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Socioeconomic surveys on private tanker water markets in Jordan: Objectives, design and methodology

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1 Introduction

1.1 Background and survey objectives

In Jordan, which is one of the water poorest countries in the world, water supply is generally intermittent. As a consequence, water supplied by private water vendors via tanker trucks is an important source of drinking water for many Jordanians. The impacts of partially illegal private tanker water markets on sustainable water supply in Jordan's cities are manifold and complex. The markets significantly contribute to the welfare of commercial establishments and households. However, they also have strong negative impacts on sustainability for example through groundwater depletion. A deepened understanding of emergence, spreading, and functioning of private tanker water markets in Jordanian cities is a precondition for developing policies and interventions towards more sustainable water supply regimes.

The study of publicly available data and reports on private tanker water markets in Jordan revealed that there is a need for empirical data and investigations on the supply side of private tanker water as well as on the demand side, especially in terms of commercial establishments who are the major customers of tanker water within cities.

Against this background, in the period from September 2015 to October 2016 five mostly quantitative surveys were conducted within the Stanford-led Belmont Forum "Jordan Water Project (JWP)"[1] in order to collect socioeconomic as well as physical and technical data about private tanker water supply and demand in three different Jordanian cities.

The objective of the surveys is to provide an empirical basis for two major fields of investigation:

- Socioeconomic studies (e.g. market analyses) on the impacts of private tanker water markets on water supply in the city of Amman with a focus on sustainability issues.[2]
- Modelling studies on private tanker water markets in Jordan as part of a hydro-economic model on freshwater resources sustainability in Jordan (e.g. estimation of demand functions for piped and tanker water of commercial establishments, simulation of partially illegal markets of private tanker water providers, spatial statistical analyses of commercial water consumption).

Jordan's capital Amman was the location of three surveys targeted at the following key market actors of tanker water: (i) operators of private wells selling water to private water tankers, (ii) water tanker drivers purchasing water from private wells and delivering the water throughout the city of Amman and (iii) commercial establishments using piped and/or tanker water. In order to broaden the empirical basis for advanced modelling studies and simulations on the country level the survey with commercial establishments was repeated in a slightly modified version with (iv) commercial establishments in the city of Irbid and (v) commercial establishments in the city of Ajloun.

In this discussion paper the design and methodology of all five surveys is described in detail. For the Amman surveys in addition the survey locations and the spatial distribution of interviews are specified and represented by GIS maps.

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[1] The Jordan Water Project (JWP) is an international research effort aimed at "Integrated Analysis of Freshwater Resources Sustainability in Jordan". Available online: https://pangea.stanford.edu/researchgroups/jordan/ (accessed on 18 April 2017).

[2] Cf. Sigel, K. et al (2017): Impacts of private tanker water markets on sustainable urban water supply: An empirical study of Amman, Jordan. UFZ Report No 2 (in preparation).

1.2 Locations of survey interviews in Amman

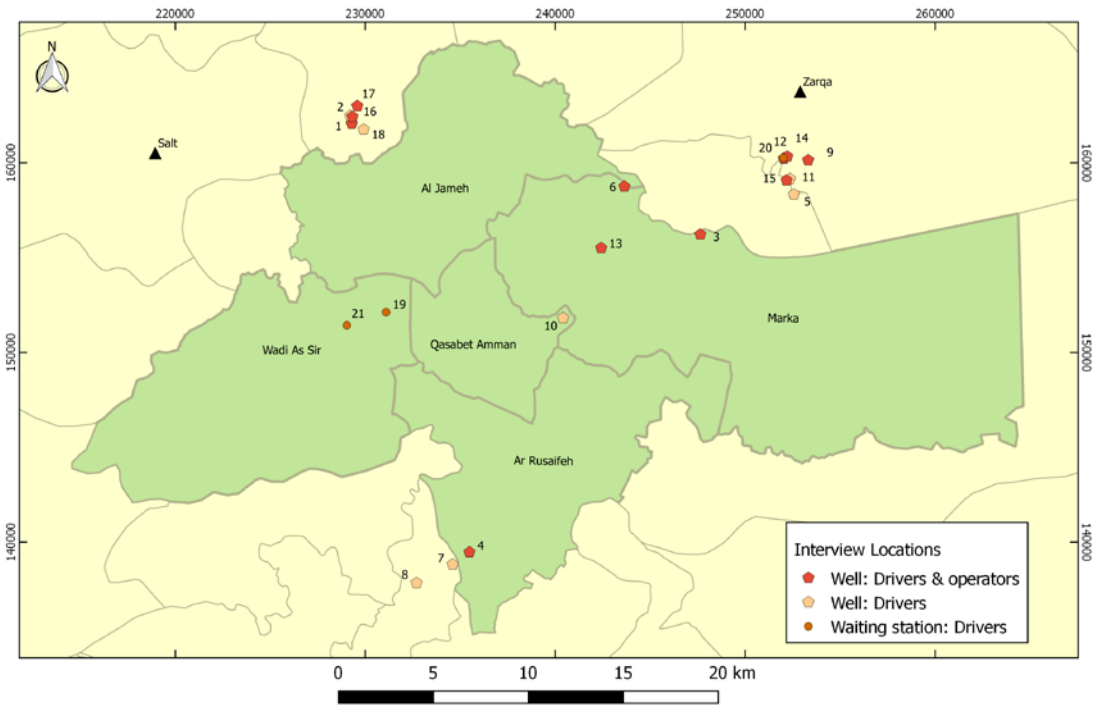
The interviews with water tanker drivers (n=300) were conducted at two different types of locations: private wells in and around the city of Amman and so-called "waiting stations" which serve as inner-city supply stations for tanker water. In total, 18 private wells and 3 waiting stations were surveyed. At 11 out of the 18 surveyed private wells in addition the well operators were interviewed (cf. map 1).

The following table shows the number of drivers' and well operators' interviews conducted at the different survey locations.

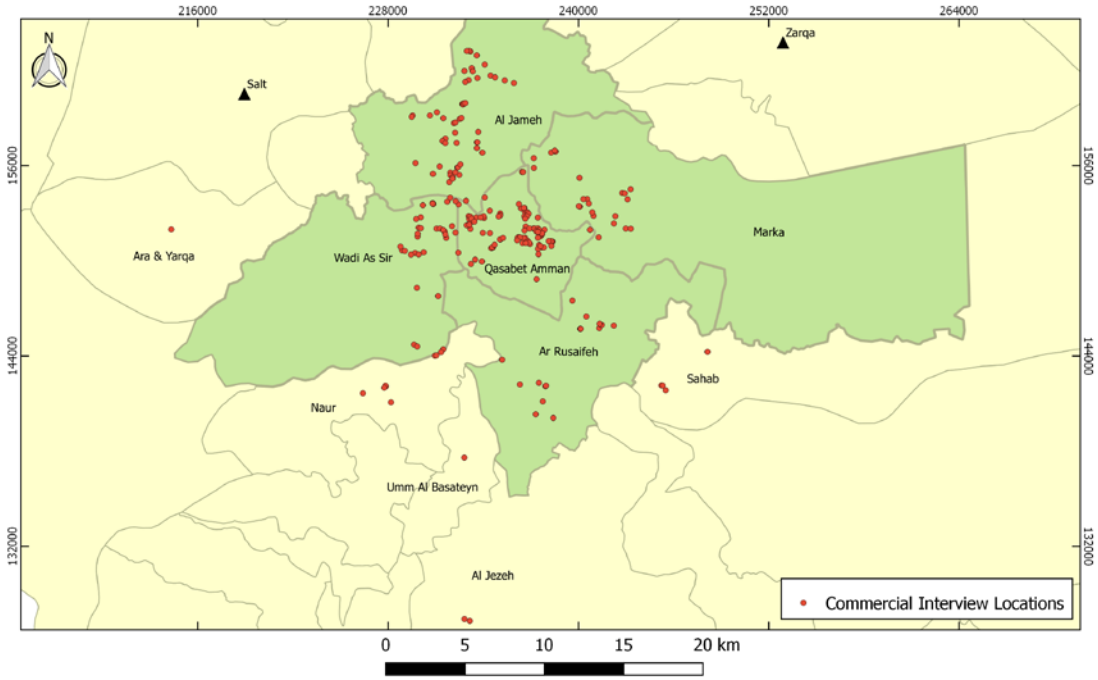
Table 1: Locations of survey interviews with water tanker drivers and well operators in the city of Amman and corresponding number of interviews

Location No.	**Tanker drivers survey**		**Well operators survey**
	Number of interviews	Percentage	Number of interviews
Private wells:			
1	5	1.7	1
2	23	7.7	-
3	17	5.7	1
4	8	2.7	1
5	8	2.7	-
6	6	2	1
7	24	8	-
8	15	5	-
9	8	2.7	1
10	21	7	-
11	9	3	-
12	18	6	1
13	19	6.3	1
14	10	3.3	1
15	20	6.7	1
16	19	6.3	1
17	15	5	1
18	22	7.3	-
Waiting stations:			
19	13	4.3	-
20	9	3	-
21	11	3.7	-
Total	**300**	**100**	**11**

The interviewed commercial establishments (n=242) are distributed across the whole city with a focus on the five main subdistricts of Greater Amman Municipality (GAM): Qasabet Amman, Marka, Ar Rusaifeh, Wadi As Sir, and Al Jameh (cf. map 2). The number of surveyed commercials per subdistrict is depicted in table 2.



Map 1: Locations of surveyed private wells and tanker water waiting stations in and around the city of Amman



Map 2: Locations of surveyed commercial establishments in the city of Amman (in green: the five main subdistricts of Greater Amman Municipality) [3]

[3] The number of red circles is smaller than the sample size (n=242) because the GIS reading for 5 surveyed establishments is missing.

Table 2: Number of surveyed commercials in the city of Amman per subdistrict (the 5 main subdistricts of Greater Amman Municipality are marked by "")*

	Number of surveyed commercials per subdistrict	Frequency	Percent	Valid percent
Valid	Qasabet Amman District*	94	38.8	39.7
	Al Jameh District*	53	21.9	22.4
	Wadi As Sir District*	34	14.0	14.3
	Marka District*	22	9.1	9.3
	Ar Rusaifeh District*	18	7.4	7.6
	Naur District	8	3.3	3.4
	Sahab District	4	1.7	1.7
	Al Jezeh District	2	0.8	0.8
	Ara and Yarqa District	1	0.4	0.4
	Umm Al Basateyn District	1	0.4	0.4
	Total	237	97.9	100
Missing	*no GIS data*	5	2.1	
Total		**242**	**100**	

2 Survey design and methodology

2.1 Well operators survey in Amman

This qualitative survey aims to investigate the supply of water by privately owned wells that sell (parts of their) water to private water tankers delivering water throughout the city of Amman. The survey is intended to cover a large variety of well types, such as wells with different type(s) of license(s) (drinking, agriculture, industry etc.), ownership structures, and also business strategies (e.g. wells belonging to agricultural or non-agricultural sites).

Survey sampling, data collection and data processing:

From September 2015 to January 2016, a total number of 21 randomly selected privately owned groundwater wells were visited to conduct structured, guided interviews with well operators and also water tanker drivers (cf. section 2.2). A total number of 11 well operators were willing to participate in an interview, thereof 2 well owners (the location of the 11 wells is depicted in map 1, section 1.2).

A first version of the questionnaire was piloted with one well operator. The final survey questionnaire consisted of the following five sections (cf. Appendix I): (i) general questions about the technical features of the well and well operation and management, (ii) water quantities sold, (iii) pricing, sales and customer service, (iv) business costs, and (v) closing questions about factors influencing the business and expected business challenges in the future.

The interviews were carried out in Arabic by one and always the same interviewer and lasted between 20 and 33 minutes (mean: 26 minutes). The data of the 11 questionnaires was translated into English, entered into Microsoft Excel and checked for consistency.

2.2 Tanker drivers survey in Amman

This quantitative survey aims to explore private water tanker drivers delivering water, drinking and non-drinking, throughout the city of Amman.

Survey sampling, data collection and data processing:

From October 2015 to January 2016, a total of 300 randomly selected water tanker drivers were surveyed based on structured, guided interviews. The drivers were met at 18 private groundwater wells and 3 waiting stations (cf. map 1 and table 1 in section 1.2). In fact, 291 out of the 300 interviewees (97.0%) were driving a green tanker (drinking water) and 9 (3.0%) a blue one (non-drinking water). Thus, this survey mostly covers private tanker water classified as drinking.

The drivers normally were willing to conduct the interview (high response rate), not least because they were in the mode of waiting for something – to get served at the well, to get the tanker filled or for customers to come. Several interviews took place in a non-anonymous atmosphere when the interviewee was surrounded by several other drivers joining the conversation. In these cases the presence of a third party might have distorted the interview responses to some extent.

The 300 face-to-face interviews were guided by a questionnaire developed on the basis of comprehensive pretests. The pretests were intended to scrutinize the applicability of certain questions, refine their wording and identify possible omissions, i.e. significant aspects which had not yet been considered in the draft versions. Not least they helped to optimise interview duration.

The final questionnaire (cf. Appendix II) consisted of several questions structured according to the following thematic core sections: (i) job description and income, (ii) technology, (iii) water sources, (iv) water quantities sold, (v) pricing, sales and customer service, (vi) costs, (vii) water quality, and (viii) closing questions about the business, influencing factors and future challenges.

The interviews were conducted in Arabic by two different enumerators working independently. The duration was between 13 and 30 minutes (mean: 18 minutes). The data of the 300 questionnaires was translated into English, transferred into Excel and checked for consistency.

According to recent data from the Jordanian *Department of Motorvehicles and Licensing* the total number of private water-tanker trucks in the governorate of Amman is 1469 (data from 2015 – 2016). Based on this figure the survey covers more than 20.4% of the licensed private water-tankers circulating throughout the city of Amman.

2.3 Commercials survey in Amman

This commercials survey, also designed as a quantitative survey, aims to collect and analyse data about the water use behaviour of commercial establishments in the city of Amman with a special focus on tanker water. No preselection was made with regard to the bulk water sources used. The survey covers establishments that use private tanker water as well as others that do not.

Survey sampling, data collection and data processing:

The commercials survey in the city of Amman was carried out from September 2015 to February 2016 on the basis of structured, guided interviews. The sampling strategy aimed to cover the commercial sector of Amman in a representative way with a focus on small and

medium sized establishments. The surveyed establishments were classified according to the following 6 categories.[4]

- S: Retail stores, service establishments, sports facilities, supermarkets, others (e.g. car washes, dry-cleaners, bakeries)
- R: Restaurants, coffee shops
- H: Hotels, hostels, hospitals
- O: Office buildings (large buildings where water is managed and paid centrally)
- C: Construction sector
- V: Water vendors (water stores selling or delivering filtered water in containers)

The categories allow for analysing the water consumption patterns of different user groups but also for identifying the establishment sizes by adequate questions in the questionnaire as basis for the estimation of demand functions. In order to get a representative sample the city was divided into geographical zones. Each zone was covered by survey interviews, and within each zone as many different categories of establishments as possible were included. In total, 242 commercials were interviewed by face-to-face interviews, 216 of them being located in the five main subdistricts of Greater Amman Municipality (cf. map 2 and table 2 in section 1.2). The categories of establishments were covered in the survey in the following proportions:

Table 3: Number of surveyed commercial establishments in Amman per category

Number of surveyed commercials per category	**Frequency**	**Percent**
S: Retail stores, service establishments, sports facilities, supermarkets, others	65	26.9
R: Restaurants, coffee shops	69	28.5
H: Hotels, hostels, hospitals	43	17.8
O: Office buildings	15	6.2
C: Construction sector	26	10.7
V: Water Vendors	24	9.9
Total	**242**	**100**

75% of the interviewees were employees of the establishment, 22% owners and for the remaining 3% the exact status remained unclear. The overall response rate of interviews was lower than that with water tanker drivers, several representatives of visited establishments denied an interview.

The 242 face-to-face interviews were guided by a questionnaire which was pretested in the same way as described for the tanker drivers survey (cf. section 2.2). The final questionnaire (cf. Appendix III) consisted of 5 core sections with detailed questions about the following topics: (i) water sources and water use, (ii) bulk water consumption and expenditure, (iii) size of the establishment, (iv) piped water use, and (v) tanker water use. Section (iii) was splitted up into specific blocks of questions for the different categories of establishments.

The field team consisted of 8 interviewers and 1 supervisor. In the majority of cases the interviewers went into the field separately. The interviews were conducted in Arabic and lasted between 10 and 60 minutes (mean: 19 minutes). The data of the 242 questionnaires was translated into English, transferred into Excel, and checked for consistency.

[4] Establishments can fall in more than one category, such as office buildings that include a restaurant.

2.4 Commercials survey in Irbid

Like the commercials survey conducted in Amman (cf. section 2.3), this quantitative survey aims to explore private water tanker drivers delivering water, drinking and non-drinking, throughout the city of Irbid.

The city of Irbid is located about 70 kilometres north of Amman and 20 kilometres south of the Syrian border in the governorate of Irbid. From 1994 to 2015 the population increased from 208,329 to 502,714. The corresponding growth rate is 6.44% per year.

Survey sampling, data collection and data processing:

This quantitative survey with commercial establishments in Irbid was conducted from July 2016 to October 2016 on the basis of structured, guided interviews. The total number of face-to-face interviews is 50. Similarly to the commercials survey in Amman (cf. section 2.3), the establishments were classified in 6 different categories and the city was divided into geographical zones in order to take representative samples. However, one difference was made regarding survey sampling: In order to cover the commercial sector of Irbid in a more representative way, sample size guidance values were defined for 5 different size classes of establishments, expressed by the number of employees (1 – 4, 5 – 19, 20 – 49, 50 – 99, 100 and more). The required sample sizes per size class were determined with reference to a sampling note published by the *World Bank* for *Enterprise Surveys* and were used as broad reference values.[5] The highest class (100 and more employees) was given low priority. The categories of establishments and the corresponding rates of coverage are shown in the following table.

Table 4: Number of surveyed commercial establishments in Irbid per category

Number of surveyed commercials per category	Frequency	Percent
S: Retail stores, service establishments, sports facilities, supermarkets, others	25	50.0
R: Restaurants, coffee shops	4	8.0
H: Hotels, hostels, hospitals	9	18.0
O: Office buildings	0	0.0
C: Construction sector	7	14.0
V: Water Vendors	5	10.0
Total	**50**	**100**

The types of respondents were distributed as follows: 76% were employees, 10% owners, 6% managers of the establishment and for 8% the exact status remained unclear. The survey questionnaire was taken from the Amman commercials survey (cf. Appendix III) in a slightly revised version with some additional questions on water tariffs, wastewater charges and disposal. The interviews were carried out in Arabic by 4 enumerators and 1 supervisor and lasted between 15 and 60 minutes (mean: 27 minutes). The data of the 50 questionnaires was translated into English, entered into Excel, and checked for consistency.

2.5 Commercials survey in Ajloun

Like the commercials survey conducted in Amman (cf. section 2.3), this quantitative survey aims to gain insights on private water tanker drivers delivering water, drinking and non-drinking, throughout the city of Ajloun.

[5] See http://www.enterprisesurveys.org/methodology, accessed 16 June 2017.

Ajloun, located about 76 kilometers northwest of Amman, is the capital of the more rural Ajloun governorate. The inhabitants of the city increased from 6,624 in 1994 to 9,990 in 2015 with an annual growth rate of 2.86%.[6]

Survey sampling, data collection and data processing:

The commercials survey in Ajloun, designed in the same way as the Irbid survey (cf. section 2.4), was conducted in September 2016 based on structured, guided interviews. The total number of interviews also is 50. The following table shows the categories of establishments and the corresponding rates of coverage for the Ajloun survey.

Table 5: Number of surveyed commercial establishments in Ajloun per category

Number of surveyed commercials per category	Frequency	Percent
S: Retail stores, service establishments, sports facilities, supermarkets, others	27	54.0
R: Restaurants, coffee shops	8	16.0
H: Hotels, hostels, hospitals	2	4.0
O: Office buildings	0	0.0
C: Construction sector	1	2.0
V: Water Vendors	12	24.0
Total	**50**	**100**

In the Ajloun survey the majority of interviewees were owners of the establishment (80%), followed by employees (18%). The status of the remaining 2% of respondents remained unclear. The 50 face-to-face interviews were guided by the same questionnaire as in Irbid (cf. section 2.4). The interviews were carried out in Arabic by 1 enumerator and 1 supervisor. The interview duration was between 9 and 20 minutes (mean: 14 minutes). The data of the 50 questionnaires was translated into English, entered into Excel and checked for consistency.

3 Outlook

The survey data will serve as an empirical basis for several future studies on private tanker water markets in Amman and Jordan. The Amman surveys will be analysed using descriptive statistics in order to investigate water use and demand patterns of commercial establishments and the particular role of tanker water as an important bulk water source. The data will also feed into studies on market performance of the tanker water sector in Amman. The commercials surveys conducted in the cities of Amman, Irbid, and Ajloun will undergo econometric analyses to derive commercial water demand functions capturing the use of both piped and tanker water in Jordan, with the aim to enhance our understanding of water consumption patterns in the Middle East and North Africa region and of commercial water demand in general. The data of all five surveys is also used to inform and parameterise the main hydro-economic multi-agent model of the JWP, allowing for a better representation of commercial water users in the model and a spatial simulation of private tanker water markets across Jordan. Hopefully the collected data will provide new insights into the role of private tanker water markets in Jordan and other arid countries.

[6] See https://www.citypopulation.de/Jordan-Cities.html and https://en.wikipedia.org/wiki/Irbid, accessed 24 April 2017.

Appendix: Survey questionnaires

Appendix I: Questionnaire for well operators in Amman

Version: final
Date of interview: _____
Interview No.: _____
Location of well (administrative subdistrict): _____
Location of well (GIS coordinates): _____
ID number of well: _____
Name of enumerator(s): _____
Duration of interview: _____ minutes
Type of respondent (well owner/well operator/other: _____)

If you don't fill information into an entry field please distinguish between two categories:

- ***"I don't know" or "no response" (in Excel: ??)***
- ***"---" which corresponds to not applicable (in Excel: !!)***

A. Introduction

We are undertaking a survey to understand tanker water supply/commercial water use. We are academics from Jordan University of Science and Technology. Your responses will be held in strictest confidence and your participation in this survey is strictly voluntary.

B. General questions

[B.1.] Are you the owner of this well? Yes _____ No _____

[B.1.1.] If no: What is your role? _____

[B.2.] How many people are working here? _____

[B.3.] In which year was this well drilled? _____

[B.4.] For how many years has this well been operated? _____

[B.5.] How deep is this well? _____m

[B.6.] Has this well been re-drilled (deeper) or relined? Yes_____ No_____

[B.6.1.] If yes: when? _____

[B.6.2.] If yes: why? _____

[B.7.] Does the productivity of this well depend on the season?

Yes _____ No _____

[B.7.1.] If yes: By which factor? _____(summer divided by winter)

[B.8.] For which categories is the license of this well? *[several answers possible!]*

1. Drinking; 2. Agriculture; 3. Industrial; 4. Livestock; 5. Other:_____

[B.9.] Do you sell water for tankers? Yes ____ No _____

[B.9.1.] If yes: Why? _____

[B.9.2.] If yes: Did the owners of this well always aim to sell its water to tankers? Yes____ No____

[B.9.3.] If no: Why? _____

[B.10.] Do you also work as a farmer? Yes____ No_____

[B.10.1.] If yes: How much of your water do you use for agriculture? _____ %

[B.10.2.] If yes: How much do you sell to tankers? _____ %

[B.10.2.1.] How do you decide about the percentage? What is your underlying business strategy?

_____

[B.10.3.] If yes: Which are the main agricultural products you cultivate?

_____

[B.10.4.] If yes: Did your choice to sell tanker water affect which agricultural products you cultivate? Yes _____ No _____

[B.10.4.1.] If yes: In what way? _____

[B.11.] Do you store water in tanks? Yes _____ No _____

[B.11.1.] If yes: What is the total capacity of storage? _____m3

[B.11.2.] If yes: How do you treat your water (e.g. chlorination, sand filter)?

_____

C. Water quantities sold

[C.1.] What is your **average** water abstraction rate? _____ m3 per year

[C.2.] [Important:] What is the **average** amount of water you sell?

[C.2.1.] _____ m3 per year

[C.2.2.] Summer: _____ m3 per month

[C.2.3.] Winter: _____ m3 per month

D. Pricing, sales and customer service

[D.1.] [Important:] Which types of customers do you serve and what are their shares in total sales? *[if type of customer is not served fill in: 0%]*

[D.1.1.] Private trucks: _____%

[D.1.2.] Public trucks: _____ %

[D.1.3.] Farmers: _____%

[D.1.4.] Other: _____; _____ %

[D.2.] What is the number of opening hours of this well?

[D.2.1.] In summer: _____

[D.2.2.] In winter: _____

[D.3.] What is the **average** waiting time for tanker trucks at your well?

[D.3.1.] In summer: _____hours

[D.3.2.] In winter: _____hours

[D.4.] Are you in competition with other wells in the area? Yes _____ No _____

[D.4.1.] If yes: How do you ensure that you are competitive?

_____

[D.5.] [Important:] What is the **average** price you charge to customers?

[D.5.1.] Summer: _____ JD per m3

[D.5.2.] Winter: _____ JD per m3

[D.6.] Do you charge a different price to tanker trucks vs. farmers? Yes _____ No _____

[D.6.1.] If yes: In summer, how much do you charge on **average** to farmers _____ JD per m3

[D.6.2.] [Important:] If yes: In summer, how much do you charge on **average** to truck drivers _____ JD per m3

[D.7.] Within one season: Do you sell your water for a constant per-unit price? Yes_____ No _____

[D.7.1.] If yes: How do you determine this constant per-unit sales price?

_____

[D.7.2.] If no: Do you give a discount for higher quantities? Yes ____ No ____

[D.7.2.1.] If yes: Please describe _____

[D.7.3.] If no: Is your sales price customer-specific? Yes _____ No _____

[D.8.] What is the most common mode and timing of payment (e.g.: cash, bill, credit card, payment immediately after purchase, monthly payment etc.)

_____

_____

E. Costs

[E.1.] How much money do you pay to the Ministry of Water and Irrigation? _____ JD per year

[E.2.] Which **business cost** do you incur? *[ask explicitly for all cost types and also for other cost types which are not yet included in the table]*

	Cost type	Amount	Measurement unit
1	[Important:] Electricity cost		JD per month
2	[Important:] Wage for staff		JD per month
3	Water quality monitoring cost		JD per year
4	Well maintenance cost (e.g. for pumps)		JD per year
5	Chlorination cost		JD per (month/year)
6	Government fees		JD per year
7	Well license cost		JD per year
8	Other:		

[E.3.] What are the fixed costs of setting up a tanker operation for a farmer or land owner (e.g. well drilling or improvements; overhead tanker delivery pipes; tanks; road paving/hard standing; tanks; etc.)? _____ JD

F. Closing questions

[F.1.] What would be your estimation of the total quantity of water sold via the tanker market in Amman? _____ m3 per (day/week/month)

[F.2.] Beyond seasonality: Are there any factors which influence your business in a good or bad way? Yes _____ No _____

[F.2.1.] If yes: Which factors?

_____

_____

[F.3.] How did the business develop over the last years?

_____

[F.4.] Which changes do you expect in the future?

_____

[F.5.] What are the most pressing challenges you face?

_____

Thank you very much for this interview!

G. For the enumerator only

[G.1.] ADDITIONAL NOTES: Please record further findings of interest

_____

_____

_____

[G.2.] How would you rate the overall quality of this interview? Good/Fair/Poor

[G.3.] Remarks, characteristics of the interview/the respondent/the interview situation, etc.

_____

Appendix II: Questionnaire for tanker drivers in Amman

Version: final
Date of interview: _____
Interview No.: _____
Location of interview (administrative subdistrict): _____
Location of interview (GIS coordinates): _____
Name of enumerator(s): _____
Duration of interview: ____ minutes
Type of respondent: (truck driver/assistant/other: _____)

If you don't fill information into an entry field please distinguish between two categories:

- ***"I don't know" or "no response" (in Excel: ??)***
- ***"---" which corresponds to not applicable (in Excel: !!)***

A. Introduction

We are undertaking a survey to understand tanker water supply/commercial water use. We are academics from Jordan University of Science and Technology. Your responses will be held in strictest confidence and your participation in this survey is strictly voluntary.

B. Job description, income

[A.1.] Are you the owner of the tanker truck(s) that you are driving? Yes ____ No _____

[A.1.1.] If yes: How many trucks do you own? _____

[A.2.] Do you work with an assistant? Yes _____ No _____

[A.3.] [Important]: What are your working hours?

[A.3.1.] In summer: _____ hours per (day/week/month)

[A.3.2.] In winter: _____ hours per (day/week/month)

[A.4.] Do you cooperate with other truck drivers? Yes _____ No _____

[A.4.1.] If yes: What does your cooperation look like?

_____

_____

[A.5.] Is there competition among the tanker truck drivers delivering water for Amman?

Yes _____ No _____

[A.5.1.] If yes: What does competition look like? How does it influence your decisions?

_____

_____

[A.6.] [Important]: If respondent is **non-owner** of truck: How much money do you make on **average**?

[A.6.1.] In summer: _____JD per ride

[A.6.2.] In winter: _____JD per ride

[A.7.] If respondent is **non-owner** of truck: Do you have a model of profit-sharing with the owner of the truck? Yes ____ No ____

[A.7.1.] If yes: What does the model of profit-sharing look like? (e.g. 1/3 for the tanker owner, 2/3 for the driver) *[ensure that the number relates to the profit and not to costs]*

_____

[A.8.] [Important]: If respondent is **owner** of truck: Which minimum profit margin do you pursue?

[A.8.1.] In summer: _____ JD per ride

[A.8.2.] In winter: _____ JD per ride

B. Technology

[B.1.] [Important]: What is the capacity of the tanker truck that you are driving **today**? _____ m^3

[B.2.] What is the color of this truck?

Green _____ blue _____ red _____ other _____

[B.3.] How much water is usually lost or wasted?_____ liters per tanker ride

C. Water sources

[C.1.] What is the name of the private well you usually get your water from? _____

[C.2.] [Determine the GIS coordinates of this well and fill in Excel-file]

[C.3.] What is the number of opening hours of this well?

[C.3.1.] In summer: _____

[C.3.2.] In winter: _____

[C.4.] How long do you have to wait on **average** to get bulk water?

[C.4.1.] Summer: _____ hours

[C.4.2.] Winter: _____ hours

[C.5.] In general: How do you decide which well to drive to? Please describe (e.g. geographical aspects, price of bulk water, time for queueing, quality of water, etc.)

_____

_____

[C.6.] Does it ever happen that you go to a well and you don't get as much bulk water as you want to? Yes _____ No _____

[C.6.1.] If yes: Why? _____

[C.7.] Are there sometimes situations in which you would go to other water sources than wells (e.g.: rivers, springs, etc.)? Yes _____ No _____

[C.7.1.] If yes: Please give an example _____

_____

[C.8.] [Important]: Please estimate: What is the **average** distance you usually transport the water from the well to the point of delivery?

_____ km *[single way!]*

D. Water quantities sold

[D.1.] [Important]: What is the **average** amount of water you sell to your customers?

[D.1.1.] In summer:_____ m3 per _____ (day/week/month)

[D.1.2.] In summer:_____ m3 per customer

[D.1.3.] In winter:_____ m3 per _____ (day/week/month)

[D.1.4.] In winter:_____ m3 per customer

[D.2.] [Important]: How many rides do you make per day (i.e. how often do you fill your truck per day)?

[D.2.1.] In summer: _____

[D.2.2.] In winter: _____

[D.2.3.] On the busiest days: _____

F. Pricing, sales, and customer service

[F.1.] Which types of customers do you serve and what are their shares in total deliveries? *[if type of customer is not served fill in: 0%]*

[F.1.1.] Households: _____ %

[F.1.2.] Commercial/industry: _____ %

[F.1.3.] Construction sector: _____ %

[F.1.4.] Public establishments: _____ %

[F.1.5.] Agriculture: _____ %

[F.1.6.] Other: _____; _____ %

[F.2.] How much time on **average** elapses from customer request to delivery of water?

[F.2.1.] Summer: _____ hours

[F.2.2.] Winter: _____ hours

[F.3.] Do you mainly have customers that regularly buy from you? Yes ____ No ____

[F.4.] Is there a minimum sales quantity which holds for certain customers?
Yes ____ No ____

[F.4.1.] If yes: What is this minimum quantity? _____ m3

[F.5.] [Important]: What is the **average** price you charge to customers?

[F.5.1.] Summer: _____ JD/m3

[F.5.2.] Winter: _____ JD/m3

[F.6.] Within one season: Do you sell your water for a constant per-unit price?
Yes___ No ____

[F.6.1.] If yes: How do you determine this constant per-unit sales price?

_____

[F.6.2.] If no: Do you give a discount for higher quantities? Yes ____ No ____

[F.6.2.1.] If yes: Please describe _____

[F.6.3.] If no: Is your sales price customer-specific? Yes ____ No _____

[F.6.4.] If no: Does your sales price depend on the distance of delivery? Yes ____ No ____

[F.7.] What is the most common mode and timing of payment? (e.g.: cash, credit card, payment immediately after purchase, monthly payment)

[F.7.1.] For the payment scheme between truck driver and well owner:

_____

[F.7.2.] For the payment scheme between truck driver and his customers:

_____

G. Costs

[G.1.] [Important]: What is the **average** price you pay for bulk water?

[G.1.1.] Summer: _____ JD/m^3

[G.1.2.] Winter: _____ JD/m3

[G.2.] Beyond season: What does the price of bulk water from wells depend on (e.g.: distance of well to Amman etc.)

_____

_____

[G.3.] Which **other costs** (beyond cost for bulk water!) do you incur? *[ask explicitly for all cost types and also for other cost types which are not yet included in the table]*

	Cost type	Amount	Measurement unit
1	[Important]: Fuel cost		JD per km
2	[Important]: Wage for staff (e.g. assistant)		JD per hour
3	Oil change cost		JD per month
4	Tanker maintenance cost		JD per month
5	Tanker cleaning cost		JD per month
6	Traffic violation cost (penalties)		JD per month
7	Truck physical damage insurance cost		JD per year

8	Business license cost		JD per year
9	Transport license cost		JD per year
10	Other:		
11	Other:		
12	Other:		
13	Other:		
14	Other:		

[G.4.] Please estimate: What is the price for a tanker truck with a capacity like yours?

[G.4.1.] Second-hand: _____ JD

[G.4.2.] New: _____ JD

H. Water quality

[H.1.] Does the water quality of the wells where you buy your bulk water fluctuate significantly over time? Yes _____ No _____

[H.2.] What problems of well water quality occur? (e.g. high salinity in winter)

_____

[H.3.] Do customers care about water quality? Yes _____ No _____

[H.3.1.] If yes: Do they care more about water quality than about water price?

Yes _____ No _____

I. Closing questions

[I.1.] What would be your estimation of the total quantity of water sold via the tanker market in Amman? _____ m3 per (day/week/month)

[I.2.] Beyond seasonality: Are there any factors which influence your business in a good or bad way? Yes _____ No _____

[I.2.1.] If yes: Which types?

_____

_____

[I.3.] How has the business developed over the last years?

_____

[I.4.] Did the tanker water business change after Disi? Yes _____ No _____

[I.4.1.] If yes: In what way? _____

[I.5.] Which changes do you expect for the future?

_____

[I.6.] What are the most pressing challenges you face as a tanker truck driver?

_____

Thank you very much for this interview!

J. For the enumerator only

[J.1.] ADDITIONAL NOTES: Please record further findings of interest

_____

_____

_____

[J.2.] How would you rate the overall quality of this interview? Good/Fair/Poor

[J.3.] Remarks, characteristics of the interview/the respondent/the interview situation etc.

_____

_____

Appendix III: Questionnaire for commercial establishments in Amman

Version: final

Date of interview:_____

Interview No.: ____

Location of establishment/construction site (administrative subdistrict):

_____

Location of establishment/construction site (GIS coordinates):

_____

Name of enumerator(s): _____

Duration of interview: _____ minutes

Type of respondent: (employee/owner/other: _____)

Type of establishment (detailed description): _____

Form of organisation: (public/private/other: _____)

Type of establishment coded: **S:** retail store, service establishment, sports facility, other; **R:** restaurant; **H:** hotel, hospital; **O:** Office building; **C**: Construction sector; **V**: Water vendor

Phone number of contact person of the establishment (if possible):

If you don't fill information into an entry field please distinguish between two categories:

- ***"I don' know" or "no response" (in Excel: ??)***
- ***"---" which corresponds to not applicable (in Excel: !!)***

E. Introduction

We are undertaking a survey to understand tanker water supply/commercial water use. We are academics from Jordan University of Science and Technology. Your responses will be held in strictest confidence and your participation in this survey is strictly voluntary.

F. S/R/H/O/V: Water sources and water use

[B.1.] Does your establishment have a piped water connection? Yes____ No_____

[B.1.1.] If yes: How many hours of piped water supply do you receive per week? _____

[B.1.2.] If yes: How many hours is the average gap between two supply periods? _____

[B.2.] Does your establishment use tanker water? Yes_____ No _____

[B.2.1.] If yes: Why do you use tanker water? _____

_____

[B.3.] Do you think piped water is of better quality than tanker water? Yes _____ No _____

[B.4.] What is piped water and/or tanker water used for in your establishment? *[use the following categories: drinking, cooking, personal hygiene, cleaning, laundry, irrigation, swimming pool, other]*

[B.4.1.] Piped water: _____

[B.4.2.] Tanker water: _____

[B.5.] Does your establishment use **further sources** of water beyond piped water and tanker water? Yes ____ No _____

[B.5.1.] If yes: Describe type of further source and quantify *[use the following categories: bottled water, store water bought from vendor, groundwater from own well, rainwater, recycled waste water, greywater, other]*

	Type of further source	Quantities [only substantial amounts are of interest]
1		_____m3 per (week/month/year)
2		_____m3 per (week/month/year)
3		_____m3 per (week/month/year)
4		_____m3 per (week/month/year)

C. S/R/H/O/C/V: Bulk water consumption and expenditure

[C.1.] [Important]: In summer: How much bulk water does your establishment/construction site use in total? _____ m3 per (week/month/quarter)

[C.1.1.] [Important]: How much of this is piped water? _____m3 per (week/month/quarter)

[C.1.2.] [Important]: How much of this is tanker water? _____m3 per (week/month)

[C.2.] In summer: What is the **average** expenditure you pay for …

[C.2.1.] piped water? _____JD per (month/quarter)

[C.2.2.] tanker water? _____JD per (week/month)

[C.3.] [Important]: In winter: How much bulk water does your establishment/construction site use in total? _____m3 per (week/month/quarter)

[C.3.1.] [Important]: How much of this is piped water? _____ m3 per (week/month/quarter)

[C.3.2.] [Important]: How much of this is tanker water? _____ m3 per (week/month)

[C.4.] In winter: What is the **average** expenditure you pay for …

[C.4.1.] piped water? _____ JD per (month/quarter)

[C.4.2.] tanker water? _____ JD per (week/month)

[C.5.] [Important]: In summer: What is the average price you pay for …

[C.5.1.] piped water? _____ JD per m3

[C.5.2.] tanker water? _____ JD per m3

[C.6.] [Important]: In winter: What is the average price you pay for …

[C.6.1.] piped water? _____ JD per m3

[C.6.2.] tanker water? _____ JD per m3

[C.7.] Are you connected to the public sewage network? Yes _____ No _____

D. S/R/H/O/C/V: Size of the establishment/construction site

[D.1.] [Important]: S/R/H/O/C/V: Total number of employees: _____

[D.1.1.] Full time: _____

[D.1.2.] Part time: _____

[D.2.] S/R/H/O/C/V: How many hours do your full time employees work on average per week? _____

[D.3.] S/R/V: Number of opening hours: _____

[D.4.] [Important]: S/R/H/O/C/V: Floor area: _____m2

[D.5.] S/R/V: Display window length: _____m

[D.6.] [Important]: S/R/H/O/V: **Average** rent: _____ JD per (m2/month/year)

[D.7.] O: Number of offices within the complex of buildings: _____

[D.8.] H: Total number of beds: _____

[D.9.] H: **Average** number of beds occupied: _____per (day/week/month)

[D.10.] H (hotels only): **Average** price per person per night: _____JD

[D.11.] R(/H): Number of restaurant tables: _____ *[for hotels/hospitals: only if they have a restaurant]*

[D.12.] V: How many liters of self-filtered water do you sell? _____ liters per (day/week/month)

[D.13.] [Important]: S/R/H/O/V: What is the **average** number of customers/clients/guest/patients? _____ per (day/week/month)

E. C: Facilities of the construction site (not for establishments)

[E.1.] How large is your storage capacity? _____ m3

[E.2.] How many toilets/urinals does your site have? _____

[E.3.] How many sinks does your site have? _____

[E.4.] How many showers/bathtubs does your site have? _____

[E.5.] How many kitchens does your site have? _____

F. S/R/H/O/V: Facilities of the establishment (not for construction sites)

[F.1.] Do you have a rooftop storage tank? Yes _____ No _____

[F.2.] Do you have a basement storage tank? Yes _____ No _____

[F.3.] How large is your storage capacity in total (rooftop tank plus basement tank)? _____ m3

[F.4.] How many toilets/urinals does your establishment have? _____

[F.5.] How many sinks does your establishment have? _____

[F.6.] How many showers/bathtubs does your establishment have? _____

[F.7.] How many kitchens does your establishment have? _____

[F.8.] What is the total capacity of air conditioning units? _____ tons

[F.9.] H/O: How many drinking fountains for customers does your establishment have? ____

[F.10.] Does your establishment sell self-filtered water here? Yes ____ No _____

[F.10.1.] If yes: How much? _____ liters per (week/month)

[F.11.] Do you have a swimming pool in the establishment? Yes _____ No _____

[F.11.1.] If yes: How large is it _____
(m3 or measurements)

[F.11.2.] If yes: How often do you re-fill your pool? _____times per month

[F.12.] Do you have any irrigated area belonging to the establishment (garden, etc.)?
Yes _____No _____

[F.12.1.] If yes: How large is the area _____ m2

[F.12.2.] If yes: How much water is used for irrigation? _____ m3 per month

G. S/R/H/O/V: If you use piped water, …

[G.1.] What was the amount of your last piped water bill? _____ JD per
(month/quarter/year)

[G.2.] Do you have a special contract with Miyahuna with regards to the supply timing or the connection size? Yes _____ No _____

[G.2.1.] If yes, please describe: _____

_____

[G.3.] Is there a large variation in piped water quality? Yes _____ No _____

[G.4.] Do you treat the piped water which you receive (e.g. boiling, filtering)?
Yes _____ No _____

[G.4.1.] If yes: Please describe _____

H. S/R/H/O/C/V: If you use tanker water, …

[H.1.] S/R/H/O/V: Only if you use also piped water: Do you use all available piped water before deciding to buy additional tanker water? Yes _____ No _____

[H.2.] S/R/H/O/V: Is there a large variation in tanker water quality? Yes _____ No _____

[H.3.] S/R/H/O/V: Do you treat the tanker water which you receive (e.g. boiling, filtering)? Yes _____ No _____

[H.3.1.] If yes: Please describe _____

[H.4.] S/R/H/O/C/V: Does your establishment/your construction site have its own tanker trucks? Yes _____ No _____

[H.4.1.] If yes: How many? _____

[H.4.2.] If yes: What is their capacity? _____ m3

[H.4.3.] If yes: What is the cost of your own tanker water? _____ JD/m3

[H.4.4.] If yes: Do you additionally buy water from private tanker trucks?
Yes ____ No _____ *[if no: continue with questions from block I.]*

[H.5.] S/R/H/O/C/V: What is the typical size of the tankers you order? _____m3

[H.6.] S/R/H/O/C/V: Do you have a long-term supply contract with one supplier?
Yes _____ No _____

[H.6.1.] If no: Do you always buy from the same supplier? Yes_____ No _____

[H.7.] S/R/H/O/C/V: By what is your choice of supplier influenced? Please prioritize *[fill in numbers, 1., 2., 3., 4.]*

Water quality:____

Water price: ____

Reliability of service (e.g. trustiness, service quality): ____

Other: _____; ___

[H.8.] S/R/H/O/C/V: Is there a minimum tanker water quantity you have to buy?
Yes ____ No _____

[H.8.1.] If yes, how much is it? _____m3

I. S/R/H/O/C/V: Closing questions

[I.1.] Do you face crisis situations with regard to water supply? Yes ____ No _____

[I.1.1.] If yes: Which types of situations are these and how do you react?

_____

_____

[I.2.] What would be your estimation of the total quantity of water sold via the tanker market to the commercial/construction sector in Amman? _____ m3 per (day/week/month)

[I.3.] S/R/H/O/V: Does your establishment belong to the tourism sector?
Yes ____ No ____

Thank you very much for this interview!

J. For the enumerator only

[J.1.] *ADDITIONAL NOTES: Please record further findings of interest*

_____

_____

_____

[J.2.] How would you rate the overall quality of this interview? Good/Fair/Poor

[J.3.] Remarks, characteristics of the interview/the respondent/the interview situation etc.

_____

_____