TOWARD AN ASSESSMENT OF THE SUSTAINABILITY OF WATER GOVERNANCE IN
ISRAEL USING AN INTEGRATIVE SUSTAINABILITY ASSESSMENT APPROACH

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i. Abstract

Water governance is a key policy issue for Israel primarily due to scarcity of water in the Country and broader regional environmental, economic, political and social challenges. In recent years a concerted effort to maintain water supply has lead to large-scale investment in alternative technologies such as desalination and treatment/reuse of grey water and wastewater. In addition, Israel prioritizes water allocations for agriculture, industrial and domestic uses. This research project seeks to shed light on these developments from an integrative sustainability assessment perspective. A sustainability analysis of this kind has not been previously completed for Israel. This project contributes to an initial sustainability assessment of Israel water policy through an evaluation of the Country’s most recent master plan. Using policy documents and primary observations from site visits to water infrastructure at Mekorot Visitor's Centres this project evaluates water policy relating to resource maintenance and efficiency, as well as socio-ecological civility and democratic governance. Key recommendations include increasing public involvement in decision making, building social capacity for involvement in the water sector and clarifying plans for aquifer rehabilitation.
1.0 Introduction

1.1 Context

The highly developed nature of domestic water governance for the State of Israel provides an opportunity for investigation from a sustainability assessment perspective. This report will focus on two key areas of sustainability: resource maintenance and efficiency as well as socio-ecological civility and democratic governance (Gibson, 2006). These areas of sustainability were selected due to the availability and accessibility of information for evaluation purposes. As well they represent areas of concern identified by various stakeholders in Israel. Resource use has been more of a concern from the government and industry perspective while social involvement and democratic governance has been a concern for non-governmental stakeholders such as environmental non-profits and citizen groups (Helmer and Ya'ayon, 2012; Magen, 2002). Governance in this context acknowledges framing the decision-making process to include more than government and to define the system with reference to the process and actors in a wider sphere of influence (Pierre, 1997; Stoker, 1998). More detailed information will be provided regarding governance in the literature review (see section 2.3).

Israeli water governance is a key policy issue primarily due to the natural resource context of the country. Climatically, Israel is in a semi-arid zone with a mean rainfall of 25-1000 mm. Precipitation follows a steep negative gradient from north to south (Kay
The main sources of fresh water are the coastal aquifer, mountain aquifer and the Sea of Galilee (Lake Kinneret) (Figure 1). There are other local aquifers and brackish sources which supply water and are of greater significance to overall supply in the Negev desert region of the south. In addition to the physical geographic context, the distribution of population in Israel also has an influence on the domestic water policy system. The higher population in the coastal region puts more stress on the coastal aquifer in terms of supply of drinking water and creation of wastewater (Brenner, 2012). While the Negev desert in the south has a lower population and larger tracts of agricultural land. There is redistribution of drinking water and wastewater nationally through the National Water Carrier (Feitelson and Rosenthal, 2012). The National Water Carrier is a water transport system which conveys water from the relatively water-rich part of the country in the north to the water-poor part of the country in the south through a series of connected pumping stations and pipelines (Figure 1; See Appendix 1 for a detailed map of water infrastructure operated by Mekorot, the Israeli National Water Company). Secondary pipelines carry water and wastewater in an east-west direction (Figure 1).
Figure 1: Map showing major water sources for Israel and the National Water Carrier (NWC). Major sources of fresh water are the Coast Aquifer, Mountain Aquifer and Sea of Galilee (Lake Kinneret). The main pipeline of the NWC is shown which conveys water from Lake Kinneret to the populations in the centre (Tel Aviv – Jaffa) and south of the country (Be’er Sheba, Arad and beyond) (Feitelson and Fischhendler, 2009).

It should be noted Israeli water governance is also of interest for geopolitical reasons (Feitelson and Fischhendler, 2009; Tal, 2006). It is relevant to consider agreements signed under the Oslo Treaties signed in the mid-1990s between Israel, Jordan and the Palestinian Authority in regards to shared water resources in the Jordan River Watershed and the Mountain Aquifer. Under these treaties a joint management regime would be established and to date this has been partially implemented (Feitelson and
Fischhendler, 2009). Under these agreements water infrastructure and provision was to be cooperative with connections made between the National Water Carrier for supply and treatment of water from the Mountain Aquifer for Palestinian and Israeli communities (Fischhendler, Dinar and Katz, 2011). Provision of water services to Palestinian Authority (PA) by Israel was to be deducted from a taxes collected by Israel for the PA (Fischhendler, Dinar and Katz, 2011). In the post Oslo era, connections between Israeli and Palestinian water provision systems have been largely decoupled and provision of water services transferred to each respective government (Fischhendler, Dinar and Katz, 2011). Further, under agreements Israel is allowed to pump from the Yarmouk River in the winter (Figure 2). This water is returned to Jordan in the summer and stored in Lake Kinneret. Israel is allowed to continue to use boreholes in the Arava desert located on the Arava aquifer shown in Figure 2 which are on the Jordanian border (Feitelson and Fischhendler, 2009). Jordan is entitled to an equivalent amount of water that Israel uses from the Jordan River South of Lake Kinneret (Feitelson and Fischhendler, 2009). Allocations under these agreements are built into the water budgets of current master plans in Israel (Water Authority, 2011).
Figure 2: Map of some of the features of water sharing agreements negotiated as part of the Oslo Agreement between the Palestinian Authority, Israel and Jordan (Feitelson and Fischhendler, 2009). The Joint Water Committee (JWC) which includes representatives from Palestinian Authority and Israel administers water and wastewater projects in the West Bank.
The focus of this research will be solely domestic water governance and will not focus on the larger geopolitical or inter-boundary water governance unless it is in the context of a domestic issue (For study limitations see Section 3.4). As well, this project will not include a discussion of resource equity and fairness concerning the allocations of regionally shared water resources mentioned above due to the limited resources and scope of this master’s project. This project will not include an analysis of policies and water governance in regions governed by the Palestinian Authority (PA). The PA has its own jurisdiction and plans in regards to water resources which were not included as part of the scope of this project (Alsharif et al., 2008). This decision was made by the researcher due to concerns with availability of primary data where the government resources of the PA water authority are not available in English and concerns over the limited scope of this study. Water is a trans-boundary resource and, considering the political and security issues of the region future agreements regarding water, governance and management will be necessary (Aliewi and Assaf, 2007). In future, extensive research will be required to determine the sustainability of current and future agreements including issues of equity and fairness as these resources become available for study and should integrate data from all parties involved including Jordan, Israel and the Palestinian Authority (Section 5.1).

The main functional focus of water governance in Israel is that of supply for domestic use and maintaining adequate quantities is of primary concern (Saleth and Dinar, 2000). Several key influences to meeting and maintaining this supply have been demographic,
economic and natural climatic cycles such as droughts. In recent years a concerted effort to maintain this supply has led to large-scale investment in alternative technologies such as desalination and treatment/reuse of grey water and wastewater (Tal, 2006). In addition, Israel prioritizes water allocations for agriculture, industrial and domestic uses and regulates the price each user pays for water (Becker and Lavee, 2002; Rejwan, 2011). Policy priorities to maintain agriculture as a strategic resource and promote development in the southern part of the country have had an influence on any redistribution dynamics of water (Water Commission, 2002, 3; Water Authority, 2011, 35). There is more demand from agriculture in the south and higher demand from domestic drinking water in the central coastal region (Brenner, 2012). The stakeholders who include the agricultural lobbies, unions and organizations associated with these water uses influence the planning and institutional context of water governance (Fischhendler and Heikkila, 2010).

The management of water in Israel is highly institutionalized and regulated which provides an interesting opportunity to study the governance of a natural resource. Israel has a centralized national planning focus in regard to water reflected in laws, plans and policies. Most significantly, this can be seen in the Water Law of 1959 and the creation of the Water Authority as an administrative body to oversee the domestic water sector (Menahem, 1997). The majority of Master planning and decision making is completed at the national level. Management and supply issues are dealt with in a national context and municipalities serve as liaisons from suppliers to customers (Rejwan, 2011). The various government agencies involved in areas of public health, finance, the
environment and recreation must collaborate and share jurisdiction of various aspects of the water sector (Rejwan, 2011).

There have been some significant developments that have occurred in the Israeli water sector in the last fifteen years including, but not limited to, the establishment of the Water Authority and related institutional changes, significant price reforms and the decision to use desalination to meet national demand (Tal, 2006). This research project provides an evaluation of two sustainability issues: resource maintenance and efficiency, and socio-ecological civility and democratic governance, have not been explored in the literature to date.

1.2 Purpose

The purpose of this research is to evaluate current Israeli water governance in the areas of resource maintenance and efficiency as well as socio-ecological civility and democratic governance. As well, it will serve as an application and a test of the suitability of two of Dr. Robert Gibson’s sustainability criteria (Gibson, 2005; please see section 3.0 Methodology for a more detailed account of the framework and adaptations) to a domestic natural resource issue and contribute to the growing body of literature on sustainability assessment.
1.3 Research Goals

1. To adapt Gibson’s Sustainability Assessment Criteria through the development of a list of key questions that specifically addresses the evaluation of a water governance regime.

2. To evaluate Israel’s water governance processes through document analysis and observational evidence (see section 4.0) using two of Gibson’s criteria (described above) and the questions developed based on the criteria for analysis purposes (see section 3.3).

3. To make recommendations for improvements to water plans and policies administered by the Israeli Parliamentary Review Committee and Water Council.

2.0 Literature Review

The purpose of this section is to identify and compare conceptualizations of sustainability and introduce concepts related to resource governance which contribute to the methodology used in this project (Section 3.0). Each section will review key contributions to sustainability or resource governance and the final section (section 2.5) will provide a map that guides the reader through the conceptual foundations of this project.
2.1 Sustainability and Sustainable Development

The concept of sustainable development was popularized and further developed by the World Commission on Environment and Development (WCED) and the resulting report from the commission’s proceedings *Our Common Future* (Cohen et al., 1998). Sustainable development and sustainability have been defined in many different contexts over the past twenty years (Daly, 1990; Hopwood, Mellor and O’Brien, 2005; Lehtonen, 2004). A study by Glavic and Lukman provides a useful clarification and categorization of some of the terms associated with sustainability (2007). There is, however, disagreement on a discrete definition of the concept or acceptable standards of this type of development (Cohen et al., 1998; Mebratu, 1998; Redclift, 2005). In response to this disagreement, Faber, Jorna and Van Engelen, aimed to better understand sustainability using a “study of conceptual foundations” whereby they established that there are three main elements of the definition of sustainability which include the determination of what is sustainable or the ‘artefact’, a notion of innovation or change or ‘goal orientation’ and the relationship with the surrounding environment (2005). The authors followed definitions of sustainability through the survey of organizations and the examination of the literature and determined it ranged from a static view of a goal to a more dynamic process oriented toward continual improvement (Faber, Jorna and Van Engelen, 2005). Others have preferred to focus on sustainable development in terms of being the practical manifestation of its drivers in scientific knowledge (Cohen et al., 1988). In a paper by Goodland, where the focus is
environmental sustainability the author discusses some of the contributions of economic and biological theory to thoughts on sustainability (1995). The author explains the influence of scale, seeing human economic activities as part of the subsection of the finite environment allowing for one to consider the importance of valuing the underlying biological systems that maintain resources (Goodland, 1995). This leads to various connections to ecological thinking that model sustainability under the guise of ecosystems with characteristics such as carrying capacities and influences to growth like trade and technology (Rees, 1996).

Through the evolution of sustainability thinking, certain disciplines have favoured using the term sustainability rather than sustainable development. This is due to sustainable development’s connotations of gradual behavioural change and the importance placed on socio-political and distributional issues instead of curbing consumerism (Robinson, 2004). This project will primarily refer to sustainability as a conceptual entity in line with the terminology used in the chosen framework developed by Gibson (2005) detailed in the methods section (Section 3.0).

2.2 Contrasting Conceptualizations of Sustainability: Pillars and Integrative Assessments

Another quality of sustainability, relevant to this investigation, is its characterization as an entity that combines aspects of human development such as socio-economic issues with that of ecological or environmental implications (Hopwood, Mellor and O’Brien,
2005). This approach highlights specific aspects that contribute to sustainable development. These three aspects were conceptualized as pillars of sustainability at the UN World Summit on Sustainable Development with a fourth pillar of cultural or institutional sustainability being added to the environmental, social and economic (Hosseini and Kaneko, 2012; Karlsson et al., 2007).

In contrast to sustainability modelled as pillars there are various others options. Pope details an explanation made by Gibson that looks at an alternative to the pillars. The ‘deep green’ conceptualization holds that the environment be brought into every part of decision making from social to economic to cultural decisions (Pope, 2004). It is sometimes characterized as concentric circles where the environment is the outermost circle, society is imbedded in the environmental circle and a circle representing the economy is imbedded in the society circle (Pope, 2004). Other characterizations put the emphasis on society, where development reflects a normative decision of what should be sustained which is technical in execution (Van Zeijl-Rozema et al., 2008). In a paper by Haking and Guthrie, the author analyzes some of the usage of the term “integration” in the sustainability assessment literature (2008). Horizontal integration, as described by the authors, challenges the pillar type sustainability evaluations by bringing together biophysical and socio-economic elements (Haking and Guthrie, 2008). Rosch et al. detail an integrative sustainability framework developed by the Institute for Technology Assessment and Systems Analysis (ITASA) which contains three main elements: ‘securing human existence’, ‘maintaining society's productive potential’ and ‘preserving
development and action options' (2009). These principles are distinctly anthropocentric in representing the environment and economy as sustaining to society.

Karlsson et al. argue that the method by which sustainability is conceptualized directly influences resulting sustainability frameworks and indicators (2007). The foundation for this research project is rooted in applying the concepts of sustainability to assessment and evaluation so it is relevant to consider how sustainability is conceptualized. The embedded nature of deep green sustainability as well as the horizontal integration alternative would acknowledge the reliance of society and the economy on the environment. Indicators under a deep green regime would ask how the socio-economic decisions may affect the environment. Likewise, the ITASA principles were developed into preconditions and indicators which show interactions between human and natural systems without separating out environmental, economic and social aspects (Rosch et al., 2009). Klein-Vielhauer uses the ITASA integrative sustainability concept to explore the sustainability of the tourism and leisure industry and details how the values of integration shape the specific framework and indicators (2009). In contrast evaluations which conceptualize sustainability under pillars create frameworks and indicators under each pillar identified with little to no connections made between them. These pillar type sustainability assessments have the benefits of working with existing organizational and institutional capacities under which experts and procedures are generally separated into social, economic and environmental aspects (Moldan, Janouskova and Hák, 2011). Despite their organization benefits, pillar frameworks cannot capture interactions between various subsections contributing to sustainability. The framework used as the
evaluation criteria for this project draws on the idea of an integrative sustainability assessment and will be detailed further as part of the methodology in Section 3.0 (Gibson, 2006).

2.3 The Increasing Importance of Governance

In addition to the theoretical foundations of sustainability evaluation, the case study aspect of this project also places the research in the context of water governance. It is important to be able to contextualize the plans, legislation, and other documents that are reviewed as part of this project. Although these governance instruments are produced by the National Government of Israel, they are also influenced by other stakeholders. These specific groups in the Israeli context, which will be detailed more closely in the Introduction to the Case Study in section 3.5, have a dynamic relationship driving transformation in policy (Section 3.5; 4.2.2, 4.1.5). Literature concerning policy analysis has identified that these stakeholders often play a role that rivals government action and thus should be given extensive consideration. It has been argued that ‘networks’ of non-hierarchical and non-market entities have helped to exercise control and allocate resources in a similar or complimentary way to traditional authorities (Rhodes, 1996). Peters and Pierre recognize and characterize how “societal actors have become influential over policy and administration... unimaginable in earlier times” (1998). The variety of policy actors and their interactions spatially and structurally is sometimes referred to as the wider governance issues in the scope of an analysis.
(Stoker, 1998). Treib et al. provide some clarification of the conceptual governance literature and terms (2007). As this concept developed, there was debate in the literature that questioned to what extent there was “governance without government,” and whether measures should be taken to take back government control (Peters and Pierre, 1998). This idea of “governance without government” is less important in the context of this project because of the level of control that Israeli government structures exercise in the water sector. Empirical studies have shown that governance groups pose less of a threat to governmental control than initially conceived (Kjær, 2007). Governments have identified benefits to incorporating elements of governance theory into their policies and have used citizen involvement and public private partnerships in their activities (Kjær, 2007). It follows that there are several modes of governance that have been characterized, which can be differentiated based on the level of involvement from state and public actors, their structure whether they are hierarchical, co- and self governance or based on dominance of one actor over another. Governance also exists at different spatial scales from local to national and transnational governance (Van Zeijl-Rozema et al., 2008). Governance networks have been implemented as tools to try to work toward sustainable development. A major challenge to the success of governance mechanisms in practice comes from not clarifying the definitions of concepts such as sustainable development which are to be used in policy and practice. Sustainable development and governance exist within a spectrum and it is important to clarify both concepts early in the process of working through a situation (Van Zeijl-Rozema, 2008).
These changes towards involvement of governance networks have implications for democracy, transparency, public participation and the decision making process (Fung and Wright, 2001). Trends toward governance networks allow for democratic institutions to be more responsive and effective and the state to be more “fair, participatory, deliberative, and accountable” (Fung and Wright, 2001). As well, some researchers have pointed out that the influence by dominant or special interest groups can still be seen in the sphere of network governance (Klijn and Skelcher, 2007). Despite this influence by dominant groups, good governance has come to mean processes which allow for public participation and inclusion as much as “efficiency and order” (Scholte, 2002). Connected to the idea of public participation is the study of these governance relationships and their contributions through concepts such as social capital. Lehtonen provides a review of the concept of social capital (2004). The concept can be traced back to economics where social capital is a type of stock which can be valued much like manufactured or natural capital. The capitals approach is a conceptualization of sustainability whereby the maintenance or increase of each stock contributes to sustainable development. Social capital is the interaction between various people that has an influence on the productivity of a community (Lehtonen, 2004). In the context of this project, social capital will include the relationships and networks facilitated by government as well as the influence of non government actors on formal institutions. The trend toward the increasing prominence of governance in policy and practice has been extended to include natural resources and the environment. Governance strategies which involve the government, the local community and market actors are
seen to take advantage of the strengths and offset the weaknesses of each stakeholder in the management of a resource (Lemos and Argawal, 2006). Government or state actors help to implement democratic proceedings and legitimacy. Local communities and the public provide more spatial and temporal context while helping to allow for more equitable distribution of resources. Market actors are able to inject efficiency and competition into items like the provision of environmental services (Lemos and Argawal, 2006). Some have called this type of preferential collaboration between stakeholders “new governance” (Lockwood et al., 2010). Practically, it has been employed to more systematically allow stakeholders to work with the government to influence and carryout integrated management strategies for conservation, heritage, eco-tourism programs or help with the regulation of industry through setting or enforcement of standards (Head, 2005). In the area of water and resource management, Saleth and Dinar identify that acknowledgement of the spatial and structural linkages between formal and informal institutions as well as local, regional and national institutions can help to ensure more effective policy reform (2005). Further, in considering the governance of natural resources such as water it is important to consider scale. Geographically, there are several scales appropriate for different parts of the water system. These can include environmental scales such as watershed or basin as well as political scales such as political or economic power structures. Some scholars consider appropriate scales for water governance related to transboundary water and cooperation (Feitelson and Fischhendler, 2009). There are also stakeholders at each level of scale and finding a way to find a balance to practically manage a resource and
be inclusive is a challenge. In addition to the environmental management perspective, there are perspectives that look at the political and economic power struggles that influence the scale of governance and how boundaries affect natural resource regimes (Feitelson and Fischhendler, 2009).

Considerations of governance are especially relevant as there is a trend in the last fifteen years towards institutional reforms in water management (e.g. market-based allocation, decentralization and privatization, integrated water resource management, and economic viability and physical sustainability) that has been observed in many countries (Saleth and Dinar, 2000).

2.4 Water Management Strategies

Water planning and management strategies have traditionally aimed to limit variability and maintain a reliable supply for a variety of human needs (Richter et al., 2003). Sometimes referred to as “sustained yield”, traditional water management had its roots in utilitarian and anthropocentric values of nature. Sustained yield promotes an ideal that human use of natural resources, including water, is the most valued use and therefore resources should be continually available for human consumption (Cortner and Moote, 1994). Often water policies of this kind developed gradually to solve simple issues of supply (Lockwood et al., 2010). This traditional strategy was replaced by a more ecosystem centric approach during the 1980’s that aimed to manage water resources for other values, such as environmental and cultural values including
biological diversity and indigenous rights, not solely maximum output for human exploitation (Cortner and Moote, 1994). Water management values have continued to evolve to include values for sustainability (Loucks, 2000). The progression of values in water management has culminated in a variety of management strategies. Many modern water policies and planning initiatives have adopted some combination of command and control, adaptive, community or regional and integrated resource management. Command and control is a top-down strategy that sets a standard and aims to enforce it on the system (Holling and Meffe, 1996). Adaptive management takes more of an experimental approach aimed to solve an issue then reassess its effectiveness and is an iterative process (Loucks, 2000). It follows that the water policy made under this type of regime must be able to be adaptable, flexible and approach challenges “a learning approach” (Pahl-Wostl, 2007). Community or regional management is a bottom up approach in which local residents have an active part in resource management. Integrated resource management focuses on linking institutional and policy mechanisms for multiple resources such as water and land due to the multidimensional and connected issues of management with the goal of system sustainability (Mitchell, 2005). These strategies reflect recognition of the need for increase coordination and attention to complex resource issues that exist at different spatial and temporal scales and can be approached to include governance and sustainability aspects detailed in the previous sections (Lockwood et al., 2010). Some of the complex issues related to water management include scarcity, use regimes, technology and climate change (Iglesias et al., 2007). Scarcity is generally discussed as a
physical characteristic in cubic meters per capita, but also includes dimensions of economic or social scarcity, as described by Wolfe and Brookes (2003). This expanded definition of scarcity allows for “opportunities in policy making and capacity building (Wolfe and Brookes, 2003). Often integrated management takes on community and adaptive elements (Pahl-Wostl et al., 2007). The trend towards integration coupled with the increasing presence of the community in matters of water resource management has opened up new issues in water governance as resource management casts a wider scope.

2.5 Conceptual Map

The concepts from this literature review are included in a conceptual model (Figure 3). It provides a graphical summary of the contributions of sustainability, governance and resource management to this project.
Figure 3. Summary of Concepts from Literature Review. This research compares two main conceptualizations of sustainability: integrative sustainability and pillar sustainability. As this project evaluates the sustainability of the Israeli water sector, it integrates concepts of governance and resources management strategy.
3.0 Methods

3.1 Introduction

This case study used multiple methods of analysis. The two forms of data collection were non-obtrusive observation and document analysis. The information collected through both methods was evaluated using modified criteria from Gibson’s “Beyond the Pillar’s Sustainability Assessment” (Section 3.3). These criteria were adapted to fit the scope of this report and the specific background conditions of the case study (Gibson, 2006). These adaptations are detailed below (Section 3.2, 3.3). The two data sources and the literature review provide the ability to triangulate results. Triangulation in the context of this project involves using multiple methods of data gathering but can also mean multiple theories, researchers or methods (Bechhofer and Patterson, 2000). The aim of triangulation in social science research is to provide perspectives of the same phenomenon “as a means of mutual confirmation of measures and validation of findings” (Berg, 2012, 6). Documents were sourced from relevant governmental institutions in Israel (section 3.2). Observations involved field visits to Visitor’s Centres run by Mekorot, the main water distributor in Israel (section 3.2).

The case study design was chosen for the evaluation of Israeli Water Governance because it warrants the use of multiple sources of evidence and complex multivariate conditions (Yin, 2003). This inquiry seeks to provide initial information for an area not well studied in the literature. The case study approach provides the potential to focus in
on the Israeli water sector in depth without knowing how much the context and background has an influence on how policy and plans have been developed.

3.2 Sources of Data and Types of Analysis

The documents represent a secondary form of qualitative analysis and were sourced through Israeli Government internet search engines and through requests for information (For a list of core documents and source please see Appendix 3.0). Initially, the Israeli Government Main Website (gov.il) was searched in Hebrew using the key words for "water authority" and "water sector". Results returned were to links at the Israeli Water Authority Website and several from the Ministry of the Environment. The Water Authority website (water.gov.il) was searched with key words in Hebrew for "policy" and "legislation" and a list of legislations and regulation with relevant application to the water sector were retrieved. All Israeli laws and regulations were accessed online by searching Nevo, The Legal Database for Israel. The Ministry of the Interior mmi.gov.il database was searched for National Outline Plans related to the water sector. Plans, legislation and committee reports relating to different areas of the water sector were retrieved as part of this search. General internet searches were preformed using key word searches in Hebrew for "water sector", "water authority", "water quality", "water sector planning", "water governance", "water organizations", "public and water sector" and "water regulation". Key word searches were repeated in English by adding Israel to the above key word searches. Online requests for information
were sent to the Water Authority, the Ministry of the Interior, Ministry of Health and the Ministry of the Environment for water sector plans and information. Most requests were returned with documents or links to documents and information. Inquiries for water sector master plans earlier than 2002 were met with responses related to the unavailability of digitized copy or inaccessibility of the physical document.

The plans and other documents that were reviewed as part of this study were limited to electronically accessible documents and through requests for information from government repositories. For an overview of some key historical documents and master plans for the water sector as detailed in the literature please refer to section 3.5. Search terms were guided by institutional and power structures outlined in the introduction to the case study. A document was identified as key to water governance in the preliminary internet search on the various institutional websites or if it was mentioned in the literature I reviewed as part of the literature review (section 2.0). Searches were conducted in Hebrew, one of the official languages of the State of Israel and English, which is widely used by academia and for international communication (Israel Ministry of Foreign Affairs, 2008).

The documents were then evaluated based on the selected two areas of Gibson's evaluation criteria. These “criteria of selection” defined the analysis of data in the documents and were established prior to the analysis. The documents were coded initially at the word level using key words developed from criteria and questions (please see Table 1; Section 3.3). Following this, larger themes were labelled during synthesis of the results, documents were isolated for patterns and then considered in light of
previous research following the sequence described by Berg (2012, 352). A list of key words used to initially code the documents can be found in Appendix 1. The focus was interpretation for context and qualities of each part of the coded content. This also included consideration of latent content where documents were read for their “deep structural” messages, i.e. the document may refer to the list of non-governmental organizations that can participate in a process, while a structural read may look at what is being said about the involvement of such organizations (Berg, 1998).

In addition to the document analysis, observation data were gathered at the publically accessible Visitor’s Centers of Mekorot, the National Water Distribution Corporation of Israel, in the form of photographs and written notes. Two of the five Mekorot Visitor’s Centres were accessed: The Shaftdan Purification Plant - Third Pipeline to the Negev Center and the Yarkon Springs Center at Rosh Ha’ayin (See Appendix 4.0 for examples of photographs taken). The researcher joined the organized program that was attended by various diverse groups from government employees to college students. Tours could be booked by groups generally ten people or more. As an individual, the researcher had to join an existing group tour. The tour guides knew the researcher was not part of the larger group visiting and that she was a visiting student researching the Israeli water sector from Queen’s University, a North American University. The content of the tour was in presented in Hebrew and the researcher was told by the guides that the content of the tour was tailored to the majority of the participants and no special arrangements were to be given to the researcher. Presentations at the Visitor’s Centers consisted multimedia, exhibits and site tours. As part of the observations at the publicly accessible
Visitors Centers the researcher was a participant-observer (Bechhofer and Paterson, 2000). The data gathered through observation helped to clarify operational details related to the specific water facilities but the primary focus was to take note of the information presented by the company and the manner it was presented during the presentation. The observational data was then evaluated using the Gibson criteria discussed.

The method of observation at site visits was adapted from Marshall and Rossman (2011). The researcher identified that observations would be most effective as part of the site visits. The observations followed an open format whereby no information was filtered or selected for before the site visit. Observations included the systematic noting of events, information and artefacts while at the tours of the Visitor’s Centres. The artefacts could include a variety of items pertaining to the Visitor’s Centre including the educational tools and models as well as the water filtration equipment machinery (Marshall and Rossman, 2011). Observations were mainly auditory and visual. Detailed field notes recorded content and photographs were taken. The technique Marshal and Rossman describe for field notes was employed in which the researcher described the site visit tour information and presentations in detail and cleaned up notes were coded using analytical comments from the terms listed in Appendix 1.0 (2011).
3.3 Evaluation Criteria

The selected evaluation criteria, adapted from “Beyond the Pillars” were developed by Robert B. Gibson (2006). These criteria are part of his integrative sustainability assessment process. The integrative aspect of the framework is that it looks to the relationship and interactions between social, economic and ecological ‘pillars’ commonly associated with definitions of sustainability (Gibson et al., 2005, 94). Integrative sustainability is described in more detail as part of the Literature Review Section 2.0. There are eight areas of interest under the framework which “constitute a minimal set of core requirements” for sustainability (Gibson et al., 2005, 95). Due to the limited scope of this project two of the eight areas were selected. This research would therefore be not be an integrative study according to Gibson but does look at the connections between the pillars of sustainability. These two selected areas were adapted to fit the context related to conditions of the case study. Table 1 shows the original criteria and the context related adaptations. Any specifications to the criteria were made to help garner information relating to water governance in Israel. The modifications to the criteria were done after the document collection thus no documents or information was precluded from analysis based on the modifications.

The two areas selected were:

1. Resource maintenance and efficiency

2. Socio-ecological civility and democratic governance.
These areas were chosen in an attempt to reflect technological as well as social aspects of the system. As well, the two areas were chosen as there was more readily available information than on some of the other criteria Gibson presents. Resource maintenance and efficiency information was gleaned directly from specific statistics and reports such as the National Water Efficiency Report 2011, Table 11A Water Production and Consumption as well as Master Plans which had projections and development scenarios (Rejwan, A. 2011), (Central Statistics Bureau, 2011), (Water Commission, 2002). These reports contain information relating to the status of the water resource, the systems in place to reduce damage and increasing efficiency in the context of society. However, current information related to socio-ecological civility and democratic governance for water governance is not as readily available. The information is more indirect, found as part of legislation or master plans, which detail environmental awareness and conservation programs, how the public can be involved in selected committees and measures to insure transparency. An initial informal exploratory survey by the researcher of the types of information available in the Israeli context produced predominantly more of a presence of information related to resource maintenance and efficiency than socio-ecological civility and democratic governance.

Resource Maintenance becomes an issue of sustainability when future generations’ ability and access to these resources is affected by actions taken in the present (Pope, Annandale and Morrison-Saunders, 2004). Further, resource maintenance is a current and dire sustainability issue if the present generation has difficulties with access to
water. Efficiency is often seen as an approach to lessening the impacts of resource use. Israel has been described as having a chronic resource scarcity problem (Tal, 2006). One focus of this research project is on determining how Israel's geographical qualities, as a resource poor and developing nation, influence its use of water resources. Gibson's framework identifies that system gains in efficient use of a resource can lead to other material consumption driven by an expanding economy, which means there will be “no net gain” in savings (Gibson et al., 2005, 106). As mentioned in section 1.1, Israel prioritizes its agricultural industry, a significant water user. This has led to the development of increase in grey water use and purification. It has also influenced technological development and implementation (Section 1). Further, as previously mentioned, Israel has favoured centralized and national approaches to water and is becoming a world leader in research and development of water technologies.

The second criterion explored was socio-ecological civility and democratic governance. Socio-ecological civility focused on looking for mechanisms and capacity building in “individual, community and other collective decision making bodies to apply sustainable principles in a more open and better informed deliberations” (Gibson, 2005, 107). This includes more open and transparent processes for public participation and public access to information. Israel has taken steps in the last few years to streamline and reform certain areas of the water sector with the creation of the Water Authority, to act as a central reference point for governance (Fischhendler and Heikkila, 2010). As well, there are several key governance committees in Israel examining different areas of water such as quality standards drinking, regulation and policy, efficiency and drilling (Rejwan,
2011). There is little published up to date information on whether the stakeholders in government, public and private sector are able to participate in the greater governance community and affect the decision making process. As stated earlier in the case study introduction there have been a number of changes to the Israeli water governance sphere in the past ten years that have had little review or attention.

3.4 Challenges and Limitations

There was consideration of the manifested or surface content i.e. a document stating it was hard to convey technical information to the public. This project also considered latent messages i.e. the attitude conveyed by the tone of a document when mentioning public participation which communicated it has a hassle and a road block to development. As well there was a consideration in the differences in language usage for some of the concepts. The stock of certain categories of documents including plans and committee reports represent a relatively narrow time period in the history of Israel's water sector. Another limitation of this study is related to the selection of documents from the State of Israel. The project follows jurisdictional boundaries instead of water system boundaries. This limits the integrative quality of this sustainability assessment which would ideally use study boundaries which allow for consideration of optimized economic, ecological and social boundaries (For background on Integrative Sustainability Section 2.2). This is a descriptive case and the results of this project will not be able to
be generalized. The results of this analysis will be representative of the particular documents selected and cannot express causal relationships (Berg, 1998).

From a conceptual study design standpoint, another limitation of this study comes about due to the selection of two of the eight areas of Gibson’s Criteria to evaluate Israeli water governance. According to Gibson’s conceptualization of sustainability all eight areas of the criteria must be evaluated for the sustainability assessment to be truly integrative (Gibson, 2006).

The researcher was influenced by cultural and language bias. Culturally, the researcher is a Jewish-Canadian whose first language is English. The level of knowledge of Hebrew, one of the official languages of Israel, of the researcher is intermediate-advanced and she has spent time in Israel in a professional capacity prior to the execution of this project.
## Table 1: Evaluation Criteria with case specific adaptations

<table>
<thead>
<tr>
<th>Gibson’s Criteria</th>
<th>Case Adaptations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource maintenance and efficiency</td>
<td>- Does scarcity influence technology development and implementation of resource efficiency?</td>
</tr>
<tr>
<td>Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.</td>
<td>- Are demands on resource and ecosystems lessening while economic growth and development occur?</td>
</tr>
<tr>
<td></td>
<td>- How does scale influence the implementation of technology for resource maintenance and efficiency?</td>
</tr>
<tr>
<td></td>
<td>- Where are the efficiencies and savings going towards i.e. high value agricultural crops, pharmaceuticals, to meet the demands of growing population, improving the integrity of the system, etc.?</td>
</tr>
<tr>
<td>Socio-ecological civility and democratic governance</td>
<td>- What is the status of</td>
</tr>
<tr>
<td>Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision-making practices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- transparency and public involvement</td>
</tr>
<tr>
<td></td>
<td>- civil society (non-market and non-government groups)</td>
</tr>
<tr>
<td></td>
<td>- social capital (commitment and engagement of the community) in the decision making process of the water sector in Israel?</td>
</tr>
<tr>
<td></td>
<td>- Are governance structures adaptable and dynamic? Are they able to meet the needs of complex situations? i.e. Drought year, conservation programs, population changes</td>
</tr>
<tr>
<td></td>
<td>- How effective are the mechanisms for developing understanding, knowledge and involvement in the water sector? As part of the governance structure is there a way to build civil capacity for effective involvement in decision making?</td>
</tr>
</tbody>
</table>
3.5 Case Study Introduction

This section provides a review of previous studies that help to provide context to this results of this project. The following subsections will focus on describing studies of governance, historical reports and documents and assessments of sustainability for the Israeli water sector as described in the literature. The studies of governance characterize trends and significant developments (section 3.5.1). The content and contributions of historical reports and documents are described from sources in the academic literature in section 3.5.2. These documents could not be accessed as primary documents as part of data gathering and thus, the literature provides key background evidence. The information related to previous assessments of sustainability highlights alternative approaches and accounts to the evaluation of the Israeli water sector (section 3.5.3).

3.5.1 Previous Assessments of Governance of Water in Israel

The dynamics in Israeli water governance have changed over the history of the country and several studies in governance have focused on how the prevailing ideologies of the time dominated water policy. Feitelson and Fischhendler looked into the concept of scale in intra-Israel and Israeli-Arab water governance (2009). Their focus was to determine how scale of governance changed in relation to power, economic factors, shifts in dominant ideologies and sanctioned discourse. Most relevant to this project is
the analysis of Israel’s domestic water governance from the period of 1930’s to present showing how scale evolved from the community level to national level management to a mixture of both evolving to meet the dominant ideologies of water management. In the early period the concept of transfer - “trans-basin” was key to overall development. The authors focus on the formation of the national water planning company (TAHAL) which planned the national water pipeline as a key contributor and first step to national control of water which culminated in the Water Law 1959 (Feitelson and Fischhendler, 2009).

Using the theoretical foundations of policy networks, Menahem tracked the structures and actors in the Israeli water sector (1998). Initially, the author looked at the foundations for centralization of planning and governance and their influence by agriculture and the central role agriculture played in the ideology of early governments. The majority of the water portfolio was originally under the authority of the Ministry of Agriculture who appointed the Water Commissioner and was the head of the Water Council (Menahem, 1998). The author then traced water policy through several phases summarized in Figure 4, making connections between the prevailing paradigms and water sector development (Menahem, 1998).
Figure 4: A summary of phases in the policy governance of the Israel's water sector (Menahem, 1998).

3.5.2 Key Committee Reports and Master Plans 1980-2002

Several studies point to the successive water crises of the 1980's as a tipping point to questioning the existing water policies and governance structure (Fischhendler and Heikkila, 2010; Kay and Mitchell, 1998; Mizrahi, 2004). These crises were predicted by researchers as early as the 1970's. The rate of expansion of use of water resources outstripped the capacity of the system and the conservation efforts at the time. It caused questioning of the status quo of management and the control that agriculture had over the water sector (Menahem, 1998). The concern intensified in the 1990's as peace process negotiations had implications for future agreements for the region's shared water resources (Kay and Mitchell, 1998).

Some of the initial plans for the water sector focused on the transport of water influenced by several studies completed in the US in the 1930's and 1940's and...
culminated in the plans for the National Water Sector (Feitelson and Fischhendler, 2009). There had been plans and expert reports created for the water sector prior to the 1980’s crisis, however these plans focused on maintaining the status quo by seeking out additional supplies and considered access the highest priority (Kay and Mitchell, 1998). The 1988 master plan represents a departure as it was the first plan to echo the modern policy to provide reliable supply rather than increase the amount of water in the system. Details of the Master Plan of 1988 included plans for recycling of domestic wastewater, use of winter flood water, desalination of saline groundwater and the protection of major water sources mainly used for drinking water. As well, there were details on goals to control the demand to match available resources, introduce treated wastewater for use in irrigation and reduce outflows due to spills from Lake Kinneret, seepage into the Mediterranean Sea and floods (Schwarz, 1994). Further, it focused on cutting down water taking from the Coastal Aquifer and priorities for investment in the water sector (Magen, 2002). The plan cut naturally sourced water supplied to agriculture from 1.2 billion cubic meters in 1988 to 740 million cubic meters in 2000. It met direct opposition from the Director of the Planning Committee in the Ministry of Agriculture who claimed that allocations could be met with desalination, however, this was not recommended as part of the plan. The plan was generally not implemented (Kay and Mitchell, 1998). A significant State Comptroller Report from 1990 looking into the water sector highlighted the rejection of the 1988 Master Plan. The State Comptroller Report 1990 produced public outrage as it was stated that reservoirs and water quality had been allowed to
In 1994 another plan was produced at the request of the Water Commissioner by the planning firm TAHAL and was updated in 1997. The plan provided two policy options under which to consider proposed actions: the “business as usual” case that considered security and social aspects and the “economic” case considered the least investment financially for the government. The economic case proposed delays on implementation of desalination, less investment in the water sector, the continuation of the release of wastewater effluent unused in agriculture to the sea and the elimination of the subsidies on natural water prices (Magen, 2002, 57). There is no mention of environmental or ecological objectives in the main recommendations of this plan. This plan was being produced during a time when there were considerations for changing the structure of water governance. The Ministry of Finance aimed to become a significant part of the new structure outlined in the report through acquiring the responsibility for water pricing. As a result of opposition, this plan again was shelved (Menahem, 1998).

During the intervening time between the formulation of 1997 Master Plan and its rejection, the Public Committee for Examining the Management of the Supply of Water led by Saul Arlozoroff was convened regarding the key issue of water price. The committee made recommendations to implement economic tools to guide in the planning for the water sector just as increases in water pricing and dismantling administrative allocations of water. As well the report recommended diverting potable
water from agriculture while aiming to aid impacted farmers financially. It called for increases in prices to promote efficient use and a delay to the building of desalination plants until all efforts to curb consumption in agriculture were exhausted (Magen, 2002, 58). There were also recommendations to decentralize decision-making, which was dominated by agricultural interests, and strengthen the Water Commission. Reforms recommended since the 1970's in reports made by the Arlozoroff Committee, the State Controller in 1990 and the Parliamentary Committee in 2002 focused on the need to integrate "long range water policy guided by profession and technical expertise" (Fischhendler and Heikkila, 2010). A decision was made in 2004 by Cabinet to implement reform. This involved the establishment of the new Water Authority under the portfolio of the Ministry of National Infrastructure. The Authority, which would replace the Water Commission, became the primary decision-making and administration body for the water sector by 2007. The Water Authority Council was also formed as part of this directive (section 4.2.2). This effectively also removed the impediments for moving forward on development of desalination (Teschner et al., 2012). The Bein Commission of Inquiry into the Water Economy released a report in 2010 which recommended the formulation of the current Master Plan, reviewed as part of this project, for planning production of water from “various sources, limitations and a plan for years of drought and global climate change" among other recommendations accepted by the Cabinet (Bein, 2010; Prime Minister's Office, 2010).
3.5.3 Previous Sustainability Assessments of the Water Sector in Israel

Israel's national water management strategies have been categorized as trial and error processes which have their respective successes and drawbacks with regards to sustainability and environmental consequences. In a foundational paper Kay and Mitchell evaluated total water use in Israel in the period 1958-1992 under a resource performance evaluation and concluded the reliability and resiliency of the system were compromised through overuse of groundwater resources (1998). In a study that followed, the above researchers evaluated the Israeli system pre and post publication of the 1988 Water Master Plan for instances of departures from sustainable use thresholds which were defined as the “annually renewable resource supplied by precipitation; estimates of that sustainable threshold have changed over time” (Kay and Mitchell, 1998). They found that the plan had not produced significant changes (Kay and Mitchell, 1998).

There are several papers that discussed some of the sustainability issues in the Israeli water sector without a concerted effort to synthesize the information into a formal assessment. Tal reviewed major national investments in policy and technological infrastructure in Israel with regards to increasing and maintaining water supply including water transport, wastewater treatment and reuse and desalination (2006). Yarkon gives a detailed account of the Israeli water economy and highlighted the trend of less high quality water and the increase in reuse of wastewater due to availability (2002). Water quality assessments under a sustainable use and management paradigm have been executed for the Sea of Galilee and the Dead Sea (Hambright, Parparov and Berman,
2000; Lipchin, 2006). Drawing on the relationship between the water and energy sectors, Teschner et al. evaluated past Israeli policies that indicated the polices lowered the ability to respond to future challenges. The authors made recommendations on how policies could be shifted to a more sustainable system (2012).

The motivation to complete this project is due to the fact that a sustainability analysis of this kind has not been completed for Israel and review of the most recent master plan from a sustainability perspective is insufficient in the literature.
4.0 Results

As part of this evaluation, core documents were assessed and analysed as detailed in the methods section 3.0. For a detailed list of the documents assessed please see Appendix 3.0 Table 2.0). Appendix 2.0 Table 3.0 provides a summary of the main points regarding the criteria areas analyzed for individual core documents. Selected photographs from site visits are included in Appendix 5.0 The results are organized in terms of the key questions asked as part of the criteria and detailed in Section 3.3 and Table 1.0. Following the results is a discussion of the findings for each the two criterions separately (sections 4.1.5 and 4.2.6).

4.1 Resource Maintenance and Efficiency

4.1.1 Resource Scarcity

The scarcity of water is a key driver of water governance in Israel. The information introduced as part Section 1.0 details the geographical and demographic constraints to the water resource in Israel. This issue was considered in several different contexts within the documents. Acknowledgement of scarcity and planning in the face of shortage was featured in the Master Plans 2011 and 2002, the National Water Efficiency Report, Parliamentary Committee Review Report as well as a major section in the Water Law 1959 (Magen, 2002; Rejwan, 2011; Water Authority, 2011).
The documents contained policies related to scarcity in the context of a severe shortage or drought. Several reports made the distinction that the condition of scarcity and periods of shortage affect the integrity of the natural water system and can result in irreversible impacts (Rejwan, 2011, 9; Water Authority, 2011, 45). The Water Law 1959 provides a legal framework for rationing during times of drought. Articles 36-44 give the Government Authority the ability to ration and redistribute based on quality and use of water. The law acknowledges previous usage rights to water and sets hydrological conditions under which users may be entitled to less water (Water Law, 1959). It also gives the power to impose a levy on water producers of selected water sources to reflect the regional and national water shortage (Article 116.2, Water Law 1959).

Scarcity and shortage was included in the projections and forecasting of water budgets and use scenarios in plans and reports (Water Authority, 2011; Water Commission, 2002). There is special prioritization during emergencies or severe shortages for domestic uses over industrial uses, agricultural uses and allocations to nature (Water Authority, 2011, 44-45; Water Commission, 2002, 3).

In addition to response to shortages, there were also policies related to demand management and efficiency measures to lessen the burden throughout the system. The National Efficiency Report states plainly: “In response to the drought conditions and water shortages that have prevailed in recent years, the State of Israel employed numerous policies for increasing efficiency in water usage and for providing alternative water sources” (Rejwan, 2011, 29). Key policies mentioned include “the demand management multi-media awareness campaign of 2009, reclamation of domestic
effluent for irrigation in the agricultural sector, and the production of new water from large-scale desalination facilities” (Rejwan, 2011, 29). Further, other initiatives are mentioned for implementation of efficiency technology in urban areas, agricultural and government buildings (Water Authority, 2011, 69; Water Law 1959, Article 9.1; Rejwan, 2011, 26). As well, there have been considerations to change the fee structure for water and impose tariffs (Rejwan, 2011, 29). Water tariffs or water taxes differ based on the quantity of water used and they increase significantly if consumption is higher than the baseline set for domestic and industrial consumers respectively (Rejwan, 2011). Much of the investment into efficiency is focus toward the agricultural sector and the many different types of technology available in Israel for conservation and to minimize water loss including micro-sprinklers, micro-drip irrigation, computerized control systems that provide the exact needs of plant to the roots directly and genetically modified crop strains that live on alternative water sources (Rejwan, 2011). As well, "research and development in technologies that increase agricultural irrigation-efficiency, provides funds for investments in regional drainage and water conservation projects, and offers free education of the most recent technologies to farmers" (Rejwan, 2011, 26).

4.1.2 Concerns and Responses to Scarcity

Despite the policies and investments identified above, there are concerns raised within the documents. The current Mater Plan explains that there are fewer institutional resources and budget being allocated to water planning and programs (Water Authority,
2011, 70). The plan states that the long term effect of this will be less knowledge transfer from current professionals to the future planners and managers of the water sector (Water Authority, 2011, 70). As well available technology is not being implemented as widely as possible (Water Authority, 2011, 70).

Also acknowledged in the documents was the enacting of emergency regulations to take action in the Israeli water sector (Magen, 2002, 6). Recommendations in the Parliamentary Review of the Water Sector were made to give the Water Commissioner the powers to diminish the supply from various water sources, to issue new production licenses, publish tenders for new water sources, establish planning committees for quick procedure in approving projects in the water sector, and enforce comprehensive inspection (Magen, 2002). The document illustrated that in the early 2000's the Israeli water sector was in a state where it could not perform routine management actions due to political gridlock and emergency legislation actions were taken (Magen, 2002).

4.1.3 Scale, decision making and distribution

Another issue that warranted consideration in the scope and analysis of this project was that of scale. In the introduction some of Israel’s geographical and demographic qualities were discussed where it was highlighted that the majority of the decision making for water governance was taking place at the national level (section 1.1). Consequently, this does have an influence on the implementation of technology for resource maintenance and efficiency. National legislation has concentrated the powers
to plan, regulate and develop the water sector with the Governmental Authority for Sewage and Water (also known as the Water Authority) (Control of Water Drilling Law 1955; Water Law 1959). As a result, each new water development has been required to submit a plan which reviews technical, economic and financial aspects of the development (Articles 44.7 and 63, Water Law 1959). Water developments, producers and existing permits were also subject to the legislation (Article 74.2, Water Law 1959). As articulated in Article 25 of the Water Law 1959, the director of the Water Authority may put conditions on any water production licence to ensure efficient production, storage, transport, and distribution of water, and pollution prevention. This helps to maintain a quality and quantity standard of any water introduced into the system as outlined in the Water Law 1959 (Article 25). Quality standards are defined by use with Health Ordinance 1940 defining drinking quality standards and the Public Health Regulation for wastewater quality standards and rules for sewage treatment 2010 defining grey water for use in agriculture. Quantities produced are not only controlled by planning but also verified through the Water Measurement Law 1955 that requires measurement of water supplied and water consumed.

Planning and development of water infrastructure also mirrors the national scale of the water legislation. The influence of scale in this case goes beyond a matter of jurisdiction, however, because water infrastructure in Israel is connected at the national level through a pipeline and transportation system (Appendix 1.0; Goldberg, 2012, Site 2). The distribution network for water, the National Water Carrier and other connected pipeline systems carries water along several trunks from north to south and east to
west. The main trunk lines of the NWC finished in 1964 transports water from the Sea of Galilee and the Yarkon River in the north to the Negev Desert in the south. Mekorot, the National Water Corporation, operates the NWC and the required pumping infrastructure. The pumping infrastructure is required because the Negev terminus is at a higher elevation than the water sources (Goldberg, 2012, Site 2). The 2011 Master Plan does mention that “interregional cooperation” must address the areas of Judea and Samaria (the West Bank) as well as Gaza to coordinate on water infrastructure but does not elaborate further (Water Authority, 2011, 71).

The transport of water at the national level allows for policies that favour centralization and coordination. The 2001 policy decision to invest in large scale desalination plants complements the existing distribution network at the national scale (Magen, 2002). Desalination plants are a major investment of capital and require a reliable input of energy. The existing Israeli water transportation system facilitates movement and storage. There are plans to augment the system to accommodate the three existing desalination plants and the two planned plants (Tenne, 2011).

The 2011 master plan vision states (Water Authority, 2011):

“The water system will operate in a centralized and integrated manner which maximizes the advantage of size and national networking of the supply system, including the natural and artificial sources of water. The Sea of Galilee will be primarily designated for the north of Israel. Supply to the center of the country, and the other regions, will be largely based on
desalination plants, as a complementary source to the natural sources of water." (Water Authority, 2011, 20).

In addition to the stated integration of the supply system there is also a preference toward centralized sewage treatment. The major waste water treatment plant operated by Mekorot, the Shafdan, reflects this sentiment processing the waste of 25 cities (Goldberg, 2012, Site 2). There are legislative and planning mechanisms e.g. Fast-track approvals from the Ministry of Health for connecting gray water to agriculture, National Outline Plan 34 for Sewerage to increase connection between sewage producers with treatment facilities and a priority to centralize facilities especially in regards to treatment of urban wastewater and the transport of treated wastewater for use in agriculture (Water Authority, 2011, 21). The National Sewerage Plan provides details controlling where sewers and treatment facilities are to be built (National Outline Plan 34, Section 7, p. 9-10). Public utility companies providing sewerage services are required to provide services within their specific regions. There are controls on companies that wish to operate outside their service area and permissions are required from the local governmental authority as well as the Water Authority (Article 31, 37 and 40, Water and Sewerage Corporation Law, 2003). Although it has evolved, the centralization of the water sector reflects the political and ideological ethos surrounding nation-building in the time pre and post establishment of Israeli statehood. The policies helped to facilitate the priority of agriculture over urban water use and development through
centralized control of water resources and allocations and price subsidies (Menahem, 1998).

4.1.4 Balancing Development Goals and Demands on the Water Resource

To paraphrase the Water Law 1959 Article 1.1, all the water sources of the country are the property of the public or a common good and the state exercises the right to control it and use it for the needs of the citizens and for the development of the country. The previous section dealt with the first part of this legislation whereby the state controls the use of water at the national level and how this level of scale influences planning and policy. This section highlights policy that influences the demand on water as a resource and connects it to the economic system. Many of these measures include aspects of efficiency such as demand management and conservation, reuse and introduction of new sources. All of the policies should be viewed in consideration of some of Israel’s development goals to increase quality of life to OECD standards and development policy which includes elements of “security, social well-being and environmental conservation” (Water Authority, 17; Water Commission, 2002, 3).

Programs and policy generally target agriculture, domestic and industrial uses separately but there are connections in water reuse. The value of agriculture as already articulated is as a strategic resource and management is not purely for its economic viability (Water Commission, 2002, 3). The policy attaches value to agriculture for domestic production and to preserve open landscape characteristics. There have been
limits put on agricultural production to 200,000 hectares (Water Commission, 2002, 3). Efficiency is imposed on the agricultural sector through a quota system that allocates a limited amount of potable water to the sector and to each farmer individually. There are government programs in place to help farmers maximize use-efficiency through various technological methods and minimize water loss (Rejwan, 2011, 26). As well, a policy decision in 1990 led to the widespread reuse of treated domestic wastewater in agriculture. Through the mechanism of having lower tariffs on wastewater than potable water and providing incentives to use non-potable brackish or effluent water, the government has increased the use of secondary sources. The incentives include a bonus of 20% volume effluent for every volume of potable exchanged and providing 60% of the funding required for pipes to transfer the effluent to agricultural land (25). In 2011, this supplied 38% of irrigation requirements (400 MCM) (Rejwan, 2011, 20). The industrial sector has been targeted in much the same way as the agricultural sector. The government has made the tariffs for provision of brackish water lower than that of potable water and the sector also maintains efficiency through a quota system for potable water. Incentives are in place for companies to maintain their own water treatment facilities (Rejwan, 2011, 27). The domestic and tourism sectors are addressed by the same policies that include approaches to wastewater treatment and reuse as well as reduction of “wasteful use” (Rejwan, 2011, 21). As stated previously, the domestic sector provides the stock of effluent currently being used in agriculture. The reuse of effluent is limited by the capacity of treatment facilities and transport infrastructure. Other policies include reducing wastage along pipelines by lower pressures and
installing conservation devices on taps. Conservation strategies include the widespread implementation of automatic water readers and exponential increase in tariffs for heavy water users (Rejwan, 2011, 23). As mentioned previously there have been public awareness campaigns targeting different domestic uses (Rejwan, 2011, 29).

Current plans tend to emphasize the lessening of reliance on “natural potable water” through the use of secondary sources, such as treated wastewater and brackish water, and “artificial water” produced through desalination (Rejwan, 2011, 15; Water Authority, 2011, 17; Water Commission, 2002, 4). Figure 5 illustrates the breakdown of water types by use and projects using the existing quotas and policies. Overall, these policies have been relatively successful using less natural potable water through use of effluent and desalination. Desalination will require a significant investment in energy infrastructure such as the building of “independent private power plants of a total capacity of 4000-5000 MW in the next 10 years” (Tenne, 2011). Table 4 shows the water coming from all sources as forecasted in the Desalination Master Plan (Tenne, 2011). As well, there are other environmental issues associated with monitoring water quality and releases of waste brine to the sea (Tenne, 2011).
Table 4: Israel’s water resources including desalination (MCM/Year). These figures do not include effluents, storm water and brackish water for irrigation in the amount of 500 MCM/Year (Tenne, 2011).

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2013</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural resources</td>
<td>675</td>
<td>1 170</td>
<td>1 170</td>
<td>1 170</td>
</tr>
<tr>
<td>Brackish water desalination</td>
<td>30</td>
<td>50</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Sea water desalination</td>
<td>140</td>
<td>545</td>
<td>600</td>
<td>750</td>
</tr>
<tr>
<td>Total resources</td>
<td>845</td>
<td>1 765</td>
<td>1 840</td>
<td>1 990</td>
</tr>
<tr>
<td>Total demand</td>
<td>1 382</td>
<td>1 765</td>
<td>1 840</td>
<td>1 970</td>
</tr>
<tr>
<td>Gap</td>
<td>537</td>
<td>0</td>
<td>0</td>
<td>-20</td>
</tr>
</tbody>
</table>

Lowering the demand from various sectors can be part of a strategy to lessen the stress on ecosystems. The agricultural sector consumes the most water by volume followed by the domestic and then the industrial sector (Central Bureau of Statistics, 2012, 873). The amount of potable water agriculture uses has decreased over the last twenty years through efficiency measures and the use of effluent as mentioned previously. This also represents a diversion of 84 percent of the wastewater from the domestic sector (Rewjan, 2011, 20).
Figure 5: Historical, current, and predicted national consumption volumes (millions of cubic meters (MCM)) by water type: treated domestic wastewater ('Effluent'), brackish water from semi-saline aquifers ('Brackish'), desalinated sea and semi-saline water ('Desalinated'), and natural potable water resources from the coastal and mountain aquifers and the Sea of Galilee watershed ('Natural Potable'). The dashed line delineates the average volume of water that replenishes the natural reserves across 3 time periods: 1960-1993 (1249 MCM), 1993-2015 (1155 MCM), and declining from 2015-2050. Data Sources: Water Authority, Planning Department. (Water Authority, 2011).

Another perspective is making the focus on increasing the amount of the resource available to nature. This was identified as a goal in the Transitional Master Plan and 2010 Master Plan by defining the needs of nature in the same way as any other sector as a way of internalizing deficits in the natural system (Water Commission, 2002, 22). Table 5 from the Desalination Master Plan shows water demands that include needs for nature and rehabilitation of aquifers.
Table 5: Water demand forecast in million cubic meters (MCM) per year. (Tene, 2011).

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2013</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>430</td>
<td>530</td>
<td>530</td>
<td>530</td>
</tr>
<tr>
<td>Industry</td>
<td>85</td>
<td>95</td>
<td>100</td>
<td>110</td>
</tr>
<tr>
<td>Urban</td>
<td>730</td>
<td>840</td>
<td>880</td>
<td>980</td>
</tr>
<tr>
<td>Aquifer rehabilitation</td>
<td>0</td>
<td>120</td>
<td>130</td>
<td>150</td>
</tr>
<tr>
<td>Neighbors</td>
<td>130</td>
<td>130</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Nature</td>
<td>7</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Total demand</td>
<td>1,382</td>
<td>1,765</td>
<td>1,840</td>
<td>1,970</td>
</tr>
</tbody>
</table>

As part of the planning literature it was identified that in times of drought, water available to nature was impacted to meet the needs of the population (Section 4.1.1)). As part of these plans desalination is regarded as having the potential to meet the needs of the population without overdraining on naturally sourced water (Water Authority, 2011, 15; Water Commission, 2002, 12). There was a recommendation that water allocations from nature be legislated and that a new policy regarding reservoirs be developed. In 2004, the Water Law was modified to include a provision for a right to preserve and restore nature and landscapes including “springs, streams and wetland habitats” (Article 6.6, Water Law 1959). Also as part of these documents there have been concerns raised that despite all these efforts the integrity of the system has been breached and a ‘red line’ has been crossed indicating that irreversible damage has been done to the natural water system (Magen, 2002, 32). Although prioritization of water for nature is a commendable step it should be cautioned that these figures estimating the
needs of nature should be considered in light of literature and independent studies that show how much water should actually be allocated to nature for ecological integrity.

As part of the review of information of this project some connections were made between economic development and water use by sector. The following findings are meant for illustrative purposes to show the role that major water users play in the economy. Correlations between the economic productivity and the water use require analysis outside the scope of this project. At the macro level, Israel has experienced economic growth about 5 percent per year for the 5 years preceding the economic crisis in 2008 and it again experienced growth in 2009 (MFA, 2010). The economy and individual sectors that are primary users of water in Israel have experienced economic growth during the period in which efficiency and demand management policies have been in effect. The consumption of water has either stabilized or decreased in these various sectors (Figure 5). Agriculture was worth 10.8 billion NIS in net domestic product in 2011 (Central Bureau of Statistics, 2012, 873). Figure 6 shows the intended purpose of the agricultural output. In terms of gross domestic product (GNP) agriculture represents about 2.6 percent and less than 2 percent of exports. However, in the past it played a much more important role representing at its peak, 60 percent of exports and 11 percent of GNP in 1950. Despite playing a minor role in terms of the scope of exports, the absolute value of agricultural exports has increased from 20 million dollars to 1.6 billion dollars over 60 years (MFA).
Industry, primarily manufacturing, consumes a much smaller fraction of the water used. In terms of output, manufacturing represented about 13-14% of net domestic product from 2009-2011 (at current value) (Central Bureau of Statistics, 2012, 662). Industrial exports have increased from $6 billion in 1985 to 39.8 billion dollars in 2008 and 34.6 billion dollars in 2009 (MFA, 2010). Tourism, which is included in domestic water programs, represents less than 3 percent of gross national product but about 5 percent of the income from all exports and 16.8 percent of the export of services in 2006. It represented 2.8 billion dollars of foreign currency earnings in 2006 (MFA, 2010).
4.1.5 Discussion and Reflections on Resource Maintenance and Efficiency in the Israeli Water Sector

The plans, policies and programs reviewed as part of this project emphasize reducing the reliance and use of naturally sourced water through demand management, conservation, efficiency programs, and waste water reuse and through producing additional potable water through desalination (Section 4.1.1). Table 6.0 provides a summary of findings and discussion under criteria.

As part of this project, scarcity of the water resource was identified as a key motivator of implementation of both technology and programs (Section 4.1.2). The perception of scarcity of the water resource in Israel has changed and developed over a period of 60 years (Section 3.5.1; 3.5.2). Prior to the period which this project focuses (prior to 2000), the technology and innovations in the agricultural sector facilitated the use of less water and land including drip irrigation, crop substitution and recycled water (Feitelson, 2013). Efficiency programs are extensively developed in the policy documents reviewed and target multiple economic sectors including domestic, agriculture and industrial activities (4.1.1). This project evaluated the growth of Israeli economy under water conservation programs (4.1.4). The literature points to a shift in Israel from the goal of self-sufficiency to more reliance on an economic model in which higher value crops are produced and others imported (Feitelson, 2013). This allowed Israel to make the shift from an Industrial to a post-Industrial economy (Feitelson, 2013).

It should be noted that findings indicate that the agricultural sector receives special attention and designation under water policies (section 4.1.4). In their analysis of water
policy reform in Israel surrounding the 2007 creation of the Water Authority, Fischhendler and Heikkila found that agriculture was exempted from the differential water pricing scheme for higher than basic needs enacted during the drought of winter 2007-2008 (2010). Agriculture is still a majority user of water in Israel and must be included in efforts for reducing overall consumption.

The technological fix and associated conservation programs targeting the domestic sector did slow the rate of increase of water consumption (Kay, 2000). However, despite sweeping efficiency measures motivated by the perception of resource scarcity, management decisions allowed for overdraft on natural water sources due to growing demand from the domestic sector and allocations for expanding agriculture during times of natural climatic variation and droughts (Fischhendler and Heikkila, 2010). This had significant impact on the integrity of the water systems (Kay, 2000). The overdrafts lead to secondary impacts such as an increase in the salinity of aquifers, soil and groundwater due to seawater intrusion (Tal, 2006). Some other impacts include the nitrification of soils and groundwater from increased utilization of wastewater in agriculture (Tal, 2006). The literature has characterized many of the management decisions undertaken by the Israeli government as reactionary and based on short term benefits (Kay, 2000; Kay and Mitchell, 1998). Some of the effects of short term reactionary planning affected the decision making process in addition to the resource context. These effects include a lack of investment the in planning and recruitment of professions in the water sector and the enactment of emergency regulations to gain traction to act in the water sector (Section 4.1.2).
Through this analysis, it has become apparent that despite the acknowledgement of scarcity, management decisions can lead to precarious situations. The decision to desalinate seawater as part of the national water strategy was made in response to the socio-ecological situation in Israel. For years prior to this decision, political gridlock dominated the water sector. Ministry of Finance blocked investment in desalination developments on the supply side and the Agricultural lobby blocked changes to water pricing on the demand side (Feitelson and Rosenthal, 2012). The multi-year drought of 1998-2001 lead to a crisis whereby the water managers of the time had to deal with “increasingly stressed resources with very limited options” and the policy decision was made to desalinate in 2001 and target the supply side (Teschner, Garb and Paavola, 2013). The plans analyzed as part of this project are directly influenced by this policy decision and emphasize meeting the gaps in demand with the production of additional water through desalination (Section 4.1.4). It should be noted that the first large scale sea water desalination plant opened in 2005 at Ashkelon with a capacity of 100 MCM per year (Tenne, 2011). The literature points to several factors in the delay in implementation including wetter seasons following the drought which dulled the urgency of the construction, the need for private investment of capital and the scoping and selection of land on the coast (Feitelson and Rosenthal, 2012; Teschner, Garb and Paavola, 2013). Currently, there are two additional plants online which contribute 37 MCM per year at Palmachim, and 127 MCM per year plant at Hadera with another under construction at Soreq at a capacity of 150 MCM and one in the planning and bidding stage at Ashdod at a capacity of 100 MCM (Feitelson and Rosenthal, 2012;
Goldberg, 2012). Dreizin, Tenne and Hoffman provide details for the considerations of planning the implementation of desalination in their study focusing on the cost and benefits (2008). Considerations in planning include the capacity of the desalination should be over the planning period, the geographical distribution of the plants, the minimum and maximum capacities at each geographical location, the optimal quality of desalinated water, the preferred desalination technology and optimal installation schedule (Dreizin, Tenne and Hoffman, 2008).

From the perspective of Gibson's criteria desalination directly affects waste and overall material and energy use per unit of benefit but has the potential to provide a larger base for the socio-ecological systems. Specifically, plans outline that with desalinated water available, 50 MCM per year will be available for nature conservation and 120 MCM for aquifers starting in 2013 (Section 4.1.4). Other benefits include better quality water for domestic, agricultural and industrial users where desalinated water supply will reduce water softening costs and lower concentrations of nitrates, chlorides (up to 50%), salinity (up to 74%) and turbidity of existing water sources (Dreizin, Tenne and Hoffman, 2008). On the other hand, the plans reviewed as part of this project identified several key concerns related to these plants including the energy needs and environmental issues related to monitoring water quality and releases of brine to the sea (Section 4.1.4). Einav and Lokiec completed a detailed analysis of all the risks and potential environmental issues surfacing from the Ashkelon Seawater Desalination Plant. They characterized much of the effects to soil, ground water, marine environment, increased use of energy and noise pollution to be mainly local in nature
(Einav and Lokiev, 2003). The Ashkelon plant was built in an area used and zoned for industrial activities and from the perspective of impact of groundwater it was minimal because water piping was not laid on the land. Interactions of the brine with the marine environment are one of the main concerns (Dreizin, Tenne and Hoffman, 2008). Often brines will not mix completely due to currents and will sink to the sea floor creating a “salty desert” and affecting vulnerable benthic communities (Einav and Lokiev, 2003).

The brine water is diluted with cooling water from a nearby power plant and is designed to not exceed 10% higher salinity than background water. Another marine based issue that is a concern is that of the release of red plumes into the sea from the brine discharge which is caused by high iron coagulant in the backwash filters mixing with the brine (Dreizin, Tenne and Hoffman, 2008).

As part of the findings of this project integrating desalination into the water infrastructure is seen to complement the existing network and interconnected nature of water management in Israel (Section 4.1.3). In addition to the benefits yielded from the existence of a network of water transport in the form of the National Water Carrier the proximity of the desalination plants to the energy infrastructure is also important. The energy demands of the desalination technology are significant estimated at about 4000-5000 MW in the next ten years (Section 4.1.4). Other studies estimate that the electricity used by the water sector in Israel is expected to double from 2.8 billion kW in 2006 to 5.7 billion kW in 2015 increasing the sector’s usage by 2-4% (Teschner et. al, 2012). The type of energy supplied to desalination plants also have an impact on carbon emissions which if supplied by only coal has been estimated at 135,000 tonnes of CO₂.
for every 45 MCM of water desalinated (Teschner et al., 2012). Teschner et al. explores the current situation where permits for natural gas plants are applied while concurrently getting permits for desalination plants (2012). Investments in alternative power sources including solar and wind power to meet desalination are included as goals in policy documents but have not been fully implemented (Tenne, 2011).

Standards on extraction and quality control for new water developments were identified in Section 4.1.3. Drilling and extraction of water is highly controlled at the national level and is evaluated for technical, economic and financial characteristics (Section 4.1.3). A question to revisit in a future study would be connecting water extraction permits to the amount of natural water used and whether it will decrease in response to the desalinated water coming online as projected in plans.
<table>
<thead>
<tr>
<th>Gibson’s Criteria</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource maintenance and efficiency</td>
<td>Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.</td>
<td></td>
</tr>
<tr>
<td>Ensure Sustainable Livelihoods</td>
<td>Current policies facilitate the provision of reliable water supply across the economic sectors identified in government policy from domestic, agricultural and industrial activities (section 4.1.4). State the influence of development goals to increase quality of life to OECD standards in the creation of water policy (Section 4.1.4).</td>
<td></td>
</tr>
<tr>
<td>Long-Term Socio-ecological integrity</td>
<td>Specific threats to the integrity of the socio-ecological system are identified in findings. These include impacts to nature during droughts (mainly irreversible) (section 4.1.1), overuse (4.1.1), pollution (4.1.3) and scarcity issues (4.1.1). Strategies to reduce directly reduce threats due to overuse and droughts included demand management, reuse, rationing and efficiency policies (4.1.1). Strategies to reduce threats to integrity due to pollution included standards on permitting system for water companies which informs quality standards and required barriers and security around water sources (4.1.3). Threats to the socio-ecological integrity including access issues are considered in a broad context domestic needs and economic objectives in documents. Desalination is promoted as a strategy for coping with these access issues as well as legislative reforms for water companies (4.1.4).</td>
<td></td>
</tr>
<tr>
<td>Waste Reduction</td>
<td>Efficiency policies identified as part of this analysis which range from conservation, demand response and reuse aim to lower the use of potable water sources (section 4.1.1, 4.1.4).</td>
<td></td>
</tr>
<tr>
<td>Extractive Damage</td>
<td>Drilling and extraction of water is evaluated for technical, economic and financial characteristics (Section 4.13). Desalination has some associated negative impacts including interactions with the marine environment (Section 4.1.5).</td>
<td></td>
</tr>
<tr>
<td>Reducing Material and Energy Use per unit benefit</td>
<td>Desalination has been selected to meet gaps between demand and supply. Although the desalination technology is projected to more efficient over time huge investments in infrastructure and energy use are still required (Section 4.1.4, 4.1.5).</td>
<td></td>
</tr>
<tr>
<td>Progression towards sustainability</td>
<td>This area of sustainability experienced a surge in progression with efficiency and technological measures and programs implemented. However, desalination is a key concern from waste and energy perspective.</td>
<td></td>
</tr>
</tbody>
</table>
4.2 Social ecological civility and democratic governance

4.2.1 Transparency and public involvement

Transparency and public involvement are connected in the Israeli water sector in regards to the planning process (Water Authority, 2011, 73). There are other forms of transparency which are also expressed that are closely related to issues of access to information, corporate governance and accountability that are expressed as part of legislation (Ministry of Health, 2007; Water and Sewerage Corporation Law 2001).

The current planning process for the water sector does identify transparency as a goal. The most recent Long Term Master Plan for the Water Sector (Water Authority, 2011), states:

“Numerous discussions were held with work groups and wide forums of specialists and interested parties, and with various government ministries. The summaries and policy papers were published on the Water Authority's web site, and constituted an important element in formulating the alternatives, components and recommendations.”

(Water Authority, 2011, 73).

Despite these efforts, the authors of the Plan express relaying information to the public as a challenge and the increasing difficulty in doing so because of the variety of the types of information needed to be shared (Water Authority, 2011, 11). The other plan reviewed as part of this research was a transitional plan that mainly considered the necessary decisions of government to jumpstart development and programs in the
water sector and not the decision making process. It had a tone of urgency and had more information about necessary actions that were prescribed (Water Commission, 2002, 3, 12, 18). Another report that focused on transparency in detail, despite its technical nature, was the revision of the drinking water quality standards (Ministry of Health, 2007). The report featured an expressed purpose in striving for transparency and informing the public through its decision making process. It detailed the extensive planning and discussion meetings undertaken before final recommendations were made and contents of the report decided upon. The Committee, often known as Adin’s Committee after its chief scientist and investigator Dr. Avner Adin, stated it was important to maintain transparency to the public throughout the revision process. Two government websites published summaries of the discussions from the 22 primary meetings and 55 secondary meetings which took place over the span of two and a half years. The public was able to view intermediate recommendations, minutes and see the opinions of several experts in the area of drinking water quality and there was a public hearing. In response to the recommendations the committee received 120 submissions. The committee reviewed all the comments in their final meeting, responding to them and incorporated them into their final decisions (Ministry of Health, 2007, 11). The process was striving for transparency it was not fully participatory as public comments were incorporated in the final stage.

Transparency is also referenced in legislation relevant to the water sector. There are extensive details regarding the transparency standards that water and sewage companies must adhere to regardless of whether they are public or private corporations.
(Article 70-71, Water and Sewerage Corporation Law 2001). The Freedom of Information Act 1998 applies to water and sewage companies, which generally applies to government or public corporations, giving the public the right to know quality of water, wastewater and reclaimed water in the public domain (Article 57, Water and Sewerage Corporation Law 2001). Water is a public good in the eyes of the law and information regarding its use is required to be publically accessible. As detailed in the legislation, the Local Municipal Authority can direct the public to the appropriate company supplying their water services (Article 57, Water and Sewerage Corporation Law 2001). The Water Law 1959 considers transparency to the public directly in regards to public health risks and orders given by the government to remedy water sources (Article 20.11.7). The actions of the Water Authority in regards to any tests or verifications done to suppliers and their results regarding additions of supply are to be made available to the public (Article 44.10.2, Water Law 1959).

**4.2.2 Legislated or Formal Involvement of Civil Society in Decision Making Process**

The main organizations that have a role in planning and implementation of the water sector in Israel are the Water Authority and the Water Authority Council. The Water Authority is responsible for the administrative and planning aspects of the water sector including regulation, establishing guidelines for licenses, pricing, standards for wastewater treatment, rules regarding production and use of water (Water Authority, 2012; Article 124.15, Water Law 1959). The Water Authority Council is responsible for
the “timely authorization of all decision making and policy-setting made by the Israeli Water Authority and any ministries” (Magen, 2011, 8). The Council has eight members, six from government ministries and two members from the public. One of the public members is nominated by the Minister of National Infrastructure, the second is nominated by the Minister of Agriculture (Article 124.15.1, Water Law 1959). There are also qualifications that the members representing the public must meet that follow the qualifications needed for any director of a government corporation (Article 124.15.2). The Water Oversight Council should also be considered as part of the decision making process of the Israeli water sector. The Oversight Council advises the Minister of National Infrastructure and is made up of 27-35 members and two thirds are considered representatives of the public. The other third are government representatives (Article 126.2, Water Law 1959). The public representatives represent various interest groups such water producers and groups of water consumers. The majority of these groups are market oriented (Article 126.3, Water Law 1959). There is one representative spot for a member who represents environmental interests and is selected from a preapproved list of organizations (Article 126.3, Water Law 1959).

4.2.3 Social Capital and Building Capacity

One of the characteristics of the Israeli water sector is the trend of centralization. This was discussed previously in section 4.1.3 relating to scale and geography. However, this has been extended to the governance structure as well. In recent years the government
has taken action through consolidating the majority of power in the operation of the water sector in the hands of the Water Authority. This organization now dominates the planning part of the decision making process. There are opportunities for organizations to be connected to the decision making process of this organization in their membership in the Water Authority Council and Water Oversight Council. The nomination for membership in these various groups is decided upon by Ministry of Agriculture and National Infrastructure (Article 124.15.1, Water Law 1959). The seat reserved for the environmental representative in the oversight committee must be selected from a short list of organizations that have gained government approval (Representation Act of Public Bodies Concerned with the Environment 2002 Amendment). The several lobbyist groups representing farmers has dominated the Water Authority Oversight Council (Magen, 2002, 82).

The influence of non-governmental organizations and citizen groups in the governance structure and the planning process of the water sector are relatively weak (Article 124-126, Water Law 1959). Although certain reports identify the importance of transparency and public awareness of the issues as important, there is little information about how the government aims to utilize the unique perspective of these organizations to formulate policy for the water sector (Ministry of Health, 2007; Water Authority, 2011, Water and Sewerage Corporation Law 2001). If the government is involved in building civil capacity and increasing involvement in decision-making they are not communicating it as clearly as possible (Goldberg, 2012; Water Authority, 2011). The networks that have been most influential in the last decade for the productivity of the
water sector recently have been related to technology as can be seen in the extent to which technological solutions and knowledge has been implemented (section 4.2.5 and section 4.1.4).

4.2.4 Flexibility and Adaptability to Challenges of the Water Sector

Another defining characteristic of the case study is the highly developed governance system that includes institutions, organizations, legislation, policies, plans and programs. The natural resource context of Israel, (detailed in section 1.1) includes times of scarcity, years of drought and other climatic events to name a few of the challenges. It is also worth mentioning that demographic distribution and existing or future political agreements also affect water governance. Ideally, the structures in place should have some attention to adaptability and flexibility to be able to deal with changing conditions. The *Water Law 1959* does include provisions for adapting to changing regional conditions and for redistribution efforts (section 4.1.1). As part of this legislation the power to initiate such responses rests in the hands of the Director of the Water Authority. In response to changes in conditions of quality or quantity of water, the Authority may initiate the building of pipes and substitute sources for another (article 20, *Water Law 1959*). As referenced previously, the *Water Law 1959* makes provisions for rationing regions or sectors of the country when water is in scarcity (Article 36-44). The majority of the country falls under these conditions where demand is greater than supply (MFA, 2002). Water regulations specify the priority uses, from
highest priority to lower priority, whether domestic including public services apart from public gardens, industrial and agriculture (Article 8, Regulations for Water Use in Rationing Regions 1976). The rationing system established allocations for municipalities for domestic use and quotas for agriculture and industry.

Although the allocations allow for a certain degree of control over water resource use, several severe crises motivated large scale reforms which increased flexibility of the water system. These crisis included: quality issues in 1970's (Tal, 2006), mid 1980's drought culminating in 1985 (Kay, 2000; Kay and Mitchell, 1998) and 2001-2005 severe drought (Menahem and Gilad, 2013). Some of the changes have aimed to make the allocation or quota system in agriculture more responsive to the actual climatic conditions. Quotas for 75 percent of the water to be used in agriculture are given out on the 1st day of the year in January; the other 25 percent is released on the 1st of April considering the climatic and hydrological conditions (Article 8.2, Regulations for Water Use in Rationing Regions 1976). Other changes to the allocation system have targeted the administrative structure and pricing. Sewage and water companies must be separate incorporated entities whereas in the past some of these services were provided directly by municipal authorities (Articles 1-14, Water and Sewerage Corporation Law 2001). These changes were also coupled with a country wide zoning plan which provided guidelines for these newly formed corporations regarding where sewage developments could be built and what they were required to treat (National Outline Plan 34 – National Sewerage Plan 2003). In the domestic sector, quotas and allocations have been exchanged for a pricing system. There was an initial price for the
first amount of water – 7 cubic meters (per housing unit; 3.5 cubic meters per month per person), as well as higher rates for the next 5 cubic meters (per housing unit; 2.5 cubic meters per person) of any additional usage. Local authorities and the water distribution companies were allowed to meet the needs of their consumers without allocation conditions and encouraged to conserve based on the lower rate for lower consumption levels (Water Authority, 2012). There were also moves to implement reforms in agriculture and industry increasing the price of water to meet the price of production and looking into alternatives to the allocation system (Water Authority, 2011, 44-45).

Creating more flexibility in the water system in Israel has been interpreted as making the system less vulnerable to some of the challenges mentioned. Agriculture and industry measures have contributed decreasing system vulnerability through the use of secondary water sources and increasing efficiency as discussed in Section 4.1.1 and 4.1.4. As well, large-scale investment in treatment infrastructure and artificial supply through desalination also make Israel less vulnerable to demographic or regional political challenges on the larger scale. The step toward large-scale investment in desalination came after overcoming much of the previous lack of adaptability in the water sector that was being plagued by inaction and maintaining the status quo (Magen, 2002, 73). Plans and decision-making were primarily evaluated based on shorter term economic means. Additionally, clarification was required on the hierarchy of ministries in providing input to decision making. Often decisions were blocked at the strategic and tactical level even when adopted water policy dictated action otherwise (Magen, 2002,
The situation got to the point at which the Parliamentary Committee set with the task of evaluating the water sector recommended the enactment of emergency laws to enable action. Basic law in Israel states, “In a state of emergency, the Government is entitled to introduce emergency regulations in order to defend... the existence of vital supplies and services” (Magen, 2002, 73). These emergency regulations however were used to complete routine activities in the water system. The allowance to give the power to the responsible authority to take action had to be enacted through emergency regulations. Through some clarifications in legislation, the Water Authority was given the majority of the decision making and planning capacity of the sector and the Water Authority Council became the body responsible for seeing that decisions were fulfilled in a timely manner. This is a continuous process that requires monitoring. More recent plans as the 2011 Master Plan seem to acknowledge that flexibility and adaptability are required in light of “coping with the uncertainty, with technological changes and with the situation of the water system” (Water Authority, 2011, 15).

4.2.5 Knowledge Structures and Promoting Understanding

There are many mechanisms through which understanding and knowledge of the water sector is promoted in Israel and they have all had a degree of success. A large amount of the efforts to develop understanding, knowledge and involvement in the Israeli water sector has been targeted at agriculture. The main policy strategies targeting agriculture have underlying partnerships and programs in research and development (R&D) as well
as education (National Water Efficiency Report, 2011; Water Authority 2011). Several programs work in conjunction to offer funds for investment in R&D that "increase irrigation efficiency, provides funds for investments in regional drainage and water conservation projects, and offers free education of the most recent technologies to farmers" (National Water Efficiency Report, 2011, 26). The government's policy seems to highlight the "active involvement" of farmers providing input to researchers and industry on the challenges they face and working in tandem to develop solutions (National Water Efficiency Report, 26). In addition, the government provides incentives through a "national investment support-program for farmers that employ advanced water-saving and other technologies, and grants for rain-supplied wheat farming in the southern (particularly dry) part of the country." It is worth recognizing that the government is taking advantage of the existing and flourishing R&D community that exports a fair amount of technology worldwide (Azoulai, 2011; Mayer, 2011). Further, the agriculture sector has a pretty well developed sense of community and large organized lobbying force that is well represented in consumer advocates of the Water Authority Council (Magen, 2002, 82; Articles 126.2-126.3, Water Law 1959). The Ministry of Agriculture has a history of direct involvement in water allocations and decision making for water infrastructure and agriculture is still a majority user of water by volume in Israel (Central Statistics Bureau, 2011). Similar initiatives have been put in place for industry. An effort has been made to initiate R&D relationships and though the encouragement of use of brackish water. Industry is still, however, a much smaller user of the water and there are government
incentives programs mentioned above for investment in onsite water treatment and reuse this is an area. The government does outline that they will be working with the Manufacturers Association of Israel to develop changes to the water pricing structure in place (Water Authority, 2011, 65).

Several recent conservation programs and policies which target the domestic and tourism sector had the aim to “warn the public of the water crisis, and to request their prudence in water use” (National Water Efficiency Report, 2011, 23). The policies do promote understanding but they do not necessarily take advantage of inherent social structures in the education system to promote knowledge. The domestic sector group seems to be viewed as more diffuse. Plans do not communicate any partnerships with organizations with the mandate of education or awareness in the area of water.

There is also concern raised that more work needs to be done in terms of developing the personnel in the water sector. There is concern that some of the knowledge acquired over time may be lost due to lack of transfer to upcoming public sector professionals resulting in “lack of investment in the development for the future of the water sector.” Some potential remedies include more connection to individuals in higher education through the means of participation in research, scholarships, and maintaining connections with professional bodies globally (Water Authority, 2011, 69-70).
4.2.6 Discussion and Reflections on Socio-ecological Civility and Democratic Governance in the Israeli Water Sector

One of the key findings in the results section 4.2 was that Israeli water governance and decision making is largely dominated by national governmental organizations. Table 7.0 provides a summary of findings and discussion under criteria. As detailed in section 4.2.2, some of the major organizations include the Water Authority Council, the Water Authority and Water Oversight Council. Although there are selective roles for the public as part of the Water Authority Council and the Water Oversight Council, the admission to these roles is highly controlled by the Ministry of Water and Energy, the Ministry of Agriculture and the Knesset (Parliament) (Section 4.2.2).

Previous studies of Israeli water sector governance have suggested that this dominance of government is directly related to the foundational institutional structure of the water sector and the relatively emergent civil society (Fischhendler and Heikkila, 2010; Menahem, 1998; Weinthal and Parag, 2003). The Water Law 1959, which was evaluated as part of this project (Section 4.0) provides the “basis for the establishment of an institutional structure” related to the water sector (Fischhendler and Heikkila, 2010). Initially, its primary aim was giving “Israel's national government complete control over the resource” (Fischhendler and Heikkila, 2010). It reflected the prevailing ideologies of the time related to nation building. These ideologies included the central role of the state as the primary decision making authority, the foundation of an agrarian society, the expansion and development in the dessert and the equalization in the supply of
resources within all parts of the country (Fischhendler and Heikkila, 2010; Menahem, 1998).

While there have been significant changes to the Law since the 1950’s to include elements of newer paradigms and ideas related to environmental, social and economic interests the entrenched structure and the main actors remained relatively the same until recently with the reforms which created the Water Authority (Fischhendler and Heikkila, 2010). It was over this period of almost 50 years that both planning and the physical infrastructure came to reflect the interests of these actors (Mizrachi, 2004).

Additionally, it is worth recognizing the dominance of consensus lead decision making in the Israeli political and planning process. Several studies point toward how leading actors within the Ministries worked to monopolize the agenda during the process of reform and creation of the Water Authority (Fischhendler and Heikkila, 2010; Mizrachi, 2004). Although it is not the sole responsibility of the government to create and nurture governance networks related to water one of the findings of this project was that the government did encourage development of networks related to technology transfer and agriculture channels with established relationships to the water sector (Section 4.2.5).

Another reason postulated for the dominance of government in water governance in Israel is the relatively recent involvement of civil society and the weak social capacity of these organizations (Weinthal and Parag, 2003). This complements another aspect of inquiry in this project looking into the social capacity and engagement of the larger governance community (Section 4.2.2; 4.2.3). The findings showed limited involvement by civil society including non-governmental organizations under controlled settings
In a study looking into the implementation of Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention) by Israel Weinthal and Parag evaluated the social capacity of Israeli non-governmental Organizations (NGO) (2003). The study chronicled the wider Israeli environmental movement and involvement of NGO’s in implementation and enforcement of legislation (Weinthal and Parag, 2003). Environmental NGO’s in Israel remained small and less active than movements in the West at the same time or in other developing countries. These organizations largely become more engaged in the late 1980’s and into the 1990’s (Weinthal and Parag, 2003; Hananel, 2010). Further, the majority environmental NGO’s surveyed in 2001 “focus[ed] their attention on conducting seminars and conferences and carrying out scientific research” and “shifted their focus away from national issues such as conservation programs to local environmental issues and/or to create umbrella organizations devoted to a specific issue” (Weinthal and Parag, 2003). Menahem connected the major changes in Israeli water planning such as the adoption of desalination in the late 1990’s to the rise of activism related to peace accords and privatization (1998).

Significant reforms influenced by a growing environmental lobby lead to changes to the Water Law 1959 in the 2000’s. As indentified in the literature and as part of this project, a 2005 amendment established nature as a water user incorporated and a change in policy in 1990 which lead to the construction of several wastewater treatment plants and the policy of wastewater recycling (Feitelson and Fischhendler, 2009). Further, environmental NGO’s have been occupying new roles as watchdogs using legal channels
to cause the government to uphold their commitments and engage in discussions targeting questions of environmental justice regarding resource allocations (Weinthal and Parag, 2003). They have adopted a more “cooperative stance toward government authorities” in governance and decision making (Weinthal and Parag, 2003).

This project evaluated channels and mechanisms for transparency in water governance finding that transparency was acknowledged in the most recent planning process, current legislation and as implemented in the evaluation of water quality standards (Section 4.2.1). The results of this project focused on reporting areas where transparency was included. It is also worth considering the areas transparency and public participation was not valued and where other more technical and financial criteria were considered of primary importance such as the criteria for evaluation of water projects, discussed in section 4.1.3. Further, despite the inclusion of transparency as a value in the Master Plan of 2011, legislation in regard to water and sewage corporations and the Report on Water Quality Standards (see Section 4.2.1) there is not a standard institutionalized manner for the public to participate in decision making in a transparent and on going basis except for inclusion in the Water Council and Water Oversight Council (Ministry of Health, 2007; Water Authority, 2011, Water and Sewerage Corporation Law 2001). Findings in this project found there is some transparency but the openness of deliberations of the decision making process is minimal (Section 4.2.1). Public participation and the level of transparency is left to the discretion of the committee organizing the specific Master Plan, Outline Plan or Development Plans (Shmueli, 2005).
Although, the literature has shown that engagement and social capacity seems to be increasing the actual involvement and positions that non-government organizations occupy in the water sector are minimal and many NGO's still only have “observer” status in many deliberations (Weinthal and Parag, 2003; Fischhendler and Heikkila, 2010). As well, in the Israeli planning process at the regional and national levels, both of which are relevant to the planning of the water sector, the involvement of non-government actors is only allowed once much of the scoping and alternatives decision making has been completed (Shmueli, 2005). Involvement in the early stages is not embedded in planning law or practice and policy makers are at the stage of pilot projects and experimentation in public participation methods (Shmueli, 2005).

This project found that there were several types of mechanisms to allow for adaptability and flexibility in planning and decision making in the water sector (Section 4.2.4). The redistribution of water using the National Water Carrier, the reuse of grey water and the implementation of desalination has lowered the vulnerability of the system (Section 4.2.4). In addition, allocation and pricing of water can be adjusted to be responsive to usage patterns and climatic conditions (Section 4.2.4). The power to initiate these changes rests in the hands of the Water Authority and legislation gives the Director of the Water Authority the ability to initiate these responses to directly target the resource by using the water available more efficiently or by putting more water into the system (Section 4.2.4). However, the lack of the water sector’s ability to respond and take action was one of the main reasons reorganization and reform in the early 2000’s (Feinerman, Frenkel, and Shani, 2013; Fischhendler and Heikkila, 2010). Other reasons
include that the previous method of governance did not fit trends within the water system where more water was going toward the domestic consumption and less towards agriculture (Feinerman, Frenkel, and Shani, 2013). The domestic sector is less flexible in consumption patterns than agriculture (Feinerman, Frenkel, and Shani, 2013). The powers to regulate were spread over multiple authorities in different ministries and this “generated conflicts between different interests, caused preferences for sectorial over national considerations, and obviated long-run decision-making” (Feinerman, Frenkel, and Shani, 2013). Concentrating the power to regulate in the hands of one organization required significant negotiations and trade-offs (Fischhendler and Heikkila, 2010). Several studies post the 2007 establishment of the Water Authority have asked whether it has been able to respond to challenges such as the water crisis in winter 2007/2008 which followed the severe drought years of 2001-2005 (Feinerman, Frenkel, and Shani, 2013; Menahem and Gilad, 2013). The answer is mixed. Menahem points a 2010 Commission Inquiry Report which stated “Ministry of Finance and more specifically the Budget Division did not allocate the funds necessary for most of the approved projects” for the Water Authority (2013). Despite the reform, the majority of the core beliefs of the initial policy actors remained the same. Many of the actors in the various Ministries did not let go of what they held as part of their core powers and continued to try to block projects they did not agree with for whatever reason (Menahem, 2013). At the same time that there is some evidence that the Water Authority has had some accomplishments including the emergency programs and projects initiated by the Water Authority have yielded “a lasting effect on the per-capita consumption” such as a
decline in usage of 15% during the years of 2010-2011 (Feinerman, Frenkel, and Shani, 2013).
Table 7: Findings Summary Table for Discussion and Reflections on Socio-ecological Civility and Democratic Governance in the Israeli Water Sector

<table>
<thead>
<tr>
<th>Gibson's Criteria</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Socio-ecological civility and democratic governance</td>
<td>Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision-making practices.</td>
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<tr>
<td>Capacity building</td>
<td>Network building is focused on technological development and agriculture focused (Section 4.2.3).</td>
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<td>Open and Informed Deliberations</td>
<td>Transparency mechanisms are entrenched in legislation in regards to access to information from sewage and water companies for public health concerns (Section 4.2.1). Current Long Term Master Plan and the Water Quality Standards Review included transparency as a goal, explained efforts to hold working groups with interested parties and disseminate resulting contributions. Openness of overall planning deliberations is minimal. Participation of civil society was limited and often late in the process (Section 4.2.1).</td>
</tr>
<tr>
<td>Fostering Reciprocal Awareness and Collective Responsibility</td>
<td>Water planning documents discuss the difficulty in relaying messages to the public due to type and variety of information (Section 4.1.2). Number of stakeholders involved from the public stakeholders is two in the Water Authority Council selected from a preapproved list. There is one environmental member of the Water Oversight Council and two thirds of 27-35 members are public however they are mainly market representatives (Section 4.2.2). There is uneven representation of non-government, non-market actors and public or civil society actors. With many more government and market stakeholders being including in decision making bodies (Section 4.2.2).</td>
</tr>
<tr>
<td>Integrated use of administrative, market, customary and personal decision-making practices</td>
<td>Programs structured to influence the public and industry using administrative, market and personal decision-making practices (Section 4.2.5). Coordination of water resource activities is currently facilitated through the Water Council and the Water Oversight Council (Section 4.2.2). Governance structure provides some mechanisms for collaboration which reflect the interconnected physical nature of water sources mainly due to sector centralization (Section 4.2.4).</td>
</tr>
<tr>
<td>Progression towards sustainability in the area of social civility and democratic governance is incrementally positive or neutral.</td>
<td>Although involvement of non-government actors is minimal in decision making there is an increase in social capacity of civil society and transparency that has and may continue to gradually influence water governance if the trend continues. There are many barriers to overcome in established power structure and lack of history of institutionalized involvement of public in planning process.</td>
</tr>
</tbody>
</table>
5.0 Recommendations and Conclusion

Addressing the purposes of the project:

1. Key questions adapted Gibson’s Sustainability Assessment Criteria for the evaluation of a water governance regime were formulated as part of methodology section 3.0.

2. The results and discussion section 4.0 fulfilled the goal to evaluate documents and observational evidence related to the Israeli water sector using Gibson’s criteria and the adapted questions.

3. Key areas that should be clarified by the Water Council include:
   a. The water allocations to nature during times of drought
   b. Specific plans to rehabilitate aquifers
   c. The policy for use of aquifers and natural potable water, revision of related legislation and criteria related to water drilling
   d. Enforcement of water drilling and pollution releases penalties
   e. Strategic level coordination of infrastructure planning integrating desalination with energy resources allow existing water transport corridors
   f. Consideration of societal implications of desalination in economic terms
g. A more consistent procedure for involvement of the public in the planning process and processing of their feedback

h. Allow for a more open process in selecting the public positions allocated on the Water Council

i. Phase in more representatives from the public environmental sector as well as smaller and domestic sector consumer groups to reflect evolving water consumption into the Water Council Oversight Council

j. Aim to build civil capacity and increase involvement from the public in decision making

k. The direction in pricing and planning reforms that reflect climatic and environmental conditions

l. Institute regulated long term planning regime

5.1 Future Research Directions

1. Complete an analysis of Israeli water governance and management using all of eight areas Gibson’s Criteria.

2. Choose one issue in the Israeli context: Virtual Water, Desalination, Water and Energy Connections and look into detail for the implications to the criteria.

3. Evaluate emerging plans for joint management of shared water resources for the Jordan River and the Dead Sea using this framework.
4. Complete the above while including an evaluation of trans-boundary issues and water transfers in the region i.e. widening the spatial scope to meet the water system.

5. Perform the above evaluation using documents from Jordan, Israel and the Palestinian Authority to evaluate concepts of fairness and equity in water allocations.

6. Utilization of these questions and criteria for an analysis in a different country and governance structure, perhaps a water rich country.
6.0 Sources Cited:


Israeli Legislation Cited [Hebrew]

The Control over Water Drilling Law, 5715-1955
The Petroleum Law, 5712-1952
The Public Health Ordinance, 1940
The Water and Sewerage Corporation Law, 5761 - 2001
The Water Measurement Law, 5715-1955
The Water Law, 5719-1959
Regulations for Water Use in Rationing Regions, 5736-1976
Appendix 1: Map of major water infrastructure operated by Mekorot, the Israeli National Water Company (Mekorot Corporation, 2012).
Appendix 2: List of Search Terms used for initial coding in documents

Sustainability

Resource maintenance and efficiency
Resource
Management
Maintain
Connection
Efficiency
Scarcity
Scale
Economic growth
Development
Savings
Technology
Distribution
Geographical
Impacts
System

Socio-ecological civility
Democratic governance

Democrat* (* indicates that this includes variations such as democratic, democracy, etc)
Community
Decision Making
Planning
Public
Informed
Education
Understanding
Transparent
Access to information
Governance
Committee
Stakeholders

Published
Participate
Social Capital
Non-government
Organizations

Adaptable
Changes
### Appendix 3: Table 3.0: Summary of criteria as discussed in the reviewed documents.

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<tr>
<td>Resource maintenance and efficiency</td>
<td>Considers the management of water, setting a goal for per capita consumption which will maintain sustainability and resource allocation efficiency. Internal objectives of the water sector efficiency in management, infrastructure and utilization. Provides examples of programs for savings, water reuse and pricing reforms.</td>
<td>Stated shift in policy from one of &quot;brinkmanship&quot; or risky on the verge of collapse to more stable and proactive in preventing shortfalls while maintaining quality. Accomplished through introducing desalination as well as more storage capacity. Water allocated to nature. Investment in treatment and reuse. Considers water important for quality of life.</td>
<td>Plan Bleu: &quot;water-use efficiency, limiting wastage of potable water, and limiting water losses.&quot; Maintain the natural potable water consumption at average or below natural supply rate. Priority improvements through the system for long term use of all alternative sources. Attention to potential shortages and causes. Details incentives, programs in each sector (i.e. residential, industrial, and agricultural) for water conservation.</td>
<td>Comments overall in the need for more administrative cohesiveness to streamline efforts in wastewater reuse. Warning’s, reviews and plans not acted on and general irresponsible management of water resource in the last 25 years. Policy reform needed as desalination introduced. Price subsidies caused need for allocations and inefficient system.</td>
<td>Goal of meeting Israel’s sewage disposal needs while balancing the need to maintain public health, environmental quality, the quality of surface water including rivers, groundwater, open landscapes, agriculture, natural features and views, and economic efficiency. No sewerage developments can impact the efficiency of treatment. All effluent and sludge to be treated.</td>
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<tr>
<td>Criteria Area</td>
<td>Resource maintenance and efficiency</td>
<td>Water is a described as a public good to which every user has a responsibility to use efficiently and try to engage in conservation. Government facilities are required to have efficiency measures in place. The resource will be controlled to suit the needs of citizens and to aid in the further development of the country. Gives the government power to maintain production, consumption regularity and efficient use. Encouragement of savings, using alternative sources, conversion of grey water into drinking water through budgetary means. Allows for distribution to regions with compromised quality or quantity.</td>
<td>Outlines the responsibilities of a company providing sewerage service. Included must responsibility of monitoring wastes and remediing any impact to humans, property, a body of water, wastage of water or environmental pollution. Highlights that the Minister of environment will apply punishment if the public is endangered from any action by a company or its employees.</td>
<td>Sets out conditions on drilling licences which aim to protect public health or domestic supply. Attach conditions on the how it is drilled, the amount of water that can be supplied from this well/source or the purpose for which the water is used.</td>
<td>All recommendations and subjects discuss drinking water primarily. Changes to more conclusive tests and higher quality standards. Mention need for stabilization and standards for desalinized water. All surface water should be treated. Recommendations to ensure the qualifications of all those working on the water system through the Ministry of Health. Institute more regular checks at source, at treatment area and through stations through out the system.</td>
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<td>Socio-ecological civility and democratic governance</td>
<td>Mention that social justice is one of the national goals and applies to the water sector. Decision making in water sector must consider social, environmental and economic aspects. Principle of social fairness - “maintaining fairness in allocating water between the sectors, and equality between all water consumers in the same sector, in terms of the water services and prices.” Identify that water regulations and allocation impacts livelihoods. Highlights importance of transparency and involvement of public in decision making process and formulation of the plan. Issues in governance personnel, independence of Water Authority.</td>
<td>Discusses decision making process in water sector mainly in regard to government decisions with a tone of urgency. Mentions the reorganization of the Water Commission and water system. Highlight’s the need to review master plans every 3 years and adapt to changes. Strategic investment at the planning level and more policy tools to communicate changes. Recognize the need for the public to be on side in conservation efforts. Focus of the development policy is social well being.</td>
<td>Water Authority is the main decision making, planning and policy body and the Water Authority Council is responsible for seeing timely authorization of actions. Public interest members part of the Water Authority Council. Mention that all water in Israel is public property and reference the Water Law. Mention conservation and education programs for general public and farmers.</td>
<td>Main essence of this inquiry looks at the institutional problems and potential solutions this is specifically targeting the decision making process. Highlight that in the past proactive and strategic decisions were held back due to economic criteria and concerted ministerial efforts. Hierarchy of water sector is unclear and decisions not always implemented. There is a lack of efficiency. Identify the need to involve the public and environmental groups in addition to the other consumer interest groups. Recommend more up to date data on water sector to be published. Comment on the need to make national water distribution company Mekorot more viable.</td>
<td>Protection of public and communal land being used for sewerage development. Discuss service standards for informing the public. Regional authorities will establish sewerage committees. All representatives will be chosen by government: health, water commission, environment ministries and one chosen by regional council. There are to be no developments for treatment approved which emit heinous smells, noise, or affect public health.</td>
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<tr>
<td>Socio-ecological civility and democratic governance</td>
<td>Responsibility to citizens to provide water. Gives details with regard to Water Council and Water Authority. The responsibilities, who nominates the members of the Council their terms. Two members of the National Governmental Authority are from the public nominated by Ministry of Infrastructure and other by Ministry of Agriculture from approved list of organizations. Two Third of the Water Council are to represent the public. Water data is to be published and announcements are made for different water conditions drought, winter season. Public access to information regarding health risks as well as any checks done by the Water Authority and their results regarding additions of supply. Annual Reporting and planning announced.</td>
<td>Aim to serve customers free from discrimination. One of the main focuses of the law was to take this responsibility away from the local government and transfer to public or private corporations. Provision of licences to companies aim to control responsibilities and regional provision of services. The standards, quality and nature of services will be decided by the Board Auth and the Commissioner rather than dictated in the law. All companies are required to comply with freedom of information act, 1998 whether they are public or not.</td>
<td>Aim to control and make accountable drilling permits and water providers. Director of Water Authority has the responsibility to publicize any submission for a water drilling permit at the location local authority. Any responses are to be written and processed quickly. Under the jurisdiction of the Ministry of Infrastructure to make regulations for drilling.</td>
<td>Details the transparency of this committee and consider public as a necessary stakeholder. The committee engaged responses received from their public hearings. All the comments in their final meeting incorporated them into their final decisions. Focused on transparency of the main channel of information which is that of the Ministry of Health recommend annual report on tests to drinking water.</td>
<td>Some information on publication of changes in drinking water quality. Facilities that produce secondary use or grey water must indicate clearly to users and public that it is not drinking water quality.</td>
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</table>
## Appendix 4: Table 4 of Core Documents Reviewed

<table>
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<th>Document Name</th>
<th>Date Retrieved</th>
<th>Source</th>
<th>Comments</th>
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<td>Water Law 1959</td>
<td>May 24 2012</td>
<td>Nevo The Legal Database <a href="http://www.nevo.co.il/law_word/law01/235_001.doc">www.nevo.co.il/law_word/law01/235_001.doc</a></td>
<td>Hebrew</td>
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<td>The State of Israel: National Water Efficiency</td>
<td>July 6 2012</td>
<td>Israel Water Authority <a href="http://www.water.gov.il/Hebrew/ProfessionalInfoAndData/2012/04-The-">http://www.water.gov.il/Hebrew/ProfessionalInfoAndData/2012/04-The-</a></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Date</td>
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<tr>
<td>Control over Water Drilling Law 1955</td>
<td>July 4 2012</td>
<td>Nevo The Legal Database <a href="http://www.nevo.co.il/law_word/law01/235_003.doc">http://www.nevo.co.il/law_word/law01/235_003.doc</a></td>
<td>Hebrew</td>
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<tr>
<td>The Master Plan for Desalination in Israel, 2020</td>
<td>May 29 2012</td>
<td>Israel Water Authority <a href="http://www.water.gov.il/Hebrew/ProfessionalInfoAndData/2012/07-Israel-Water-Sector-Desalination.pdf">http://www.water.gov.il/Hebrew/ProfessionalInfoAndData/2012/07-Israel-Water-Sector-Desalination.pdf</a></td>
<td>English</td>
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<tr>
<td>Regulations for Water Use in Rationing Regions, 1976</td>
<td>July 6 2012</td>
<td>Nevo The Legal Database <a href="http://www.nevo.co.il/law_word/law01/235_035.doc">http://www.nevo.co.il/law_word/law01/235_035.doc</a></td>
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Appendix 5 Selected examples of photographs taken from Mekorot Visitor’s Centres.

Photograph 1: Photograph from site visit to Shaftdan Wastewater Treatment Plant. Shown is the initial screening phase of water entering the treatment plant. Large particles, wood and plastics are separated out of the water during this phase.
Photograph 2: Site visit to Shaftdan Wastewater Treatment Plant. This is a sludge pump which processes wastewater after various clarifiers and settling ponds.
Photograph 3: Site Visit Shaftdan Wastewater Treatment Plant. Shown is part of the presentation in the Visitor's Centre where guides illuminated a replica model of the treatment plant to highlight different phases of the treatment.
Photograph 4: Site visit photograph from Yarkon Springs Center at Rosh Ha'ayin. The photograph shows pumps used to connect the water sources to the National Water Carrier.