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# The Shrinking Dead Sea and the Red-Dead Canal: A Sisyphean Tale?

Stephen C. McCaffrey\*

## I. INTRODUCTION

The Dead Sea has long been known the world over as a unique geographic feature, having cultural, religious, and political significance.<sup>1</sup> Aristotle is said to have been “the first to tell the world about the salty body of water where no fish live and people float.”<sup>2</sup>

Despite its name, the Dead Sea is neither “dead” nor a “sea.” Though it is a very large body of water, measuring some fifty-miles long and eleven-miles wide at its widest point, the Dead Sea is, in fact, a lake. Like other inaccurately named large bodies of water (such as the Caspian Sea, the Aral Sea, and the Sea of Galilee), its name reflects its size and salinity, not its geographic or legal character. Moreover, while the degree of its salinity—around ten times that of the Mediterranean—renders the Dead Sea inhospitable to nearly all forms of life, there are microscopic life forms that have adapted to the chemistry of its waters. Additionally, large and diverse populations of birds and other animals live in and around the lake.<sup>3</sup>

There are other well-known features of the lake that define its uniqueness. For instance, the Dead Sea is the lowest point on the Earth’s surface, some 400 meters, or 1340 feet, below sea level, and as will be discussed below, its level is becoming progressively lower as its size decreases. Moreover, the Dead Sea is located in one of the most arid regions on Earth, the Middle East. Additionally, it is roughly bisected from the north to the south by the border between Jordan on the eastern side, and Palestine (the West Bank) and Israel on the western side, placing it in the middle of some of the most hotly-contested land on earth. Finally, the Dead Sea, which has no outlets, is the terminus of the Jordan River basin, a watershed shared by two upstream states, Lebanon and Syria.

Its geologic and human history would naturally lead one to assume that the Dead Sea is a permanent feature of Middle-Eastern geography. But human intervention has cast the Dead Sea’s future into doubt. Its surface area has shrunk by some thirty percent in the past fifty years, due to a twelve-meter (or about

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1. See, e.g., Israel Ministry of Foreign Affairs, *Israel and Jordan Launch Global Campaign to Save the Dead Sea*, 10 Aug. 2002, available at [http://www.mfa.gov.il/mfa/mfaarchive/2000\\_2009/2002/8/](http://www.mfa.gov.il/mfa/mfaarchive/2000_2009/2002/8/) (follow “Israel and Jordan Launch Global Campaign to Save the Dead Sea-August 2002” hyperlink) [hereinafter *Israel and Jordan*] (stating that “[t]he biblical Sodom and Gomorrah, Mt. Nebo and Madaba grace the Dead Sea’s shores, which also served as the cradle of early Christianity[] and capital of ancient Moab”).

2. TED Case Studies, No. 429, *The Dead Sea Canal*, <http://gurukul.ucc.american.edu/ted/deadsea.htm> [hereinafter *The Dead Sea Canal*].

3. *Israel and Jordan*, supra note 1.

forty feet) lowering of its water level. This article will briefly look at the causes of the Dead Sea's rapid and continuing shrinkage, and current plans to restore it to its former level.<sup>4</sup>

## II. BACKGROUND

It might be thought that the cause of the Dead Sea's decrease in size is related to its extremely arid environment. It is true that the lake loses some two billion cubic meters of water per year due to evaporation.<sup>5</sup> But this is obviously not a new development; the Dead Sea has maintained its size in the face of this evaporative loss for millennia. In fact, it is this tremendous volume of evaporation over time combined with the Dead Sea's location at the terminus of the Jordan River that has given rise to a unique concentration of minerals in the lake, and in general its special character.

Historically, the flow of water into the Dead Sea was approximately equal to the rate of evaporation. Two-thirds of this flow came from the Jordan River and the rest from seasonal streams, or *wadis*, that feed the lake.<sup>6</sup> However, the Dead Sea's water balance began to change in the 1930s, as increased human settlement in historic Palestine (roughly speaking, present-day Israel plus the West Bank and Gaza Strip) placed greater demands on the waters of the Jordan River. Today, Jordan and especially Israel both heavily rely on water from the stream. The third riparian of the Lower Jordan River, Palestine's West Bank, has been blocked by Israel from gaining access to the river since 1967,<sup>7</sup> but would certainly seek a share of its water in any permanent status agreement with Israel.

These heavy demands placed on the river by its riparians are linked to the overall availability of water in the region. Water specialists, such as Mallin Falkenmark and Peter Gleick, have set the threshold for "absolute water scarcity" at 500 meters<sup>3</sup> per person per year.<sup>8</sup> The average availability of water per capita in Palestine is presently about 70 meters<sup>3</sup> per year. Jordan's supply is more than double that at 160 meters<sup>3</sup> per year. Even Israel, which utilizes about 330 meters<sup>3</sup> per year on a per capita basis, is well below the absolute scarcity threshold. Thus,

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4. *A note on sources of information:* I have been an adviser to the Palestinian National Authority since the late 1990s, and in this capacity have had access to documents relating to the proposed Red Sea-Dead Sea Water Conveyance ("RSDSC") as currently conceived. These documents, unfortunately, remain confidential. I therefore cannot refer to them as would usually be done in a law review article. When factual information of a non-confidential nature contained in the documents is presented in this article, reference will be made generically to that source.

5. *The Dead Sea Canal*, *supra* note 2.

6. *Id.*

7. AARON T. WOLF, *HYDROPOLITICS ALONG THE JORDAN RIVER: SCARCE WATER AND ITS IMPACT ON THE ARAB-ISRAELI CONFLICT 49-64* (United Nations University Press 1995).

8. See M. Falkenmark & C. Widstrand, *Population and Water Resources: A Delicate Balance*, 47 *POPULATION BULL.* No. 3, Population Reference Bureau, Washington D.C. (1992); Peter H. Gleick, *Water and Conflict: Fresh Water Resources and International Security*, 18 *INT'L SECURITY* 79, 101-102 (Summer 1993).

it is not surprising that the Jordan River, as the principal surface watercourse in the area, is crucial to meeting the water needs of these three riparians.

Of the five co-riparians of the Jordan River Basin, Lebanon uses the least of its water, diverting only about 10 million cubic meters per year (“mcm”).<sup>9</sup> Syria and Jordan consume significantly greater quantities, most of which are drawn from the Yarmouk River, a tributary of the Jordan that joins it below Lake Tiberias (the Sea of Galilee). Jordan diverts some 320 mcm per year into its East Ghor/King Abdullah Canal, which parallels the Lower Jordan River on its east bank and is used for irrigation. Syria withdraws an average of 260 mcm per year from the Jordan Basin through a number of small impoundments on the Yarmouk; Israel prevented Jordan and Syria from constructing the planned Maquarin storage dam on the river.<sup>10</sup>

Israel consumes more Jordan River water than any of the other riparians, diverting some 700 mcm per year from Lake Tiberias into its National Water Carrier (“NWC”). This is as much water as the Jordan River delivers to Lake Tiberias, which helps to explain why the Dead Sea is shrinking. Israel’s NWC, which began operation in the early 1960s, conveys this water out of the Jordan River Basin for delivery to coastal cities and farms in the Negev desert. None of this water returns to the Jordan River. Palestine, on the other hand, withdraws no water from the Jordan River because Israel prevented the Palestinians from gaining access to the river since it captured the West Bank in the 1967 Six Day War.

Even if Palestinians had access to the portion of the Lower Jordan River to which the West Bank is riparian, however, it would not significantly benefit them. Diversions by Israel from Lake Tiberias into the NWC, and to a lesser extent, those by Israel, Jordan, and Syria from the Yarmouk, reduce the flow of the Jordan River below Lake Tiberias to a trickle. The water that does flow in the Lower Jordan principally consists of that which is diverted there by Israel from two sources, neither of which is usable without expensive treatment: saline springs that would otherwise flow into Lake Tiberias, contaminating water diverted by Israel into the NWC; and wastewater from the Israeli city of Tiberias. These two sources, together with return flows from irrigation on both banks of the Jordan that are laden with salt and agricultural chemicals, make up a large part of the water that flows into the Dead Sea. Even this volume of water (which may be also polluted) stands to decrease as the burgeoning populations of the riparian states place increasing demands on shared freshwater resources.

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9. Lebanon has ample supplies of freshwater from other sources, such as the Litani River.

10. However, Jordan and Syria are proceeding with plans to construct the Wehdeh Dam on the Yarmouk River. See generally Oula Al Farawati, *Water Ministry to Issue New Wehdeh Dam Tender*, Jordan Times, March 10, 2002, available at <http://www.jordanembassyus.org/03102002006.htm>.

### III. THE PROPOSED SOLUTION: THE "RED-DEAD CANAL"

Beginning as long ago as the nineteenth century, there have been a number of proposals designed to generate electricity or desalinate seawater by taking advantage of the 400-meter difference in elevation between sea level, whether that of the Mediterranean or the Red Sea, and the Dead Sea. The plans would convey seawater via tunnels, canals, or pipelines to the Dead Sea for use in power generation, and more recently, desalination.

Israel, taking advantage of its position on the Mediterranean Sea, originally proposed a conveyance from its coast to the Dead Sea (referred to in shorthand as the "Med-Dead" canal). For its part, Jordan proposed bringing water from its seacoast on the Gulf of Aqaba, the northeastern arm of the Red Sea (the "Red-Dead" canal). Both plans were originally designed only to generate electricity. Then in 1996, Harza Engineering of Chicago completed a study proposing the use of a Red-Dead canal to produce electricity that would in turn power a desalination plant to produce fresh water. This study provided the basis for the project currently under consideration.<sup>11</sup>

According to its supporters, a Red Sea-Dead Sea Water Conveyance<sup>12</sup> ("RSDSC") would have a number of benefits in its present form. As articulated by Jordan and Israel, notably at the Johannesburg Summit on Sustainable Development held in August 2002 and at the Third World Water Forum in Kyoto in March 2003, the "shared vision" of the Red Sea-Dead Sea Water Conveyance Project, also referred to as the "Peace Conduit," is as follows: (a) "saving" the Dead Sea; (b) making drinking water available at affordable prices to Jordan, Israel, and the Palestinian National Authority; and (c) building a symbol of peace and cooperation in the Middle East.<sup>13</sup>

The present version of the project is being chiefly promoted by Jordan, with support from Israel and the World Bank.<sup>14</sup> In view of the riparian status of the West Bank as to both the Jordan River and Dead Sea, the Palestinian Authority ("PA") also has clear interests in the project and is a participant with Jordan and Israel in the feasibility study process. Palestinians stand to benefit from the project if freshwater is in fact delivered from it to the West Bank as described below.

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11. *The Dead Sea Canal*, *supra* note 2.

12. This is the name that was given the project currently under consideration in the Terms of Reference for an Environmental, Technical and Economic Feasibility Study and Environmental and Social Assessment, prepared by the World Bank in cooperation with Israel, Jordan, and the Palestinian Authority (Final Draft, 19 April 2005) (hereafter TORs) (on file with the author). While information contained in the TORs will appear on the World Bank's website by the time this article is published, the TORs themselves are confidential at the time of this writing. They are therefore cited only for information that is otherwise publicly available.

13. *Id.* at 13.

14. See, e.g., *Israel and Jordan*, *supra* note 1 (stating that Jordan and Israel "have joined forces to bring international attention to the environmental jeopardy facing the Dead Sea Basin and to promote the 'Peace Conduit' as a viable solution").

The proposed project involves pumping water from the Red Sea at Aqaba, Jordan, to an elevation of 220 meters. The water would then flow across the Wadi Araba, in some places exposed and in others tunneling through the Jordan Rift Valley mountains, in all covering some 200 kilometers before descending over 600 meters into the Dead Sea, thereby introducing water from the Red Sea into the Dead Sea. The seawater would be sent through a hydroelectric plant and a hydro-static reverse osmosis treatment facility, producing electricity and fresh water, and refilling the Dead Sea to the level of the 1930s over a period of ten to twenty years. When the Dead Sea reaches its historic levels, the current scheme reduces the flow of Red Sea water to match the rate of evaporation. Constructing the conveyance would be no small undertaking. It would represent a major feat of engineering, taking some ten years to complete at a cost in the neighborhood of \$5 billion. The conveyance would run generally along the border between Jordan and Israel, entirely in Jordanian territory.

As already indicated, the stated purpose of a “Red-Dead Canal” has changed over time. Originally conceived as a method of generating electricity, such a project was later touted as a means of producing badly-needed freshwater. The most recent justification given for the scheme has been that it will have the environmental benefits associated with “saving” or restoring the historic level of the Dead Sea. This was the first element of the “shared vision” of the project as announced at the 2002 Johannesburg Summit. The production of drinking water was relegated to second place in the “shared vision,” with the project’s value as a symbol of peace and cooperation in the Middle East being listed third. The production of electricity is no longer mentioned, though it would occur and is indeed an essential part of the desalination process. It is unclear whether this shifting in priorities and justifications is driven more by heightened environmental awareness, political factors relating to the present inequitable allocation of Jordan River water, or an attempt to make the project more attractive to potential funders, particularly in environmentally-conscious Europe.

As currently conceived, the project’s environmental benefits would result in greater revenues from increased tourism. The Harza study estimated a \$320 million benefit from tourism alone.<sup>15</sup> According to Harza, there would be commercial benefits from the project as well, flowing from preservation of the important salt and potash industries based on the unique mineral characteristics of Dead Sea water.

But the production of drinking water clearly appears as the project’s most vital feature. The RSDSC would eventually produce some 850 mcm of freshwater per year, two-thirds of which would go to Jordan (principally Amman), and one-third to the Jerusalem area of Israel and Palestine.<sup>16</sup> It has been

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15. *The Dead Sea Canal*, *supra* note 2.

16. Israeli Ministry of Foreign Affairs, *The Red Sea and the Mediterranean Dead Sea Canals Project*, 10 Aug. 2002, available at [http://www.mfa.gov.il/mfa/mfaarchive/2000\\_2009/2002/8/](http://www.mfa.gov.il/mfa/mfaarchive/2000_2009/2002/8/) (follow “The Red Sea and the Mediterranean Dead Sea Canals Project” hyperlink) [hereinafter *Canals Project*].

estimated that Jordan's share would eliminate its water deficit, which has been projected to be 430 mcm per year in 2020.<sup>17</sup>

#### IV. EVALUATION

Despite the optimistic predictions of the project's proponents, it potentially suffers from several significant problems, some of which are factual while others are legal. Beginning with possible issues of a factual character, the freshwater that will be produced by the project will be quite expensive. Once the seawater is desalinated, it will have to be pumped uphill to Amman and Jerusalem, each of which is over 1100 meters above the level of the Dead Sea. When the expense of pumping water to this altitude is coupled with that of the desalination process, it is estimated that the water will cost the ultimate consumer \$1.30 per cubic meter.<sup>18</sup> This is more than twice the cost of desalinated water available near the coast; raising the question of whether it would be cheaper to transport water from coastal desalination facilities to areas of need, rather than to deliver it via a project that will be very costly to construct.

Secondly (and ironically), the construction and operation of the RSDSC could actually have adverse environmental effects in addition to the positive ones. These possible impacts include: the mixing of Red Sea and Dead Sea waters, resulting in the introduction of alien species of plants and other biota into the Dead Sea and changes in the mineral composition of its water; adverse effects on Red Sea coral reefs from the removal of the contemplated quantities of water from the Red Sea; disruption of wildlife migration patterns in the Wadi Araba along the route of the conveyance; and the potential for a leak along the course of the canal, which could contaminate local fresh groundwater.

There are also significant legal issues to consider. First, customary international law requires notification of all riparian states, regardless of their position in the basin, of planned measures that may have a significant effect on other riparians or, arguably, on the basin itself.<sup>19</sup> Given the possible impacts the RSDSC could have, Jordan and Israel should notify the other riparians—namely Lebanon and Syria—of the project details, and offer to consult with them on the project.<sup>20</sup> It is unknown if this has been done. Furthermore, the large withdrawals of water from the Gulf of Aqaba implicate the interests of Egypt and Saudi Arabia, which should also have been notified and consulted regarding the project.<sup>21</sup> The parties participating in the planning process—Jordan, Israel, the

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17. WOLF, *supra* note 6, at 143.

18. *The Dead Sea Canal*, *supra* note 2.

19. See generally STEPHEN C. MCCAFFREY, *THE LAW OF INTERNATIONAL WATERCOURSES* 397-413 (2001).

20. Notification of Lebanon and Syria is also called for by the World Bank's rules. See World Bank Operational Manual, Bank Procedures, Projects on International Waterways, BP 7.50 (October, 1994).

21. *Id.*

PA, and the World Bank—share the duty to notify and consult potentially affected states, and could all, in theory, be responsible for a violation of the obligation.<sup>22</sup>

The project has also raised difficult issues on a political level. In particular, the terms of reference for the feasibility study regarding the project have engendered controversy over such questions as whether the PA is a “riparian” to the Dead Sea and the Jordan River—something that most observers had taken for granted. More generally, the Palestinians are concerned that, as with other proposed projects involving the provision of desalinated water to Palestine, Israel (with the support of the United States) may attempt to use the RSDSC to avoid having to reallocate the freshwater resources—including both surface water and groundwater—that it shares with the Palestinians.

## V. CONCLUSION

At first blush, the Red Sea-Dead Sea Water Conveyance Project strikes many observers as being an example of the hubris of engineers: overly complex, highly expensive, and even far-fetched. However, the fact that it is being seriously considered demonstrates how precious additional supplies of freshwater are in this arid and water-stressed region, and the lengths to which people will go to produce it. Despite the issues it raises, it appears to be within the realm of possibility that the project will ultimately go forward, given the strong support it enjoys on the part of Israel, the World Bank, and especially Jordan.

Only time will tell whether the project is economically viable, and to what extent it will have significant adverse environmental effects. It is also unknown whether Lebanon, Syria, Saudi Arabia, and Egypt will assert their interests, possibly delaying the project or even bringing about its demise. What does seem clear is that the Jordan River riparians will, in the future, need to continue to strive to perform the difficult task of providing sufficient freshwater to their growing populations. However, unless a region-wide cooperative solution can be reached, they remain, like Sisyphus, condemned to repeatedly fall short.

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22. The World Bank, as an international organization, possesses international legal personality and could theoretically be held responsible in an appropriate way for such a breach. The status of the PA as an international legal person is less clear.

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