordan has a water crisis that can lead to civil unrest in Amman and throughout the country. This crisis is rooted in Jordan's lack of water resources, but this is not the only driver of the crisis. Jordan's water crisis also is driven by a failure to reform water sector policies and the lack of infrastructure to efficiently deliver water to citizens throughout the country, and especially Amman.

Any water project in Jordan that fails to address water tariff and agricultural water use reform and needed infrastructure repair and completion will have a negligible or negative impact on human rights, which are already threatened by Jordan's water sector. First, failing to address the inequitable and inefficient water tariff and agricultural water use policies perpetuates policies that favor political elites over the population at large, in particular poor and vulnerable populations, thus putting interests of some ahead of the human rights of many. Second, pumping any additional sources of water through Jordan's, and particularly Amman's, incomplete and dilapidated water infrastructure is wasting valuable water resources that will be hard to replace, affecting Jordan's ability to protect its citizens' human right to water, both currently and in the future. Finally, projects that deliver alternative sources of water to Amman, such as Disi, are cost-ineffective sources of water. The failure to address failing water policies and aging and incomplete water infrastructure magnify the cost of these expensive alternatives. These investments are being wasted, which inhibit Jordan from protecting Jordanians' Right to Water as well as other human rights.

As it is operating, the Disi pipeline is stopgap measure for Jordan's water crisis. It is an alternative water resource that is protecting the interests of Jordan's political elite and being wasted in Amman's incomplete water infrastructure while also exposing water users in Amman to elevated levels of radionuclides. This internationally funded project, without further interventions, is only prolonging a dangerous status quo in Jordan. Without real reforms to Jordan's water sector, the threat to Jordan's water availability will continue. These short-term water solutions allow the threats of social instability to linger. Nevertheless, if the international community who funds and supports Jordan's water sector supported and encouraged reforms to Jordan's water sector, the Disi project could be a bridge to a sustainable water policy that eliminated the constant threat of civil unrest.

Jordan may need to acquire alternative sources of water in order to protect the Right to Water. However, in order for these types of project to be rights respectful, water sector policies and water infrastructure must be addressed. Otherwise, funding of such projects will not achieve a Jordanian government that is able to protect the Right to Water and the potential for civil unrest will remain.

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<a href="https://books.google.com/books?id=yfjAwAAQBAJ&amp;pg=PA26&amp;lpg=PA26&amp;dq=disi+jordan+bot+25+years&amp;source=bl&amp;ots=-TRF7DhVxG&amp;sig=FojOMXILohVKi1loIPCXObqGenw&amp;hl=en&amp;sa=X&amp;ei=OYy4VIHfIsXjoASVi4HoAw&amp;ved=0CC4Q6AEwAg#v=onepage&amp;q=disi%20jordan%20bot%2025%20years&amp;f=false">https://books.google.com/books?id=yfjAwAAQBAJ&amp;pg=PA26&amp;lpg=PA26&amp;dq=disi+jordan+bot+25+years&amp;source=bl&amp;ots=-TRF7DhVxG&amp;sig=FojOMXILohVKi1loIPCXObqGenw&amp;hl=en&amp;sa=X&amp;ei=OYy4VIHfIsXjoASVi4HoAw&amp;ved=0CC4Q6AEwAg#v=onepage&amp;q=disi%20jordan%20bot%2025%20years&amp;f=false</a> (p.26)
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Interviews: Amman residents, hydrogeologists, engineers, Ghazi Khalil Reem Maysoun Zoubi Bassam Saleh Maen Bawab, USAID personnel