How widely applicable is river basin management?[1]

I. Dombrowsky[2] and E. Feitelson[3]

Abstract

The basin scale has been promoted as the optimal management unit in order to internalize external effects caused by multiple water uses. Most recently it has been advanced as part of the European Water Framework Directive. Yet, eventually the scale of water management is socially and politically construed, and the question is whether the basin scale is equally adequate for different climatic and locational contexts and what specific institutional arrangements should look like.

To address these questions it is necessary to examine very different conditions. To this end this paper presents a comparative analysis of water management in the Elbe Basin, shared by the Czech Republic and Germany and the Kidron/Wadi Nar Basin shared by Israelis and Palestinians. The two basins differ fundamentally in size, climate, topography, settlement patterns and political framework conditions. In the case of the Elbe Basin, an ex post analysis of the effectiveness of the existing institutional arrangements was carried out. In the Kidron/Wadi Nar Basin the economic viability and the political feasibility of alternative management options were analyzed ex ante.

The paper finds that in the case of the Elbe Basin a river basin management approach was quite successfully adopted by establishing an international coordination mechanism. The cost-benefit analysis for the Kidron/Wadi Nar Basin shows that a basin approach where wastewater is being treated on the basis of gravity flows performs worse than a scenario where all the wastewater produced in the Kidron/Wadi Nar – Og/Muqalek area is jointly treated in one wastewater treatment plant in the Kidron Valley/Wadi Nar. Hence, due to economies of scale a pure basin approach is not desirable from a physical-economic perspective. However, if the options are analyzed from a political perspective, it turns out that neither the first best Kidron/Wadi Nar solution nor the second best basin solution are likely to be realized, as both of them are subject to objections by influential Israeli and Palestinian stakeholder groups. Instead, the most feasible approach appears to be a two-plant solution based on outsourcing where the Jerusalem wastewater is being treated in the Og/Muqalek basin and the remaining Palestinian wastewater in the Kidron/Wadi Nar. This, however, implies that the river basin management approach can not be considered as universally applicable. Instead, climate, water

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[2] Department of Economics, Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany, Email: ines.dombrowsky@ufz.de.

[3] Department of Public Policy, Hebrew University, Jerusalem, Israel, Email: msfeitel@mscc.huji.ac.il.

uses, settlement patterns, basin size and political framework conditions play a critical role for the choice the adequate scale and the design of institutional arrangements for the management of water resources.

Key words
Water resources, river basin management, institutional arrangements, contextual factors, Elbe, Kidron/Wadi Nar

1 Introduction

The basin scale has long been promoted as the optimal management unit to manage water resources and to address water quality and ecological concerns in river basins (UN 1958; Teclaff 1967; Newson 1992). Advocates of basin management argue that basin management allows for the internalization of the multiple externalities occurring within watersheds (Rogers 1993; Sadoff et al. 2002). Since the 1992 Dublin International Conference on Water and the Environment and Agenda 21, where integrated water resource development and management was noted as the first action in the freshwater chapter (UNCED 1992), basin management has been endorsed by a wide variety of influential organizations. These include the World Bank (World Bank 1993), Global Water Partnership (GWP 2000), the Green Cross International (Green Cross International 2000), the US Environmental Protection Agency (EPA 1996) and the European Union (EU 2000). In the EU basin management is currently mandated through the European Water Framework Directive that entered into force in December 2000.

However, as Hartje (2002) notes, basin management was mainly adopted within large temperate countries. Here cities mainly developed along the main rivers and the rivers served as sources of water supply, as transport arteries and as recipients of wastewater. With the introduction of the water closet and industrialization water quality became a main concern, which is now often being addressed through a river basin management approach. However, even in the temperate zones the implementation of basin management is fraught with difficulties, mainly due to the institutional discrepancy between basins and existing institutions (Moss 2003; Moss 2004). Moreover, many of the world's rivers cross borders (Wolf et al. 1999), and thus intra-country basin initiatives pertain only to a limited set of basins. While about 42% of all international river basins have some form of transboundary agreements in place (UNEP 2002), the majority of these only cover certain parts of river basins (Teclaff 1996; Dombrowsky 2007; Dombrowsky 2008b). Other agreements tackle several border rivers shared by two countries at the same time (Fischhendler and Feitelson 2003; Fischhendler and Feitelson 2005). Hence, empirical evidence indicates that comprehensive river basin management approaches remain rare, in particular in transboundary contexts. This raises the question whether basin management is indeed the ‘best’ management option in all cases, and whether it is equally adequate for different climatic and locational contexts. This question can also be seen as part of the ongoing discourse in geography regarding the determination of scale – whether it is determined by operational considerations, or whether it is socially and politically construed (McMaster and Sheppard 2004). That is, whether the scale of management of water is determined mainly by the physical geography (the basin) or by political considerations. A second, related question is what institutional arrangements for water resources management should look like and to

what extent institutional approaches in one specific context can be transferred to very different contexts.

In order to address these questions in this paper two very different settings will be analyzed, the Elbe Basin, mainly shared by the Czech Republic and Germany and the Kidron/Wadi Nar Basin shared by Israelis and Palestinians. In Section 2 the settings of these two basins in terms of size, climate, topography, settlement patterns and political framework conditions will be presented. In Section 3 the main findings of an ex post analysis of the effectiveness of the existing institutional arrangements in the Elbe Basin will be summarized. In Section 4 alternative physical and institutional management options for the Kidron/Wadi Nar – Og/Muqalek region will be identified and their economic viability and political feasibility will be assessed ex ante. Based on these analyses the questions whether the basin scale is equally adequate for different contexts and whether institutional arrangements can be considered as transferrable will be discussed in Section 5.

2 The setting: Elbe and Kidron/Wadi Nar Basins

The Elbe Basin and the Kidron Basin/Wadi Nar represent two very dissimilar cases of river basins. Both of them are international, and both of them are terminal basins, ending in a see. Yet, as shown in Table 1, they are different in almost all other dimensions.

The Elbe is a large perennial river, stretching over 1000 km (Figure 1). The Elbe Basin is shared by four countries: Germany, the Czech Republic, Austria and Poland. However, more than 99% of the basin area of 148,268 square kilometers (km^2) is located in Germany and the Czech Republic, with shares of 65.5% and 33.7% respectively (IKSE 2005) (see Fig. 1). The basin is located in a temperate climate zone with a mean annual precipitation of 630 mm. The Elbe River and its tributaries serve as an important source of drinking water, are used for hydropower generation, as a transport route and at the same time receive the discharges of wastewater treatment plants (WWTPs). Many large cities in the catchment developed along the Elbe's stem and its main tributaries including Berlin, Prague, Dresden and Hamburg. During the Cold War, the basin straddled the Iron Curtain, with Poland, the Czechoslovak Soviet Republic and the German Democratic Republic being located in the former East Block, and the German Federal Republic in the West. In the meantime, all basin countries are member states of the European Union. The main water management issues in the Elbe basin include water quality, ecological status, river continuity for fish migration, flood control and navigability.

In contrast, the Kidron/Wadi Nar is a small, 24 km long (123 km^2), arid basin featuring a steep altitude gradient without permanent freshwater flows. It extends from the south-eastern parts of the city of Jerusalem to the Dead Sea. Rainfall ranges from 600 mm in the West to 50 mm at the Dead Sea in the East. With the exception of the Mar Saba Monastery there are no human habitations that developed along the Kidron River itself, but the towns and villages within the basin are limited to its upper catchment. The wadi receives the wastewater flows of approximately 240,000 people in or at the fringes of the catchment (about 140,000 Palestinians and 100,000 Israelis) of which about 165,000 live in Jerusalem (Klawitter et al. 2007b). It covers Israeli territory within the green line as well as A, B and C areas within the

West Bank. Area A is under Palestinian control, Area B under Israeli military control and Palestinian civil control and Area C under Israeli military control (see Figure 2). While the majority of the Kidron/Wadi Nar lies in Area C, most of the Palestinian population outside Jerusalem that lives in or nearby the wadi is located in areas A and B. The main water management issues include the threat of aquifer contamination by wastewater, ecological management and the reuse of treated wastewater for irrigation.

Table 1: Geographical Characteristics of the Elbe and the Kidron/Wadi Nar Basins

Characteristic	Unit	Elbe	Kidron/Wadi Nar
Basin area	km²	148,268	123.3
Basin states and share in area		Germany (65.54 %) Czech Republic (33.68%) Austria (0.62%) Poland (0.16%)	Israeli Territories (20 %) Palestinian Territories – B Area (21 %)* Palestinian Territories – C Area (21 %)*
Channel length	km	1,094	24
Gradient	m	1,386	1,292
Climate		maritime to continental (temperate)	Sharp climatic gradient: From a Mediterranean to a desert
Mean annual precipitation	mm	628	Rainfall gradient: from 600 at the west, down to less then 50 at the Dead Sea at the East
Mean discharge	m³/sec MCM/a	861 27,152	2** 11.51
Population	million	24.52	0.25
Settlement patterns		Major cities all along the banks of the river and its tributaries	Major cities at the upper part of the watershed
Total water withdrawal	MCM/a	2,137	0
Total wastewater discharge	MCM/a	2,132	8.9
Main transboundary water issues		Surface water quality, ecological status, fish patency, flood control, navigability	Aquifer contamination by wastewater, ecological management, using treated wastewater for irrigation

* According to Oslo Interim Agreement on the West Bank and Gaza strip of September 1995 and the Wye Agreement of October 1998.
** Ephemeral stream with only wastewater flow.

3 The Elbe case

3.1 The problem

In the second half of the 20th century the Elbe increasingly suffered from domestic and industrial pollution. By the end of 1980s, the Elbe was one of the most heavily polluted rivers in Europe (IKSE 1991b). However until 1989, water-related cooperation between West Germany as downstream riparian on the one side and the German Democratic Republic and the Czechoslovak Socialist Republic as upstream riparian countries on the other was largely inhibited by the Cold War (Durth

1996). After the fall of the Berlin wall the situation of non-cooperation changed rapidly and as early as in October 1990, Czechoslovakia, the freshly reunited German Federal Republic and the European Community founded the International Commission for the Protection of the Elbe (ICPE) in order to address water quality issues in the Elbe Basin. In this rapid regime formation over a period of few months, several factors played a role. Most importantly, the political changes provided a window of opportunity for institutional change. This was used skillfully by German negotiators by building trust and by drawing upon long-term experiences with transboundary basin management in the Rhine river basin (Holtrup 1999; Lindemann 2006).

3.2 The Elbe river basin management approach

The ICPE represents a transboundary coordination mechanism for the Elbe Basin. It consists of:

- the Commission;
- a Coordination Group;
- a Secretariat; and
- different Working Groups.

The Commission consists of the German, the Czech and (until 2005) the EU delegation. It is headed by a President. ICPE decisions are taken by unanimity. They are recommendations to the member states and are not legally binding (Epiney and Felder 2002). The working groups are composed of specialists from the administrations in the member states or experts appointed by each delegation. They contribute towards the substantive work of the commission and ensure that the Commission's work program is compatible with the activities and the national and sub-national level. The common secretariat at Magdeburg is tasked with preparing, implementing and supporting the commission's work. The coordination group prepares the decisions of the commission. Each party bears the costs of representation and investigations on its own territory. The contributions to the costs of the secretariat are allocated according to a fixed key.

The ICPE aims (1) at preventing the pollution of the Elbe and its drainage area, (2) at achieving as natural an ecosystem as possible and (3) at reducing the pollution of the North Sea. In order to achieve these objectives, the ICPE pursues an action program approach. In the respective action programs the commission identifies priority actions from a basin perspective and sets time lines for their implementation. However, the responsibility for the implementation of the respective measures rests solely with the member states. The ICPE on the other hand monitors their implementation of measures by regularly publishing progress reports on the internet.

So far, two water quality related action programs were prepared: the First Action Program 1992-1995 (IKSE 1991a), and the Elbe Action Program 1996-2010 (IKSE 1995). The First Action Program foresaw the construction of 139 sewerage treatment plants in the basin and a 30% reduction in the concentration of 15 industrial priority substances. The 1995 Elbe Action Program comprised a comprehensive program of measures in seven areas of activity: (1) municipal wastewater treatment, (2) industrial wastewater treatment, (3) reduction of agricultural non-point pollution, (4) reduction of pollution from contaminated sites and landfills, (5) improvement of river continuity for fish migration, (6) establishment of protected areas and improvement of

morphology, and (7) the prevention of accidental pollution. In addition, in 2003 the ICPE devised an action plan on flood control (IKSE 2003).

3.3 Effectiveness of the Elbe approach

In order to assess the appropriateness of the transboundary river basin management approach in the Elbe Basin the effectiveness of the 1995 Elbe Action Program was analyzed for the period 1996-2005 (Dombrowsky 2008a). In order to do so in a first step experts were asked to score the actual performance (AP_P) of the different action program components on a scale from 0 to 10, with 10 indicating the collective optimum (CO) (see Table 2 for average scores). In a second step the experts were asked to outline how the ICPE had contributed towards the achievement of the objectives in the different areas of activity. The estimated ICPE contribution f was to calculate the no-regime counterfactual (NR_{ID}) with $NR_{ID} = AP_P - (AP_P*f)$. The no-regime counterfactual asks what would have happened in the absence of the international regime in place. Based on the AP and NR effectiveness scores (E_i) were calculated for the different action program components with E= (AP-NR)/(CO-NR).

Table 2: Elbe Action Program - Effectiveness Scores

Area of Activity	AP_P	CO	ICPE Contribution		NR_{ID}	E_i
			qualitative	quantitative (f)		
1. Municipal wastewater	8.5	10	Medium	0.50	4.3	0.74
2. Industrial point sources	7.2	10	Low to medium	0.35	4.7	0.47
3. Agricultural non-point sources	2.7	10	Zero	0.00	2.7	0.00
4. Contaminated sites & landfills	6.8	10	Low	0.15	5.8	0.24
5. Fish migration	6.8	10	Low to medium	0.35	4.4	0.43
6. Protected areas & morphology	7.4	10	Low	0.15	6.3	0.30
7. Accidental pollution	8.4	10	High	0.85	1.3	0.82
Average	6.8	10			4.2	0.43

Source: Dombrowsky (2008: 233)

The analysis shows that overall the countries were relatively successful in achieving their overall goals (see AP_P column). At the same time, the ICPE's contribution towards achieving the goals varied significantly among the different areas of activity. Hence, some outcomes would also have been achieved in its absence. For instance one reason for the overall improvement of the water quality is the partial breakdown of industrial production in East Germany after the German reunification. The ICPE's contribution was greatest where the main responsibility for action lay with the public authorities, such as in the area of wastewater treatment and the establishment of an

international alarm plan and model. Its contribution was practically zero in the reduction of non-point pollution from agriculture, where success depended on the behavior of individual farmers. It was intermediate where multiple parties were involved in the decision-making process, such as in the area of fish migration or the establishment of protected areas. This implies an intermediate overall effectiveness score. Many experts argued that the commission mainly speeded up processes that would have happened at a slower path anyway.

Overall, due to the size of the basin and the fact that the Elbe is a transboundary as opposed to a border river it seems that the set up of a transboundary basin coordination mechanism with national level implementation and international monitoring can be considered as appropriate for the case at hand. By identifying priority action from a basin perspective ICPE contributed towards a cost-effective protection of the North Sea. By regularly publishing progress reports it exerted pressure on the governments with respect to implementation and ensured public accountability. At the same the time transaction costs for international decision-making remained manageable. Strictly spoken only 99% of the basin was covered, therefore no strict basin approach was pursued; however, this was part of a pragmatic strategy to limit transaction costs.[4]

4 The case of the Kidron/Wadi Nar – Og/Muqalek region

4.1 The problem

At present the Kidron/Wadi Nar serves mainly as a sewage conduit for the south-eastern part of Jerusalem, as well as for the eastern part of Bethlehem and for Beit Sahour (which are outside the basin) serving a population of 240,000. This includes the sewage that drains into the Kidron/Wadi Nar by gravity as well as some of the sewage that would naturally drain into the Og/Muqalek Basin located in the North East of Jerusalem which is conveyed to the Kidron/Wadi Nar Basin via a collector (see Figure 2). In addition, Ubeidiya, Abu Dis, Al Ezariya and some other small Palestinian communities also pump their sewage into the basin. The total discharge of untreated wastewater in 2006 was estimated at about 8.9 million cubic meters per year (MCM/a) (Klawitter et al. 2007b). In contrast, wastewater generated in the western parts of Jerusalem and of Bethlehem is being treated in the Sobeq treatment plant to the west of both cities. In addition, part of the wastewater from the North-Eastern part of Jerusalem and from a number of Israeli settlements drains into the Og/Muqalek Basin with primary treatment at a plant in Nebi Musa. This water is being reused by Israeli settlers for irrigation.

The untreated wastewater discharged into the Kidron/Wadi Nar represents a potential threat to scarce groundwater resources in the region. It also diminishes the attractiveness of the Mar Saba Monestary in the wadi. Furthermore, before the first Intifada in 1987 the wadi used to be an attractive site for hiking. Currently, the reuse of the untreated water for irrigation is banned in the wadi, however, at least part of

[4] In 2004 a comprehensive basin management approach was adopted in the Elbe basin including Poland and Austria in order to comply with the requirements of the EU Water Framework Directive. However, still the question remains whether the benefits of including them exceed the costs of inclusion.

wastewater is being reused at an Israeli palm tree plantation on the shores of the Dead Sea.

In 1994/5 the mayors of Jerusalem and Bethlehem agreed to build a sewage purification plant at a bend in the in the upper part of the Kidron/Wadi Nar known as the 'elbow' to be financed by the German government. The Israeli Ministry of the Environment approved the contract. Yet the Palestinian Authority's Minister of the Environment refused to sign the contract arguing that if he signed he would be acknowledging Israel's sovereignty over parts of East Jerusalem. In consequence, the sewage plant was not built. Since then, the need for action has been raised from time to time, with no results. In 2006 the Israelis Ministries of Environment and Health threatened Jerusalem's mayor with injunctive action as treatment is required according to Israeli law.

In the following it will be assumed that there will be an Israeli state and a Palestinian entity or state, and that Israel will control Jerusalem (or at least western Jerusalem) while the Palestinians will control the Bethlehem area, as well as most of the area to its north-east. Hence, regardless of the exact delineation of boundaries the Kidron/Wadi Nar Basin would remain a transboundary basin under all circumstances.

4.2 The physical management options

At present, due to political and hydrological restrictions, three geographical sites for wastewater treatment are under discussion (see Figure 2):

(1) The Wadi Nar site (the 'elbow') is located within the Kidron/Wadi Nar next to the locality Al Ubeidiya close to the existing outflow of the wastewater originating in East-Bethlehem and other smaller Palestinian localities. It is situated in Area B and hence it is under Palestinian civilian and Israeli military control.

(2) The Nebi Musa site is situated in the Og/Muqalek Basin in Area C under Israeli administration. Due to its location in the Og/Muqalek Basin pumping of sewage flows draining to the Kidron/Wadi Nar over the water divide would be necessary. There are different routes under discussion either collecting the sewage at its actual outflow and pumping it up via a pipe routing east or west of Maale Adumim necessitating permission of the Palestinian administration to cross Area A, or collecting the sewage further down the Wadi next to the Hurqanyia Road (C Area). For political reasons in the following pumping via Hurqanyia Road will be assumed.

(3) From an Israeli perspective a third option is to treat the wastewater within the municipal boundary of East Jerusalem. This option would be very expensive due to high land, construction and O&M costs.

There are different possibilities to allocate the wastewater flows over these three sites. Table 3 provides an overview over the options analyzed.

Furthermore there are two main alternatives what to do with the wastewater after treatment. The first option is to reuse the treated wastewater in irrigated agriculture ('dry' river alternative). In principle, there are potential sites for reuse within the

Kidron/Wadi Nar and in the Og/Muqalek Basins as well as at their outflows.[5] The second option is to let the treated wastewater flow in the Kidron/Wadi Nar for aesthetic reasons and recreational uses ('wet' river alternative).

Table 3: The Wastewater (WW) Treatment Options Analyzed

		Wastewater (MCM/a) treated at			Population served
Option	Site	(1) W. Nar	(2) Nebi Musa	(3) Jerusalem	'000
M1	All WW treated at W. Nar site	8.9	0	0	240
M2	All WW treated at Nebi Musa site. Pumping along Hurqanyia Road.	0	8.9	0	240
M3 ISR	Jerusalem WW treated at Nebi Musa. Palestinian WW outside Jerusalem treated at W. Nar.	0.6	8.3	0	240
M3 PAL[6]	All Palestinian WW treated at W. Nar. All Israeli WW treated at Nebi Musa.	2.0	6.9	0	240
M3 Gravity[7]	All WW naturally draining into Kidron/W. Nar treated at W. Nar site. All WW naturally draining into Og Basin treated at Nebi Musa site.	5.4	3.5	0	240
M4	Jerusalem WW treated in Jerusalem. Palestinian WW outside Jerusalem treated at W. Nar.	0.6	0	8.3	240
M5	Palestinian WW outside Jerusalem treated at W. Nar.	0.6	0	0	75
M6	Jerusalem WW treated at Nebi Musa.	0	8.3	0	165

Source: Klawitter et al. (2007b), adapted.

4.3 Cost Benefit Analysis of physical options

In order to assess the different management options from an economic perspective, a cost benefit analysis was carried out (Becker et al. 2007) and slightly revised for this paper. The cost estimates for the various options are summarized in Table A-1 and the results are also shown in Table 4. Based on the cost analysis, the least cost alternative would be M1. This option exploits economies of scale by treating all wastewater in one plant and at the same time features relatively low conveyance cost. The second best option is M3 Gravity which solely relies on gravity flows into the Kidron/Wadi Nar and Og/Muqalek Basins respectively, but which requires the construction of two treatment plants. The least desirable alternative is M4, where the Jerusalem wastewater is treated within Jerusalem.

In order to assess the benefits of the various options both benefits to agriculture and non-market benefits were taken into account. Benefits to agriculture were determined by multiplying the wastewater volumes available for reuse with an

[5] Sites for reuse in the Kidron/Wadi Nar would still have to be developed.
[6] The M3 PAL option was suggested by Palestinian team members. It was not considered in the stakeholder consultations (see Section 4.6).
[7] Similar to M3 PAL, M3 Gravity was added at a later stage of the project for analytical reasons and was not explicitly discussed in the stakeholder consultations.

estimated residual value of water in agriculture of 0.16 US$ per cubic meter (CM) (Becker et al. 2007).[8]

In order to assess non-market benefits the contingent valuation method (CVM) was applied (Becker et al. 2007). CVM involves directly asking people in a survey how much they would be willing to pay for specific environmental services. Using the payment card method Israeli and Palestinian respondents were asked how much they were willing to pay to remove the untreated wastewater from the Kidron/Wadi Nar Basin. They were also asked whether they preferred a dry or a wet river. In addition, in order to distinguish between use and non use values they had to choose among different explanations for their choices. In Israel the survey was conducted among 240 respondents in 2006 with 206 usable questionnaires. In the Palestinian territories 98 surveys were carried out in 2007 of which 88 were usable. In both entities the majority of the population favored a 'wet' solution (86% of Israelis and 64% of Palestinians). In Israel the mean willingness to pay was 53 NIS (13.33 US$) and 43 NIS (10.73 US$) for a wet and a dry river respectively. In the Palestinian territories it was 33 NIS (8.28 US$) and 22 NIS (5.55 US$) for the wet and dry solutions respectively. Both in Israel and in the Palestinian territories the use value was at 26% of the total value.

Total non-market benefits were determined in terms of the total use value from a dry and a wet river for Israelis and Palestinians respectively. In order to do so first the mean WTP was multiplied with the percentage of respondents favoring the respective solution. In a second step 50% of the value of the second choice was added for the remaining percentage of respondents. In a third step, the respective use values were multiplied with the total number of household in Israel and in the West Bank respectively (Table A.2).

Based on these assumptions the net benefits dry and wet were calculated for the various options as shown in Table 4. In order to determine the benefits to agriculture (dry) the total treated wastewater was multiplied with the residual value of the water in agriculture. Benefits to agriculture (wet) were calculated by multiplying the amount of wastewater outside the Kidron/Wadi Nar under the wet solution by the residual value of water in agriculture. Non-market values were based on the total use values displayed in Table A.2 adjusted by the respective volumes of water. For non-market benefits (wet) in addition where applicable the non-market benefits dry for the wastewater treated in Nebi Musa were added (variant (2)).

Based on the above the cost benefit analysis provides the following insights:

- The CBA only results in positive results if non-market benefits are taken into considerations (all options except for M4).
- The cooperative solution M1-wet yields the highest net benefits. Hence from an economic perspective Israelis and Palestinians could realize benefits of cooperation by agreeing on the construction of one treatment plant in the Kidron/Wadi Nar.
- The second best solution is the basin solution (M3 Gravity) where the wastewater draining to the Kidron/Wadi Nar is treated at the 'elbow' and the wastewater

[8] While the Palestinian team estimated a residual value of 0.20 $/CM, in the final analysis a value of 0.16 $/CM was applied for all sites.

draining to the Og/Muqalek Basin is treated at Nebi Musa. Hence, in the given case due to economies of scale from joint treatment the basin approach based on gravity flows does not represent the Pareto optimal solution.

- Among the solutions combining a treatment plant in Wadi Nar and one in Nebi Musa (M3 alternatives), the solution with greatest flows to the Kidron/Wadi Nar performs best (M3 Gravity>M3 PAL>M3 ISR).[9]
- M2 where all wastewater is treated in one plant in Nebi Musa is only number 6 in ranking, but close to M3 ISR.
- The unilateral options M6 as well as M5-wet and M5-dry yield positive returns but perform individually worse than any of the other solutions except for M4.
- If both M5 and M6 are realized in parallel they are equal to M3-ISR.
- Wastewater treatment in Jerusalem (M4) results in negative returns.
- Benefits are maximized if the wet river option is applied in Kidron/Wadi Nar, i.e. if the wastewater is not reused within the wadi.

Table 4: Cost Benefit Analysis

	Option	M1	M2	M3 ISR	M3 PAL	M3 Gravity	M4	M5	M6
	Site	1	2	1+2	1+2	1+2	1+3	1	2
Cost	million $/a	1.78	3.12	3.07	2.96	1.90	5.98	0.17	2.91
Total treated WW	MCM/a	8.90	8.90	8.90	8.90	8.90	8.90	0.60	8.30
Treated WW flow in Kidron (wet)	MCM/a	8.90	0.00	0.60	2.00	5.43	0.60	0.60	0.00
WW available for reuse (wet)	MCM/a	0.00	8.90	8.30	6.90	3.47	8.30	0.00	8.30
Residual value in agriculture	$/CM	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Benefits to agriculture (dry)	million $/a	1.42	1.42	1.42	1.42	1.42	1.42	0.10	1.33
Non-market benefits ISR (dry)	million $/a	2.88	2.88	2.88	2.88	2.88	2.88	0.19	2.69
Non-market benefits PAL (dry)	million $/a	0.48	0.48	0.48	0.48	0.48	0.48	0.03	0.45
Benefits to agriculture (wet)	million $/a	0.00	N/A	1.33	1.10	0.56	1.33	0.00	N/A
Non-market benefits ISR(1) (wet)	million $/a	4.66	N/A	0.31	1.05	2.84	0.31	0.31	N/A
Non-market benefits ISR(2) (wet)	million $/a	0.00	N/A	2.69	2.23	1.12	2.69	0.00	N/A
Non-market benefits PAL(1) (wet)	million $/a	0.65	N/A	0.04	0.15	0.40	0.04	0.04	N/A
Non-market benefits PAL(2) (wet)	million $/a	0.00	N/A	0.45	0.37	0.19	0.45	0.00	N/A
Net benefits (Kidron/WNar dry)	million $/a	**3.00**	**1.67**	**1.71**	**1.82**	**2.88**	**-1.20**	**0.15**	**1.55**
Net benefits (Kidron/WNar wet)	million $/a	**3.53**	**N/A**	**1.74**	**1.94**	**3.20**	**-1.16**	**0.19**	**N/A**

Source: Authors' compilation

For the purpose of this paper the most important finding is that the basin solution which relies entirely on gravity flows (M3 Gravity) is not the economically most desirable solution.

4.4 The institutional options

In a next step possible institutional arrangements for the implementation of the various physical options were explored. In principle the following institutional options are conceivable (Feitelson and Abdul-Jaber 1997):

- Separate management

[9] However, it might still be necessary to refine the cost assumptions for M3-PAL and M3 Gravity as they will require a separation of wastewater flows in Jerusalem.

- coordinated management
- joint management
- outsourcing.

Separate (or unilateral) *management* implies that decisions are taken and solutions are being implemented unilaterally without consultation with the other party. In the current case each party would treat its own wastewater and re-use it as it sees fit. On the one hand this solution is very flexible and it clearly minimizes transaction costs. On the other hand separate management may also lead to a situation where one party's action entails externalities on the other party. Under extreme circumstances one party might even impose a particular solution on the other party without the other party's consent. All this may lead to disagreement, distrust and conflict.[10]

In the context of this paper *coordinated management* refers to coordinated decision-making but separate implementation of measures. Often coordinated management entails the set up of a forum for coordination, e.g. in the form of a commission. The International Commission for the Protection of the Elbe is a classic example for coordinated management. In the case of the Kidron/Wadi Nar there would be a coordination mechanism, but each party would implement its own treatment and reuse facilities. Moreover, each party may provide treatment services for the other party. In this case there would be a need for a payment and accounting mechanism between the two parties. The power given to the respective coordination mechanism may reach from a mere discussion forum to joint decision-making on the basis of unanimity where each party has a veto. A coordination mechanism typically entails medium transaction costs as no transaction on implementation and operational issues are required. As a coordination mechanism does not impinge on sovereignty or the authority of various existing institutions it is not likely to generate extreme political opposition (also depending on the exact decision-making modus). The disadvantage of coordinated management is that it limits opportunities for the exploitation of economies of scale from joint infrastructure (unless one party pays the other). Furthermore depending on the powers of the coordination mechanism its means to enforce cross-payments may be limited.

It is assumed that in the case of *joint management* a joint management institution is being set up which also implements and operates joint infrastructure. For the Jerusalem metropolitan area Feitelson and Abdul-Jaber (1997) envisioned a joint metropolitan institution headed by Joint Metropolitan Wastewater Board, in which representatives of Israeli and Palestinians ministries, as well as of the Palestinian and Israeli Water Authority would be members, together with representatives of the relevant local authorities. This body would have a planning, a financial and an operation unit. The latter would operate the treatment plant or plants, while the financial unit would be in charge of the rates, the collection of fees and investments. The joint institution would provide services to all the jurisdictions in the metropolitan area (from Ramallah to Bethlehem) and sell wastewater for reuse to a variety of potential users. The main advantage of a joint institution is that it could pursue an optimal management approach, thus internalizing external effects and maximizing net benefits. However, transaction cost can be very high, and a joint institution

[10] Under a separate management regime each party may unilaterally opt for outsourcing.

clearly would impinge on the sovereignty of the parties, in particular through its fee setting and collection power. Thus the political acceptability may be low and it would be a very complex task to set up such an institution. Possibly a sequential approach could be chosen (Feitelson and Haddad 1998) although this would probably be less compatible with the set up of joint infrastructure. While a joint institution may have decision making and enforcement power, the decision making processes are likely to be complex, thereby adversely affecting its effectiveness. Due to the need to agree on a multitude of issues in establishing such an institution, the potential for disagreements is high.

The fourth generic option is *(joint) outsourcing*, i.e. to jointly decide to turn the construction, operation and maintenance of the WWTPs to the private sector. In this case a tender would be issued that would determine the parameters of the infrastructure to be implemented, and the rates to be charged. The tender could also be issued for each WWTP separately, thereby increasing the flexibility of operations, though, perhaps, at the expense of economies of scale. By introducing an international firm the wastewater issues may be de-politicized. Moreover, this option may increase the chance that the plants will be well maintained, as the international companies can be expected to have the necessary expertise. As the ability to collect the fees may be compromised due to the political instability, it may be necessary to assure in the tender a safety net for international companies to compete. The main issues in this option would be to agree upon the terms of the tender, to evaluate the bids and to monitor the activities of the company that wins the tender. An option might be to involve donor countries or United Nations agencies, especially if they undertake to provide all or part of the capital costs, and perhaps to underwrite the safety net. To the knowledge of the authors joint outsourcing has so far not been applied to transboundary water infrastructure. However, it clearly combines many of the advantages of joint management, such as the possibility to maximize net benefits at the basin scale with lower transaction costs in terms of implementation and operation. While there might still be considerable transaction costs involved in reaching an agreement on the tender, overall this process may face lesser political opposition than a joint institution, as it is likely to be seen largely as a business issue, or an institutional structure that is associated with third parties. Given the increasing tensions and loss of confidence between the parties, it has been argued that private sector initiatives backed by donors may become increasingly attractive in the Israeli-Palestinian case (Feitelson 2003; Feitelson 2006).

4.5 Matching physical and institutional options

In Table 5 the four generic institutional options presented in Section 4.4 are related to the eight physical alternatives introduced in Section 4.2. As can be seen from Table 5 not all institutional arrangements fit to all physical options. Furthermore, for each physical option some institutional forms may be less ideal than others.

M1 and M2 foresee one treatment plant for the entire population in the study area. For these options separate management is infeasible and at least some form of coordination is required. In principle it is possible to conceive a situation whereby one party operates the WWTP and coordinates its action with the second party, which also pays for the services rendered by the first party. Yet, this option may be difficult to realize in a situation characterized by a high level of distrust and it is also somehow contrary to the basic logic of one joint plant.

Table 5: Matching Physical and Institutional Options

Physical	M1	M2	M3			M4	M5	M6
			ISR	PAL	Gra.			
WWTP at	Wadi Nar	Nebi Musa	Wadi Nar & Nebi Musa			Wadi Nar & Jerusalem	Wadi Nar	Nebi Musa
Pop. served	240,000	240,000	240,000			240,000	75,000	165,000
Institutional								
Separate			(+)			+	+	+
Coordinated	(+)	(+)	+	+	+	(+)		
Joint management	+	+	(+)	(+)	(+)	(+)		
Joint outsourcing	+	+	+	+	+	(+)		

Notes: +: combination is possible; (+) it is possible, but not ideal; x: it is unlikely or infeasible

Thus for M1 and M2 the 'ideal' options are joint management and outsourcing as the main idea is to operate a joint treatment plant. Both of these options are difficult to set up, as they require extensive preliminary negotiations to establish the joint authority or to agree on a tender and contractor. However, the outsourcing option is likely to enjoy greater political backing, as it will not be seen as a diminution of the sovereignty of the parties or an impingement on existing authorities. Outsourcing is more likely to be more effective and may generate less disagreement. Thus, if a single joint operation is sought it should be outsourced. The choice between M1 and M2 should then be made strictly on the economic criteria and on the political feasibility of the sites. As shown in the CBA from an economic perspective M1 should be chosen, but the question is whether this option is politically feasible.

M5 and M6 can be pursued unilaterally without any coordination. Hence they are essentially separate management options. As shown in the CBA both options have positive net returns. Hence from an economic point of view it would be still better if one or both of two options were implemented unilaterally than to do nothing. However, as shown in the CBA, benefits could be higher if M1, M3 Gravity or M3 PAL was realized.

If M5 and M6 were realized simultaneously, M3 ISR-separate applied, therefore M3 ISR-separate is depicted with a plus. However, it is a plus in a bracket as the unilateral implementation of M6 or M3 ISR may generate issues with the payment of treatment fees by the Palestinian population in Jerusalem. Therefore, the preferred institutional option for M3 ISR is at least some form of coordination. In contrast to M3 ISR, M3 PAL or M3 Gravity would in any case require some form of coordination as this would require a diversion from the current physical collection of wastewater flows.

The M3 alternatives, which foresee two WWTPs, one in the Kidron and one at Nebi Musa, therefore would be managed by either a coordination institution, with cross payments between the parties, a joint institution or by outsourcing the WWTPs (to either one operator or two). As outsourcing enjoys in this case the same advantages over a joint institution that were enumerated for the M1 and M2 cases, the two most viable institutional structures for this alternative are either a coordination mechanism or outsourcing.

A coordination mechanism is clearly simpler and easier to set up, at least from a technical point of view, as the negotiations preceding it need not be as complex as

those before a tender is set out. Thus, the direct transaction costs of setting up a coordination mechanism are much lower than for outsourcing. However, an outsourcing operation is likely to be much more effective, as it will assure a higher level of professional capacity in the operation and maintenance of the WWTPs. The outsourcing option may enjoy more political support under the current highly contentious political setting, where the two parties are reluctant to engage each other officially. It is thus at this stage not possible to reach a clear conclusion regarding which of these two options is better suited for the M3 alternative. The choice among the various sub-alternatives of M3, however, should again be made on the basis of economic criteria and political feasibility. From an economic perspective, the preferred alternative is M3 Gravity.

4.6 Stakeholder perceptions and political feasibility of options

In a next step the political feasibility of the various physical cum institutional management options was assessed. In order to do so it was necessary to understand the interests of the various players within each party, and their power to affect the negotiating position of their central government (Putnam 1988).

In order to understand the positions of the different players, two efforts were undertaken. On the Palestinian side a Multi Criteria Decision Analysis (MCDA) was carried out with 17 participants identifying the preferences and rankings of different players on six selected management options (Klawitter et al. 2007a) (see Table 6). From these their interests can be deduced. On the Israeli side a series of interviews with key players (No author 2006) was carried out, in which they stated their positions regarding the various options. Furthermore a limited MCDA was conducted with five Israeli participants. The outcome of the MCDA in terms of the ranking of options by different groups is presented in Table 6. For different reasons not all options presented in this paper were discussed with all interview partners and participants in the MCDA. In this sense, the assessment should be considered as preliminary.

Table 6: MCDA Ranking of Management Options by different Groups[11]

Option	Palestinians				Israelis		
Group and No. of participants	Community level (9)	Governorate/ regional level (2)	Government/ national level (6)	Total (17)	Governorate/ regional level (4)	Government/ national level (1)	Total (5)
M1/coord.	1	1	6	1	6	4	6
M2	4	2	5	4	2	3	2
M3 ISR	2	4	1	2	4	2	3
M4	5	3	2	4	5	3	5
M5	3	5	3	3	3	5	4
M6	6	6	4	5	1	1	1

Source: Klawitter et al. (2007a)

In addition to these findings, also previous attempts to build a WWTP in the Kidron/Wadi Nar, and the experience garnered with the WWTP in the western Soreq

[11] The ranking is based on the NAIADE software (see Klawitter et al 2007a).

valley which treats sewage from west Jerusalem as well as from Beit Jalla and parts of Bethlehem was taken into account.

The Israeli Side

On the Israeli side three factors seem to structure preferences, as raised in the interviews and in the limited MCDA. The first is the desire to treat Jerusalem's sewage. This is driven largely by the Ministries of Environment and Health. Essentially, they threaten Jerusalem's mayor with injunctive action, as the city does not fulfill its obligations to treat all wastewater. As such they prompt the Jerusalem municipality and its subsidiaries, the Gihon Water Company and the Eastern Jerusalem Sewage Project, to search for solutions that can be implemented in the short term. The treatment of Jerusalem's sewage is seen as an internal Israeli obligation. A secondary environmental interest is to prevent pollution of the aquifers underlying the Kidron/Wadi Nar.

The second factor driving Israeli political preferences is the desire to use the treated wastewater in settlements in the southern Jordan valley. This issue is pushed largely by the Lower Jordan and Megillot regional councils, in which most settlements are largely based on agriculture. They seek inexpensive additional water resources. It should be noted also that Megillot receives today, virtually free of cost, all the wastewater that flows down the Og/Muqalek valley. It will thus object strenuously to any attempt to take it out of there, i.e. to a solution that will treat the wastewater in the Kidron/Wadi Nar.

The third factor driving Israeli political preferences is a deep distrust of the Palestinian capacity and willingness to maintain an intensive WWTP, or of the Palestinian readiness to pay for treatment of sewage generated in Palestinian communities in a WWTP operated by Israel. This latter distrust stems from the experience in the Soreq WWTP, where Israel treats sewage generated from Bethlehem but received no direct payments, despite an agreement to the contrary that dates back to the early 1980s between then mayors Kollek of Jerusalem and Freij of Bethlehem.

Due to these three factors almost all Israeli actors are firmly opposed to a joint treatment plant operated by the Palestinians (in the MCDA M1/coordinated was the least preferred option), and strongly prefer an option where Israelis continue to treat Jerusalem's sewage (M6 followed by M2). Several of the Israeli stakeholders noted that if the Palestinian WWTP is operated through outsourcing by a foreign firm it will mitigate their concerns regarding maintenance (source?). Thus, if the M3 ISR alternative were to be based on a outsourcing arrangement it may be acceptable to most Israeli actors, and preferable to those concerned with treating the sewage remaining in the Kidron/Wadi Nar valley.

The Palestinian Side

The majority of the Palestinians who participated in the MCDA viewed themselves as technicians, and came from the community or governorate levels. The preference of the technical strata, as well as of local levels, as expressed in the MCDA, is for a joint WWTP operated by the Palestinians (M1/coordinated). However, the participants from the governmental level expressed contrary preferences. They preferred the two-plant options (M3 ISR followed by M4) or even the unilateral option

(M5) over the joint options. This may be explained by the different perspectives of the participants from the different levels in Palestinian water governance.

As the participants from the local and regional level mainly come from the Wadi Nar region, they see in the joint alternative under Palestinian control (M1/coordinated) the possibility to obtain the maximal amount of treated water for re-use in the Wadi Nar. Moreover, a joint WWTP is more likely to attract foreign funds, thereby reducing the financial liability of the local Palestinian authorities. In contrast, the government (national) level has extensive experience in joint work with the Israeli authorities. However, that experience has proven to be largely negative. The Joint Water Committee set up in 1995 in the context of the Oslo B agreement, which was originally viewed as a first step toward joint management has since come to be viewed by Palestinians as a measure of furthering Israeli control over the West Bank's water resources (Selby 2003). Hence, it is not surprising that the governmental level in the Palestinian water sector is highly suspicious of any proposals for additional joint management projects, and thus prefers separation alternatives.

As within the Palestinian Authority the power of local and governorate levels is restricted, the fact that most of the participants in the MCDA preferred the M1 alternative has to be weighted by their limited power relative to the national level. Hence, despite the clear preference of the local level for the joint alternative in the Kidron/Wadi Nar, it seems that this option will not be seen as politically feasible by Palestinian negotiators from the national level. Thus a two-plant solution should be seen as the politically most attractive alternative from a Palestinian perspective.

4.7 Opportunities for basin management?

In order to assess the desirability of a basin approach in the Kidron/Wadi Nar – Og/Muqalek region in Table 7 the assessment of the economic viability and political feasibility of various management options is summarized. For economic reasons it is generally assumed in Table 7 that if wastewater is being treated at the Kidron/Wadi Nar site it will flow freely in the river basin (wet river option). However, given the preference of local stakeholders for a dry solution, for M1 also the dry option is displayed in brackets. As the analysis showed that for the case at hand joint management is being dominated by (joint) outsourcing for M1, M2, M3 ISR and M3 PAL outsourcing is assumed. In addition for M3 ISR coordinated management is displayed in brackets as for a two-plant solution no general conclusions could be drawn on the choice of outsourcing versus coordinated management. For the basin solution M3 Gravity in analogy to the Elbe case coordinated management is assumed (although outsourcing is also conceivable). As discussed above M4, M5 and M6 basically represent separate management options.

For both the economic criteria and political feasibility in Table 7 a rating system was applied. In addition net benefits are also displayed in monetary terms. A single plus indicates support according to the criteria, double pluses strong support, and similarly minuses stand for opposition or strong opposition. Within the brackets it is shown how the rating of the criteria would change for the permutations. Thus, pursuing the dry river solution in the M1 case requires deduction of one plus in the economic evaluation, illustrated by the minus in brackets.

Table 7: Assessment of Options for Managing Wastewater Treatment in the Kidron/Wadi Nar – Og/Muqalek Region

	M1 wet (dry)	M2	M3 ISR	M3 PAL	M3 Gravity	M4	M5	M6
	Out-sourcing	Out-sourcing	Out-sourcing (coordinated)	Out-sourcing	Coor-dinated	Sepa-rate	Sepa-rate	Sepa-rate
Economic	+++(-)	+	+	+	++	--	+	+
Net benefit $million/a	3.0 (3.5)	1.7	1.7	1.9	3.2	-1.2	0.2	1.6
Political feasibility Israeli stakeholders								
Water authority	-	++	+(-)	-	-	-	+	+
MoHealth & Environment	+	+	++(-)	?	?	+	-	-
Regional councils	-(+)	+	+	-	-	+	-	++
Jerusalem municipality	-	+	+	-	-	-	+	++
Political feasibility Palestinian Stakeholders								
Local level	+(+)	-	+	+	+	--	+	--
Government level	--	--	++	++?	++?	+	+	-

Note: Except for M1, Kidron/Wadi Nar-wet applies
Legend:
+ supportive
++ strongly supportive
+++ best
- opposed/negative
-- strongly opposed

Overall, the case study illustrates the following: From an economic perspective – maximizing net benefits for the region as a whole – the optimal solution is a joint treatment plant in the Kidron/Wadi Nar and a wet river (M1-wet) and the second best is the basin (gravity) approach with one plant in the Kidron/Wadi Nar and the Og/Muqalek basins respectively supplied by gravity flows of wastewater (M3 Gravity-wet). This implies that in the study region the basin approach from an economic perspective only represents the second best option. The reason is that given the settlement patterns in the study area with major cities being located on the watersheds and not within one particular drainage basin there are economies of scale from joint treatment. At the same time, pumping requirements from the Og/Muqalek to the Kidron/Wadi Nar remain small. The particular setting also implies that there would be gains from cooperation.

From a political point of view neither the optimal nor the basin solution are likely to be adopted at this point. The reason is that on both the Israeli and the Palestinian side there are various national and sub-national stakeholders and interest groups with quite opposing views on and interests in these options and limited convergence. At the same time it must be stressed that the basin solution has not explicitly been discussed yet with the various stakeholders. Therefore its political feasibility should still be further explored.

1. Local Palestinian stakeholders are the only group which prefers the cooperative M1 solution (with coordinated management). However, in contrast to the findings for the region as a whole they do not favor the wet, but the dry variant. While the CBA demonstrated that overall aesthetic and recreational interests in the Kidron/Wadi Nar prevail in Israel and the Palestinian territories, the local groups would rather reuse the treated wastewater for irrigation.
2. This view is principally supported by Israeli regional stakeholders in the Jordan valley which also wish to reuse the water for irrigation, however, at their sites. Hence these Israeli groups favor Israeli control over Jerusalem wastewater with a treatment plant in the Og/Muqalek basin (first choice is M6, second M2). This conflict of interest among the local groups also reflects a shortcoming of the CBA analysis: while the CBA can show the optimal solution for the region as a whole, different alternatives would have different distributional implications and the question is how the benefits of cooperation could be shared if the cooperative solution was chosen.[12]
3. In contrast to their local counterparts in the MCDA Palestinian government representatives were highly skeptical of a joint plant, even if it was to be run by Palestinians (M1/coordinated). In this aversion they de facto form an alliance with various Israeli stakeholders. Instead their preferred choice was M3 ISR. The basin (M3 Gravity) and the M3 PAL solutions as well as the option to outsource operation of any two-plant solution were not explicitly been discussed with them. However, given that M3 Gravity would involve the greatest wastewater flows to the Kidron/Wadi Nar among the three M3 options it seems that the basin solution could be even be of greater appeal to them. It could also create a symbolic connection to East Jerusalem. Furthermore, given their close cooperation with donors and experiences with outsourcing at the national level there seems to be no prima facie reason against a two-plant outsourcing solution.
4. For Israeli government and Jerusalem representatives the highest priority is to solve the East Jerusalem wastewater issue. In doing so they prefer a solution that maximizes their control over implementation. Hence their preferred choices appear to be M2 and M3 ISR followed by M6 however with differences in the order of their preferences. The Ministry of Environment is likely to prefer M3 ISR-wet with some treated wastewater flowing in the Kidron/Wadi Nar and clearly objects a unilateral solution M6 given the remaining untreated wastewater flows in the Kidron/Wadi Nar. In contrast the Israeli Water Authority and the city of Jerusalem due to their mistrust in Palestinian capacities are assumed to prefer solutions that maximize their control and minimize the need for coordination with the Palestinians. While the basin solution (M3 Gravity) has not explicitly been discussed with them, it is likely that they will continue to prefer M3 ISR not least because of symbolic reasons despite the potential additional economic benefits of M3 Gravity.

Overall, this implies that in particular M3 ISR could potentially get some level of support (or at least less opposition) from the most important stakeholder groups. In particular an outsourcing arrangement could potentially mitigate some of the Israeli concerns, thus possibly making M3 ISR more feasible than first meets the eye. This

[12] A way would have to be found to compensate those 'loosing' from the first best solution taking their potential benefits in the second best solution into account.

solution would generate considerable net benefits of an estimated US$ 1.7 million per year, which is about half of the benefits generated by the optimal solution M1.

With respect to basin management, this however implies that in the given case the basin solution is neither the optimal solution from an economic point of view nor the most feasible solution politically.

5 Discussion and conclusions

This paper asked whether basin management is indeed always the most appropriate scale for the management of water resources, and whether institutional arrangements for water management in one context are transferable to other contexts.

The ex post analysis of the water quality-related work of the International Commission for the Protection of the Elbe (ICPE) showed that in the Elbe Basin a basin management approach covering 99% of the basin was quite successfully adopted. This was done by establishing the ICPE as a coordination mechanism. In the Elbe, coordinated management means that the commission identifies priority action from a basin perspective and monitors the implementation of respective measures by the member states. Coordinated management proved to be useful in the Elbe Basin given the relatively large size of the basin and the transboundary character of the river which implies that there are no opportunities to realize economies of scale from joint measures.

In contrast, the economic analysis of alternative management options for treating sewage in the Kidron/Wadi Nar – Og/Mukaleq region shows that a basin approach where wastewater is being treated according to gravity flows is only the second best option compared to a joint wastewater treatment plant in the Kidron/Wadi Nar Basin. The reason is that the joint treatment plant allows for the realization of economies of scale. This is mainly so due to the case's small geographical scale, due to the specific settlement patterns across watersheds, due to the existing water conveyance infrastructure in place and limited pumping requirements. Hence the economics of transboundary wastewater management in the Greater Jerusalem area speaks against a gravity-based basin approach.

From a political feasibility point of view, however, neither the optimal Kidron/Wadi Nar solution nor the basin option is likely to be adopted. Instead, it seems that the option which raises least objections by influential stakeholder groups is a two plant solution where the Jerusalem wastewater is being treated in the Og/Muqalek basin and the remaining Palestinian wastewater in the Kidron/Wadi Nar. It might be easiest to reach agreement on this solution if it is based on an outsourcing arrangement, as such a system has the potential of being effectively run and maintained by a third party.

Thus, while coordinated management can be considered as an adequate institutional response in the Elbe Basin, in the Kidron/Wadi Nar case outsourcing appears to be the most feasible institutional option. Thus there are clear limits in the transferability of specific institutional forms. This, however, does not mean that certain process elements may be transferable. In terms of process it is interesting to note how in the Elbe case a political window of opportunity was used to set up the ICPE in a very

short period of time, drawing on the experiences in the Rhine basin. Also a conscious attempt was made to build trust. Furthermore, the monitoring approach supported effective implementation. It might be possible to replicate these process elements.

This, however, implies that river basin management may not be universally applicable and that the institutional arrangements that fit one particular setting may not uncritically be transferred to a different context. Instead, climate, river flow regimes, water uses, existing water infrastructure, settlement patterns, basin size and political framework conditions play a critical role for the choice the adequate scale and institutional arrangements for the management of water resources. Institutional insights mainly pertain to process. However, the more specific insights and lessons regarding the form of cooperation, the scale of management and the topics of cooperation are not easily transferable and should be seen as context specific.

From a policy perspective this paper sought to identify feasible solutions to address the wastewater issues confronting the Kidron/Wadi Nar basin. Based on the findings, we strongly recommend that outsourcing a comprehensive two-plant solution will be examined. This could lead to practical benefits in the highly contentious Israeli-Palestinian setting.

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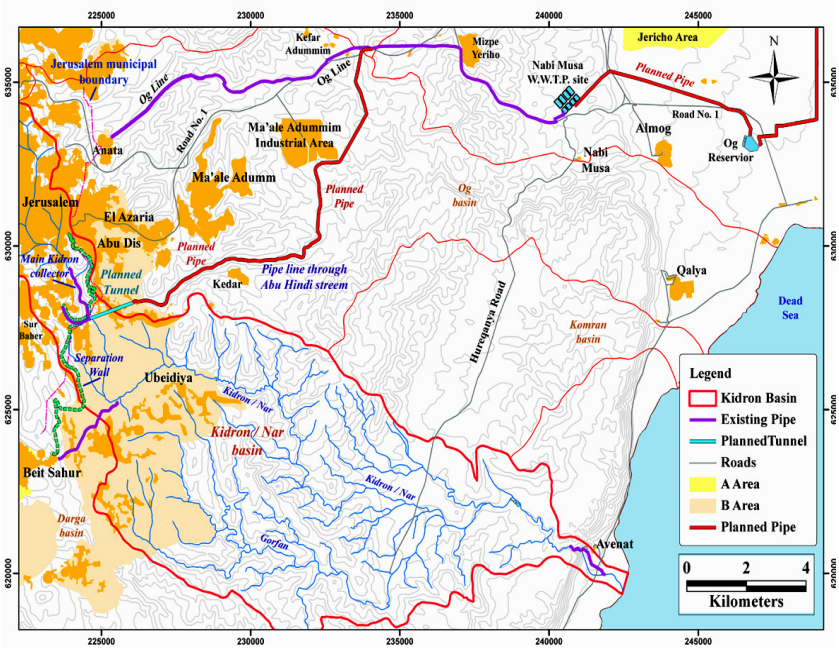
Figures

Figure 1: Elbe Basin

Source: Dombrowsky 2008: 226

Figure 2: Kidron/Wadi Nar – Og/Muqalek Region



Source: Almog (to be adapted: show all possible sites on this map!)

Annex

Table A.1: Cost Estimates for Wastewater Treatment Options

	Option	M1	M2	M3 ISR		M3 PAL		M3 Gravity		M4		M5	M6
	Site	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(3)	(1)	(2)
Pop. served	1000	240	240	75	165	135	105	240		75	165	75	165
Total WW	MCM/a	8.9	8.9	0.6	8.3	2.0	6.9	5.4	3.5	0.6	8.3	0,6	8.3
Capital cost	$/CM	0.10	0.10	0.18	0.10	0.14	0.11	0.11	0.12	0.18	0.60	0.18	0.10
O&M cost	$/CM	0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.10	0.10	0.10	0,10	0.25
Total cost	$/CM	0.20	0.35	0.28	0.35	0.24	0.36	0.21	0.22	0.28	0.70	0.28	0.35
Annual cost	million $/a	1.78	3.12	0.17	2.91	0.48	2.48	1.14	0.76	0.17	5.81	0.17	2.91
Annual cost	million $/a	1.78	3.12	3.08		2.96		1.90		5.98		0.17	2.91

Source: Authors' compilation

Table A.2: Calculation of Non-Market Benefits (Total Use Values)

Entity	River option	Mean WTP	Favored by	1st choice value	added 50% value of 2nd choice	Value	Share of use value	Use value	Total House-holds	Total use value	
		NIS	%	NIS	NIS	NIS	%	NIS	No.	million NIS	million US$
ISR	dry	42.9	0.175	7.51	21.99	29.49	0.260	7.67	1502274	11,520	2,880
	wet	53.3	0.825	43.97	3.75	47.73	0.260	12.41	1502274	18,641	4,660
PAL	dry	22.2	0.360	7.99	10.59	18.58	0.256	4.76	402071	1,913	0,478
	wet	33.1	0.640	21.18	4.00	25.18	0.256	6.45	402071	2,592	0,648

Source: Authors' compilation based on Becker et al 2007