

Task Order No. 807
Contract No. PCE-I-00-96-00002-00

REPORT No.55

***MATCHING IRRIGATION SUPPLIES AND DEMANDS
POTENTIAL IMPACT ON WATER CONSERVATION***

Prepared by

Dr. Larry G. King (EPIQ)

February 2002

For

United States Agency for International Development/Egypt

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

Partners: International Resources Group, Winrock International,
and Harvard Institute for International Development

Subcontractors: PADCO; Management Systems International; and Development Alternatives, Inc.

Collaborating Institutions: Center for Naval Analysis Corporation; Conservation International; KNB Engineering and
Applied Sciences, Inc.; Keller-Bliesner Engineering; Resource Management International, Inc.;

Tellus Institute; Urban Institute; and World Resources Institute

Table of Contents

1	Introduction	1
1.1	Overview.....	1
1.2	MISD Benchmark	1
1.3	Background Prior to the MISD Policy	1
1.4	Purpose of the Report	2
1.5	Organization of the Report	2
2	Discussion	3
2.1	Pilot Districts.....	3
2.2	MISD Pilot Program.....	3
2.2.1	Collection of Information.....	3
2.2.2	Transfer of Cropping Pattern Information	3
2.2.3	Irrigation District Use of Cropping Pattern Information	4
2.3	Water-Monitoring Program	4
2.4	Crop Water Needs	4
2.4.1	Development of Tools	4
2.4.2	Use of Tools in Pilot Districts	5
2.5	Water Saved.....	6
3	Conclusions	8
	Appendix, Tables and Figures	9

1 Introduction

1.1 Overview

The Agricultural Policy Reform Program (APRP) is a United States Agency for International Development (USAID) grant program involving several ministries. The Ministry of Agriculture and Land Reclamation (MALR) is the primary Egyptian governmental agency charged with support of agricultural production. The Ministry of Water Resources and Irrigation (MWRI) has the prime management responsibility for Egypt's water resources. The MALR, MWRI and USAID, under the umbrella of the APRP, jointly designed an agricultural and water policy package, which consists of integrated policy and institutional reforms. USAID supports the ministries' efforts through annual cash transfers based on performance in achieving identified and agreed-upon policy reform benchmarks and technical assistance.

Technical assistance for the water policy analysis activity is provided through a task order (Contract PCE-I-00-96-00002-00, Task Order 807) under the umbrella of the Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ) between USAID and a consortium headed by the International Resources Group (IRG) and Winrock International. Local technical assistance and administrative support is provided through a subcontract with Nile Consultants.

1.2 MISD Benchmark

A national MISD policy was approved jointly by MALR and MWRI as a part of Benchmark C.1 of the Memorandum of Understanding between the Government of the Arab Republic of Egypt (GOE) and USAID/Egypt for the Agricultural Policy Reform Program (APRP) Tranche IV (FY 99/00 – FY 01/02). See APRP Water Policy Program Reports 33 (December 2000), 45 (December 2001), and 45a-45e (February 2002) for details. The two ministries (MALR and MWRI) have begun a nationwide implementation of the MISD policy.

1.3 Background Prior to the MISD Policy

Historically, the MWRI released water from the High Aswan Dam (HAD) based on "indicative" cropping patterns and calendars that were determined by the MALR, often months in advance of real planting dates, and not accurate representations of crops actually grown. The present situation of free choice of crops by farmers has made determination of irrigation water demands much more difficult and has led to significant "mismatch" of supplies and demands. The MWRI has identified several specific situations that give rise to mismatching, which can be grouped into three general categories:

1. *Under- or over-estimating crop water demands under free cropping choices, including cropping patterns and calendars.*
2. *System constraints, such as canal capacity, system storage capacity, and lag time between water releases from HAD to the farm.*
3. *External factors, such as climatic change and unanticipated drainage water reuse.*

Water shortfalls have resulted from lack of information about cropping patterns and calendars and from cropping pattern and calendar selections by farmers that were not consistent with the ability of the Nile system to deliver adequate supplies when needed. Information on crop selection and the dates of planting and harvesting is essential for good water management. However, there was no routine, accurate, and systematic transfer of this information from farmers or the MALR to the MWRI, nor was there an understanding of the system constraints on the part of the MALR and the farmers. Now, both Ministries are recognizing that matching real-time irrigation water demands with water deliveries is an important step toward an efficient, demand-driven irrigation system.

1.4 Purpose of the Report

In addition to achieving improvement in MWRI's distribution of water, many people have looked to the MISD policy as a way to conserve water that is being lost through inefficient management of water deliveries. The purpose of this report is to draw information together from the MISD activities that can be used to estimate potential water conservation through full and complete nationwide implementation of the MISD policy.

1.5 Organization of the Report

This report consists of three brief chapters plus one appendix that contains all the tables and figures. Chapter 1 is the introductory material. Chapter 2 is the discussion of potential water conservation. Chapter 3 gives the conclusions from this brief study.

2 Discussion

2.1 Pilot Districts

The five MISD pilot irrigation districts and their respective governorate/directorate were: Abou Hummus (Beheira/Beheira), Abou Kebir (Sharkia/West Sharkia), Beba (Beni Suef/Beni Suef), East Isna (Qena/Qena), and Luxor (Luxor/Qena). The combined land area of the five pilot districts totals approximately 205,000 feddans.

2.2 MISD Pilot Program

The main purpose of the pilot program in each of the five districts is to mutually transfer information between the two ministries regarding cropping patterns and calendars and water supplies. The details of the MISD pilot program are given in APRP Water Policy Program Report No. 45 (December 2001). The elements are summarized in the following subsections.

2.2.1 Collection of Information

The adequacy of the information depends upon the Hood observer's ability to adequately forecast the cropping pattern expected two weeks in the future in the Hood based upon existing crops, knowledge of the farmer's practices, and direct contact with farmers.

The MALR and MWRI personnel at the district and directorate levels agree on the list of major crops for which crop area is needed in each irrigation district. All crops not on this list are included in the "other" category. Also, the total area of each Hood available for cropping is determined as well as the area served by each canal supplying water to the Hood. The gathering of crop areas then proceeds as follows:

- Twice each month (at the first and middle of the month), MALR Extension Hood observers determine the existing area (feddans) for each major crop, for all other crops as one category, and for fallow land (not irrigated) in their Hood.
- At the same time they determine existing crop areas, the Hood observers also determine the crop areas (feddans) expected for the next half-month period using the same categories, *i.e.*, each major crop, other, and fallow.
- Each Hood observer should ensure that the sum of feddans in all categories equals the total area available for cropping within the Hood.
- If their Hood is served by more than one canal, the observers keep the crop area grouped by the individual canal supplying water to each part of the Hood.

2.2.2 Transfer of Cropping Pattern Information

- Each Cooperative within the Agricultural Administration is responsible for getting the cropping pattern information from all Hoods within the Cooperative and delivering it to the Agricultural Administration.
- The Agricultural Administration enters the cropping pattern information for all Hoods into the computer database (See Report No. 45). The computer aggregates the crop area for all Hoods and branch canals within the irrigation district boundaries and produces a report that is delivered in electronic form to the MWRI district engineer either on diskette or as an email attachment.

- For the entire irrigation district, the report lists canal-by-canal the number of feddans of each major crop, other, and fallow, for both the current half-month period (existing) and the next half-month period (expected).

2.2.3 Irrigation District Use of Cropping Pattern Information

The system of gathering information established in the pilot program results in knowing the planting date of crops within a two-week period rather than the day of planting. This knowledge is adequate for delivering water in the Nile system where canal rotations are used. The MWRI district engineer can use the cropping pattern information for the existing period to manage the water already being received by the district. The “expected” cropping pattern information is used to determine the water that must be released for delivery to the district in the next half month. The irrigation district engineer enters the electronic report of cropping pattern information received from MALR into a computer program to calculate:

- for existing crops (current half month),
 - the needed water deliveries for each branch canal within the district
 - the total needed water delivery for the district
- for the expected crops (next half month),
 - the needed water deliveries for each branch canal within the district
 - the total needed water delivery for the district.

2.3 Water-Monitoring Program

A water-monitoring program was initiated in March 2000 in each of the five pilot irrigation districts to determine water supplied to each irrigation district. This information helps in assessing the extent of mismatch between irrigation supplies and demands in these pilot districts. Water flow data were summarized to give daily flow in m³. It is recommended that the MWRI continue water flow measurements as a regular part of their MISD program.

2.4 Crop Water Needs

A key component of the MISD program is for the irrigation district engineer to use the cropping pattern information transferred from the MALR to calculate the real-time crop water needs. It was recognized that better tools would improve the district engineer’s ability to make these calculations accurately and quickly and would assure that good water needs information was transferred to the CDWD of MWRI for scheduling water releases from the HAD. This section describes the development of these calculation tools and their use in the five MISD pilot districts.

2.4.1 Development of Tools

During the period June – August 2001, Dr. Marshall English, an expatriate irrigation-scheduling specialist on TDY assignment with EPIQ, developed a Microsoft Excel spreadsheet for use in the irrigation district office. This spreadsheet uses the cropping pattern information transferred from MALR to calculate the real-time crop water needs for both the “current” and “expected” half-month time periods. The “expected” need covers the water requirements for the crops expected to be in the district one half month in the future. This is the information that is transferred to CDWD for scheduling water releases. The district engineer and the directorate head of water section can use the current or existing water needs

to refine the water distribution within the districts and directorate. Details of the spreadsheet development are given in Report No. 45 (Appendix C, which is the TDY report of Dr. English). This TDY report recommended development of a more robust Microsoft Access version of this operational tool to replace the Excel spreadsheet.

Development of the Microsoft Access version began in July 2001 and is now completed (See Reports 45a – 45e). The Excel version is used in this report. Either version will give the same results.

A spreadsheet and associated suite of graphs was developed for analyzing results of either version of the operational tool that calculates water needs. It incorporates a comparison of crop water needs and water delivered on a district-wide basis. The water delivered to the district is obtained from the water-monitoring program described in section 2.3.

2.4.2 Use of Tools in Pilot Districts

Calculations of crop water needs were made for the whole period of cropping pattern and water delivery information collected during the benchmark activities, generally from March 1, 2000 through September 30, 2001. Details of data are given in the five separate Pilot District Data Reports (45a – 45e). The results of the spreadsheet calculations and comparisons for all five pilot districts are presented in the appendix to this report. Tables 1a – 1e show results of the spreadsheet calculations for the five pilot districts. For each half-month period, results are tabulated for the crop water needs of the current crops “existing” in the district and for those crops projected as “expected” from the previous half month. Also tabulated are volumes of water delivered to the district. Both the required and delivered water are expressed as average daily values over the half-month period for the total district (in million m³/day) and on a per feddan basis (in m³/(day feddan)). Also tabulated in these tables are the percent difference between water delivered and crop water needs.

Figure 1a shows the water delivered to the Abou Hummus Irrigation District compared to the calculated water needs for March 2000 – September 2001, as daily values averaged over the half-month period expressed in million m³/day. The curve labeled “existing” need shows the water needed by the existing or current crops for the particular half month. The “expected” need for the particular half month is the water needed by the crops calculated from cropping patterns that were forecast from the previous half-month. Figures 1b – 1e show these same results for the other four pilot districts.

Some significant observations can be made from Figures 1a – 1e. First, note that, in general, there are relatively small differences between the existing need and the expected need curves and considerably more differences between either of these two curves and the water delivered curve. Thus, the MISD process of forecasting the cropping pattern expected in the next half month appears adequate for improving the match of irrigation supplies and demands. In fact, considerable improvement can be made by delivering water closer to the real-time crop needs. Second, there is generally over-delivery of irrigation water in the winter and in the transition periods between winter and summer crops and between summer and winter crops and under-delivery during the peak of the summer season except for the East Isna district. Third, there appears to be a trend toward delivering water in the pilot districts closer to crop needs in 2001 than in 2000. This is believed to be true because the district personnel were trying very hard to do the best they could with the tools and information available to them. Keep in mind that the Excel spreadsheet for calculating real-time water needs from the

cropping pattern information was not put into the pilot districts until September 2001. Use of the new tool for calculating real-time crop water needs from cropping pattern information is expected to significantly reduce mismatch in the future implementation of the MISD policy.

Figures 2a – 2e give information similar to Figures 1a – 1e but expressed on a per feddan (of cropped area) basis. Since the existing and expected areas of crops do not agree exactly, two curves of water delivery are calculated. The first labeled “Delivered/(Existing Area)” is the water delivered in m³/day per feddan of existing crops. The second labeled “Delivered/(Expected Area)” is the water delivered in m³/day per feddan of crops forecast as “expected” for the time period. Similar conclusions can be drawn from Figures 2a – 2e as from Figures 1a – 1e, but values expressed as m³/day per feddan may be more meaningful to some people.

Another set of figures show plots of the percent difference (tabulated values in Tables 1a – 1e) of water delivered from existing need and from expected need (see Figures 3a – 3e). The equations used are:

$$\% \text{ Difference} = \frac{\text{Water Delivered} - \text{Existing Need}}{\text{Existing Need}} \times 100$$

$$\% \text{ Difference} = \frac{\text{Water Delivered} - \text{Expected Need}}{\text{Expected Need}} \times 100$$

Thus, positive values of percent difference mean over-delivery and negative values designate under-delivery.

2.5 Water Saved

A very critical problem facing Egypt in the future is full and efficient use of the nation’s water. Severe water shortages have been projected. Many people have looked to the MISD program as a way of saving water that is now being lost through inefficient management. The MISD working group has been asked for an assessment of how much water could be saved and made available for other use by full implementation of the MISD program. Providing an answer to the question of how much water would be saved is difficult and could be answered only by a complete and detailed hydrologic study of the water use system in Egypt. Such a study is beyond the scope of the benchmark. Careful analysis of the material presented in this report can provide an estimate of how much water could be saved in each of the five pilot districts. One should be very careful of how this information is used. The estimates of water saved in the pilot districts cannot provide a nationwide estimate because of the use-reuse relationships within the hydrologic system. With these cautions in mind, this section provides an estimate of the potential water saved in each of the five pilot districts.

In making estimates of potential water savings, one would like to try to use as much of the data collected during the benchmark activities as possible. Water delivered was compared to water needs (for both existing and expected cropping patterns) over the complete record of data collected during the benchmark activities, generally from March 1, 2000 – September 30, 2000, as shown in Table 2. The values in columns labeled “Water Saved” are obtained by subtracting water needed from water delivered so that positive values of potential water saved denote over-delivery and negative values denote under-delivery. All values tabulated in

Table 2 are expressed as average million m³/day. Within each district, each column of water delivered and saved is summed for all periods that have both existing and expected crop water needs. This process keeps the same total time period for percentages calculated for each district. Note that the first three districts (Abou Hummus, Abou Kebir, and Beba) all have the same total number of time periods, but the number of time periods for East Isna and Luxor are different.

Since all districts do not have the same total time record of data, it was decided that the best comparison would be to use a complete hydrologic year (or years). One such year is included in the data. Water delivered was compared to water needs (for both existing and expected cropping patterns) over one full hydrologic year, August 1, 2000 – July 31, 2001. Table 3 shows the results of these comparisons for the five MISD pilot districts. These results underscore the cautions of the previous paragraphs. These results should be interpreted as the water that could have been saved in each of the pilot districts in the hydrologic year 2000-2001 if water had been delivered to exactly match the crop water needs. Note the wide variation in net yearly water saved among the five districts. The rather high values for the two districts in Upper Egypt may have very little impact on potential total water that could be saved nationwide since most of the excess in Upper Egypt returns directly to the Nile. Thus this over-delivery in Upper Egypt may already be available for use elsewhere in the system and should not be counted as new water for other uses.

Note that in Table 3 we have exactly the same number of time periods for all five districts so valid comparisons can be made. The entire MISD policy is based on projected or forecast (expected) crop areas for release of water from HAD and subsequent delivery to the districts. Thus, the best estimate of potential water savings with full implementation of the MISD policy should be based on the “water saved” totals and percentages for the column labeled “Expected Crops” in each district. These percentages range from 0.95 % to 33.68 % and average 14.14%.

3 Conclusions

Conclusions of this brief study of potential water savings that could result from full nationwide implementation of the MISD policy are:

1. A complete and detailed hydrologic study (including use and reuse) of the entire Nile system is necessary to provide reliable estimates of water savings achievable as a result of nation-wide implementation of MISD.
2. The results presented herein must be used with caution as detailed in Chapter 2.
3. Using theoretical crop water requirement data, assuming it is practical to deliver water to exactly meet those requirements (i.e. ignoring system constraints and other constraining factors), and based on an analysis of the five MISD pilot district data; one can conclude that nationwide implementation of MISD will result in a significant reduction in HAD releases to meet irrigation demands.

Appendix

Tables and Figures

Table 1a. Results of spreadsheet calculation of crop water needs and comparison with water delivered to the Abou Hummus District expressed as daily average water volume over each half-month period from March 2000 through September 2001.

Per	Dates			Yr	Mo	Water Required		Delivered	Water Delivered		Area fed	Existing		Expected		Per	Dates			Water Required		Water Delivered to Area	
	From	To	Existing			Expected	% Diff. From Existing Need	% Diff. From Expected Need	Fallow	Cropped		Fallow	Cropped	From	To		Yr	Existing	Expected	Existing	Expected		
			(million cubic meters)/day					feddans	feddans	feddans		feddans	m ³ /(day feddan)										
5	1 Mar	15 Mar	0	M	1.3018		1.2117	-6.92		74718	0	74718			5	1 Mar	15 Mar	0	17.42		16.22		
6	16 Mar	31 Mar	0		1.6697	1.6625	1.3393	-19.79	-19.44		0	74718		0	74718	6	16 Mar	31 Mar	0	22.35	22.25	17.92	17.92
7	1 Apr	15 Apr	0	A	1.3230	1.3279	2.0234	52.94	52.38		0	74718		0	74718	7	1 Apr	15 Apr	0	17.71	17.77	27.08	27.08
8	16 Apr	30 Apr	0		0.4650	0.6719	2.4887	435.18	270.40		53603	21115	44003	30715	8	16 Apr	30 Apr	0	22.02	21.88	117.86	81.03	
9	1 May	15 May	0	M	0.7598	0.7008	2.7306	259.39	289.62		38866	35852	40022	34696	9	1 May	15 May	0	21.19	20.20	76.16	78.70	
10	16 May	31 May	0		0.7547	1.3618	2.5326	235.59	85.97		38866	35852	22028	52690	10	16 May	31 May	0	21.05	25.85	70.64	48.07	
11	1 Jun	15 Jun	0	J	2.3805	1.5254	3.3114	39.10	117.09		1960	72758	22028	52690	11	1 Jun	15 Jun	0	32.72	28.95	45.51	62.85	
12	16 Jun	30 Jun	0		2.9204	2.9204	2.9393	0.65	0.65		0	74718		0	74718	12	16 Jun	30 Jun	0	39.09	39.09	39.34	39.34
13	1 Jul	15 Jul	0	J	3.3082	3.3082	2.8073	-15.14	-15.14		0	74718		0	74718	13	1 Jul	15 Jul	0	44.28	44.28	37.57	37.57
14	16 Jul	31 Jul	0		3.5755	3.6176	2.8396	-20.58	-21.50		0	74718		0	74718	14	16 Jul	31 Jul	0	47.85	48.42	38.00	38.00
15	1 Aug	15 Aug	0	A	3.6780	3.6382	2.9418	-20.02	-19.14		0	74718		0	74718	15	1 Aug	15 Aug	0	49.22	48.69	39.37	39.37
16	16 Aug	31 Aug	0		3.5031	3.5429	2.8872	-17.58	-18.51		0	74718		0	74718	16	16 Aug	31 Aug	0	46.88	47.42	38.64	38.64
17	1 Sep	15 Sep	0	S	2.6682	2.6648	2.3695	-11.20	-11.08		0	74718		0	74718	17	1 Sep	15 Sep	0	35.71	35.66	31.71	31.71
18	16 Sep	30 Sep	0		2.0158	2.0158	2.0931	3.83	3.83		0	74718		0	74718	18	16 Sep	30 Sep	0	26.98	26.98	28.01	28.01
19	1 Oct	15 Oct	0	O	1.3262	1.3262	1.7310	30.52	30.52		0	74718		0	74718	19	1 Oct	15 Oct	0	17.75	17.75	23.17	23.17
20	16 Oct	31 Oct	0		0.5840	1.0580	1.4786	153.20	39.76		31844	42874		0	74718	20	16 Oct	31 Oct	0	13.62	14.16	34.49	19.79
21	1 Nov	15 Nov	0	N	1.0461	0.6243	1.9390	85.36	210.56		0	74718	27839	46879	21	1 Nov	15 Nov	0	14.00	13.32	25.95	41.36	
22	16 Nov	30 Nov	0		1.0461	1.0461	1.7851	70.65	70.65		0	74718		0	74718	22	16 Nov	30 Nov	0	14.00	14.00	23.89	23.89
23	1 Dec	15 Dec	0	D	1.0461	1.0461	0.6796	-35.03	-35.03		0	74718		0	74718	23	1 Dec	15 Dec	0	14.00	14.00	9.10	9.10
24	16 Dec	31 Dec	0		0.9807	1.0461	0.6702	-31.66	-35.93		0	74718		0	74718	24	16 Dec	31 Dec	0	13.13	14.00	8.97	8.97
1	1 Jan	15 Jan	0	J	1.0461	1.0461	0.6509	-37.78	-37.78		0	74718		0	74718	1	1 Jan	15 Jan	0	14.00	14.00	8.71	8.71
2	16 Jan	31 Jan	0		0.9807	1.0461	0.4314	-56.01	-58.76		0	74718		0	74718	2	16 Jan	31 Jan	0	13.13	14.00	5.77	5.77
3	1 Feb	15 Feb	0	F	1.0461	0.9807	1.3003	24.30	32.59		0	74718		0	74718	3	1 Feb	15 Feb	0	14.00	13.13	17.40	17.40
4	16 Feb	28 Feb	0		1.2070	1.1185	0.8681	-28.08	-22.39		0	74718		0	74718	4	16 Feb	28 Feb	0	16.15	14.97	11.62	11.62
5	1 Mar	15 Mar	0	M	1.3063	1.3273	1.5023	15.01	13.18		0	74718		0	74718	5	1 Mar	15 Mar	0	17.48	17.76	20.11	20.11
6	16 Mar	31 Mar	0		1.6680	1.6624	1.0887	-34.73	-34.51		0	74718		0	74718	6	16 Mar	31 Mar	0	22.32	22.25	14.57	14.57
7	1 Apr	15 Apr	0	A	1.5305	1.6091	1.5015	-1.90	-6.69		5139	69579		0	74718	7	1 Apr	15 Apr	0	22.00	21.54	21.58	20.10
8	16 Apr	30 Apr	0		0.5307	0.5096	2.0610	288.36	304.47		50564	24154	51545	23173	8	16 Apr	30 Apr	0	21.97	21.99	85.33	88.94	
9	1 May	15 May	0	M	0.4568	0.6747	2.1487	370.42	218.49		50564	24154	40523	34195	9	1 May	15 May	0	18.91	19.73	88.96	62.84	
10	16 May	31 May	0		0.7917	0.7489	2.0510	159.08	173.86		39077	35641	40523	34195	10	16 May	31 May	0	22.21	21.90	57.55	59.98	
11	1 Jun	15 Jun	0	J	1.2730	0.9388	2.9487	131.64	214.10		29951	44767	37348	37370	11	1 Jun	15 Jun	0	28.44	25.12	65.87	78.91	
12	16 Jun	30 Jun	0		2.3560	2.3913	2.8393	20.51	18.74		9592	65126	9664	65054	12	16 Jun	30 Jun	0	36.18	36.76	43.60	43.65	
13	1 Jul	15 Jul	0	J	3.1277	3.1277	2.8274	-9.60	-9.60		0	74718		0	74718	13	1 Jul	15 Jul	0	41.86	41.86	37.84	37.84
14	16 Jul	31 Jul	0		3.3464	3.3925	3.1509	-5.84	-7.12		0	74718		0	74718	14	16 Jul	31 Jul	0	44.79	45.40	42.17	42.17
15	1 Aug	15 Aug	0	A	3.6108	3.5648	2.9329	-18.78	-17.73		0	74718		0	74718	15	1 Aug	15 Aug	0	48.33	47.71	39.25	39.25
16	16 Aug	31 Aug	0		3.5475	3.5920	2.4517	-30.89	-31.75		0	74718		0	74718	16	16 Aug	31 Aug	0	47.48	48.07	32.81	32.81
17	1 Sep	15 Sep	0	S	3.2525	3.2197	2.2205	-31.73	-31.03		0	74718		0	74718	17	1 Sep	15 Sep	0	43.53	43.09	29.72	29.72
18	16 Sep	30 Sep	0		2.4230	2.4230	1.8417	-23.99	-23.99		0	74718		0	74718	18	16 Sep	30 Sep	0	32.43	32.43	24.65	24.65
19	1 Oct	15 Oct	0	O			1.6178							0	74718	19	1 Oct	15 Oct	0			21.65	

Table 1b. Results of spreadsheet calculation of crop water needs and comparison with water delivered to the Abou Kebir District expressed as daily average water volume over each half-month period from March 2000 through September 2001.

Per	Dates			Yr	Mo	Water: Required		Delivered	Water Delivered		Area fed	Existing		Expected		Per	Dates			Water Required		Water Delivered to Area	
	From	To	Existing			Expected	% Diff. From Existing	% Diff. From Expected	Fallow	Cropped		Fallow	Cropped	From	To		Yr	Existing	Expected	Existing	Expected		
	(million cubic meters)/day					m ³ /(day feddan)						m ³ /(day feddan)											
5	1 Mar	15 Mar	0	M	0.5822		0.8322		42.93		36385	0	36385			5	1 Mar	15 Mar	0	16.00		22.87	
6	16 Mar	31 Mar	0		0.6943	0.7002	0.8852		27.49	26.41		1651	34734	1238	35147	6	16 Mar	31 Mar	0	19.99	19.92	25.49	25.19
7	1 Apr	15 Apr	0	A	0.7920	0.7939	0.8063		1.81	1.56		684	35701	635	35750	7	1 Apr	15 Apr	0	22.18	22.21	22.58	22.55
8	16 Apr	30 Apr	0		0.9097	0.9189	0.9136		0.42	-0.58		449	35936	104	36281	8	16 Apr	30 Apr	0	25.32	25.33	25.42	25.18
9	1 May	15 May	0	M	0.8272	0.8648	0.9028		9.14	4.40		2416	33969	111	36274	9	1 May	15 May	0	24.35	23.84	26.58	24.89
10	16 May	31 May	0		0.4597	0.5022	1.0248		122.94	104.04		13061	23324	9381	27004	10	16 May	31 May	0	19.71	18.60	43.94	37.95
11	1 Jun	15 Jun	0	J	0.7745	0.7537	1.2797		65.23	69.79		15415	20970	14277	22108	11	1 Jun	15 Jun	0	36.93	34.09	61.03	57.89
12	16 Jun	30 Jun	0		1.3964	1.3769	1.1400		-18.36	-17.21		4737	31648	5144	31241	12	16 Jun	30 Jun	0	44.12	44.07	36.02	36.49
13	1 Jul	15 Jul	0	J	1.7695	1.7695	1.1748		-33.61	-33.61		0	36385	0	36385	13	1 Jul	15 Jul	0	48.63	48.63	32.29	32.29
14	16 Jul	31 Jul	0		1.8480	1.8861	1.2045		-34.82	-36.14		0	36385	0	36385	14	16 Jul	31 Jul	0	50.79	51.84	33.10	33.10
15	1 Aug	15 Aug	0	A	1.9411	1.9038	1.1338		-41.59	-40.44		0	36385	0	36385	15	1 Aug	15 Aug	0	53.35	52.32	31.16	31.16
16	16 Aug	31 Aug	0		1.8135	1.8463	1.1414		-37.06	-38.18		0	36385	0	36385	16	16 Aug	31 Aug	0	49.84	50.74	31.37	31.37
17	1 Sep	15 Sep	0	S	1.5016	1.4799	1.0631		-29.20	-28.16		0	36385	0	36385	17	1 Sep	15 Sep	0	41.27	40.67	29.22	29.22
18	16 Sep	30 Sep	0		0.9780	0.9780	0.7991		-18.30	-18.30		0	36385	0	36385	18	16 Sep	30 Sep	0	26.88	26.88	21.96	21.96
19	1 Oct	15 Oct	0	O	0.5144	0.5884	0.8061		56.70	37.00		0	36385	0	36385	19	1 Oct	15 Oct	0	14.14	16.17	22.16	22.16
20	16 Oct	31 Oct	0		0.1347	0.5094	0.7855		483.29	54.20		26780	9605	0	36385	20	16 Oct	31 Oct	0	14.02	14.00	81.78	21.59
21	1 Nov	15 Nov	0	N	0.1494	0.1403	0.8142		445.07	480.17		25857	10528	25856	10529	21	1 Nov	15 Nov	0	14.19	13.33	77.34	77.33
22	16 Nov	30 Nov	0		0.2423	0.2378	0.8839		264.74	271.72		19075	17310	19400	16985	22	16 Nov	30 Nov	0	14.00	14.00	51.06	52.04
23	1 Dec	15 Dec	0	D	0.4650	0.4649	0.7461		60.46	60.49		3173	33212	3178	33207	23	1 Dec	15 Dec	0	14.00	14.00	22.46	22.47
24	16 Dec	31 Dec	0		0.4776	0.5094	0.7091		48.49	39.21		0	36385	0	36385	24	16 Dec	31 Dec	0	13.12	14.00	19.49	19.49
1	1 Jan	15 Jan	0	J	0.5094	0.5094	0.5871		15.26	15.26		0	36385	0	36385	1	1 Jan	15 Jan	0	14.00	14.00	16.14	16.14
2	16 Jan	31 Jan	0		0.4776	0.5094	0.0000		-100.00	-100.00		0	36385	0	36385	2	16 Jan	31 Jan	0	13.12	14.00	0.00	0.00
3	1 Feb	15 Feb	0	F	0.5894	0.4776	0.4249		-27.90	-11.02		0	36385	0	36385	3	1 Feb	15 Feb	0	16.20	13.12	11.68	11.68
4	16 Feb	28 Feb	0		0.5878	0.5251	0.8259		40.51	57.29		0	36385	0	36385	4	16 Feb	28 Feb	0	16.15	14.43	22.70	22.70
5	1 Mar	15 Mar	0	M	0.5359	0.5666	0.7841		46.31	38.39		2875	33510	2875	33510	5	1 Mar	15 Mar	0	15.99	16.91	23.40	23.40
6	16 Mar	31 Mar	0		0.6559	0.6582	0.7646		16.57	16.17		2770	33615	2561	33824	6	16 Mar	31 Mar	0	19.51	19.46	22.75	22.60
7	1 Apr	15 Apr	0	A	0.7570	0.7561	0.8489		12.14	12.27		718	35667	671	35714	7	1 Apr	15 Apr	0	21.22	21.17	23.80	23.77
8	16 Apr	30 Apr	0		0.8189	0.8240	0.7820		-4.50	-5.09		792	35593	474	35911	8	16 Apr	30 Apr	0	23.01	22.94	21.97	21.78
9	1 May	15 May	0	M	0.7480	0.7632	0.8308		11.07	8.86		3425	32960	2804	33581	9	1 May	15 May	0	22.69	22.73	25.21	24.74
10	16 May	31 May	0		0.5129	0.5108	0.8923		73.98	74.69		16787	19598	16929	19456	10	16 May	31 May	0	26.17	26.25	45.53	45.86
11	1 Jun	15 Jun	0	J	0.8085	0.7933	1.1536		42.68	45.42		11983	24402	11818	24567	11	1 Jun	15 Jun	0	33.13	32.29	47.27	46.96
12	16 Jun	30 Jun	0		1.3482	1.3492	1.2692		-5.86	-5.93		2422	33963	2388	33997	12	16 Jun	30 Jun	0	39.70	39.69	37.37	37.33
13	1 Jul	15 Jul	0	J	1.4699	1.5836	1.2840		-12.65	-18.92		2422	33963	0	36385	13	1 Jul	15 Jul	0	43.28	43.52	37.80	35.29
14	16 Jul	31 Jul	0		1.6474	1.6759	1.3097		-20.50	-21.85		0	36385	0	36385	14	16 Jul	31 Jul	0	45.28	46.06	36.00	36.00
15	1 Aug	15 Aug	0	A	1.7958	1.7677	1.2465		-30.59	-29.49		0	36385	0	36385	15	1 Aug	15 Aug	0	49.35	48.58	34.26	34.26
16	16 Aug	31 Aug	0		1.7170	1.7434	1.1914		-30.61	-31.66		0	36385	0	36385	16	16 Aug	31 Aug	0	47.19	47.92	32.74	32.74
17	1 Sep	15 Sep	0	S	1.4515	1.4337	1.0018		-30.98	-30.12		0	36385	0	36385	17	1 Sep	15 Sep	0	39.89	39.40	27.53	27.53
18	16 Sep	30 Sep	0		0.6041	0.6041	0.8880		46.99	46.99		14298	22087	14298	22087	18	16 Sep	30 Sep	0	27.35	27.35	40.20	40.20
19	1 Oct	15 Oct	0	O		0.1524										19	1 Oct	15 Oct	0		17.80		

Table 1c. Results of spreadsheet calculation of crop water needs and comparison with water delivered to the Beba District expressed as daily average water volume over each half-month period from March 2000 through September 2001.

Per	Dates		Yr	Mo	Water Required (million cubic meters)/day		Delivered	Water Delivered		Area fed	Existing		Expected		Per	Dates		Yr	Water Required		Water Delivered to Area	
	From	To			Existing	Expected	% Diff. From Existing Need	% Diff. From Expected Need	Fallow feddars		Cropped feddars	Fallow feddars	Cropped feddars	Existing		Expected	Existing		Expected			
	m3/(day feddan)																					
5	1 Mar	15 Mar	0	M	0.6264	0.7485	0.7485	19.49		32266	1623	30643			5	1 Mar	15 Mar	0	20.44		24.43	
6	16 Mar	31 Mar	0	O	0.6859	0.6995	0.6698	-2.34	-4.24		1623	30643	895	31371	6	16 Mar	31 Mar	0	22.38	22.30	21.86	21.35
7	1 Apr	15 Apr	0	A	0.7390	0.7740	0.7408	0.24	-4.29		129	32137	52	32214	7	1 Apr	15 Apr	0	22.99	24.03	23.05	23.00
8	16 Apr	30 Apr	0	N	0.7253	0.7253	0.6806	-6.16	-6.16		129	32137	129	32137	8	16 Apr	30 Apr	0	22.57	22.57	21.18	21.18
9	1 May	15 May	0	M	0.4267	0.5348	0.8388	96.60	56.84		11525	20741	7380	24886	9	1 May	15 May	0	20.57	21.49	40.44	33.71
10	16 May	31 May	0	O	0.4574	0.3826	0.8453	84.82	120.96		12126	20140	15023	17243	10	16 May	31 May	0	22.71	22.19	41.97	49.02
11	1 Jun	15 Jun	0	J	0.8330	0.9033	1.0306	23.72	14.09		7954	24312	5062	27204	11	1 Jun	15 Jun	0	34.26	33.20	42.39	37.88
12	16 Jun	30 Jun	0	O	0.9584	0.9855	0.7943	-17.12	-19.40		940	31326	128	32138	12	16 Jun	30 Jun	0	30.60	30.66	25.36	24.72
13	1 Jul	15 Jul	0	J	1.0281	1.0290	0.8192	-20.32	-20.39		76	32190	52	32214	13	1 Jul	15 Jul	0	31.94	31.94	25.45	25.43
14	16 Jul	31 Jul	0	O	1.1897	1.1884	0.8168	-31.35	-31.27		0	32266	0	32266	14	16 Jul	31 Jul	0	36.87	36.83	25.31	25.31
15	1 Aug	15 Aug	0	A	1.2942	1.2942	0.6908	-46.62	-46.62		0	32266	0	32266	15	1 Aug	15 Aug	0	40.11	40.11	21.41	21.41
16	16 Aug	31 Aug	0	S	1.2811	1.2811	0.9373	-26.84	-26.84		0	32266	0	32266	16	16 Aug	31 Aug	0	39.71	39.71	29.05	29.05
17	1 Sep	15 Sep	0	S	1.0933	1.1656	0.7726	-29.33	-33.72		3206	29060	890	31376	17	1 Sep	15 Sep	0	37.62	37.15	26.59	24.62
18	16 Sep	30 Sep	0	O	0.4281	0.5280	0.8144	90.23	54.26		17049	15217	12932	19334	18	16 Sep	30 Sep	0	28.13	27.31	53.52	42.12
19	1 Oct	15 Oct	0	O	0.3683	0.3885	0.8247	123.93	112.27		13309	18957	12324	19942	19	1 Oct	15 Oct	0	19.43	19.48	43.50	41.36
20	16 Oct	31 Oct	0	N	0.3975	0.3893	0.7408	86.37	90.29		9912	22354	10620	21646	20	16 Oct	31 Oct	0	17.78	17.98	33.14	34.22
21	1 Nov	15 Nov	0	N	0.3039	0.3246	0.6668	119.39	105.41		11683	20583	9627	22639	21	1 Nov	15 Nov	0	14.77	14.34	32.40	29.45
22	16 Nov	30 Nov	0	O	0.3328	0.3499	0.6806	104.50	94.52		8493	23773	7273	24993	22	16 Nov	30 Nov	0	14.00	14.00	28.63	27.23
23	1 Dec	15 Dec	0	D	0.4517	0.4517	0.5358	18.62	18.62		0	32266	0	32266	23	1 Dec	15 Dec	0	14.00	14.00	16.61	16.61
24	16 Dec	31 Dec	0	N	0.4235	0.4517	0.5973	41.04	32.23		0	32266	0	32266	24	16 Dec	31 Dec	0	13.12	14.00	18.51	18.51
1	1 Jan	15 Jan	0	J	0.4517	0.4517	0.5638	24.81	24.81		0	32266	0	32266	1	1 Jan	15 Jan	0	14.00	14.00	17.47	17.47
2	16 Jan	31 Jan	0	O	0.4235	0.4517	0.1477	-65.13	-67.31		0	32266	0	32266	2	16 Jan	31 Jan	0	13.12	14.00	4.58	4.58
3	1 Feb	15 Feb	0	F	0.4294	0.4699	0.6755	57.30	43.76		3500	28766	0	32266	3	1 Feb	15 Feb	0	14.93	14.56	23.48	20.94
4	16 Feb	28 Feb	0	N	0.5092	0.4977	0.7557	48.41	51.84		3500	28766	3500	28766	4	16 Feb	28 Feb	0	17.70	17.30	26.27	26.27
5	1 Mar	15 Mar	0	M	0.5896	0.5884	0.6636	12.56	12.79		3705	28561	3500	28766	5	1 Mar	15 Mar	0	20.64	20.45	23.24	23.07
6	16 Mar	31 Mar	0	O	0.6618	0.7103	0.5582	-15.64	-21.41		3044	29222	661	31605	6	16 Mar	31 Mar	0	22.65	22.47	19.10	17.66
7	1 Apr	15 Apr	0	A	0.9696	0.9694	0.6201	-36.05	-36.03		0	32266	0	32266	7	1 Apr	15 Apr	0	30.05	30.04	19.22	19.22
8	16 Apr	30 Apr	0	N	0.5429	0.9804	0.6611	21.78	-32.57		12565	19701	0	32266	8	16 Apr	30 Apr	0	27.56	30.38	33.56	20.49
9	1 May	15 May	0	M	0.5189	0.5599	0.7521	44.94	34.33		14351	17915	13124	19142	9	1 May	15 May	0	28.96	29.25	41.98	39.29
10	16 May	31 May	0	O	0.5129	0.5529	0.7600	48.18	37.46		14871	17395	13570	18696	10	16 May	31 May	0	29.48	29.57	43.69	40.65
11	1 Jun	15 Jun	0	J	1.0664	0.6118	0.7923	-25.71	29.50		0	32266	13625	18641	11	1 Jun	15 Jun	0	33.05	32.82	24.56	42.50
12	16 Jun	30 Jun	0	O	0.9837	0.9249	0.8481	-13.78	-8.30		433	31833	2188	30078	12	16 Jun	30 Jun	0	30.90	30.75	26.64	28.20
13	1 Jul	15 Jul	0	J	1.1314	1.1179	0.8056	-28.79	-27.93		0	32266	390	31876	13	1 Jul	15 Jul	0	35.07	35.07	24.97	25.27
14	16 Jul	31 Jul	0	O	1.2542	1.2539	0.8396	-33.06	-33.04		0	32266	0	32266	14	16 Jul	31 Jul	0	38.87	38.86	26.02	26.02
15	1 Aug	15 Aug	0	A	1.2166	1.2376	1.0217	-16.02	-17.45		2256	30010	1740	30526	15	1 Aug	15 Aug	0	40.54	40.54	34.05	33.47
16	16 Aug	31 Aug	0	S	1.1754	1.1754	1.0072	-14.31	-14.31		2256	30010	2256	30010	16	16 Aug	31 Aug	0	39.17	39.17	33.56	33.56
17	1 Sep	15 Sep	0	S	0.7733	0.8198	0.9746	26.03	18.88		9964	22302	8706	23560	17	1 Sep	15 Sep	0	34.68	34.80	43.70	41.37
18	16 Sep	30 Sep	0	O	0.3909	0.4581	0.8631	120.77	88.41		17156	15110	14314	17952	18	16 Sep	30 Sep	0	25.87	25.52	57.12	48.08
19	1 Oct	15 Oct	0	O		0.2074							23093	9173	19	1 Oct	15 Oct	0		22.61		

Table 1d. Results of spreadsheet calculation of crop water needs and comparison with water delivered to the East Isna District expressed as daily average water volume over each half-month period from March 2000 through September 2001.

Per	Dates		Yr	Mo	Water Required (million cubic meters)/day		Delivered		Water Delivered		Area fed	Existing		Expected		Per	Dates		Yr	Water Required m ³ /(day feddan)		Water Delivered to Area	
	From	To			Existing	Expected	% Diff. From Existing	% Diff. From Expected	Fallow feddans	Cropped feddans		Fallow feddans	Cropped feddans	From	To		Existing	Expected		Existing	Expected		
5	1 Mar	15 Mar	0	M			1.0726				32116					5	1 Mar	15 Mar	0				
6	16 Mar	31 Mar	0				0.9921									6	16 Mar	31 Mar	0				
7	1 Apr	15 Apr	0	A	0.8505		1.1374		33.74			5932	26184			7	1 Apr	15 Apr	0	32.48		43.44	
8	16 Apr	30 Apr	0		0.8381	0.7872	1.0934		30.46	38.90		10401	21715	10485	21631	8	16 Apr	30 Apr	0	38.60	36.39	50.35	50.55
9	1 May	15 May	0	M	0.8542	0.8452	1.1025		29.06	30.44		11649	20467	11640	20476	9	1 May	15 May	0	41.74	41.28	53.87	53.84
10	16 May	31 May	0		0.9090	0.9073	1.2797		40.78	41.05		11086	21030	11139	20977	10	16 May	31 May	0	43.23	43.25	60.85	61.01
11	1 Jun	15 Jun	0	J	1.0471	1.0327	1.2543		19.78	21.45		10552	21564	10837	21279	11	1 Jun	15 Jun	0	48.56	48.53	58.16	58.94
12	16 Jun	30 Jun	0		1.0192	1.0376	1.4622		43.47	40.93		10552	21564	10236	21880	12	16 Jun	30 Jun	0	47.26	47.42	67.81	66.83
13	1 Jul	15 Jul	0	J	0.9965	0.9949	1.4525		45.77	45.99		10186	21930	10236	21880	13	1 Jul	15 Jul	0	45.44	45.47	66.23	66.39
14	16 Jul	31 Jul	0		1.2360	1.1383	1.5976		29.25	40.35		2755	29361	5712	26404	14	16 Jul	31 Jul	0	42.10	43.11	54.41	60.51
15	1 Aug	15 Aug	0	A	1.2355	1.2112	1.7250		39.62	42.41		2755	29361	3503	28613	15	1 Aug	15 Aug	0	42.08	42.33	58.75	60.29
16	16 Aug	31 Aug	0		1.1771	1.1773	1.6484		40.04	40.01		4530	27586	4520	27596	16	16 Aug	31 Aug	0	42.67	42.66	59.76	59.73
17	1 Sep	15 Sep	0	S	1.0663	1.0887	1.5241		42.94	39.99		5982	26134	5212	26904	17	1 Sep	15 Sep	0	40.80	40.47	58.32	56.65
18	16 Sep	30 Sep	0		0.9693	0.9822	1.4864		53.34	51.33		5982	26134	5498	26618	18	16 Sep	30 Sep	0	37.09	36.90	56.88	55.84
19	1 Oct	15 Oct	0	O	0.9247	0.8840	1.4969		61.89	69.33		3968	28148	5498	26618	19	1 Oct	15 Oct	0	32.85	33.21	53.18	56.24
20	16 Oct	31 Oct	0		0.8404	0.8230	1.5212		81.00	84.83		3425	28691	3920	28196	20	16 Oct	31 Oct	0	29.29	29.19	53.02	53.95
21	1 Nov	15 Nov	0	N	0.7290	0.7197	1.5605		114.05	116.84		2614	29502	3931	28185	21	1 Nov	15 Nov	0	24.71	25.53	52.89	55.37
22	16 Nov	30 Nov	0		0.6091	0.6596	1.3242		117.39	100.76		2614	29502	2614	29502	22	16 Nov	30 Nov	0	20.65	22.36	44.88	44.88
23	1 Dec	15 Dec	0	D	0.5101	0.5130	1.3526		165.17	163.69		0	32116	2614	29502	23	1 Dec	15 Dec	0	15.88	17.39	42.12	45.85
24	16 Dec	31 Dec	0		0.4159	0.4572	0.2788		-32.97	-39.03		1103	31013	0	32116	24	16 Dec	31 Dec	0	13.41	14.24	8.99	8.68
1	1 Jan	15 Jan	0	J	0.4254	0.4254	0.7025		65.12	65.12		1993	30123	1993	30123	1	1 Jan	15 Jan	0	14.12	14.12	23.32	23.32
2	16 Jan	31 Jan	0		0.4300	0.4397	1.2738		196.26	189.74		2736	29380	2738	29378	2	16 Jan	31 Jan	0	14.63	14.97	43.36	43.36
3	1 Feb	15 Feb	0	F	0.4654	0.4563	1.0402		123.51	127.97		3439	28677	3439	28677	3	1 Feb	15 Feb	0	16.23	15.91	36.27	36.27
4	16 Feb	28 Feb	0		0.5234	0.4988	0.8887		69.79	78.18		4500	27616	4500	27616	4	16 Feb	28 Feb	0	18.95	18.06	32.18	32.18
5	1 Mar	15 Mar	0	M	0.6018	0.5793	0.8635		43.50	49.06		6757	25359	6757	25359	5	1 Mar	15 Mar	0	23.73	22.85	34.05	34.05
6	16 Mar	31 Mar	0		0.6541	0.6331	1.2109		85.12	91.26		9128	22988	9143	22973	6	16 Mar	31 Mar	0	28.45	27.56	52.68	52.71
7	1 Apr	15 Apr	0	A	0.6690	0.6541	1.0425		55.84	59.38		10151	21965	10128	21988	7	1 Apr	15 Apr	0	30.46	29.75	47.46	47.41
8	16 Apr	30 Apr	0		0.7310	0.7143	1.0924		49.43	52.93		10151	21965	10151	21965	8	16 Apr	30 Apr	0	33.28	32.52	49.73	49.73
9	1 May	15 May	0	M	1.0295	0.5350	1.0564		2.61	97.45		7170	24946	17266	14850	9	1 May	15 May	0	41.27	36.03	42.35	71.14
10	16 May	31 May	0		1.0292	1.0103	1.2241		18.93	21.16		8227	23889	8778	23338	10	16 May	31 May	0	43.08	43.29	51.24	52.45
11	1 Jun	15 Jun	0	J	1.3149	1.3149	1.3337		1.43	1.43		3648	28468	3648	28468	11	1 Jun	15 Jun	0	46.19	46.19	46.85	46.85
12	16 Jun	30 Jun	0		1.4061	1.4061	1.3632		-3.05	-3.05		0	32116	0	32116	12	16 Jun	30 Jun	0	43.78	43.78	42.45	42.45
13	1 Jul	15 Jul	0	J	1.3483	1.3483	1.3468		-0.11	-0.11		0	32116	0	32116	13	1 Jul	15 Jul	0	41.98	41.98	41.94	41.94
14	16 Jul	31 Jul	0		1.3483	1.3483	1.6225		20.34	20.34		0	32116	0	32116	14	16 Jul	31 Jul	0	41.98	41.98	50.52	50.52
15	1 Aug	15 Aug	0	A	1.3483	1.3483	1.5998		18.66	18.66		0	32116	0	32116	15	1 Aug	15 Aug	0	41.98	41.98	49.81	49.81
16	16 Aug	31 Aug	0		1.3556	1.3483	1.6764		23.66	24.33		0	32116	0	32116	16	16 Aug	31 Aug	0	42.21	41.98	52.20	52.20
17	1 Sep	15 Sep	0	S	1.2781	1.2781	1.6860		31.92	31.92		0	32116	0	32116	17	1 Sep	15 Sep	0	39.80	39.80	52.50	52.50
18	16 Sep	30 Sep	0		1.1619	1.1619	1.6711		43.82	43.82		0	32116	0	32116	18	16 Sep	30 Sep	0	36.18	36.18	52.03	52.03
19	1 Oct	15 Oct	0	O		1.0457							32116	0	32116	19	1 Oct	15 Oct	0			32.56	

Table 1e. Results of spreadsheet calculation of crop water needs and comparison with water delivered to the Luxor District expressed as daily average water volume over each half-month period from March 2000 through September 2001.

Per	Dates		Yr	Mo	Water Required (million cubic meters)/day		Delivered	Water Delivered		Area fed	Existing		Expected		Per	Dates		Yr	Water Required		Water Delivered to Area		
	From	To			Existing	Expected		% Diff. From Existing Need	% Diff. From Expected Need		Fallow feddans	Cropped feddans	Fallow feddans	Cropped feddans		Existing	Expected		Existing	Expected			
	m ³ /(day feddan)																						
5	1 Mar	15 Mar	0	M			1.0373			29317					5	1 Mar	15 Mar	0					
6	16 Mar	31 Mar	0	O			1.1157						29317		6	16 Mar	31 Mar	0					
7	1 Apr	15 Apr	0	A			1.0643						29317		7	1 Apr	15 Apr	0					
8	16 Apr	30 Apr	0	N			0.9966						29317		8	16 Apr	30 Apr	0					
9	1 May	15 May	0	M			1.1478						29317		9	1 May	15 May	0					
10	16 May	31 May	0	O	0.9347		1.1391	21.87			3773	25544	29317		10	16 May	31 May	0	36.59		44.59		
11	1 Jun	15 Jun	0	J	1.3364	1.2418	1.1900	-10.96	-4.18		0	29317	1760	27557	11	1 Jun	15 Jun	0	45.58	45.06	40.59	43.18	
12	16 Jun	30 Jun	0	O	1.4274	1.4274	1.0644	-25.43	-25.43		0	29317	0	29317	12	16 Jun	30 Jun	0	48.69	48.69	36.31	36.31	
13	1 Jul	15 Jul	0	J	1.4312	1.4312	1.0508	-26.58	-26.58		0	29317	0	29317	13	1 Jul	15 Jul	0	48.82	48.82	35.84	35.84	
14	16 Jul	31 Jul	0	O	1.4419	1.4419	1.2810	-11.15	-11.15		0	29317	0	29317	14	16 Jul	31 Jul	0	49.18	49.18	43.70	43.70	
15	1 Aug	15 Aug	0	A	1.4195	1.4195	1.3228	-6.81	-6.81		0	29317	0	29317	15	1 Aug	15 Aug	0	48.42	48.42	45.12	45.12	
16	16 Aug	31 Aug	0	N	1.2852	1.2852	1.4738	14.67	14.67		0	29317	0	29317	16	16 Aug	31 Aug	0	43.84	43.84	50.27	50.27	
17	1 Sep	15 Sep	0	S	1.0381	1.0314	1.3114	26.33	27.15		0	29317	0	29317	17	1 Sep	15 Sep	0	35.41	35.18	44.73	44.73	
18	16 Sep	30 Sep	0	O	0.9508	0.9508	1.2187	28.17	28.17		0	29317	0	29317	18	16 Sep	30 Sep	0	32.43	32.43	41.57	41.57	
19	1 Oct	15 Oct	0	O	0.7490	0.8698	0.9362	24.99	7.63		7525	21792	0	29317	19	1 Oct	15 Oct	0	34.37	29.67	42.96	31.93	
20	16 Oct	31 Oct	0	N	0.7067	0.6484	0.9358	32.42	44.32		5175	24142	9327	19990	20	16 Oct	31 Oct	0	29.27	32.44	38.76	46.81	
21	1 Nov	15 Nov	0	N	0.6187	0.6495	1.0522	70.08	62.02		5175	24142	5175	24142	21	1 Nov	15 Nov	0	25.63	26.90	43.59	43.59	
22	16 Nov	30 Nov	0	O	0.5275	0.5873	0.9257	75.50	57.63		1909	27408	3143	26174	22	16 Nov	30 Nov	0	19.24	22.44	33.77	35.37	
23	1 Dec	15 Dec	0	D	0.4287	0.4548	0.8418	96.36	85.09		2238	27079	2914	26403	23	1 Dec	15 Dec	0	15.83	17.23	31.09	31.88	
24	16 Dec	31 Dec	0	N	0.3489	0.3632	0.5097	46.08	40.35		4583	24734	4583	24734	24	16 Dec	31 Dec	0	14.11	14.68	20.61	20.61	
1	1 Jan	15 Jan	0	J	0.3578	0.3578	0.5445	52.16	52.16		6108	23209	6108	23209	1	1 Jan	15 Jan	0	15.42	15.42	23.46	23.46	
2	16 Jan	31 Jan	0	O	0.3711	0.3810	1.0752	189.73	182.22		7868	21449	7625	21692	2	16 Jan	31 Jan	0	17.30	17.56	50.13	49.57	
3	1 Feb	15 Feb	0	F	0.4055	0.4001	0.9771	140.97	144.20		9142	20175	9142	20175	3	1 Feb	15 Feb	0	20.10	19.83	48.43	48.43	
4	16 Feb	28 Feb	0	N	0.4679	0.4517	0.9598	105.14	112.48		9142	20175	9142	20175	4	16 Feb	28 Feb	0	23.19	22.39	47.57	47.57	
5	1 Mar	15 Mar	0	M	0.6174	0.5920	0.8343	35.12	40.92		7620	21697	7675	21642	5	1 Mar	15 Mar	0	28.46	27.36	38.45	38.55	
6	16 Mar	31 Mar	0	O	0.7598	0.7199	1.0142	33.48	40.89		6111	23206	6111	23206	6	16 Mar	31 Mar	0	32.74	31.02	43.70	43.70	
7	1 Apr	15 Apr	0	A	0.7908	0.7669	1.0510	32.91	37.05		5534	23783	4728	24589	7	1 Apr	15 Apr	0	33.25	31.19	44.19	42.74	
8	16 Apr	30 Apr	0	N	0.6864	0.6311	0.8564	24.76	35.70		13292	16025	13292	16025	8	16 Apr	30 Apr	0	42.83	39.38	53.44	53.44	
9	1 May	15 May	0	M	0.7860	0.7753	1.0644	35.41	37.28		11980	17337	11980	17337	9	1 May	15 May	0	45.34	44.72	61.39	61.39	
10	16 May	31 May	0	O	0.9166	0.9171	1.4228	55.23	55.13		9385	19932	9385	19932	10	16 May	31 May	0	45.99	46.01	71.38	71.38	
11	1 Jun	15 Jun	0	J	1.3487	1.3391	0.9328	-30.84	-30.34		0	29317	0	29317	11	1 Jun	15 Jun	0	46.01	45.67	31.82	31.82	
12	16 Jun	30 Jun	0	O	1.2591	1.2591	1.0664	-15.30	-15.30		0	29317	0	29317	12	16 Jun	30 Jun	0	42.95	42.95	36.38	36.38	
13	1 Jul	15 Jul	0	J	1.2859	1.2859	1.1895	-7.49	-7.49		0	29317	0	29317	13	1 Jul	15 Jul	0	43.86	43.86	40.57	40.57	
14	16 Jul	31 Jul	0	O	1.3838	1.3838	1.3314	-3.78	-3.78		0	29317	0	29317	14	16 Jul	31 Jul	0	47.20	47.20	45.41	45.41	
15	1 Aug	15 Aug	0	A	1.4135	1.4135	1.5543	9.96	9.96		0	29317	0	29317	15	1 Aug	15 Aug	0	48.22	48.22	53.02	53.02	
16	16 Aug	31 Aug	0	N	1.4056	1.4056	1.3220	-5.95	-5.95		0	29317	0	29317	16	16 Aug	31 Aug	0	47.95	47.95	45.09	45.09	
17	1 Sep	15 Sep	0	S	1.2873	1.2873	1.5726	22.16	22.16		0	29317	0	29317	17	1 Sep	15 Sep	0	43.91	43.91	53.64	53.64	
18	16 Sep	30 Sep	0	O	1.0579	1.0579	1.3773	30.19	30.19		0	29317	0	29317	18	16 Sep	30 Sep	0	36.09	36.09	46.98	46.98	
19	1 Oct	15 Oct	0	O		0.8869							29317	0	29317	19	1 Oct	15 Oct	0		30.25		

Abou Hummus District

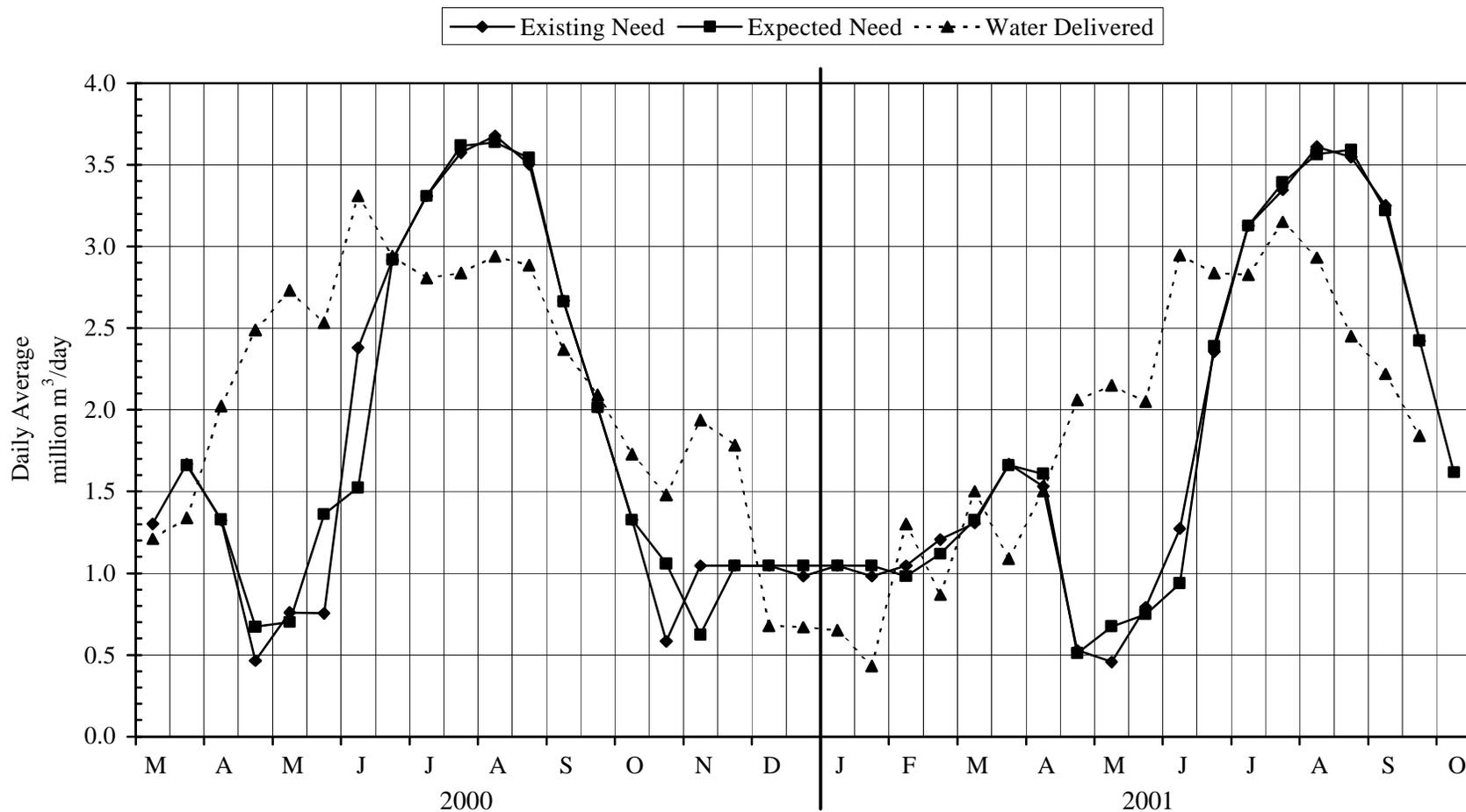
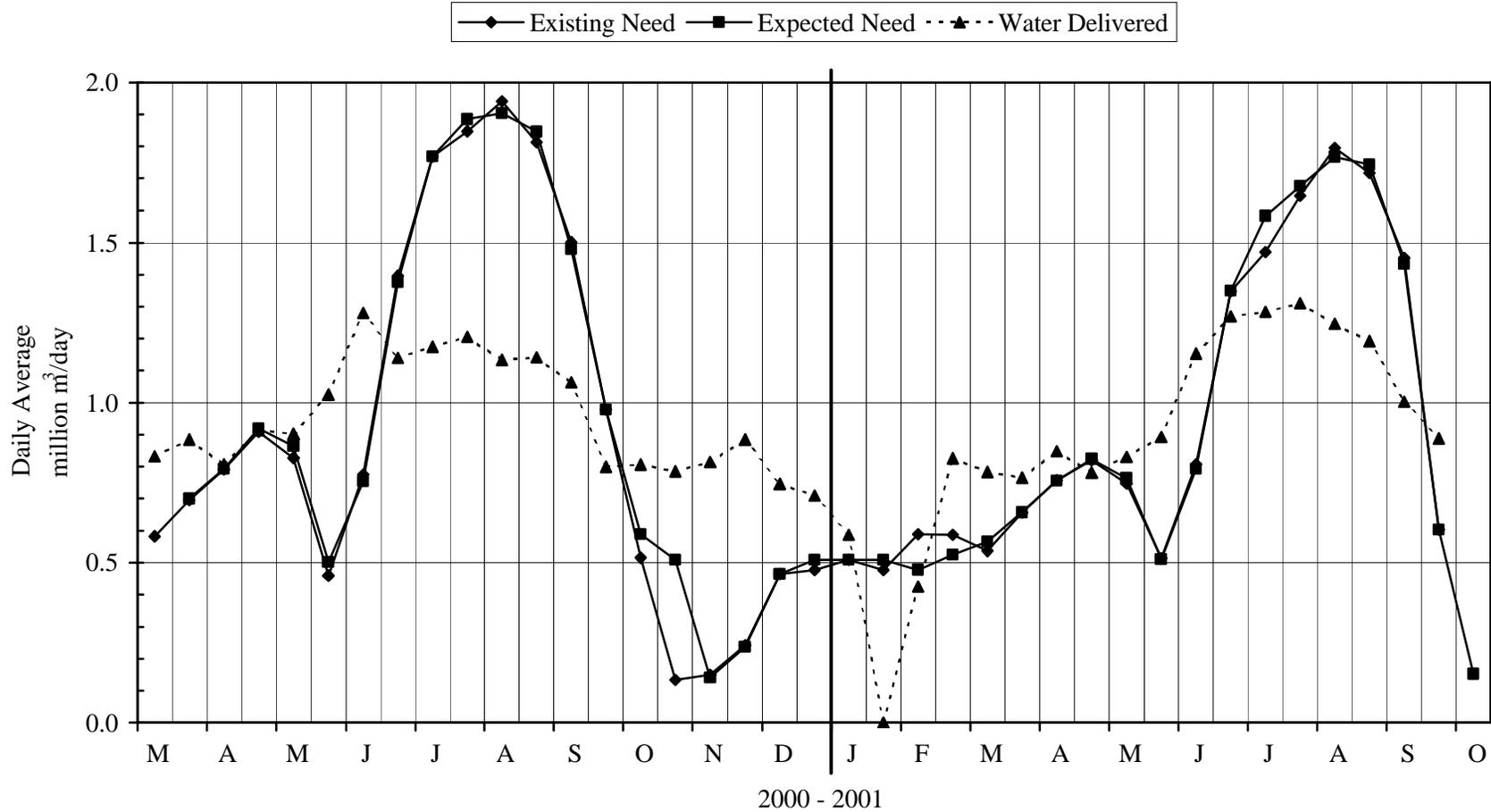


Figure 1a. Daily crop water needs and water delivered to the Abou Hummus District averaged over each half-month period and expressed as million m³/day from March 1, 2000 through October 15, 2001.

Abou Kebir District



Beba District

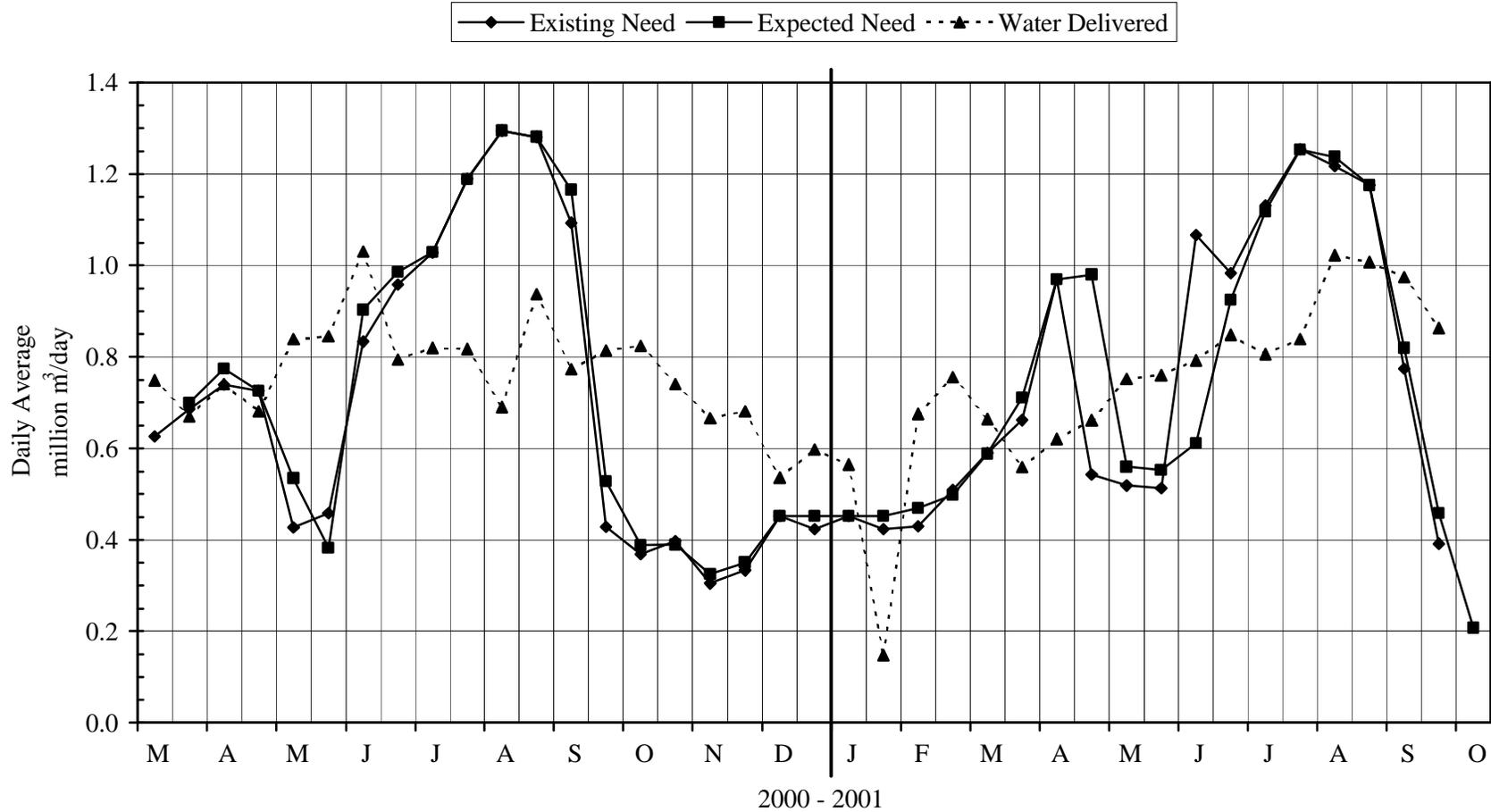


Figure 1c. Daily crop water needs and water delivered to the Beba District averaged over each half-month period and expressed as million m³/day from March 1, 2000 through October 15, 2001.

East Isna District

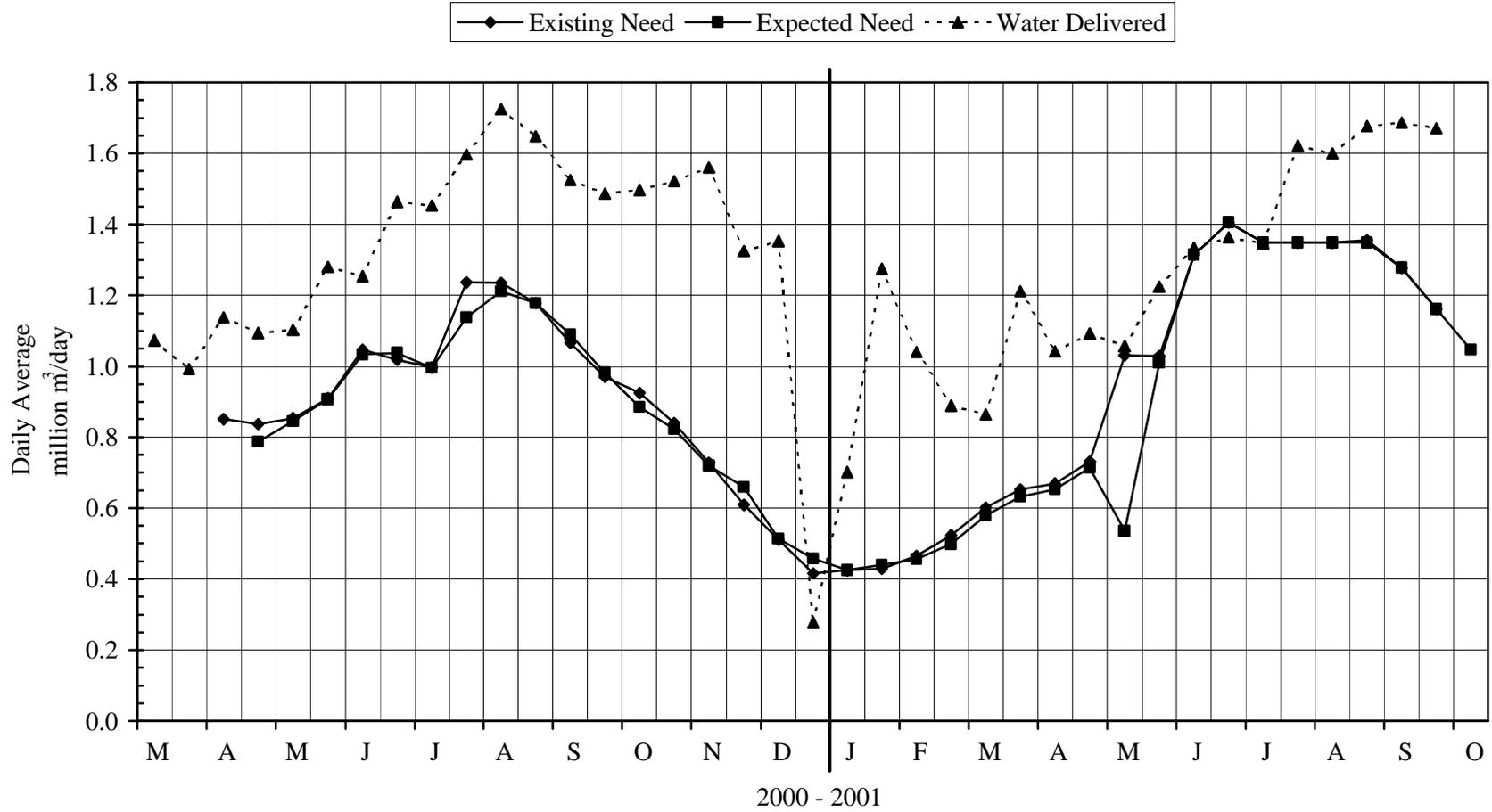


Figure 1d. Daily crop water needs and water delivered to the East Isna District averaged over each half-month period and expressed as million m³/day from March 1, 2000 through October 15, 2001.

Luxor District

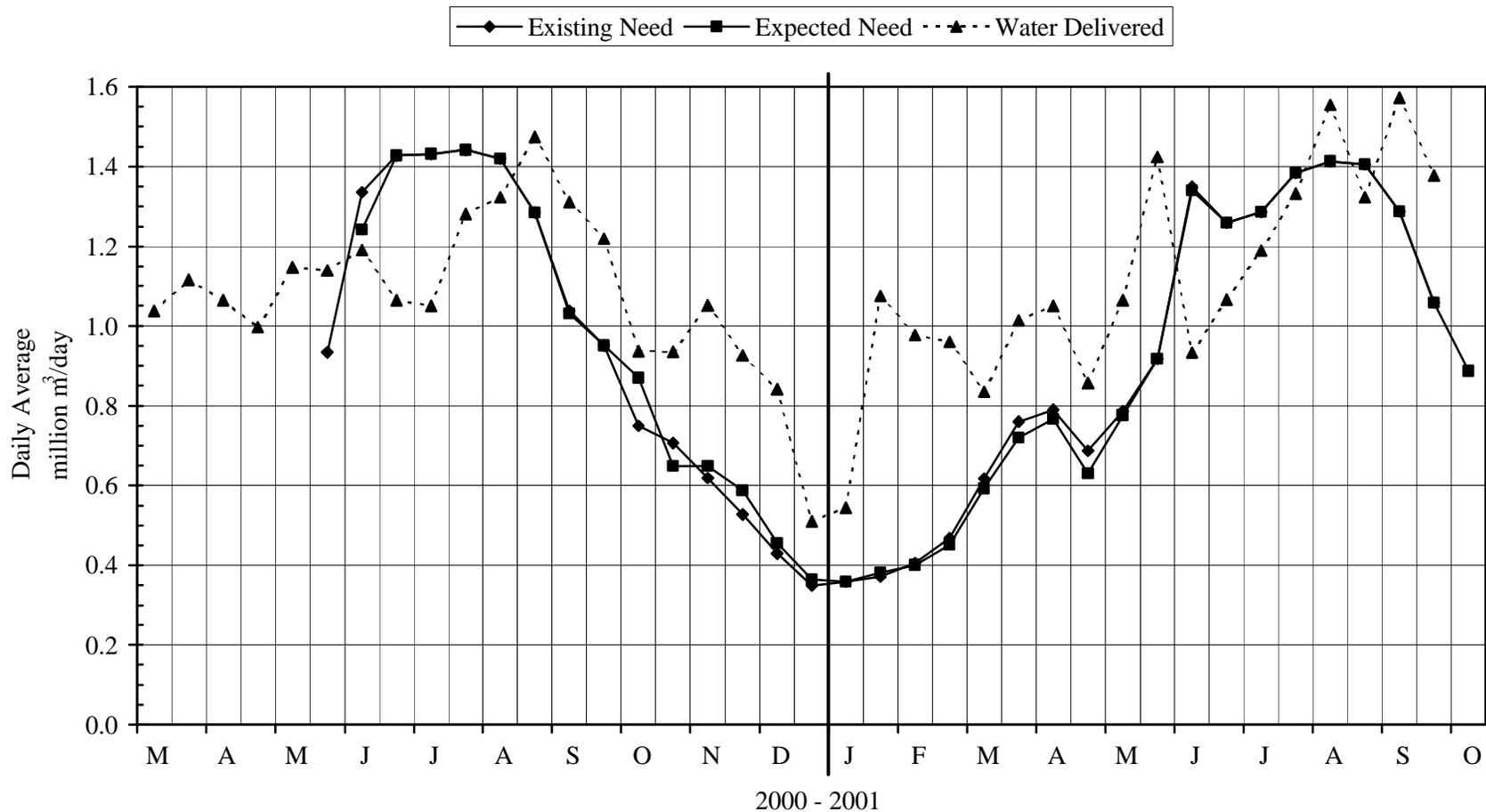


Figure 1e. Daily crop water needs and water delivered to the Luxor District averaged over each half-month period and expressed as million m³/day from March 1, 2000 through October 15, 2001.

Abou Hummus District

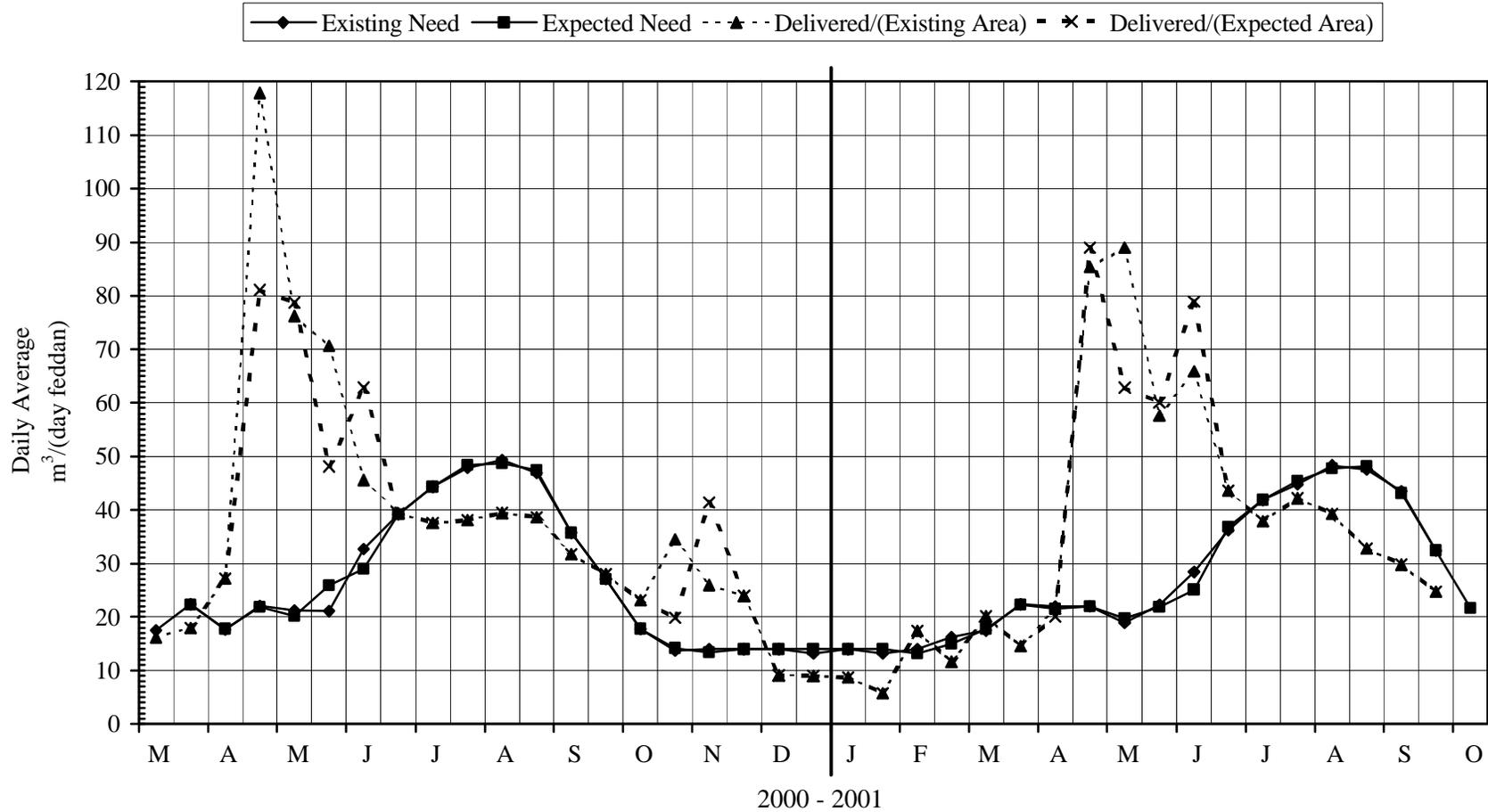


Figure 2a. Daily crop water needs and water delivered to the Abou Hummus District averaged over each half-month period and expressed as m^3/day per feddan of crop area from March 1, 2000 through October 15, 2001.

Abou Kebir District

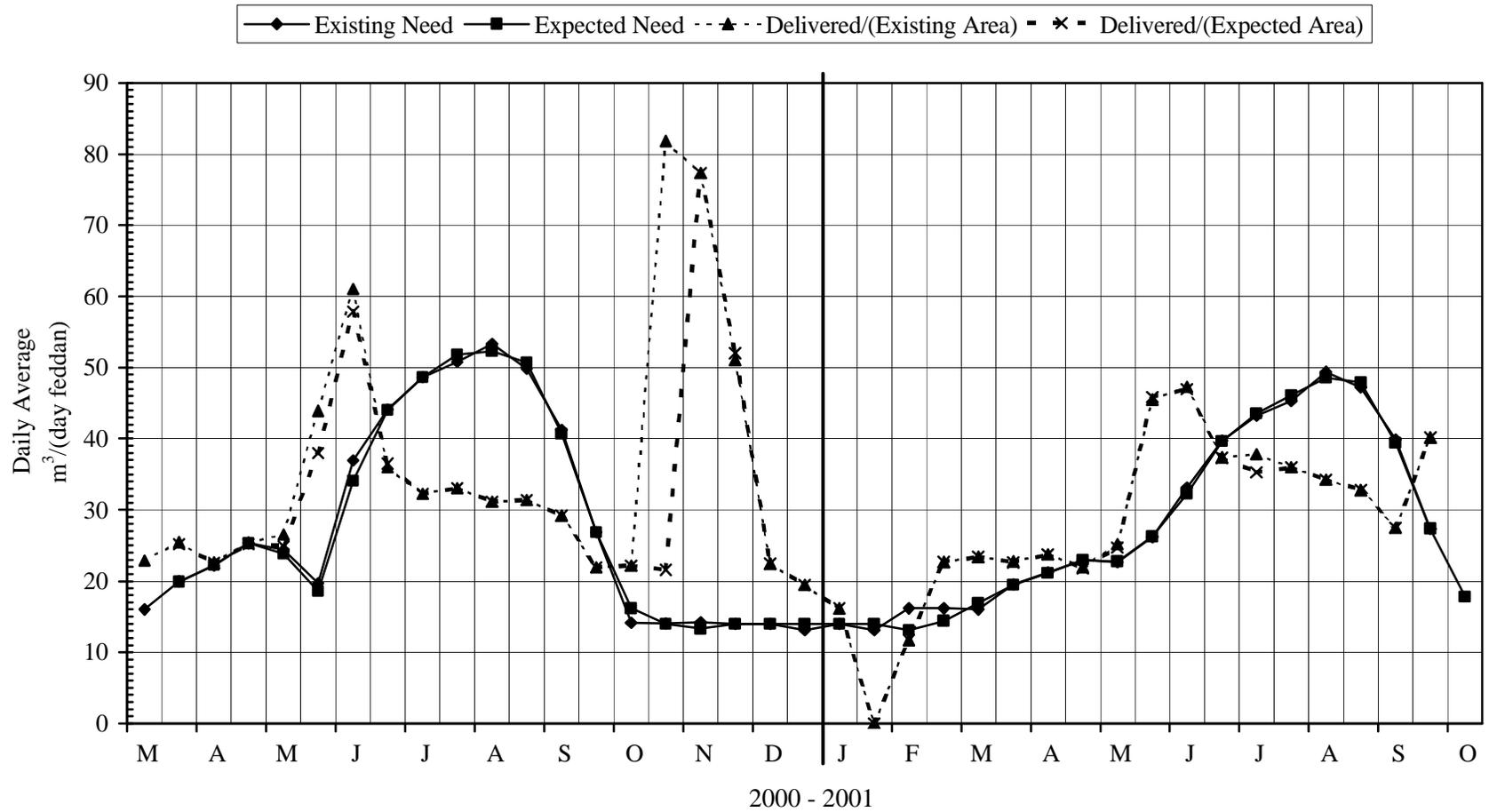


Figure 2b. Daily crop water needs and water delivered to the Abou Kebir District averaged over each half-month period and expressed as m^3/day per feddan of crop area from March 1, 2000 through October 15, 2001.

Beba District

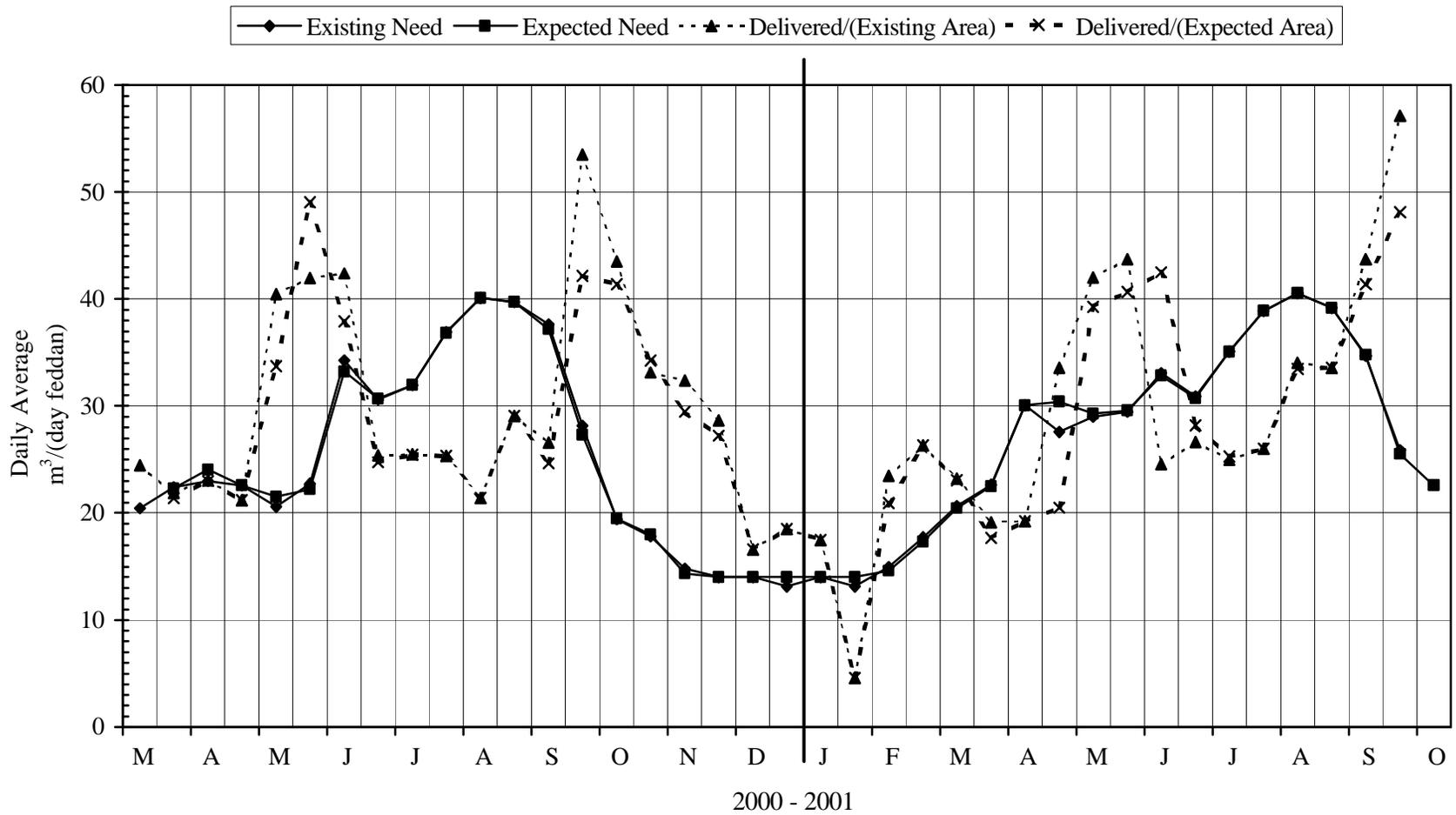


Figure 2c. Daily crop water needs and water delivered to the Beba District averaged over each half-month period and expressed as m³/day per feddan of crop area from March 1, 2000 through October 15, 2001.

East Isna District

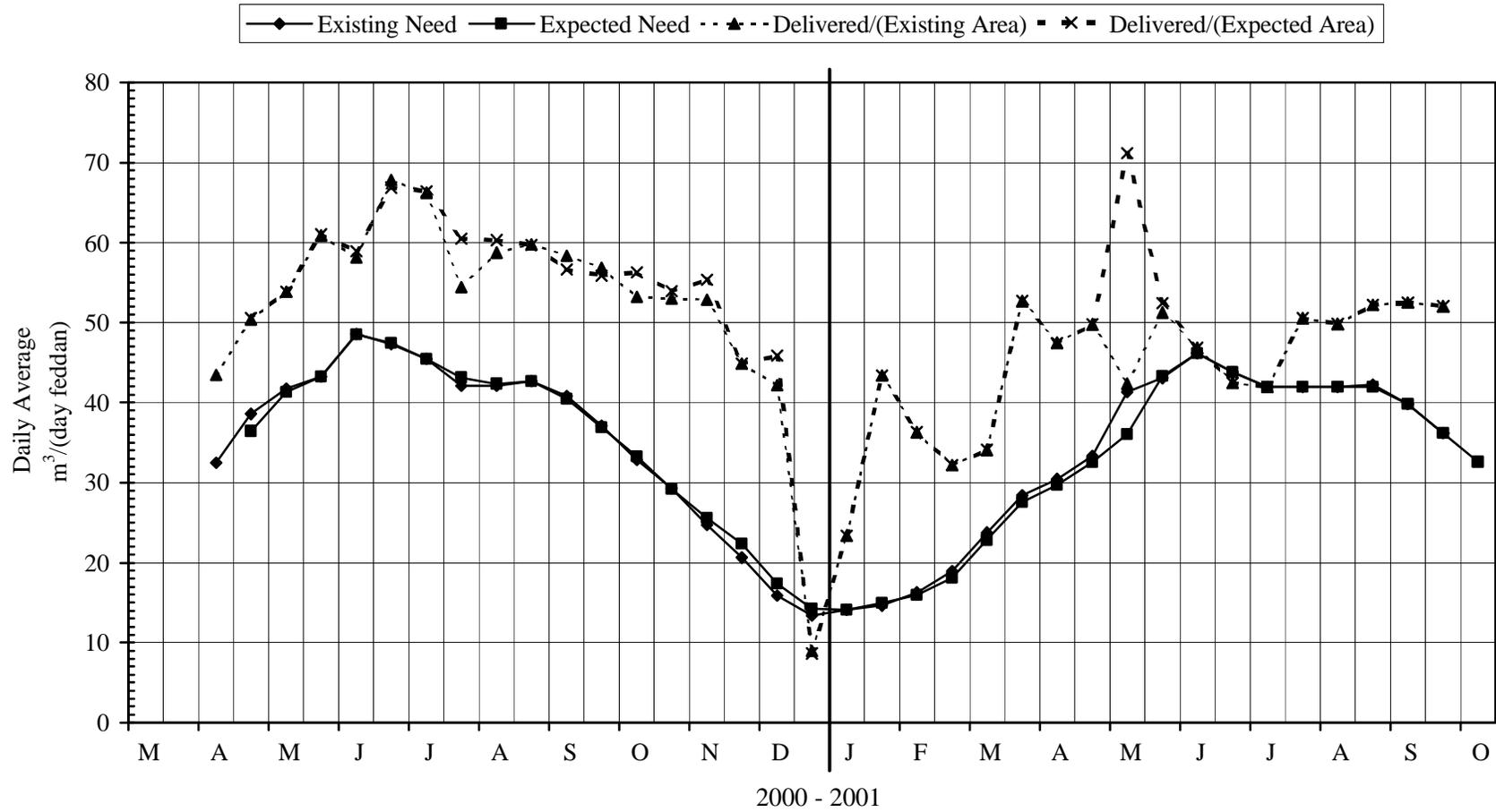


Figure 2d. Daily crop water needs and water delivered to the East Isna District averaged over each half-month period and expressed as m^3/day per feddan of crop area from March 1, 2000 through October 15, 2001.

Luxor District

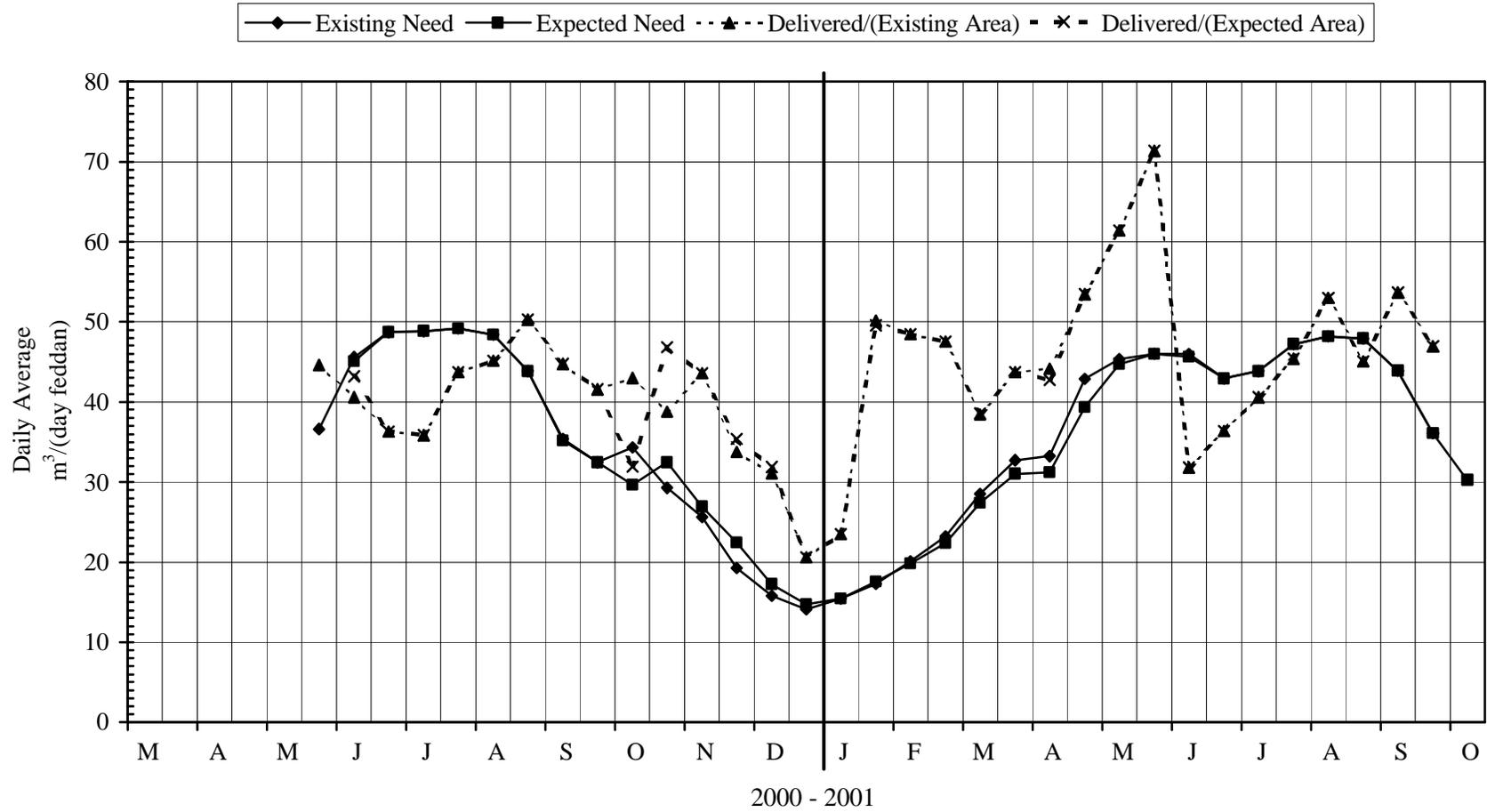


Figure 2e. Daily crop water needs and water delivered to the Luxor District averaged over each half-month period and expressed as m³/day per feddan of crop area from March 1, 2000 through October 15, 2001.

Abou Hummus District

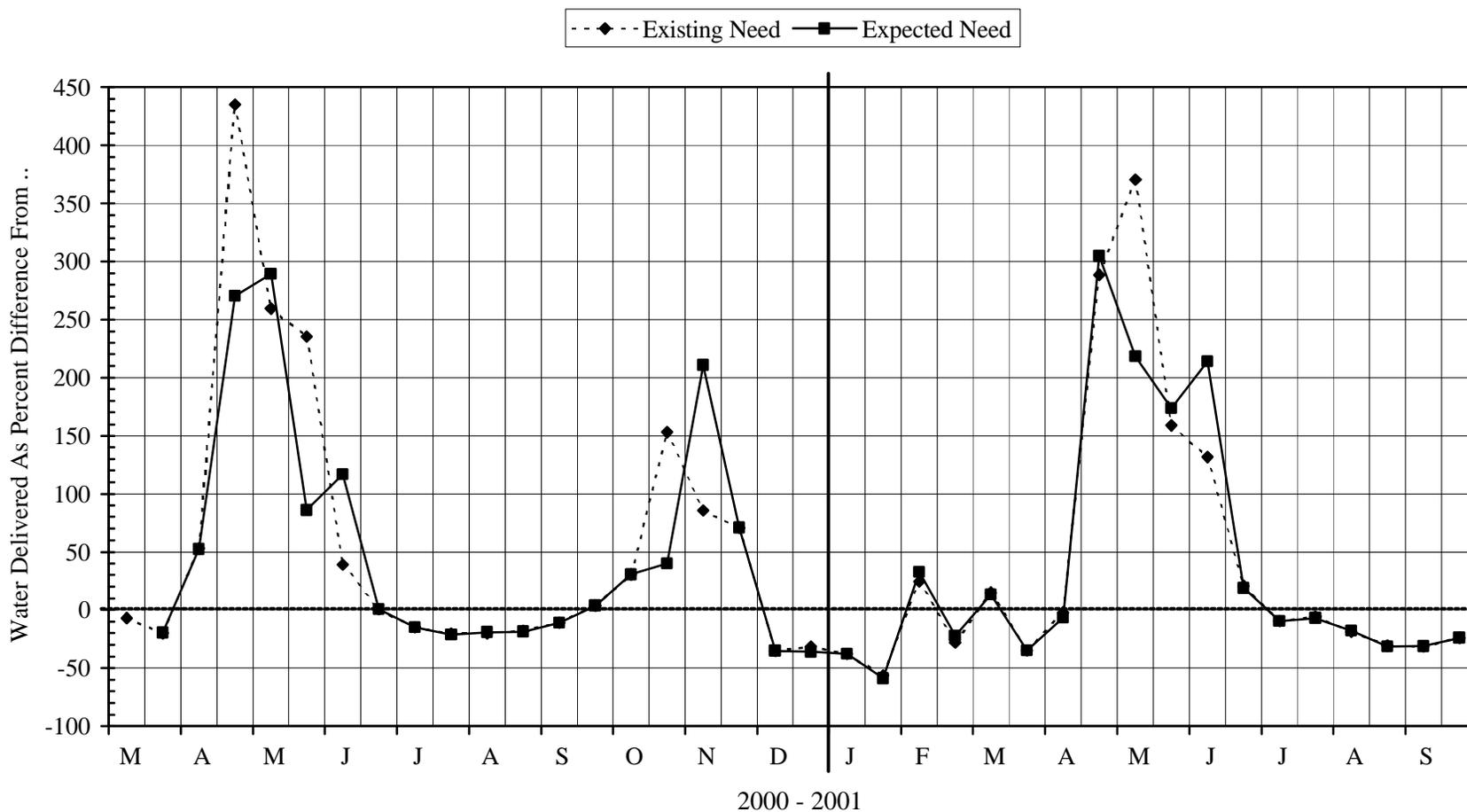


Figure 3a. Percent difference of daily water delivered from crop water needs of existing crops and expected crops in the Abou Hummus District averaged over each half-month period from March 2000 through September 2001.

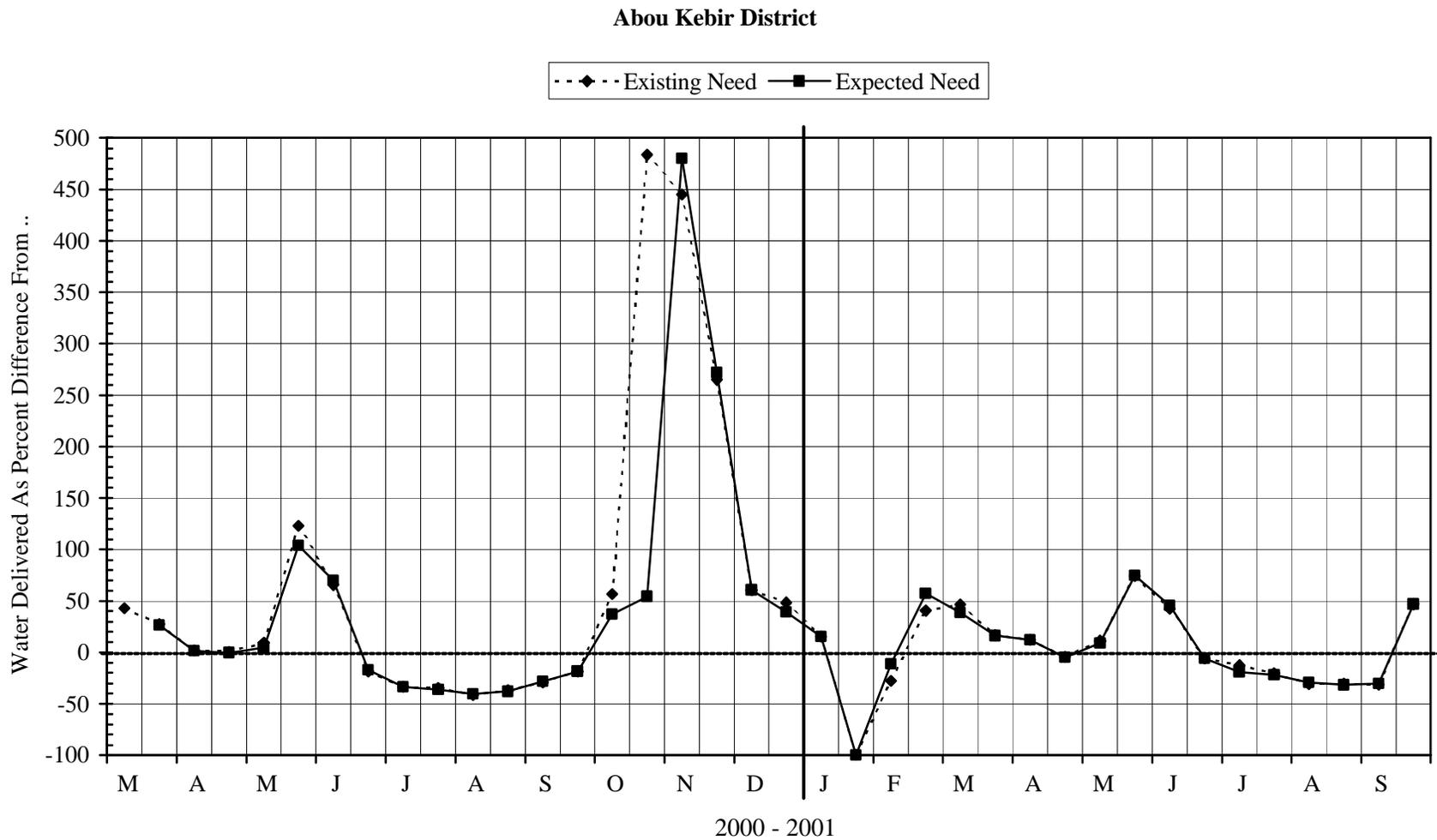


Figure 3b. Percent difference of daily water delivered from crop water needs of existing crops and expected crops in the Abou Kebir District averaged over each half-month period from March 2000 through September 2001.

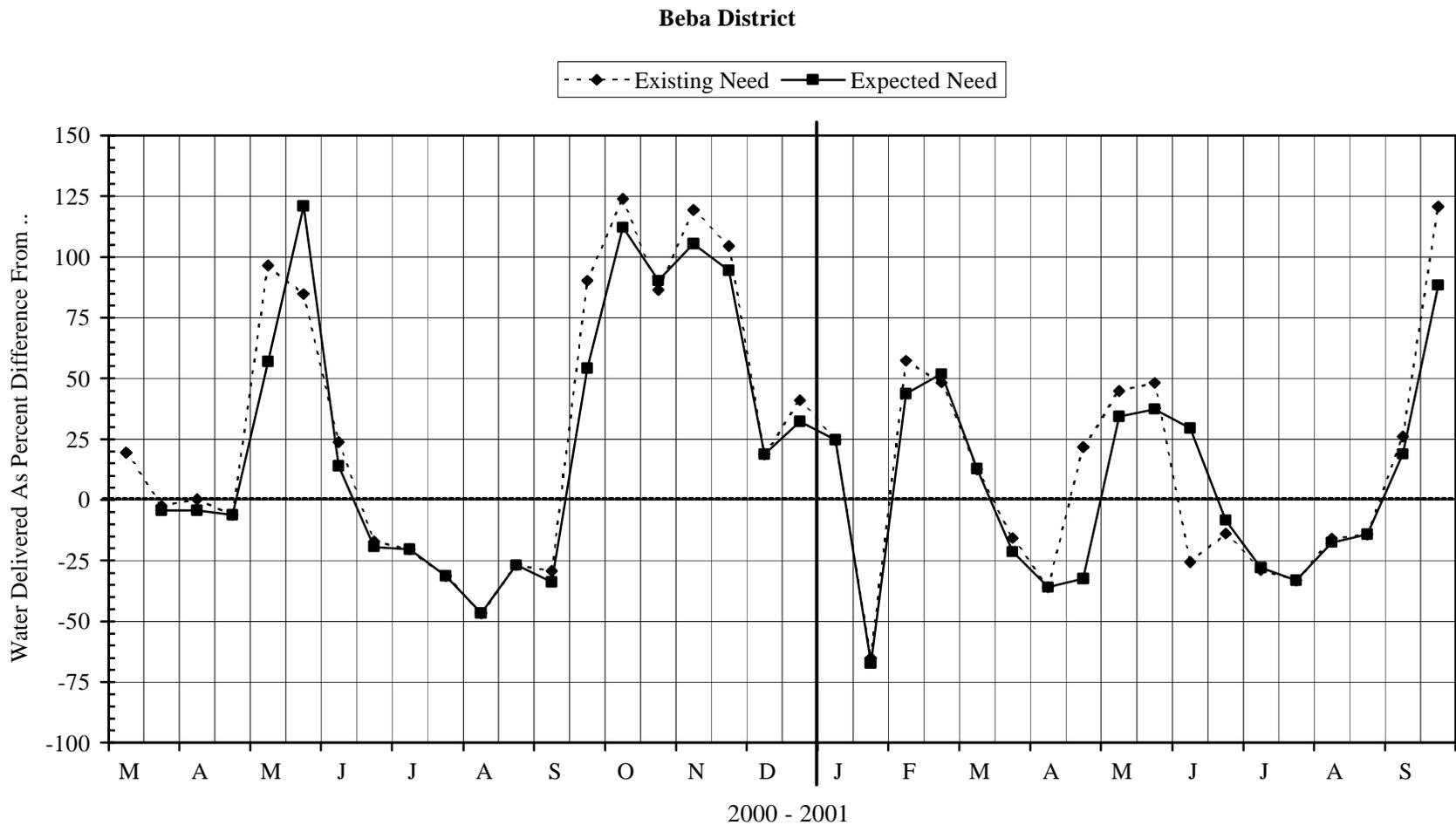


Figure 3c. Percent difference of daily water delivered from crop water needs of existing crops and expected crops in the Beba District averaged over each half-month period from March 2000 through September 2001.

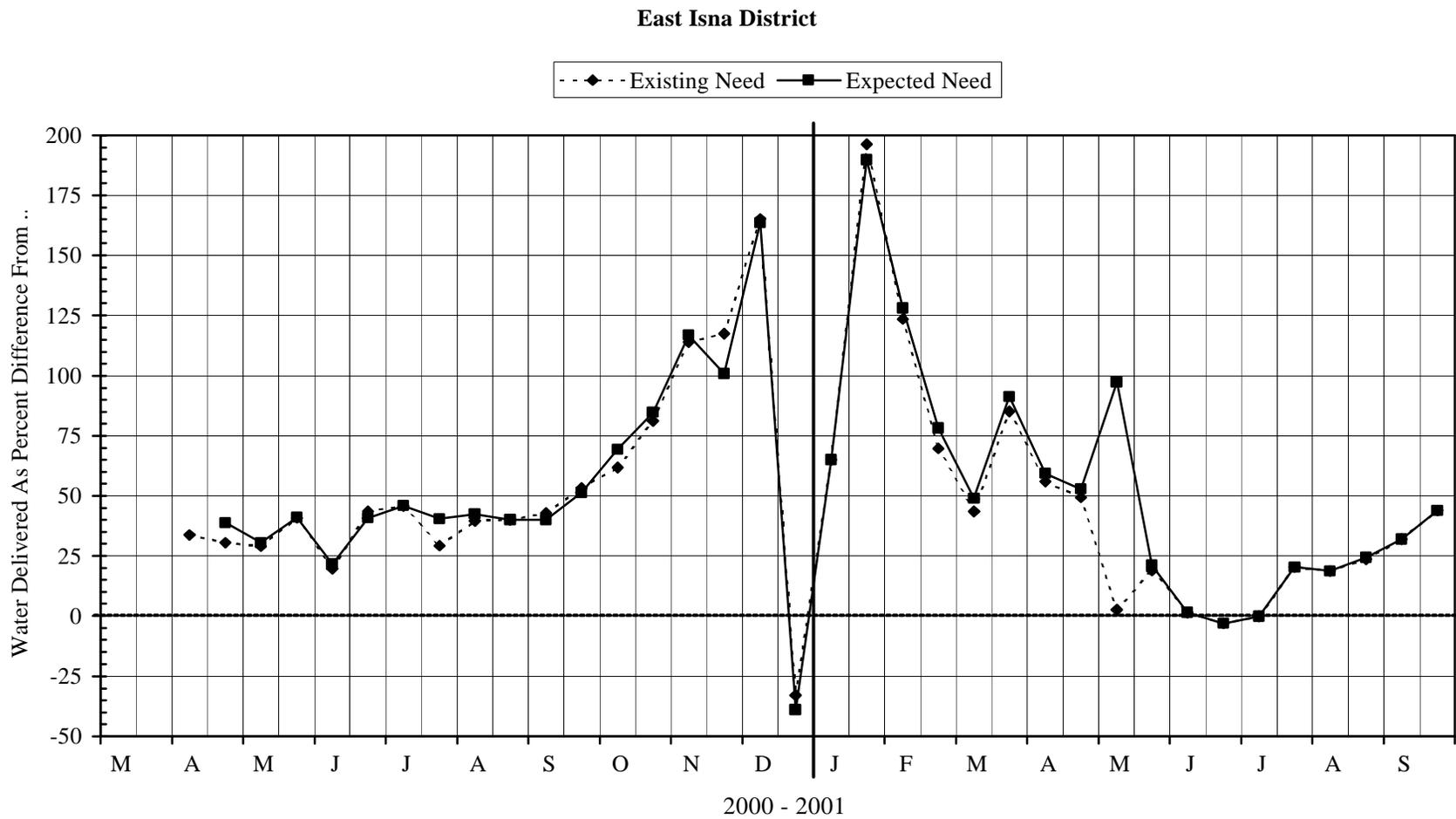


Figure 3d. Percent difference of daily water delivered from crop water needs of existing crops and expected crops in the East Isna District averaged over each half-month period from March 2000 through September 2001.

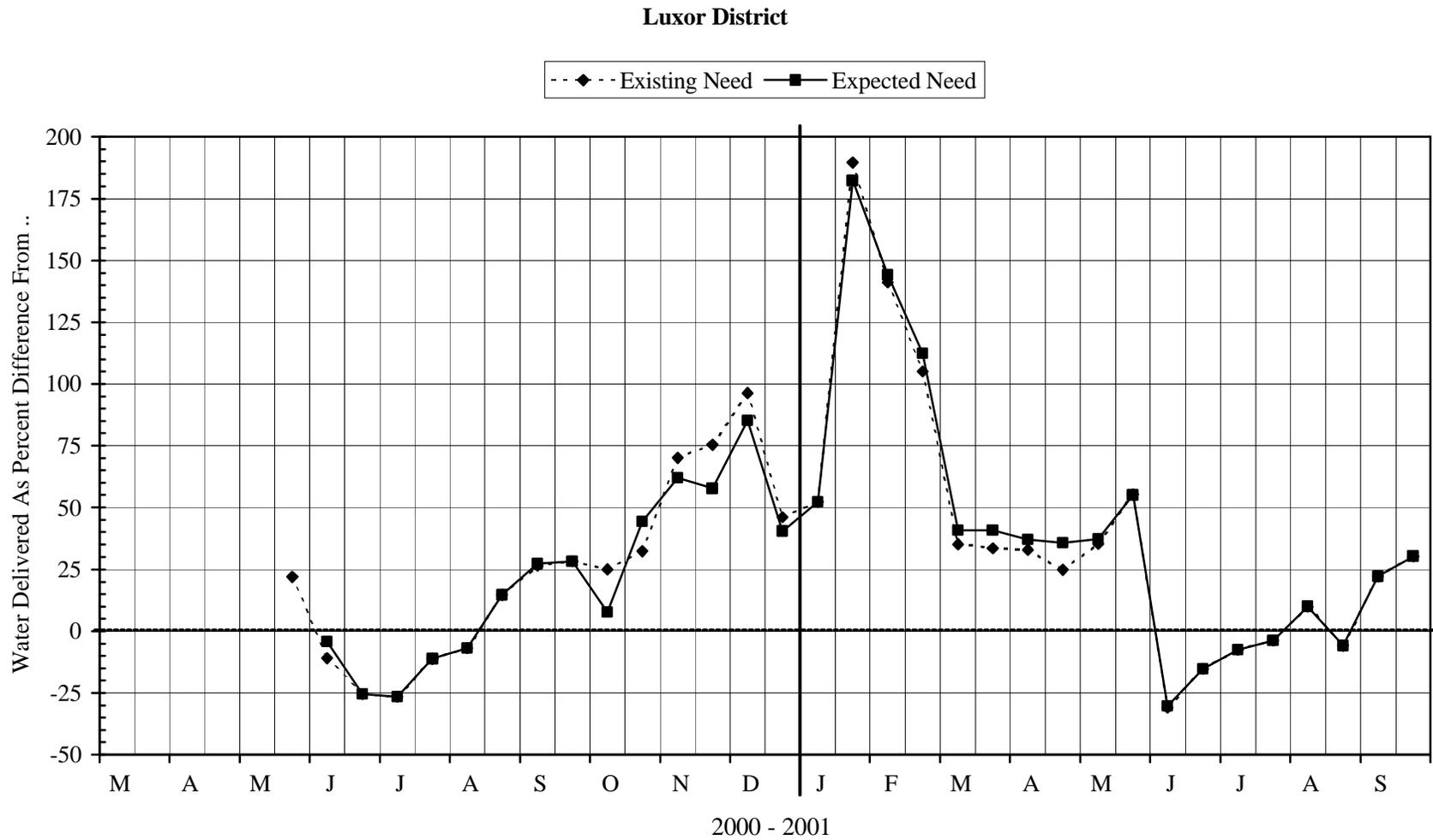


Figure 3e. Percent difference of daily water delivered from crop water needs of existing crops and expected crops in the Luxor District averaged over each half-month period from March 2000 through September 2001.

Table 2. Calculation of potential water saving from MISD program for duration of MISD benchmark activities (March 1, 2000 – September 30, 2001) in the five pilot districts.

Dates	Abou Hummus District					Abou Kebir District					Beba District				
	Water Delivered	Existing Crops		Expected Crops		Water Delivered	Existing Crops		Expected Crops		Water Delivered	Existing Crops		Expected Crops	
		Water Needed	Water Saved	Water Needed	Water Saved		Water Needed	Water Saved	Water Needed	Water Saved		Water Needed	Water Saved	Water Needed	Water Saved
From To Year	1.2117	1.3018	-0.0901			0.8378	0.5822	0.2556			0.7485	0.6264	0.1221		
1 Mar - 15 Mar 2000	1.3394	1.6697	-0.3303	1.6625	-0.3231	0.8779	0.6943	0.1835	0.7002	0.1776	0.6279	0.6859	-0.0579	0.6995	-0.0715
16 Mar - 31 Mar 2000	2.0234	1.3230	0.7004	1.3279	0.6955	0.8064	0.7920	0.0145	0.7939	0.0125	0.7408	0.7390	0.0018	0.7740	-0.0332
1 Apr - 15 Apr 2000	2.4887	0.4650	2.0236	0.6719	1.8168	0.9186	0.9097	0.0089	0.9189	-0.0003	0.6353	0.7253	-0.0900	0.7253	-0.0900
16 Apr - 30 Apr 2000	2.7306	0.7598	1.9708	0.7008	2.0298	0.9021	0.8272	0.0749	0.8648	0.0373	0.8388	0.4267	0.4121	0.5348	0.3040
1 May - 15 May 2000	2.5327	0.7547	1.7780	1.3618	1.1709	1.0148	0.4597	0.5551	0.5022	0.5125	0.8257	0.4574	0.3684	0.3826	0.4432
16 May - 31 May 2000	3.3114	2.3805	0.9309	1.5254	1.7860	1.2797	0.7745	0.5052	0.7537	0.5260	1.0306	0.8330	0.1976	0.9033	0.1273
1 Jun - 15 Jun 2000	2.9394	2.9204	0.0190	2.9204	0.0190	1.1409	1.3964	-0.2555	1.3769	-0.2360	0.7832	0.9584	-0.1752	0.9855	-0.2023
16 Jun - 30 Jun 2000	2.8073	3.3082	-0.5009	3.3082	-0.5009	1.1748	1.7695	-0.5947	1.7695	-0.5947	0.8192	1.0281	-0.2089	1.0290	-0.2098
1 Jul - 15 Jul 2000	2.8397	3.5755	-0.7358	3.6176	-0.7779	1.2030	1.8480	-0.6450	1.8861	-0.6830	0.8050	1.1897	-0.3847	1.1884	-0.3833
16 Jul - 31 Jul 2000	2.9418	3.6780	-0.7362	3.6382	-0.6964	1.1338	1.9411	-0.8073	1.9038	-0.7700	0.6908	1.2942	-0.6034	1.2942	-0.6034
1 Aug - 15 Aug 2000	2.8871	3.5031	-0.6160	3.5429	-0.6557	1.1427	1.8135	-0.6707	1.8463	-0.7035	0.9351	1.2811	-0.3461	1.2811	-0.3461
16 Aug - 31 Aug 2000	2.3695	2.6682	-0.2987	2.6648	-0.2953	1.0631	1.5016	-0.4385	1.4799	-0.4168	0.7726	1.0933	-0.3207	1.1656	-0.3931
1 Sep - 15 Sep 2000	2.0931	2.0158	0.0773	2.0158	0.0773	0.7895	0.9780	-0.1886	0.9780	-0.1886	0.8344	0.4281	0.4063	0.5280	0.3064
16 Sep - 30 Sep 2000	1.7310	1.3262	0.4048	1.3262	0.4048	0.8061	0.5144	0.2917	0.5884	0.2177	0.8247	0.3683	0.4564	0.3885	0.4362
1 Oct - 15 Oct 2000	1.4786	0.5840	0.8946	1.0580	0.4206	0.7882	0.1347	0.6535	0.5094	0.2788	0.7390	0.43975	0.3415	0.3893	0.3497
16 Oct - 31 Oct 2000	1.9390	1.0461	0.8929	0.6243	1.3146	0.8142	1.1494	0.6649	1.403	0.6739	0.6668	0.3039	0.3629	0.3246	0.3422
1 Nov - 15 Nov 2000	1.7852	1.0461	0.7391	1.0461	0.7391	0.8903	0.2423	0.6479	0.2378	0.6525	0.7273	0.3328	0.3944	0.3499	0.3774
16 Nov - 30 Nov 2000	0.6796	1.0461	-0.3664	1.0461	-0.3664	0.7461	0.4650	0.2811	0.4649	0.2812	0.5358	0.4517	0.0841	0.4517	0.0841
1 Dec - 15 Dec 2000	0.6703	0.9807	-0.3104	1.0461	-0.3758	0.7048	0.4776	0.2273	0.5094	0.1954	0.6848	0.4235	0.2614	0.4517	0.2331
16 Dec - 31 Dec 2000	0.6509	1.0461	-0.3952	1.0461	-0.3952	0.5871	0.5094	0.0777	0.5094	0.0777	0.5638	0.4517	0.1121	0.4517	0.1121
1 Jan - 15 Jan 2001	0.4315	0.9807	-0.5492	1.0461	-0.6146	0.0000	0.4776	-0.4776	0.5094	-0.5094	0.1726	0.4235	-0.2509	0.4517	-0.2791
16 Jan - 31 Jan 2001	1.3003	1.0461	0.2542	0.9807	0.3196	0.4249	0.5894	-0.1644	0.4776	-0.0526	0.6755	0.4294	0.2461	0.4699	0.2056
1 Feb - 15 Feb 2001	0.8681	1.2070	-0.3389	1.1185	-0.2504	0.8268	0.5878	0.2391	0.5251	0.3018	0.7564	0.5092	0.2472	0.4977	0.2587
16 Feb - 28 Feb 2001	1.5023	1.3063	0.1960	1.3273	0.1750	0.7841	0.5359	0.2482	0.5666	0.2175	0.6636	0.5896	0.0741	0.5884	0.0753
1 Mar - 15 Mar 2001	1.0887	1.6680	-0.5793	1.6624	-0.5738	0.7580	0.6559	0.1021	0.6582	0.0998	0.5666	0.6618	-0.0952	0.7103	-0.1437
16 Mar - 31 Mar 2001	1.5015	1.5305	-0.0290	1.6091	-0.1076	0.8489	0.7570	0.0919	0.7561	0.0928	0.6201	0.9696	-0.3495	0.9694	-0.3493
1 Apr - 15 Apr 2001	2.0610	0.5307	1.5303	0.5096	1.5514	0.7903	0.8189	-0.0286	0.8240	-0.0336	0.7070	0.5429	0.1641	0.9804	-0.2734
16 Apr - 30 Apr 2001	2.1487	0.4568	1.6920	0.6747	1.4741	0.8308	0.7480	0.0828	0.7632	0.0676	0.7521	0.5189	0.2332	0.5599	0.1922
1 May - 15 May 2001	2.0510	0.7917	1.2593	0.7489	1.3021	0.8912	0.5129	0.3784	0.5108	0.3804	0.7561	0.5129	0.2433	0.5529	0.2033
16 May - 31 May 2001	2.9487	1.2730	1.6757	0.9388	2.0099	1.1536	0.8085	0.3451	0.7933	0.3603	0.7923	1.0664	-0.2741	0.6118	0.1805
1 Jun - 15 Jun 2001	2.8393	2.3560	0.4833	2.3913	0.4481	1.2722	1.3482	-0.0760	1.3492	-0.0770	0.8530	0.9837	-0.1307	0.9249	-0.0719
16 Jun - 30 Jun 2001	2.8274	3.1277	-0.3002	3.1277	-0.3002	1.2840	1.4699	-0.1859	1.5836	-0.2996	0.8056	1.1314	-0.3258	1.1179	-0.3123
1 Jul - 15 Jul 2001	3.1509	3.3464	-0.1955	3.3925	-0.2416	1.3047	1.6474	-0.3427	1.6759	-0.3713	0.8297	1.2542	-0.4245	1.2539	-0.4242
16 Jul - 31 Jul 2001	2.9329	3.6108	-0.6779	3.5648	-0.6319	1.2465	1.7958	-0.5493	1.7677	-0.5212	1.0217	1.2166	-0.1949	1.2376	-0.2159
1 Aug - 15 Aug 2001	2.4517	3.5475	-1.0958	3.5920	-1.1403	1.2003	1.7170	-0.5167	1.7434	-0.5431	0.9930	1.1754	-0.1825	1.1754	-0.1825
16 Aug - 31 Aug 2001	2.2205	3.2525	-1.0320	3.2197	-0.9991	1.0018	1.4515	-0.4497	1.4337	-0.4319	0.9746	0.7733	0.2013	0.8198	0.1548
1 Sep - 15 Sep 2001	1.8417	2.4230	-0.5813	2.4230	-0.5813	0.8913	0.6041	0.2872	0.6041	0.2872	0.8387	0.3909	0.4477	0.4581	0.3806
16 Sep - 30 Sep 2001				1.6178				0.1524						0.2074	
1 Oct - 15 Oct 2001															
Totals:	76.4050		7.8536		7.9272	34.2937		-0.4301		-0.9820	27.8603		0.8409		0.1816
Water Saved (% of Delivered):			10.28		10.38			-1.25		-2.86			3.02		0.65

Table 2. (Continued).

Dates			East Isna District					Luxor District				
			Water	Existing Crops	Water	Expected Crops	Water	Existing Crops	Water	Expected Crops	Water	Expected Crops
From	To	Year	Delivered	Water Needed	Water Saved	Water Needed	Water Saved	Delivered	Water Needed	Water Saved	Water Needed	Water Saved
1 Mar - 15 Mar	2000	1.0726						1.0373				
16 Mar - 31 Mar	2000	1.0000						1.1261				
1 Apr - 15 Apr	2000	1.1374	0.8505	0.2869				1.0643				
16 Apr - 30 Apr	2000	1.1083	0.8381	0.2702	0.7872	0.3211		1.0016				
1 May - 15 May	2000	1.1025	0.8542	0.2482	0.8452	0.2573		1.1478				
16 May - 31 May	2000	1.2933	0.9090	0.3843	0.9073	0.3860		1.1436	0.9347	0.2089		
1 Jun - 15 Jun	2000	1.2543	1.0471	0.2072	1.0327	0.2216		1.1900	1.3364	-0.1464	1.2418	-0.0518
16 Jun - 30 Jun	2000	1.4711	1.0192	0.4520	1.0376	0.4336		1.0683	1.4274	-0.3591	1.4274	-0.3591
1 Jul - 15 Jul	2000	1.4525	0.9965	0.4561	0.9949	0.4576		1.0508	1.4312	-0.3804	1.4312	-0.3804
16 Jul - 31 Jul	2000	1.5967	1.2360	0.3607	1.1383	0.4584		1.2793	1.4419	-0.1626	1.4419	-0.1626
1 Aug - 15 Aug	2000	1.7250	1.2355	0.4895	1.2112	0.5137		1.3228	1.4195	-0.0967	1.4195	-0.0967
16 Aug - 31 Aug	2000	1.6498	1.1771	0.4727	1.1773	0.4725		1.4786	1.2852	0.1934	1.2852	0.1934
1 Sep - 15 Sep	2000	1.5241	1.0663	0.4578	1.0887	0.4354		1.3114	1.0381	0.2733	1.0314	0.2800
16 Sep - 30 Sep	2000	1.5035	0.9693	0.5342	0.9822	0.5213		1.2233	0.9508	0.2725	0.9508	0.2725
1 Oct - 15 Oct	2000	1.4969	0.9247	0.5722	0.8840	0.6129		0.9362	0.7490	0.1872	0.8698	0.0664
16 Oct - 31 Oct	2000	1.5479	0.8404	0.7074	0.8230	0.7248		0.9414	0.7067	0.2346	0.6484	0.2929
1 Nov - 15 Nov	2000	1.5605	0.7290	0.8315	0.7197	0.8409		1.0522	0.6187	0.4336	0.6495	0.4028
16 Nov - 30 Nov	2000	1.3119	0.6091	0.7028	0.6596	0.6523		0.9109	0.5275	0.3835	0.5873	0.3237
1 Dec - 15 Dec	2000	1.3526	0.5101	0.8425	0.5130	0.8397		0.8418	0.4287	0.4131	0.4548	0.3870
16 Dec - 31 Dec	2000	0.2439	0.4159	-0.1720	0.4572	-0.2133		0.5150	0.3489	0.1661	0.3632	0.1518
1 Jan - 15 Jan	2001	0.7025	0.4254	0.2771	0.4254	0.2771		0.5445	0.3578	0.1866	0.3578	0.1866
16 Jan - 31 Jan	2001	1.2830	0.4300	0.8531	0.4397	0.8434		1.0732	0.3711	0.7021	0.3810	0.6923
1 Feb - 15 Feb	2001	1.0402	0.4654	0.5748	0.4563	0.5839		0.9771	0.4055	0.5716	0.4001	0.5770
16 Feb - 28 Feb	2001	0.8956	0.5234	0.3722	0.4988	0.3968		0.9589	0.4679	0.4911	0.4517	0.5073
1 Mar - 15 Mar	2001	0.8635	0.6018	0.2618	0.5793	0.2842		0.8343	0.6174	0.2168	0.5920	0.2422
16 Mar - 31 Mar	2001	1.2080	0.6541	0.5539	0.6331	0.5749		1.0049	0.7598	0.2451	0.7199	0.2851
1 Apr - 15 Apr	2001	1.0425	0.6690	0.3736	0.6541	0.3884		1.0510	0.7908	0.2603	0.7669	0.2841
16 Apr - 30 Apr	2001	1.0776	0.7310	0.3466	0.7143	0.3633		0.8395	0.6864	0.1532	0.6311	0.2085
1 May - 15 May	2001	1.0564	1.0295	0.0269	0.5350	0.5214		1.0644	0.7860	0.2783	0.7753	0.2890
16 May - 31 May	2001	1.2233	1.0292	0.1940	1.0103	0.2130		1.4375	0.9166	0.5209	0.9171	0.5204
1 Jun - 15 Jun	2001	1.3337	1.3149	0.0188	1.3149	0.0188		0.9328	1.3487	-0.4159	1.3391	-0.4062
16 Jun - 30 Jun	2001	1.3645	1.4061	-0.0416	1.4061	-0.0416		1.0581	1.2591	-0.2010	1.2591	-0.2010
1 Jul - 15 Jul	2001	1.3468	1.3483	-0.0015	1.3483	-0.0015		1.1895	1.2859	-0.0964	1.2859	-0.0964
16 Jul - 31 Jul	2001	1.6240	1.3483	0.2757	1.3483	0.2757		1.3843	1.3838	0.0005	1.3838	0.0005
1 Aug - 15 Aug	2001	1.5998	1.3483	0.2516	1.3483	0.2516		1.5543	1.4135	0.1408	1.4135	0.1408
16 Aug - 31 Aug	2001	1.6876	1.3556	0.3320	1.3483	0.3393		1.3214	1.4056	-0.0842	1.4056	-0.0842
1 Sep - 15 Sep	2001	1.6860	1.2781	0.4079	1.2781	0.4079		1.5726	1.2873	0.2853	1.2873	0.2853
16 Sep - 30 Sep	2001	1.6702	1.1619	0.5083	1.1619	0.5083		1.3781	1.0579	0.3202	1.0579	0.3202
1 Oct - 15 Oct	2001				1.0457						0.8869	
Totals:			45.9001		13.4023		14.1405	35.2986		4.9873		5.0712
Water Saved (% of Delivered):					29.20		30.81			14.13		14.37

Table 3. Calculation of potential water saving from MISD program for one hydrologic year (August 1, 2000 – July 31, 2001) in the five pilot districts.

Dates			Abou Hummus District					Abou Kebir District					Beba District				
			Existing Crops		Expected Crops			Existing Crops		Expected Crops			Existing Crops		Expected Crops		
From	To	Year	Water Delivered	Water Needed	Water Saved	Water Needed	Water Saved	Water Delivered	Water Needed	Water Saved	Water Needed	Water Saved	Water Delivered	Water Needed	Water Saved	Water Needed	Water Saved
1 Aug -	15 Aug	2000	2.9418	3.6780	-0.7362	3.6382	-0.6964	1.1338	1.9411	-0.8073	1.9038	-0.7700	0.6908	1.2942	-0.6034	1.2942	-0.6034
16 Aug -	31 Aug	2000	2.8871	3.5031	-0.6160	3.5429	-0.6557	1.1427	1.8135	-0.6707	1.8463	-0.7035	0.9351	1.2811	-0.3461	1.2811	-0.3461
1 Sep -	15 Sep	2000	2.3695	2.6682	-0.2987	2.6648	-0.2953	1.0631	1.5016	-0.4385	1.4799	-0.4168	0.7726	1.0933	-0.3207	1.1656	-0.3931
16 Sep -	30 Sep	2000	2.0931	2.0158	0.0773	2.0158	0.0773	0.7895	0.9780	-0.1886	0.9780	-0.1886	0.8344	0.4281	0.4063	0.5280	0.3064
1 Oct -	15 Oct	2000	1.7310	1.3262	0.4048	1.3262	0.4048	0.8061	0.5144	0.2917	0.5884	0.2177	0.8247	0.3683	0.4564	0.3885	0.4362
16 Oct -	31 Oct	2000	1.4786	0.5840	0.8946	1.0580	0.4206	0.7882	0.1347	0.6535	0.5094	0.2788	0.7390	0.3975	0.3415	0.3893	0.3497
1 Nov -	15 Nov	2000	1.9390	1.0461	0.8929	0.6243	1.3146	0.8142	0.1494	0.6649	0.1403	0.6739	0.6668	0.3039	0.3629	0.3246	0.3422
16 Nov -	30 Nov	2000	1.7852	1.0461	0.7391	1.0461	0.7391	0.8903	0.2423	0.6479	0.2378	0.6525	0.7273	0.3328	0.3944	0.3499	0.3774
1 Dec -	15 Dec	2000	0.6796	1.0461	-0.3664	1.0461	-0.3664	0.7461	0.4650	0.2811	0.4649	0.2812	0.5358	0.4517	0.0841	0.4517	0.0841
16 Dec -	31 Dec	2000	0.6703	0.9807	-0.3104	1.0461	-0.3758	0.7048	0.4776	0.2273	0.5094	0.1954	0.6848	0.4235	0.2614	0.4517	0.2331
1 Jan -	15 Jan	2001	0.6509	1.0461	-0.3952	1.0461	-0.3952	0.5871	0.5094	0.0777	0.5094	0.0777	0.5638	0.4517	0.1121	0.4517	0.1121
16 Jan -	31 Jan	2001	0.4315	0.9807	-0.5492	1.0461	-0.6146	0.0000	0.4776	-0.4776	0.5094	-0.5094	0.1726	0.4235	-0.2509	0.4517	-0.2791
1 Feb -	15 Feb	2001	1.3003	1.0461	0.2542	0.9807	0.3196	0.4249	0.5894	-0.1644	0.4776	-0.0526	0.6755	0.4294	0.2461	0.4699	0.2056
16 Feb -	28 Feb	2001	0.8681	1.2070	-0.3389	1.1185	-0.2504	0.8268	0.5878	0.2391	0.5251	0.3018	0.7564	0.5092	0.2472	0.4977	0.2587
1 Mar -	15 Mar	2001	1.5023	1.3063	0.1960	1.3273	0.1750	0.7841	0.5359	0.2482	0.5666	0.2175	0.6636	0.5896	0.0741	0.5884	0.0753
16 Mar -	31 Mar	2001	1.0887	1.6680	-0.5793	1.6624	-0.5738	0.7580	0.6559	0.1021	0.6582	0.0998	0.5666	0.6618	-0.0952	0.7103	-0.1437
1 Apr -	15 Apr	2001	1.5015	1.5305	-0.0290	1.6091	-0.1076	0.8489	0.7570	0.0919	0.7561	0.0928	0.6201	0.9696	-0.3495	0.9694	-0.3493
16 Apr -	30 Apr	2001	2.0610	0.5307	1.5303	0.5096	1.5514	0.7903	0.8189	-0.0286	0.8240	-0.0336	0.7070	0.5429	0.1641	0.9804	-0.2734
1 May -	15 May	2001	2.1487	0.4568	1.6920	0.6747	1.4741	0.8308	0.7480	0.0828	0.7632	0.0676	0.7521	0.5189	0.2332	0.5599	0.1922
16 May -	31 May	2001	2.0510	0.7917	1.2593	0.7489	1.3021	0.8912	0.5129	0.3784	0.5108	0.3804	0.7561	0.5129	0.2433	0.5529	0.2033
1 Jun -	15 Jun	2001	2.9487	1.2730	1.6757	0.9388	2.0099	1.1536	0.8085	0.3451	0.7933	0.3603	0.7923	1.0664	-0.2741	0.6118	0.1805
16 Jun -	30 Jun	2001	2.8393	2.3560	0.4833	2.3913	0.4481	1.2722	1.3482	-0.0760	1.3492	-0.0770	0.8530	0.9837	-0.1307	0.9249	-0.0719
1 Jul -	15 Jul	2001	2.8274	3.1277	-0.3002	3.1277	-0.3002	1.2840	1.4699	-0.1859	1.5836	-0.2996	0.8056	1.1314	-0.3258	1.1179	-0.3123
16 Jul -	31 Jul	2001	3.1509	3.3464	-0.1955	3.3925	-0.2416	1.3047	1.6474	-0.3427	1.6759	-0.3713	0.8297	1.2542	-0.4245	1.2539	-0.4242
Totals:			43.9455		5.3847		5.3637	20.6356		0.9514		0.4751	16.9258		0.5061		0.1603
Water Saved (% of Delivered):					12.25		12.21			4.61		2.30			2.99		0.95

Table 3. (Continued).

Dates			East Isna District					Luxor District				
			Water	Existing Crops		Expected Crops		Water	Existing Crops		Expected Crops	
From	To	Year	Delivered	Water	Water	Water	Water	Delivered	Water	Water	Water	Water
				Needed	Saved	Needed	Saved		Needed	Saved	Needed	Saved
1 Aug - 15 Aug	2000	1.7250	1.2355	0.4895	1.2112	0.5137	1.3228	1.4195	-0.0967	1.4195	-0.0967	
16 Aug - 31 Aug	2000	1.6498	1.1771	0.4727	1.1773	0.4725	1.4786	1.2852	0.1934	1.2852	0.1934	
1 Sep - 15 Sep	2000	1.5241	1.0663	0.4578	1.0887	0.4354	1.3114	1.0381	0.2733	1.0314	0.2800	
16 Sep - 30 Sep	2000	1.5035	0.9693	0.5342	0.9822	0.5213	1.2233	0.9508	0.2725	0.9508	0.2725	
1 Oct - 15 Oct	2000	1.4969	0.9247	0.5722	0.8840	0.6129	0.9362	0.7490	0.1872	0.8698	0.0664	
16 Oct - 31 Oct	2000	1.5479	0.8404	0.7074	0.8230	0.7248	0.9414	0.7067	0.2346	0.6484	0.2929	
1 Nov - 15 Nov	2000	1.5605	0.7290	0.8315	0.7197	0.8409	1.0522	0.6187	0.4336	0.6495	0.4028	
16 Nov - 30 Nov	2000	1.3119	0.6091	0.7028	0.6596	0.6523	0.9109	0.5275	0.3835	0.5873	0.3237	
1 Dec - 15 Dec	2000	1.3526	0.5101	0.8425	0.5130	0.8397	0.8418	0.4287	0.4131	0.4548	0.3870	
16 Dec - 31 Dec	2000	0.2439	0.4159	-0.1720	0.4572	-0.2133	0.5150	0.3489	0.1661	0.3632	0.1518	
1 Jan - 15 Jan	2001	0.7025	0.4254	0.2771	0.4254	0.2771	0.5445	0.3578	0.1866	0.3578	0.1866	
16 Jan - 31 Jan	2001	1.2830	0.4300	0.8531	0.4397	0.8434	1.0732	0.3711	0.7021	0.3810	0.6923	
1 Feb - 15 Feb	2001	1.0402	0.4654	0.5748	0.4563	0.5839	0.9771	0.4055	0.5716	0.4001	0.5770	
16 Feb - 28 Feb	2001	0.8956	0.5234	0.3722	0.4988	0.3968	0.9589	0.4679	0.4911	0.4517	0.5073	
1 Mar - 15 Mar	2001	0.8635	0.6018	0.2618	0.5793	0.2842	0.8343	0.6174	0.2168	0.5920	0.2422	
16 Mar - 31 Mar	2001	1.2080	0.6541	0.5539	0.6331	0.5749	1.0049	0.7598	0.2451	0.7199	0.2851	
1 Apr - 15 Apr	2001	1.0425	0.6690	0.3736	0.6541	0.3884	1.0510	0.7908	0.2603	0.7669	0.2841	
16 Apr - 30 Apr	2001	1.0776	0.7310	0.3466	0.7143	0.3633	0.8395	0.6864	0.1532	0.6311	0.2085	
1 May - 15 May	2001	1.0564	1.0295	0.0269	0.5350	0.5214	1.0644	0.7860	0.2783	0.7753	0.2890	
16 May - 31 May	2001	1.2233	1.0292	0.1940	1.0103	0.2130	1.4375	0.9166	0.5209	0.9171	0.5204	
1 Jun - 15 Jun	2001	1.3337	1.3149	0.0188	1.3149	0.0188	0.9328	1.3487	-0.4159	1.3391	-0.4062	
16 Jun - 30 Jun	2001	1.3645	1.4061	-0.0416	1.4061	-0.0416	1.0581	1.2591	-0.2010	1.2591	-0.2010	
1 Jul - 15 Jul	2001	1.3468	1.3483	-0.0015	1.3483	-0.0015	1.1895	1.2859	-0.0964	1.2859	-0.0964	
16 Jul - 31 Jul	2001	1.6240	1.3483	0.2757	1.3483	0.2757	1.3843	1.3838	0.0005	1.3838	0.0005	
Totals:			29.9778		9.5240		10.0979	24.8838		5.3739		5.3632
Water Saved (% of Delivered):					31.77		33.68			21.60		21.55