Hydrogeological Report on NW Aboriginal Lands well monitoring – April to October 1999

REPORT BOOK 2000/00007

by

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PRIMARY INDUSTRIES AND RESOURCES
SOUTH AUSTRALIA

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HYDROGEOLOGICAL REPORT ON NW ABORIGINAL LANDS WELL MONITORING – APRIL TO OCTOBER 1999

Lloyd Sampson and Sandy Dodds

Monitoring equipment is now installed in the 30 wells that supply groundwater to 8 major communities in the Anangu Pitjantjatjara lands. The equipment provides standing water level (SWL) and pumping rates on an hourly basis for each well; information which should give a good indication of the sustainability of the water supply. Additionally, one rain gauge at each community gives similar information on precipitation and provides guidance on recharge.

INTRODUCTION

This report comprises brief comments on the current download of data for the period April to October 1999. A more comprehensive report covering all monitoring data to date and the results of geophysical logging of the wells will be produced as part of a major study of groundwater sustainability in the AP lands.

The location of each community is shown in Figure 1.

ANALYSIS OF LOGGING DATA

INDULKANA

General Comments

The wells do not appear to be depleting the aquifers, and are therefore not in danger of failing. The supply possibilities are limited by slow recovery (transmissivity) rather than the storage capacity (specific yield) of the aquifers.

Wells IR1 and IR2 were fitted with monitoring equipment, and results for these wells should be available at the next download. However, modifications to the power supplies for these wells are necessary to ensure data integrity and the safety of the equipment (see B. Traeger's report, Appendix 1).

Well 19. The lower pump rate of 0.35 L/s (0.6 L/s in the previous period) has eased the stress on this well, but even at this rate the well cannot maintain supply for very long (Figure 4). A 21 hour spell of continuous pumping in September resulted in 4 m of additional drawdown to 40 m. An intensive intermittent pumping period during May resulted in a similar drawdown. While these drawdowns are not into the danger zone of 41–56 m where the aquifer lies, they are as close as is advisable.

The well recovers fairly quickly, and almost regained its original SWL of 15.6 m when rested for 5 days in early September (SWL 17.14 m). Similarly in May when the bore was not pumped for 2 days the SWL recovered to 17.72 m.

The well was pumped at 0.1 L/s continuously for 44 hours in early October with only very slow additional drawdown of 1 m, so it appears that this pump rate could be applied continuously for several weeks before the SWL would drop to the danger zone of 40 m.

Well 19A. The well is still being pumped dry within two hours at the currently used rate of 0.8 L/s and never fully recovers in the intervening 12 hours (Figure 5). In May, during an intensive pumping period water levels were not allowed to recover and the SWL declined approx 10 m. However, in the long term the well appears to recover to near its original SWL of 28 m, if given time.

The well was pumped continuously for about 3 days in early October at the reduced rate of 0.5 L/s and sustained this fairly comfortably. The water level dropped at less than 1 m/day, indicating that the continuous pumping could have continued for a week or more in an emergency.

It is recommended that if a more continuous pumping regime is required then the pumping rate be reduced to 0.5–0.6 L/s.

Well 25. This well has recovered significantly thanks to reduced pumping in May, with the SWL rising to 12 m, well above its 1995 level of 14.8 m (Figure 6). After a period of stability in June-July the SWL again dropped in August-September as a result of increased hours of pumping. It appears that the pumping rate for July of about 7 hours daily at 0.65 L/s (16 kL/day) is sustainable in the long term without depleting the aquifer.

Well 26. The failure of the SWL transducer in early September throws some doubt on the earlier data back as far as July, but it appears from the continuous pumping in May that the well can sustain a rate of 0.3 L/s for some time (Figure 7).

Well 27. The well is bottoming out in spite of low and intermittent pumping rates (Figure 8). The very slow recovery rate indicates that this well, while possibly not depleting the aquifer, can never produce much water. It would be preferable to reduce the pump rate (currently at 0.4 L/s) in order to sustain longer term pumping.

Rainfall. The rainfall gauge on 19 showed about 12 mm of rain on 12 October, along with other lesser falls (Figure 3). There is no clear recharge indication in any well, although several showed a slight improvement in SWL about this time. This may have resulted from reduced pumping rates.

MIMILI

General Comments.

Both wells recover quickly to SWL values that compare favourably to those at drilling time. There is therefore no sign of aquifer depletion. The rainfall event in October was apparently insufficient to cause recharge.

Well M1. Two data errors in late August and early October relate to a meaningless shift in SWL (Figure 11). There is no sign of depletion at these pumping rates, with the SWL of 15.6 m comparing favourably with the 1978 figure of 14.7 m.

Well M3. There is no sign of depletion at these pumping rates, the SWL having been about 10 m since 1995 (Figure 12). An overshoot in the SWL when the pump turns off, marked by a spike in the plot above the relaxed SWL of 10.9, may indicate water flowing back into the well from the distribution system through a faulty non-return valve.

Rainfall. A rainfall event of 28 mm in 5 hours on 12 October 1999 did not result in any noticeable change in SWL, and was presumably insufficient to cause recharge of the aquifer (Figure 10).

FREGON

General Comments.

The wells all show SWL that are effectively unchanged since records have been kept, and therefore indicate no dewatering of the aquifers. Generally they seem capable of maintaining current pump rates, although F–14 is getting a little close to the aquifer.

Well 1. These results (Figure 15) contradict the indications of the previous period, in that the SWL has recovered to the level of 10 m. This level has been consistent since 1995 at least, there being no records previously. This well has been pumped at rates of 1.7 L/s in the past and has never shown consistent signs of depletion, but the available drawdown, with the bottom of the well at 18.6 m, is not great. It is recommended that the pump rate for this bore be maintained at 1.7 L/s.

Well 7. The well has been little used, and the SWL has been consistent at about 10 m for this period and since 1998 (Figure 16). It is actually higher than in 1983 (12 m) so there are no signs of dewatering. The pump rate of 2.3 L/s does not cause excessive drawdown, nor did the intensive production over the period May - June cause much deviation in the water level. The available drawdown is about 20 m.

Well 14. The well was pumped fairly lightly over this period, with a resulting recovery in SWL to 10.4 m (Figure 17). This is the same as the level in 1987, so there appears to be no dewatering problem. The well is slow to recover, which may limit the daily pumping rate slightly, and this limitation may be greater if the pumping water level drops below 18 m, which appears to be the top of the aquifer. Continual pumping over the period 7–10 October caused a decline in water level of 0.2 m to 17.3 m. A slight reduction in the pumping rate to, say, 2.0 L/s might be advisable if extended pumping times are anticipated.

Well E4. This well shows strong SWL overshoots when the pump is turned off, as was the case for Mimili M–3 (Figure 18). The same cause, water flow back into the well from the distribution system due to a faulty non-return valve, is suspected. The well copes with the pump rate of 1.8 L/s, which causes a drawdown to 15.8 m, still 4 m above the water cut at 19.8 m. The SWL at 10 m is much the same as it was in 1997 (9.3 m) and actually above the 1971 figure of 11.6 m. There is therefore no evidence of dewatering.

Rainfall. There were no major rainfall events, such falls as occurred being widespread (Figure 14).

KENMORE PARK.

General Comments.

Neither well appears to be dewatering the aquifer at any critical rate, at least in this period, but low aquifer transmissivities make extraction of water a problem. There are still no opportunities of recharge, with low rainfall.

Well 6. As for the previous period the well appears to cope with the current pumping rates, the SWL consistently coming back to a level of about 9.7 m (Figure 21). While there may be a small drop from the original level in 1985 of 6 m, a more critical problem is the difficulty the well has at maintaining the pumping rate of 1.7 L/s, with the drawdown getting quite low in the aquifer, so far as the latter is known. A pumping spell of 34 hours in early October resulted in an increase in drawdown from 3.5 m initially to 4.8 m at the end of the spell. The possibility of dewatering still exists, but is not particularly supported by this period's data.

Well 7. As for the previous period there was little pumping of this well, and the relaxed SWL remained constant at 11.2 m (Figure 22). This is a drop of about 0.4 m over 2 years. The large drawdown and short pumping times indicate that the more acute problem is in the transmissivity of the aquifer.

Rainfall. There were intermittent low falls in this period (Figure 20).

PUKATJA (ERNABELLA).

General Comments.

The two new wells, E–97B and E–97L, are yielding satisfactorily with no stress. E–12 and E–45 were also used extensively with only minor depletion. Other wells were little used.

Well 1. This well shows a steady drop of 0.25 m over the period (without pumping), as a result of either pumping in adjacent wells or movement of water downstream, continuing the trend from the previous period (Figure 25). There is no evidence of recharge.

Well 12. The well was pumped well nigh continuously over the period with no sign of aquifer depletion (Figure 26). However, there are some offsets in the SWL data, over the July - August period, that make them suspect in parts. Overall the result seems conclusive, confirming that of the previous period.

Well 42. The data for this well (Figure 27) are suspect, particularly the high pump rates at the start of the period, which do not correspond to lowering of the SWL, and the sensitivity of the SWL to minor change in pump rate towards the end of the period. However, it does seem that the well is consistently sensitive to pump rate, with low pump rates causing large drawdowns. The relaxed SWL dropped by about 0.2 m this period, consistent with the previous period, but this may relate to a discrepancy between actual and logger SWL levels at the end of this period that required a logger adjustment. Thus there is no clear evidence of a decline in SWL over this period.

Well 44. This well was hardly pumped at all, yet there are major rapid changes in SWL (Figure 28). Bore E–45 is located nearby, but its pumping regime does not reflect the changes in the water level data. The cause is difficult to understand and needs further investigation. Apart from this there appears to be a steady lowering of the SWL amounting to 0.2 m over the period.

Well 45. The well has been pumped extensively and this, combined with a continual drop in SWL with continuous pumping and the slow recovery when not pumping, makes any establishment of levels or long term changes difficult (Figure 29). However, some indication can be drawn from the continuous pumping over the last month of the period at 0.8L/s, which caused a drawdown of approx 1.8 m. If the aquifer is at 22 m then the well can sustain this production rate for a slightly longer period of time.

Well 97B. Equipment failure in May resulted in a reduced data set for this period, but the other data clearly shows that the well is sustaining a pump rate of 4 L/s without much additional drawdown with time (Figure 30). There is no indication of a declining SWL in the long term.

Well 97L. This well sustained a pump rate of 1.3L/s over several months with no sign of any lowering in the SWL (Figure 31). It is evident that the aquifer can sustain this pump rate. There is some indication of a slight decline in SWL without pumping during July, at a time when E97B was not pumping either. This may support the view that the aquifer is dewatering by natural drainage, but is really too slight to be significant on its own.

Rainfall. There were no significant falls in this period (Figure 24).

AMATA

General comments

While wells A–15 and A–17 appear to show signs of depletion, this may be because the wells have never had a chance to recover. A–26 has recovered in this period and the others might do so with similar treatment.

Well 15. There are possible indications of depletion, but these are obscured by variations in pumping rate and duration (Figure 34). However, taking this period in conjunction with the previous one the evidence of depletion is clearer with a drop of about 1 m in both relaxed and pumping levels over the year. There appears to be adequate available drawdown (14 m) to the aquifer at 30 m (14 years at the current rate of decline).

Well 17. As for 15. The best estimate is a decline in water level of 0.5 m over the year (Figure 35). Again there appears to be a reasonable buffer of 10 m to the aquifer at 25 m, but this is uncertain because of doubts about the aquifer location.

Well 26. The well was pumped less in this period and had a chance to recover to an SWL at 16 m (Figure 36). This is unchanged over the last year. The well appears to be slow to recover, but is not suffering depletion. There is a buffer of 9.5 m between the pumping SWL of 21 m and the aquifer at 30.5 m. The drop in SWL as a result of continuous pumping is quite severe, but the available drawdown would allow it so long as there is a subsequent rest period to allow the well to recover.

Rainfall. There was little rain in the period (Figure 33).

KALKA

General Comments

All wells are able to maintain their current pumping regimes.

Well 1. No sign of depletion (Figure 39). This well was pumped very lightly. There is a data shift of unknown origin in mid September.

Well 2. The SWL appears to have dropped by 0.1 m to 28.0 m over the period, but with pumping every day it is hard to be sure (Figure 40). The indication is backed up by the previous period's data, with a probably drop of 0.2 m over the year. With the top of the aquifer at approximately 29 m this does not give much leeway, but the aquifer may extend to the bottom of the well at 60 m.

Well 3. As with some other wells, a spike or surge, probably flowback of water from the distribution system because of a faulty non-return valve, started in this well at the beginning of July (Figure 41). This is undesirable from a data point of view and possibly damaging to the well. There is no sign of depletion in this or the previous period.

Rainfall. There were no major rainfall events (Figure 38).

PIPALYATJARA

Well 95. No sign of depletion, and the data looks good (Figure 43).

Well 96. There was a decline of 0.1 m over the monitoring period (Figure 44). The rate of decline appears greatest at times of longer pumping hours (late April - early May and in October), indicating that the depletion is caused by extraction. With an available drawdown of less than 1 m to the top of the aquifer, this depletion is a matter of concern and may require some relaxation in withdrawal rates. However, the matter is not yet urgent and additional data may clarify the picture.

There are errors in the flow data during late August and mid to late September.

Rainfall. Rainfall in the period was slight (Figure 42).

SUMMARY

We now have full sets of monitoring equipment operating on 29 wells, with the addition of two new wells in the Indulkana Ranges (no data as yet) and the temporary removal of equipment from Pukatja well E–01. The latter was effected because of a shortage of spares on this download trip, and this well was selected as being the least critical for monitoring, being inoperative at present and virtually pumped dry.

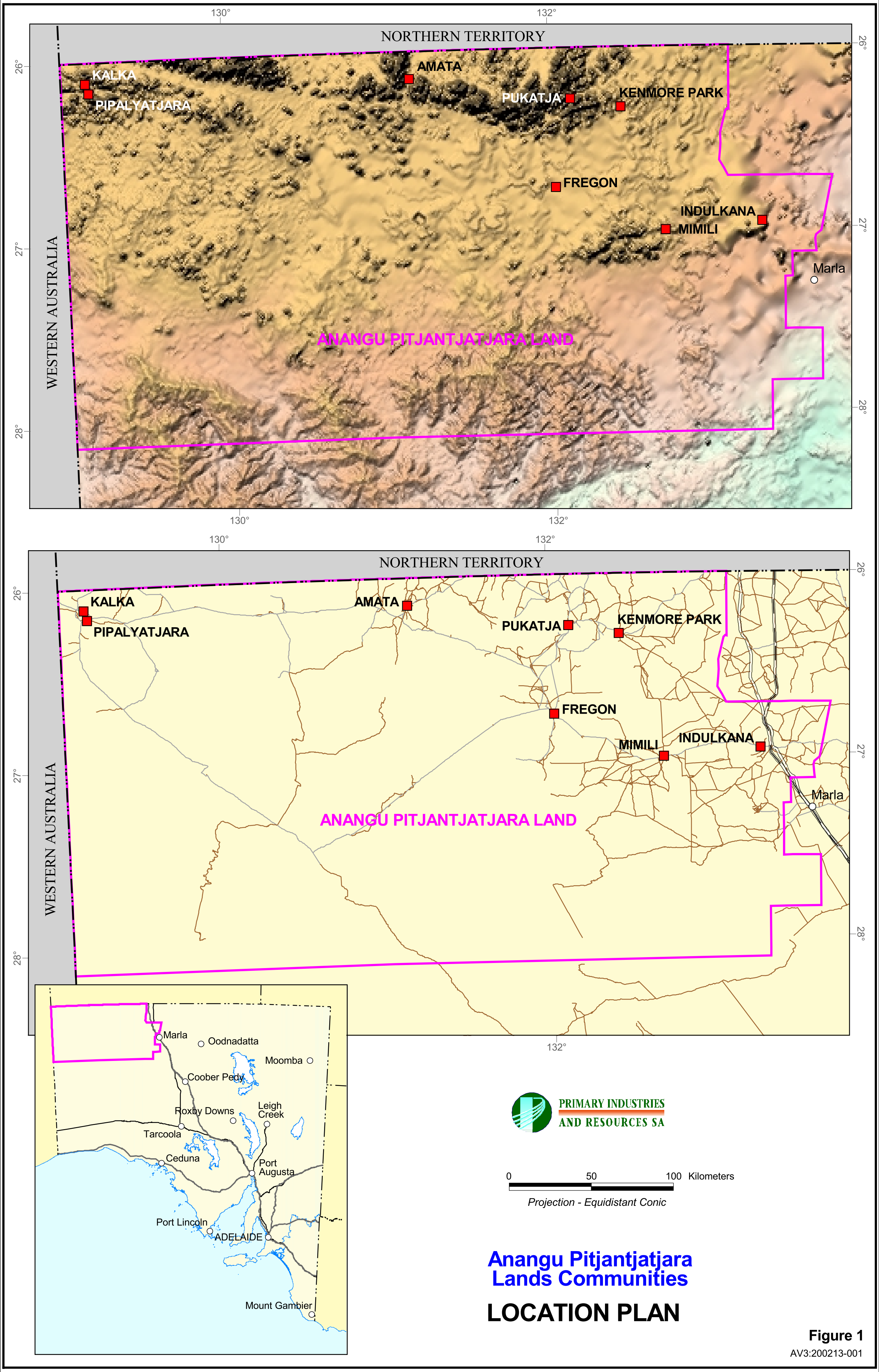
The quality of the data and reliability of the equipment has improved tremendously over the last 3 years, with fewer equipment failures and far fewer occurrences of unreliable data. SWL values are checked at each download, a manual reading being compared to that recorded by the equipment, and discrepancies are now rare and invariably of small magnitude. This improvement is due largely to the unceasing efforts of Brian Traeger in maintaining the equipment and upgrading it to the best available and affordable.

The immediate effect of the improvement in data quality has been more precise and confident assessment of well performance. This will be more evident when the full report on all data to date is available early next year, but can already be seen in the comments above.

Three wells, KA–3, M–3 and E–4, showed SWL overshoot when the pump was switched off, probably caused be water flowing back into the well from the distribution system and filling the well to a level above that supported by the aquifer. This is undesirable from a monitoring point of view and may be detrimental to the health of the well.

The two wells in the Indulkana Range, IR–1 and IR–2, need power supply modifications to ensure that the flowmeters are only powered up when the pump is running. The current situation endangers the equipment and causes spurious data.

Figures


NORTHERN TERRITORY
WESTERN AUSTRALIA
130°
132°
26°
27°
28°
KALKA
PIPALYATJARA
AMATA
PUKATJA
KENMORE PARK
FREGON
INDULKANA
MIMILI
Marla
ANANGU PITJANTJATJARA LAND
Marla
Oodnadatta
Moomba
Coober Pedy
Roxby Downs
Leigh Creek
Tarcoola
Ceduna
Port Augusta
Port Lincoln
ADELAIDE
Mount Gambier
PRIMARY INDUSTRIES AND RESOURCES SA
0
50
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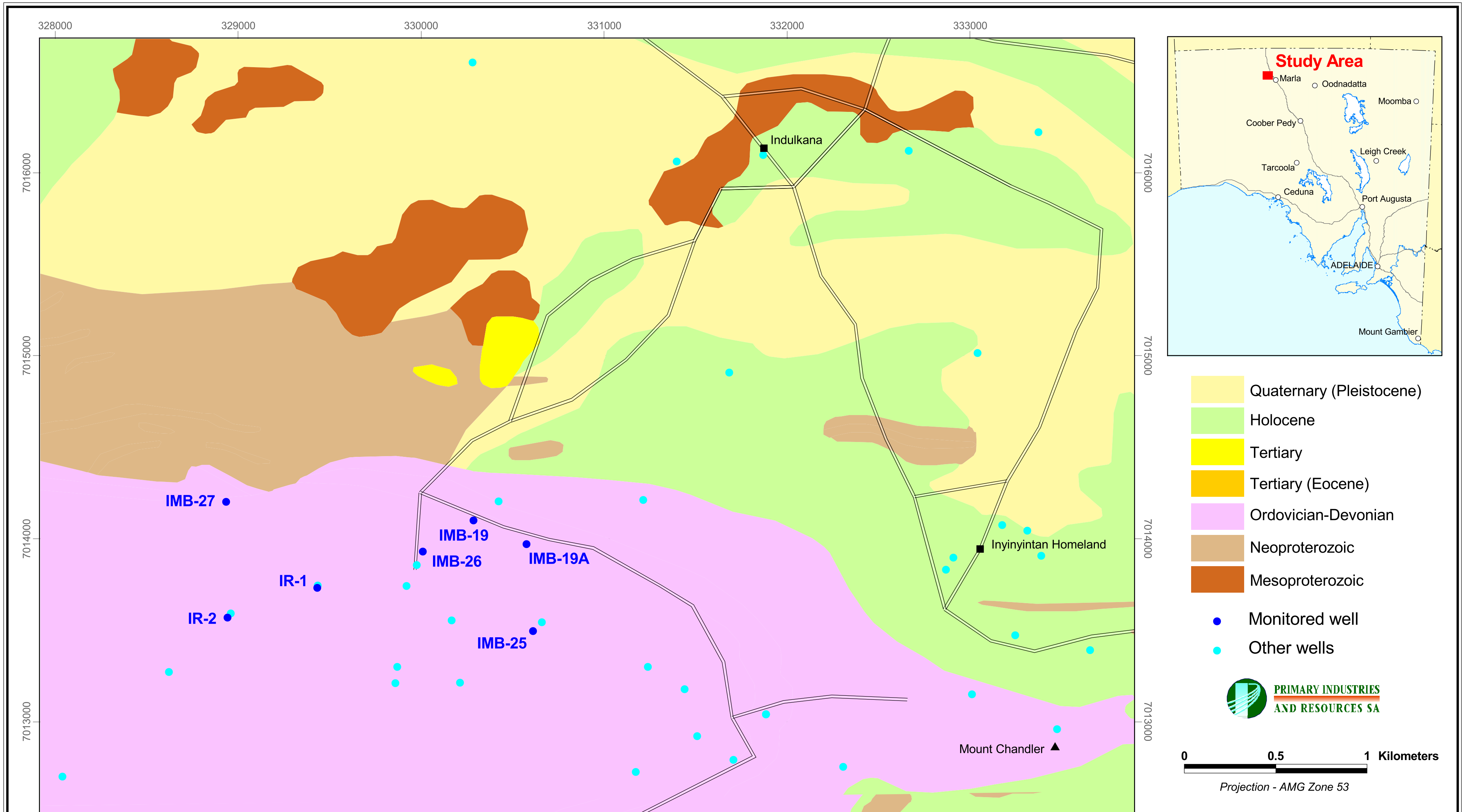
Projection - Equidistant Conic
Anangu Pitjantjatjara Lands Communities
LOCATION PLAN
AV3:200213-001
Figure 1



Indulkana
WELL LOCATION

Figure 2

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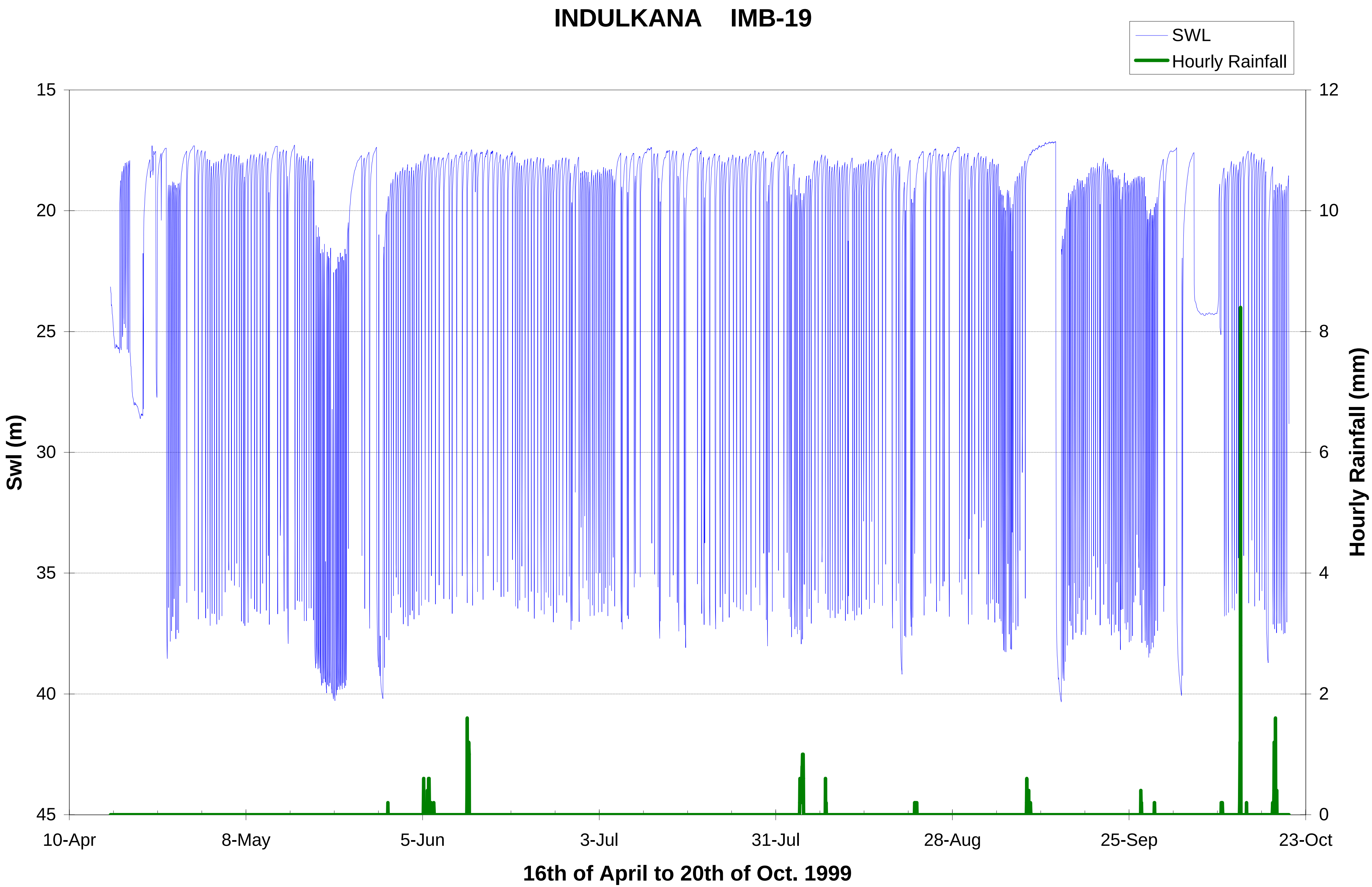


Figure 3 *Indulkana Rainfall - April to October 1999*

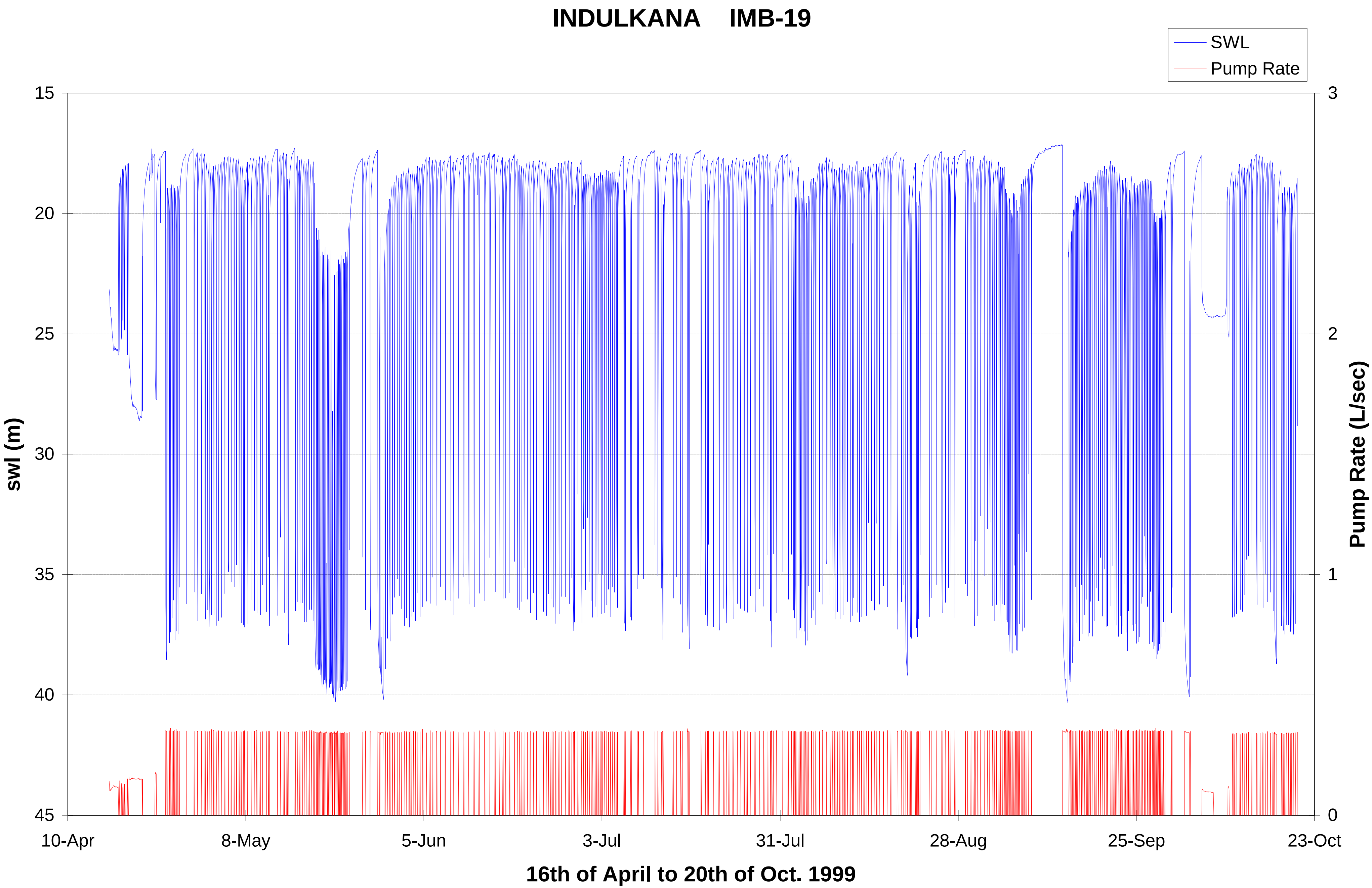


Figure 4 *Indulkana IMB-19; Hourly SWL and Pump Rate*

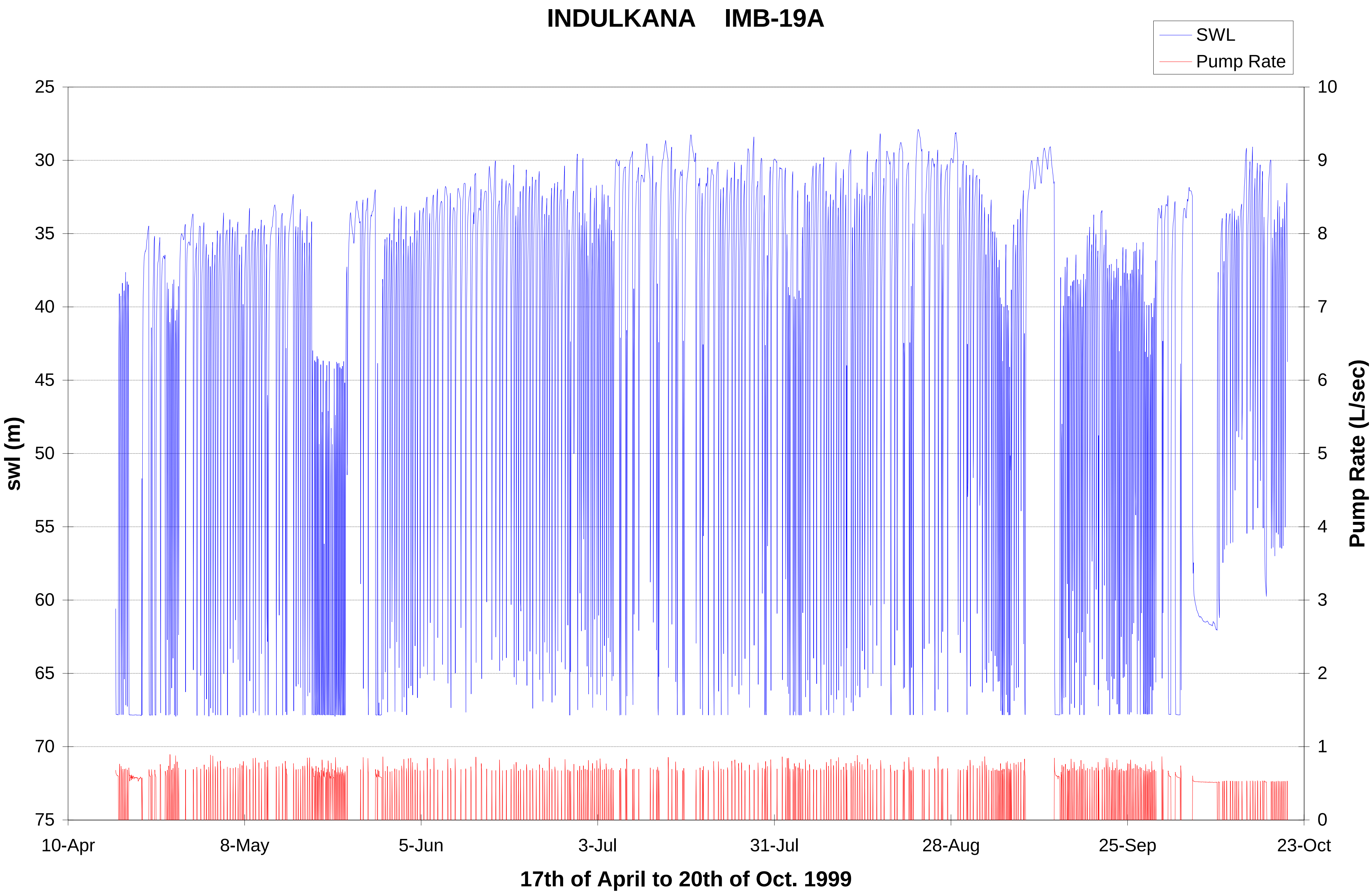


Figure 5 *Indulkana IMB-19A; Hourly SWL and Pump Rate*

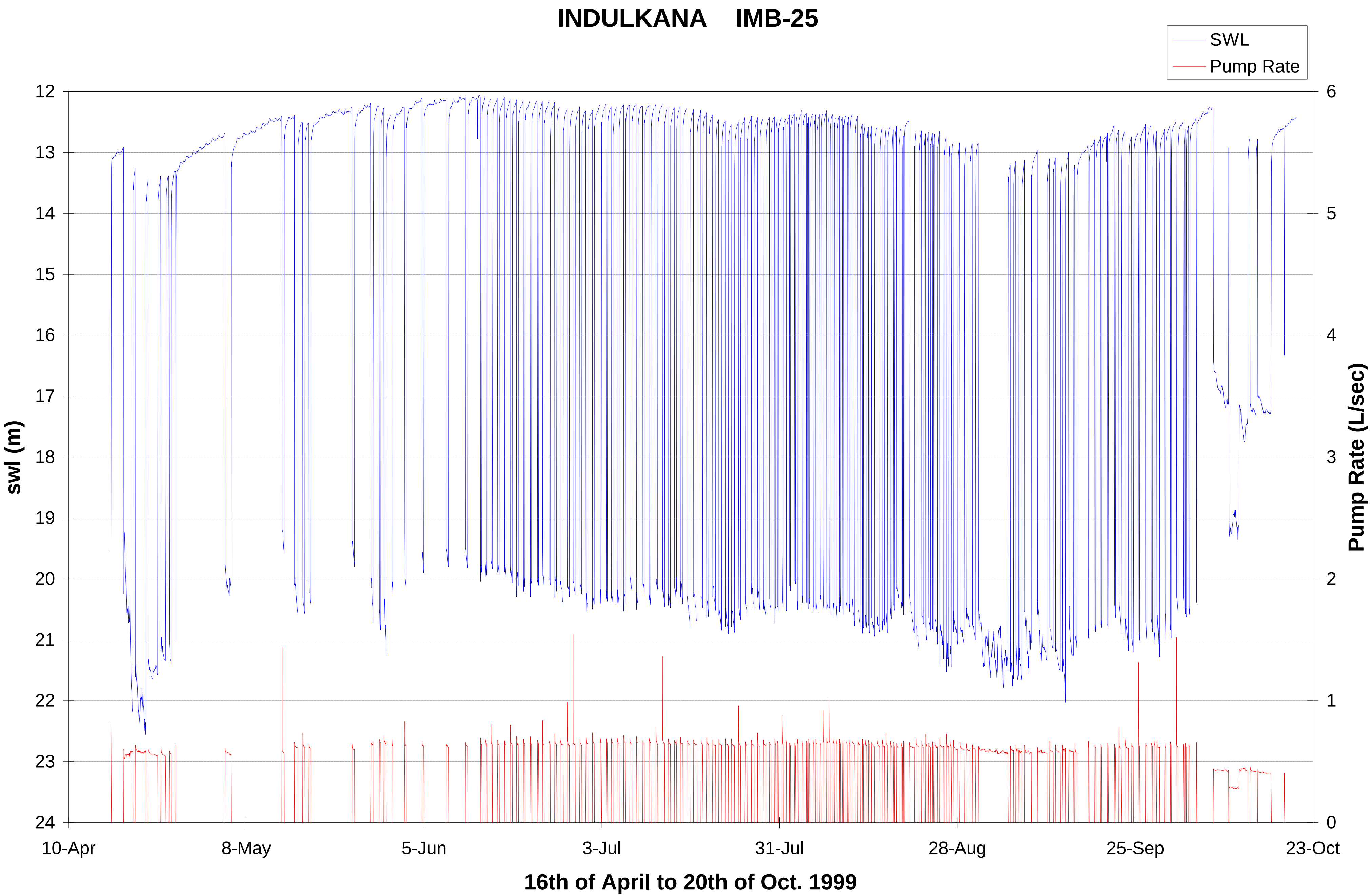


Figure 6 *Indulkana IMB-25; Hourly SWL and Pump Rate*

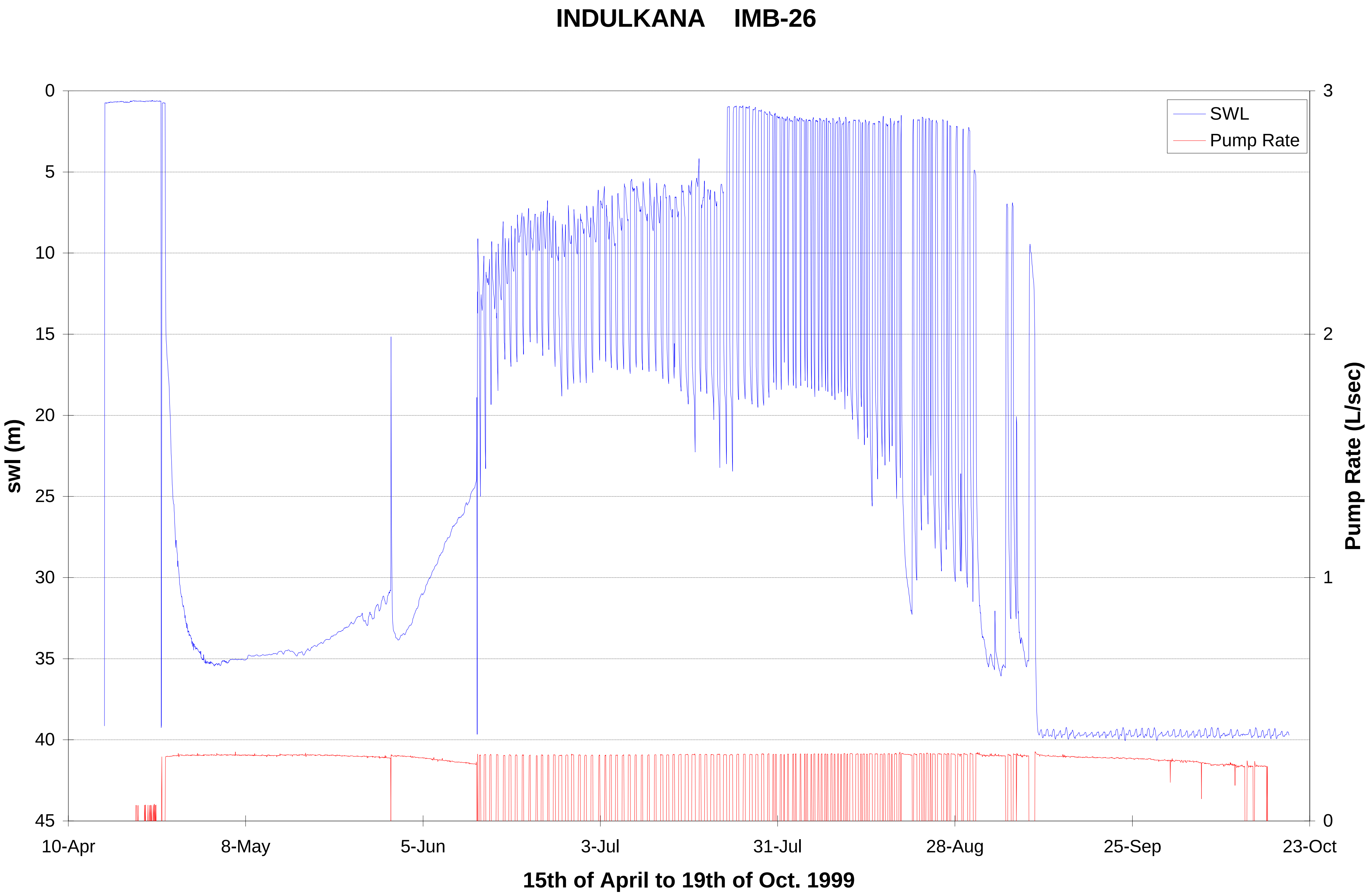


Figure 7 *Indulkana IMB-26 - Hourly SWL and Pump Rate*

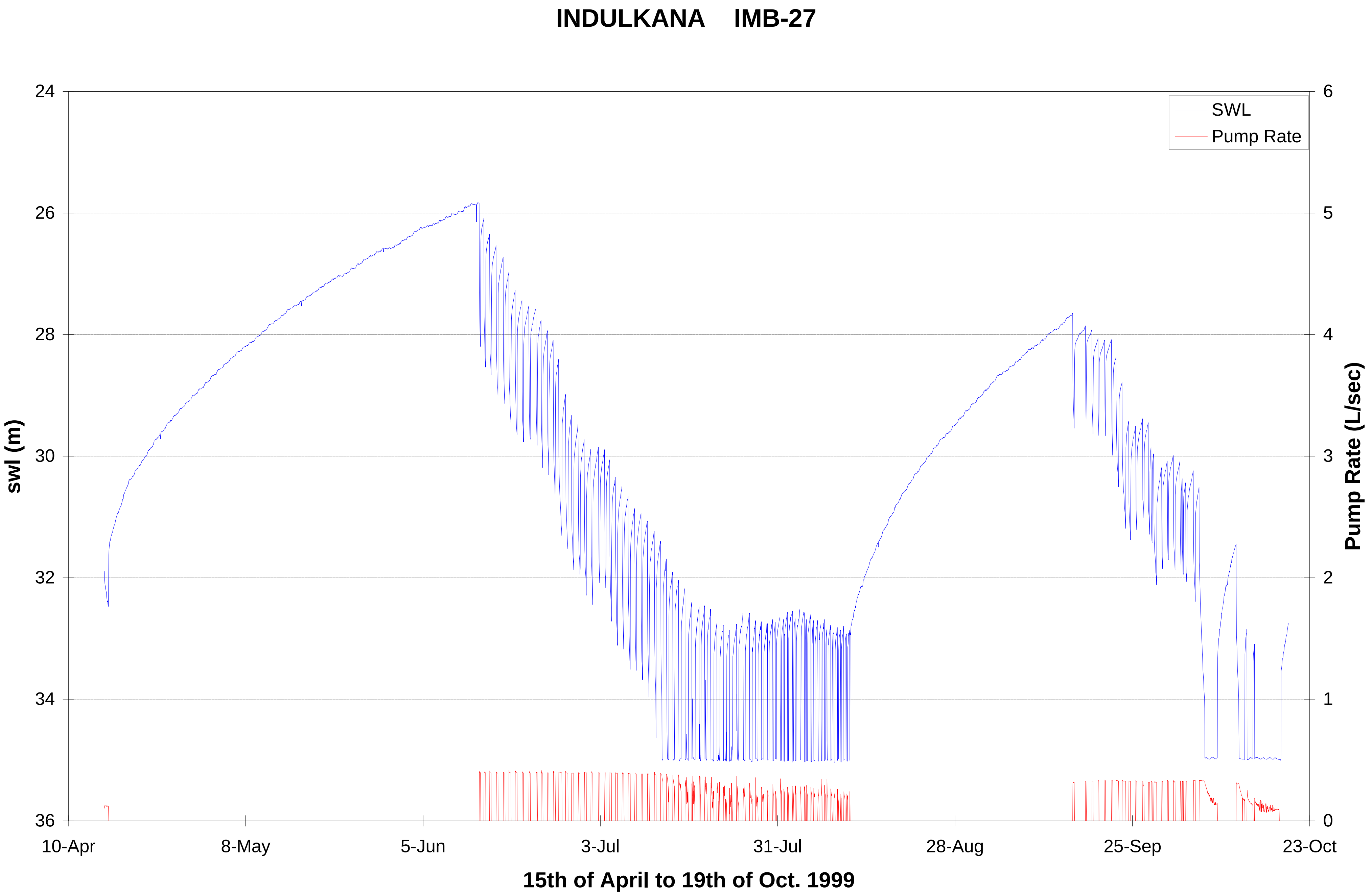
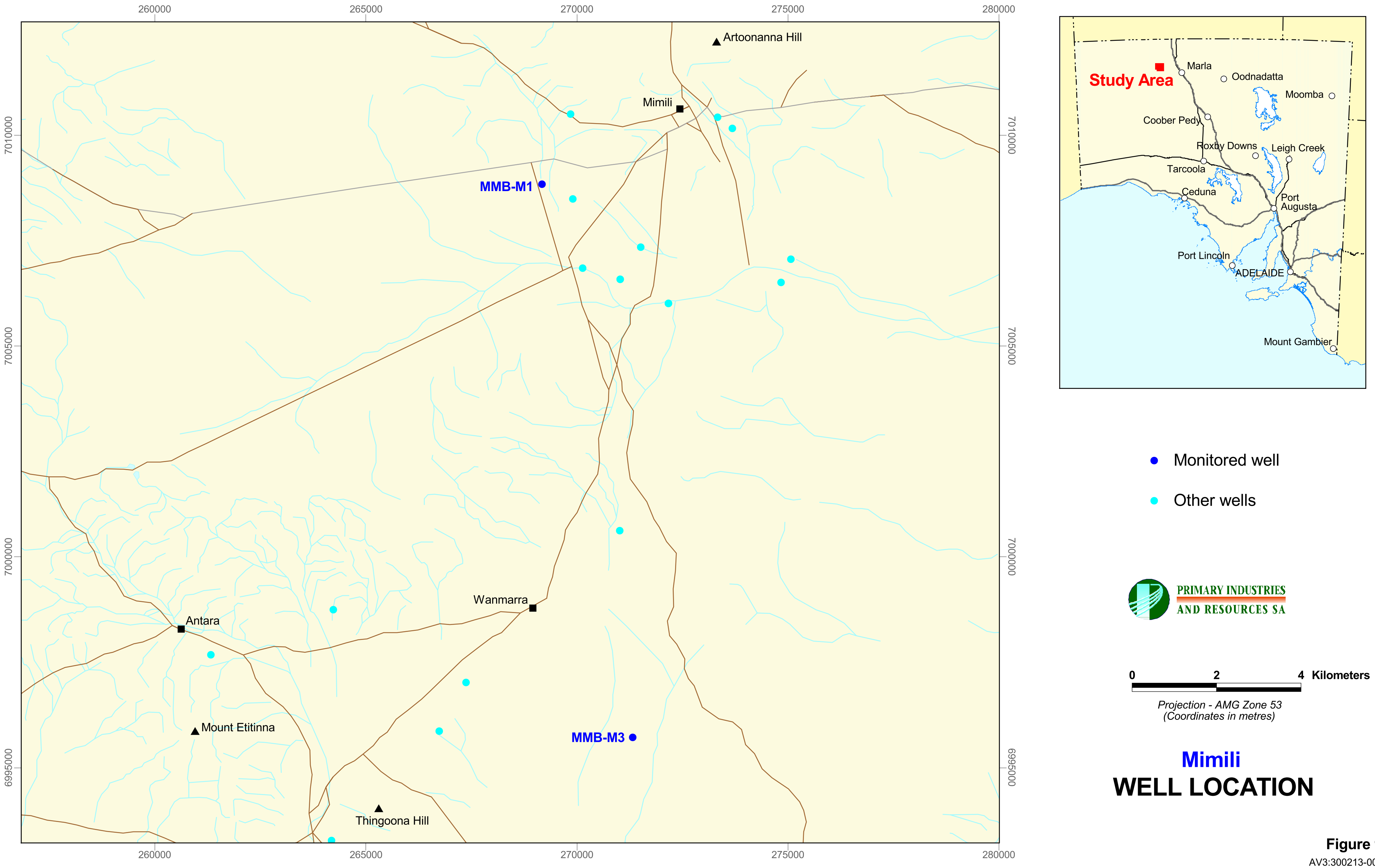


Figure 8 *Indulkana IMB-27 - Hourly SWL and Pump Rate*



Mimili

WELL LOCATION

Figure 9

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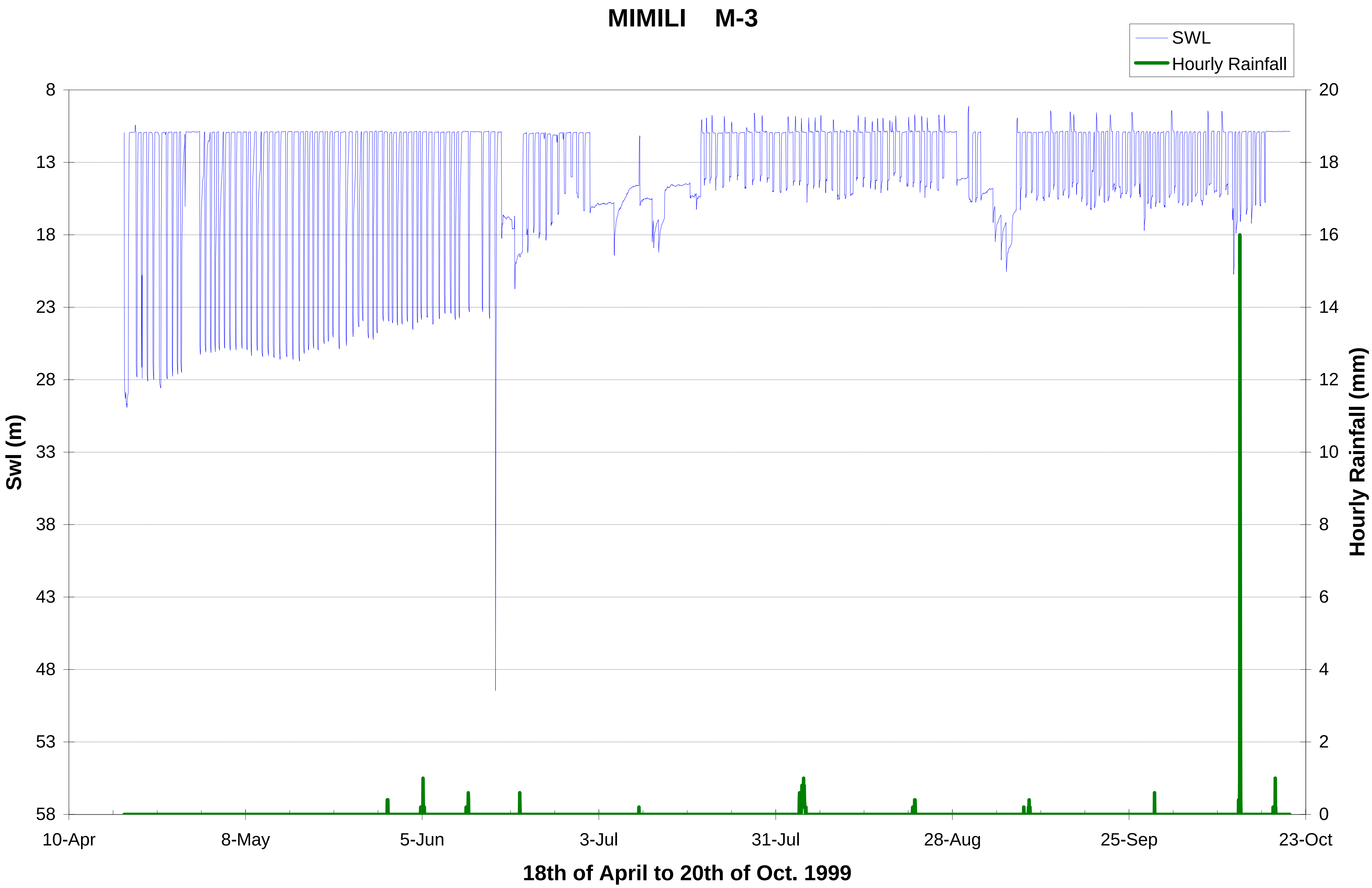


Figure 10 *Mimili Rainfall - April to October 1999*

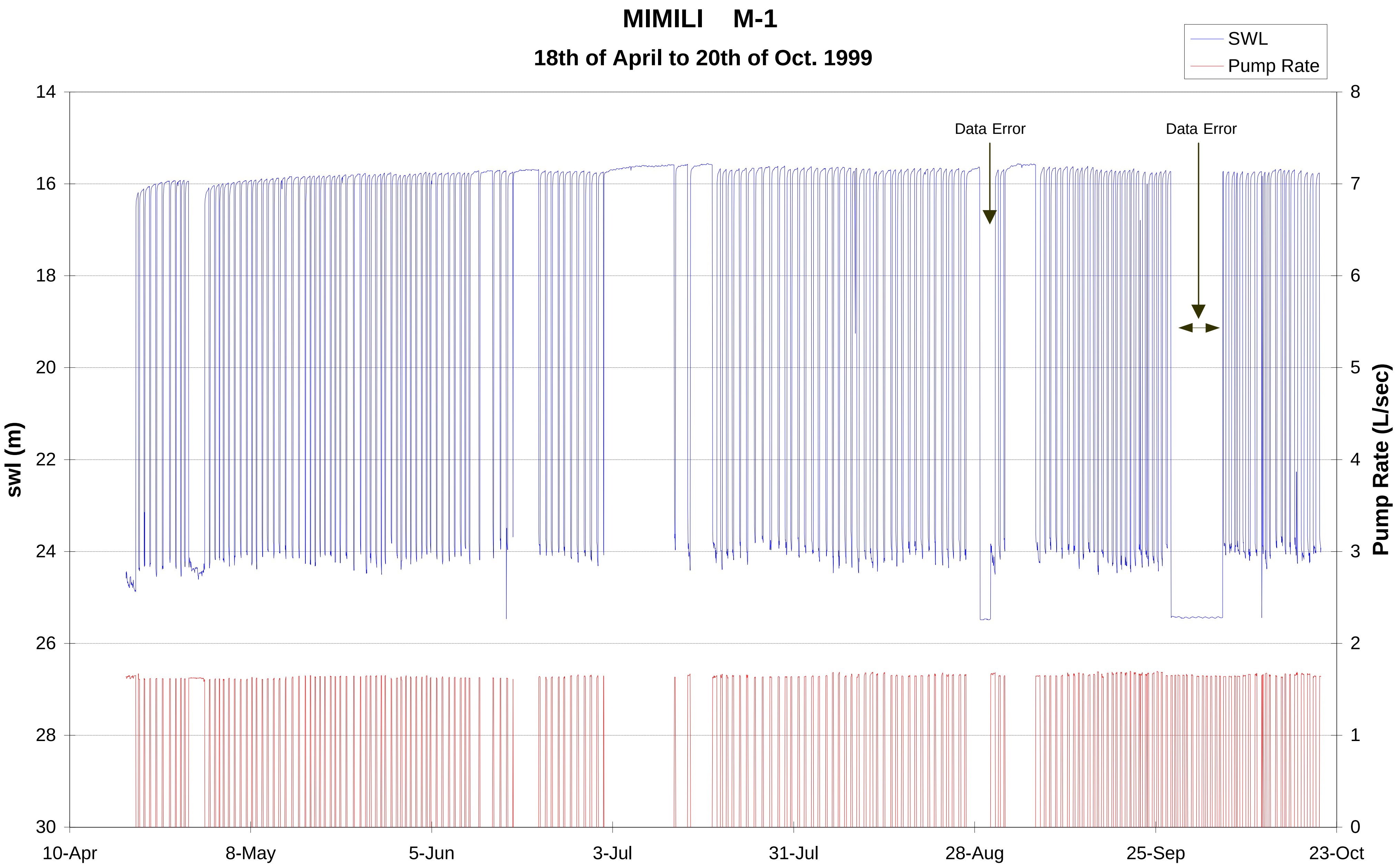


Figure 11 *Mimili M-1; Hourly SWL and Pump Rate*

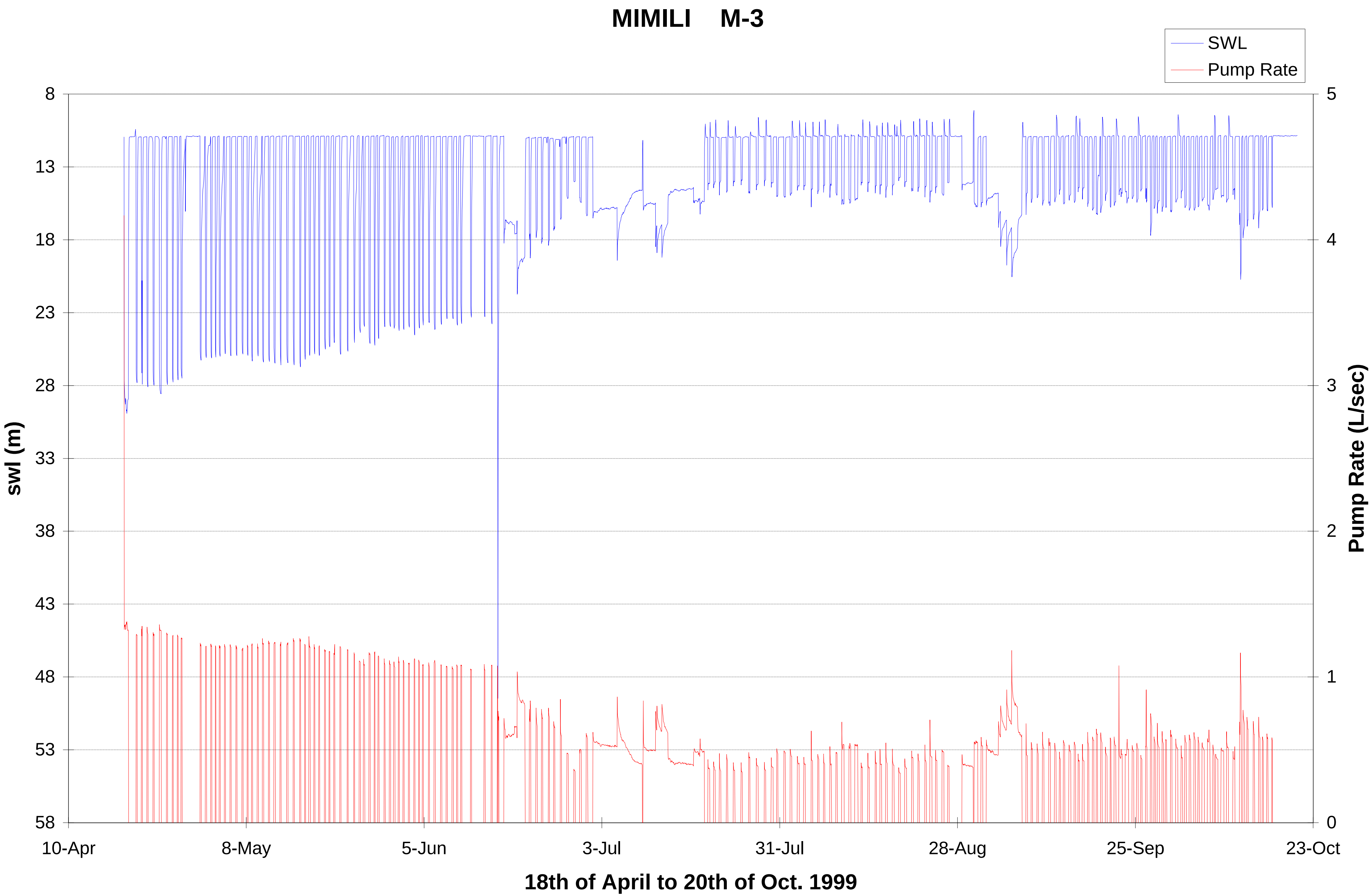
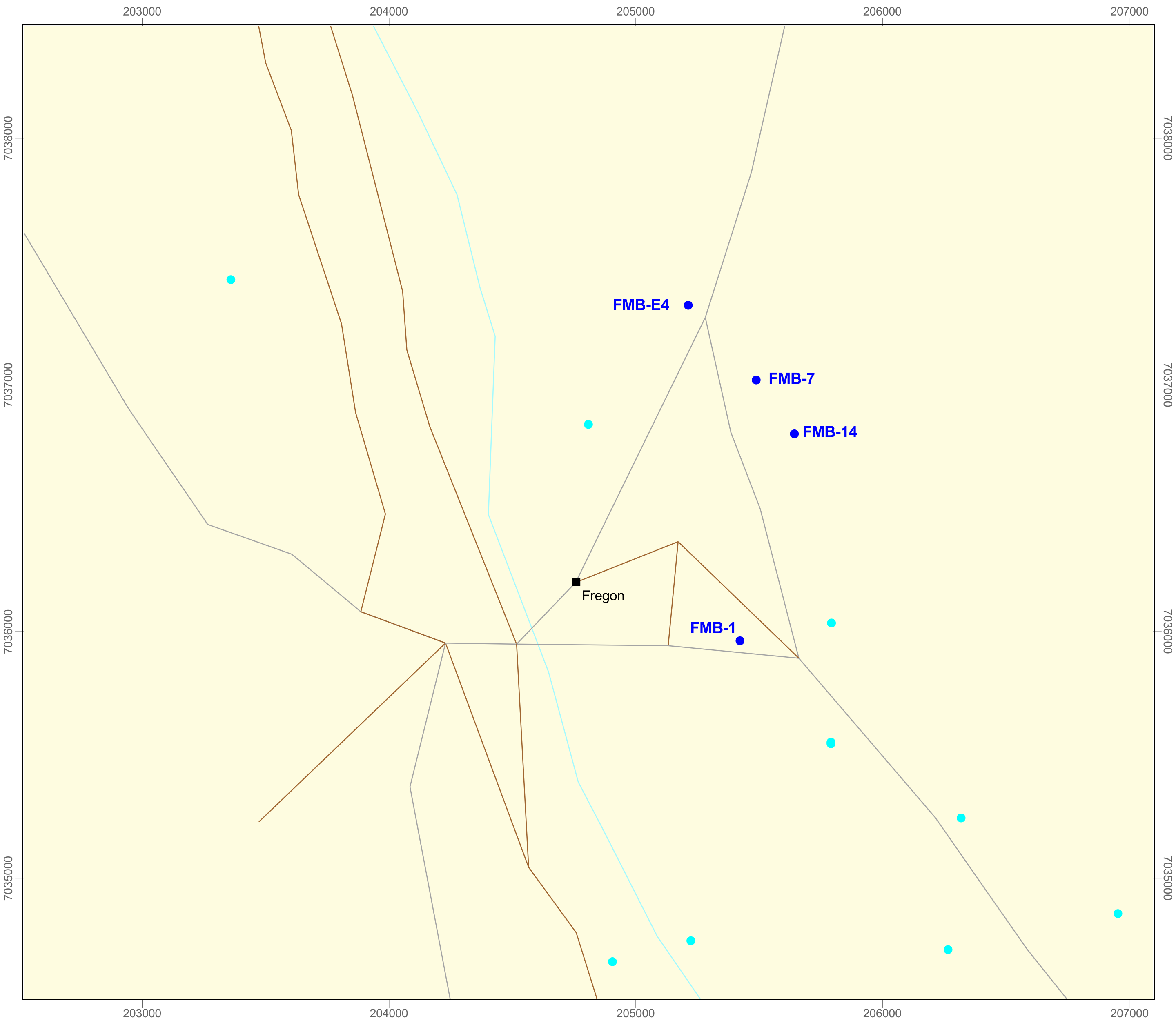


Figure 12 *Mimili M-3; Hourly SWL and Pump Rate*



● Monitored well

● Other wells

PRIMARY INDUSTRIES AND RESOURCES SA

0 500 1000 Meters

Projection - AMG Zone 53
(Coordinates in metres)

Fregon
WELL LOCATION

Figure 13

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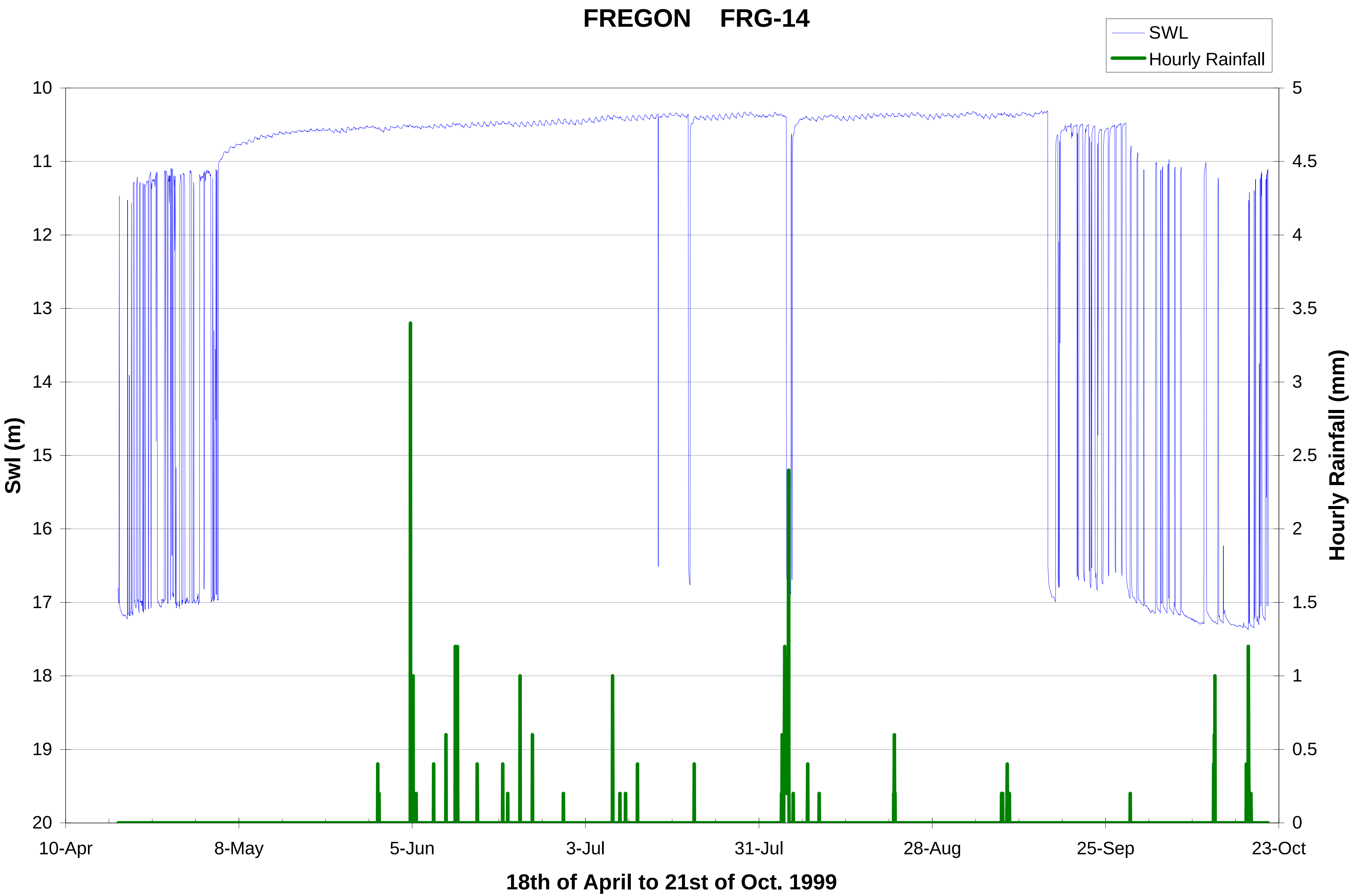


Figure 14 *Fregon Rainfall - April to October 1999*

Figure 15 *Fregon FRG-1; Hourly SWL and Pump Rate*

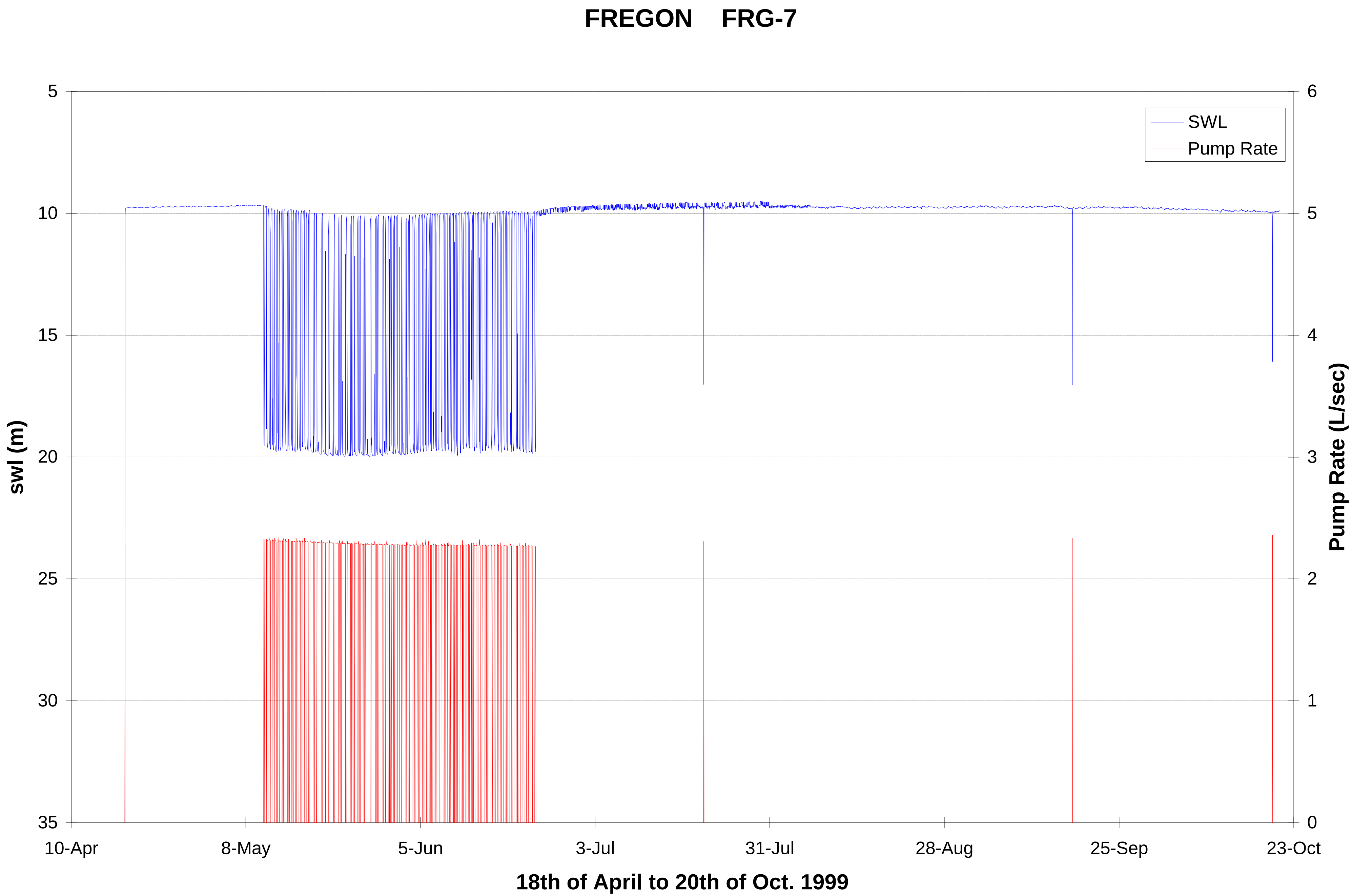


Figure 16 *Fregon FRG-7; Hourly SWL and Pump Rate*

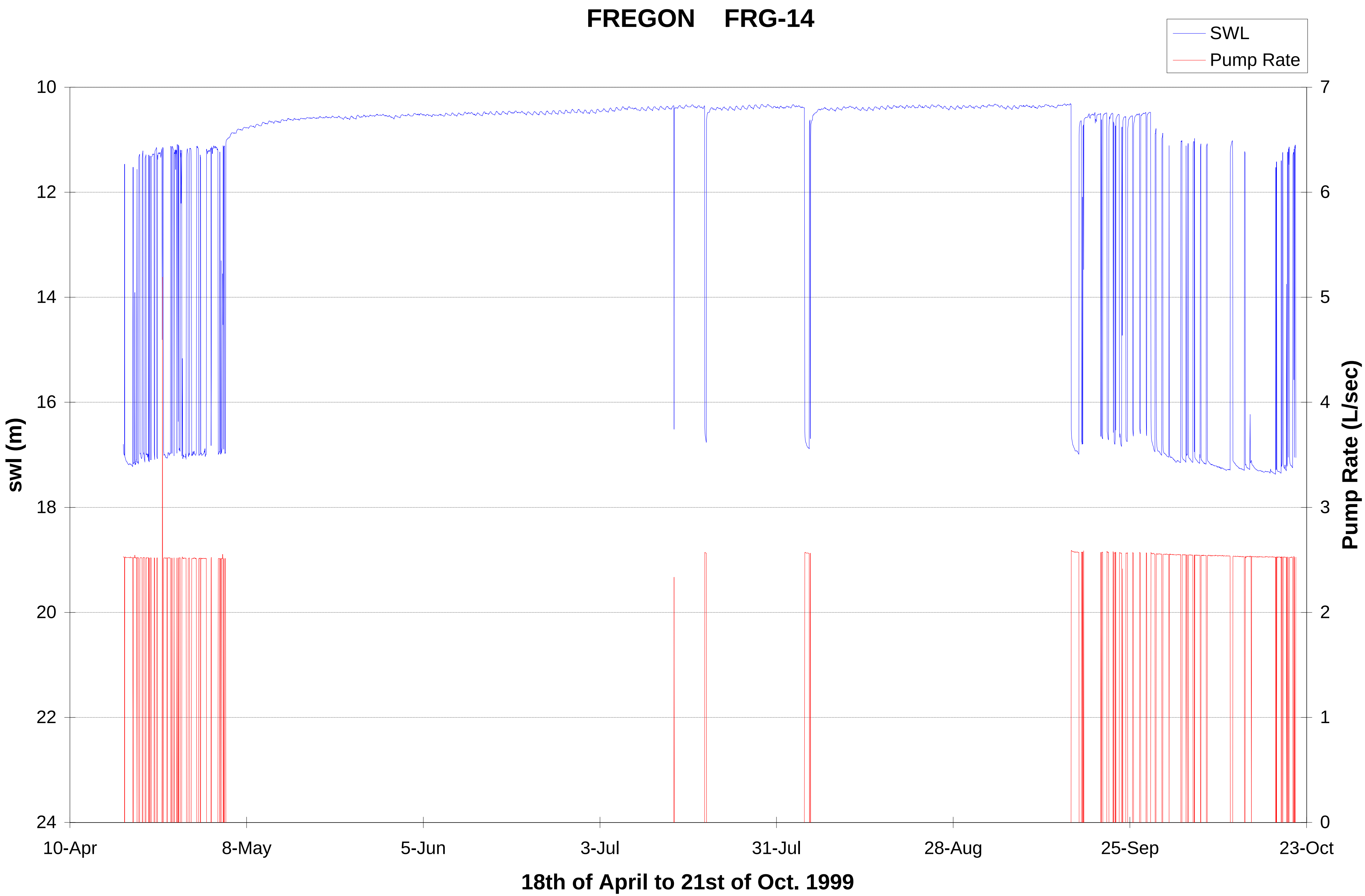
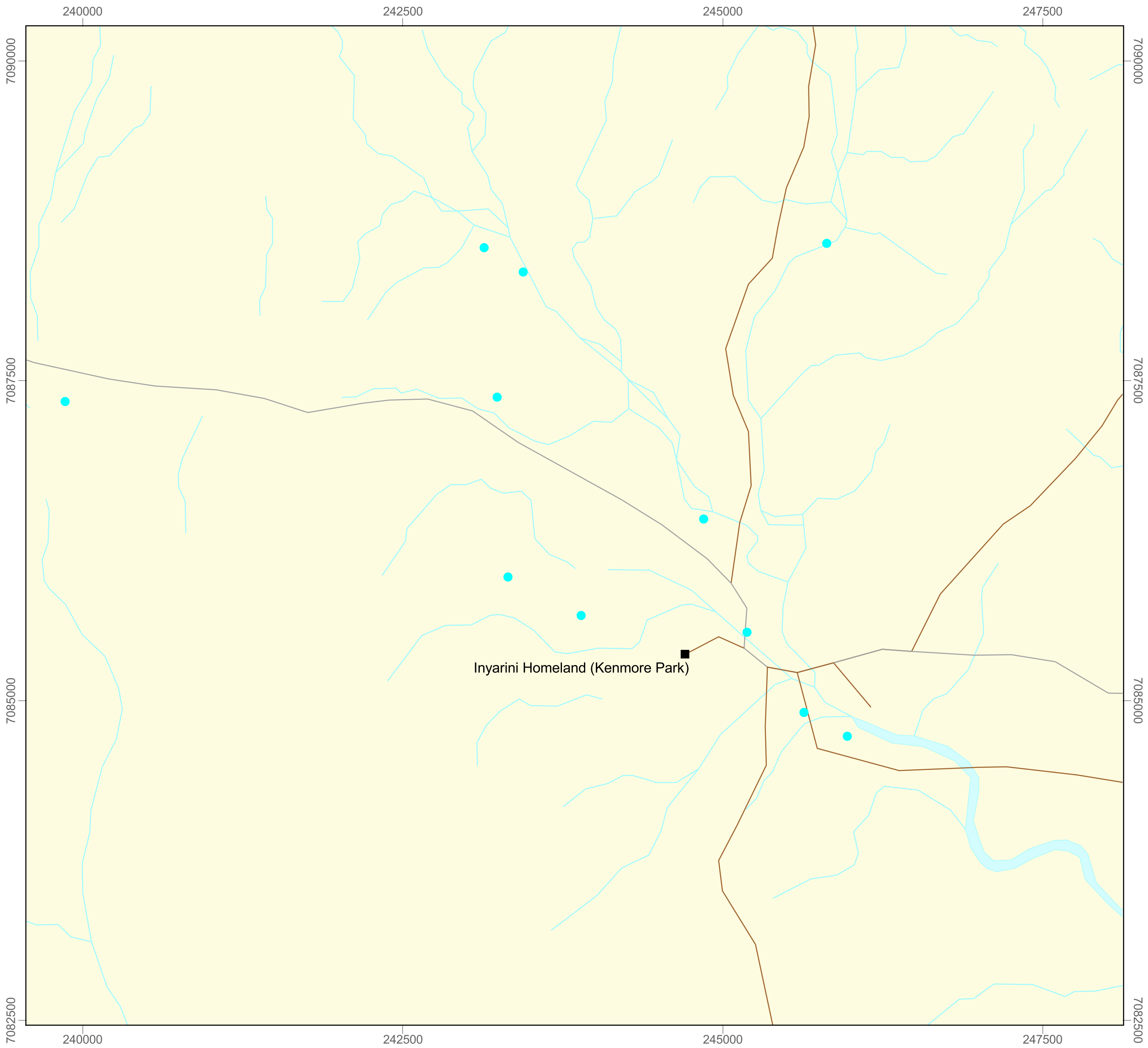


Figure 17 *Fregon FRG-14; Hourly SWL and Pump Rate*

Figure 18 *Fregon FRG-E4; Hourly SWL and Pump Rate*



● Monitored well

● Other wells

PRIMARY INDUSTRIES AND RESOURCES SA

0 1 2 Kilometers

Projection - AMG Zone 53
(Coordinates in metres)

Kenmore Park

WELL LOCATION

Figure 19

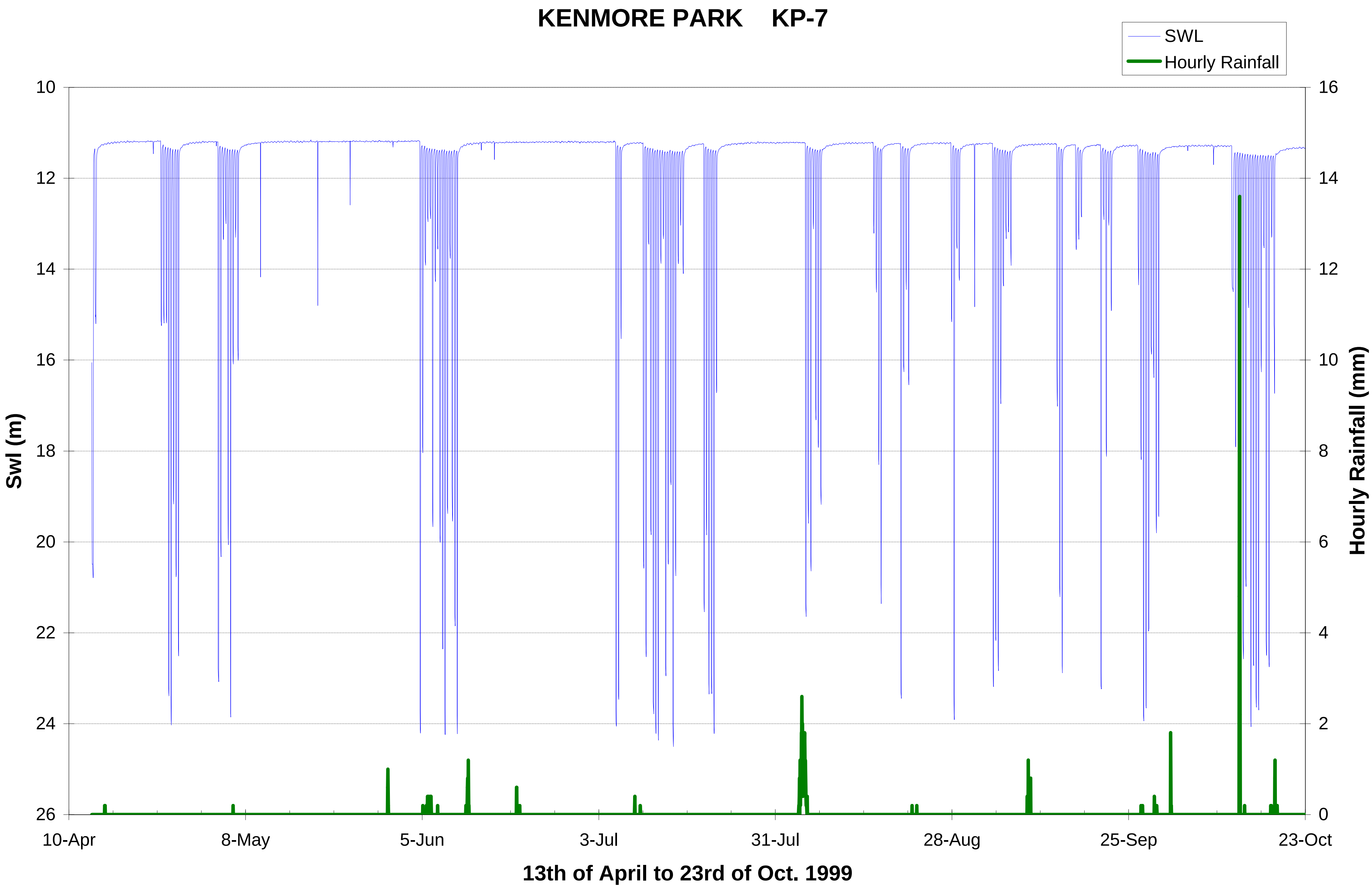


Figure 20 *Kenmore Park Rainfall - April to October 1999*

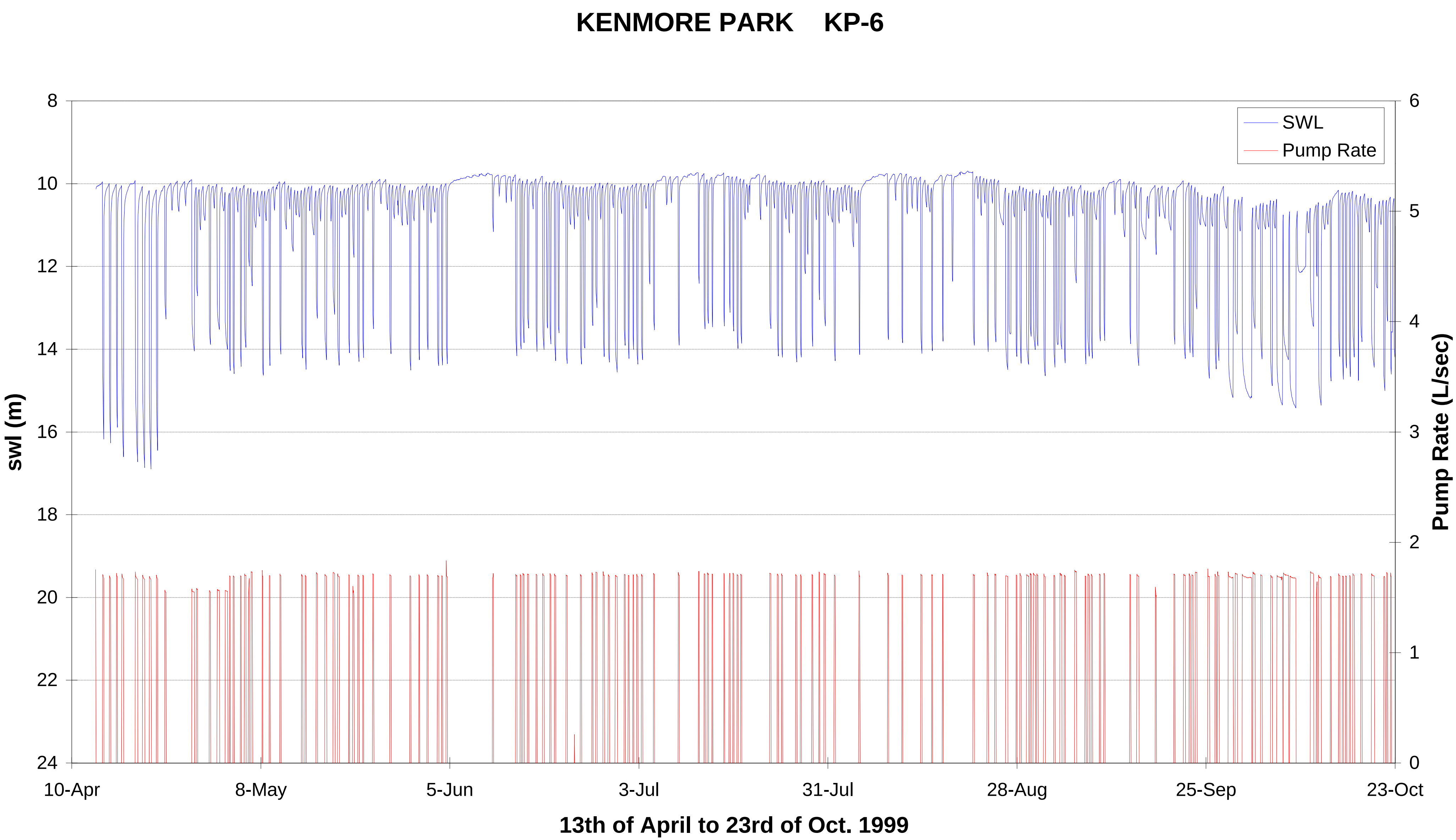


Figure 21 *Kenmore Park KP-6; Hourly SWL and Pump Rate*

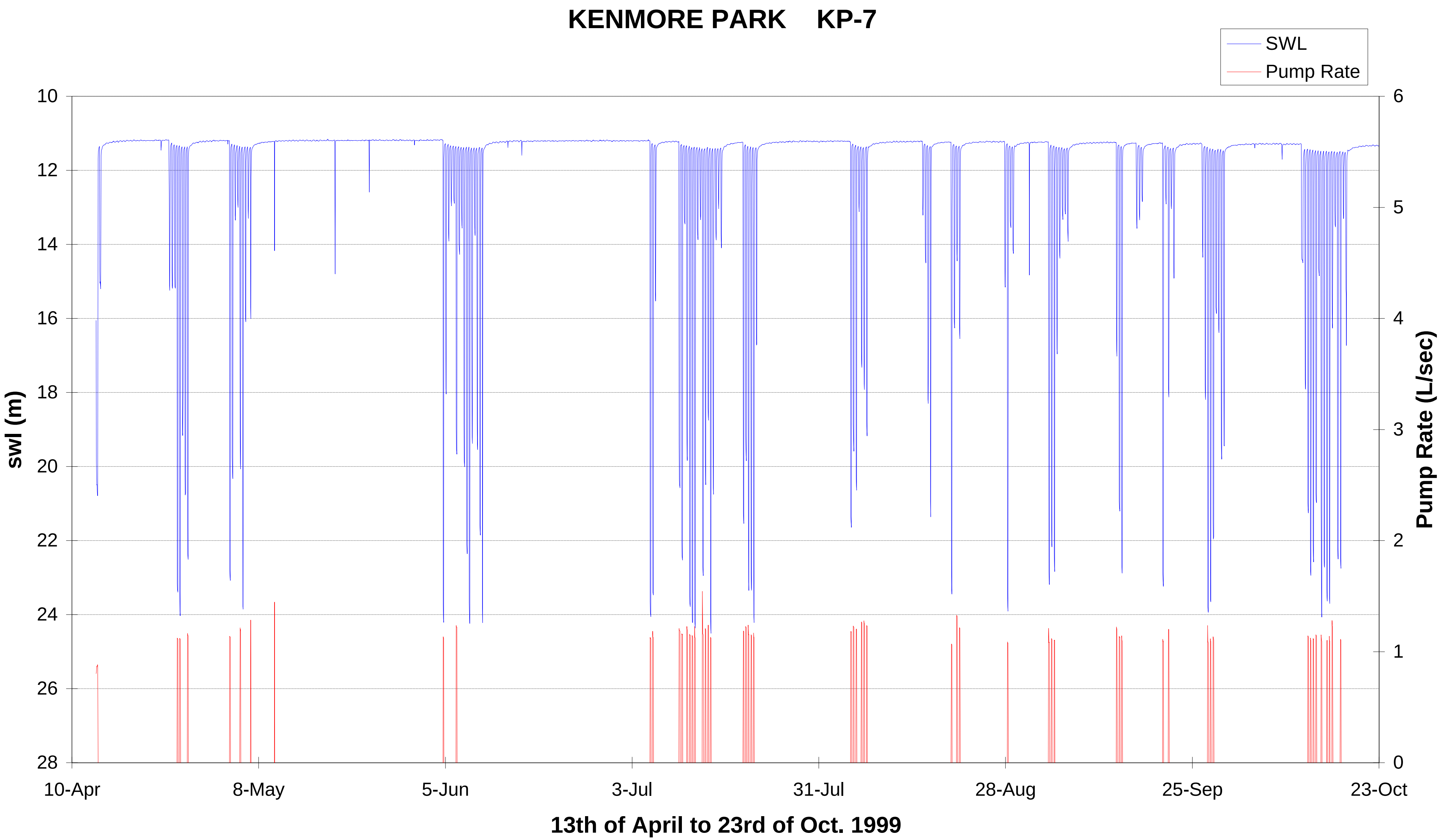
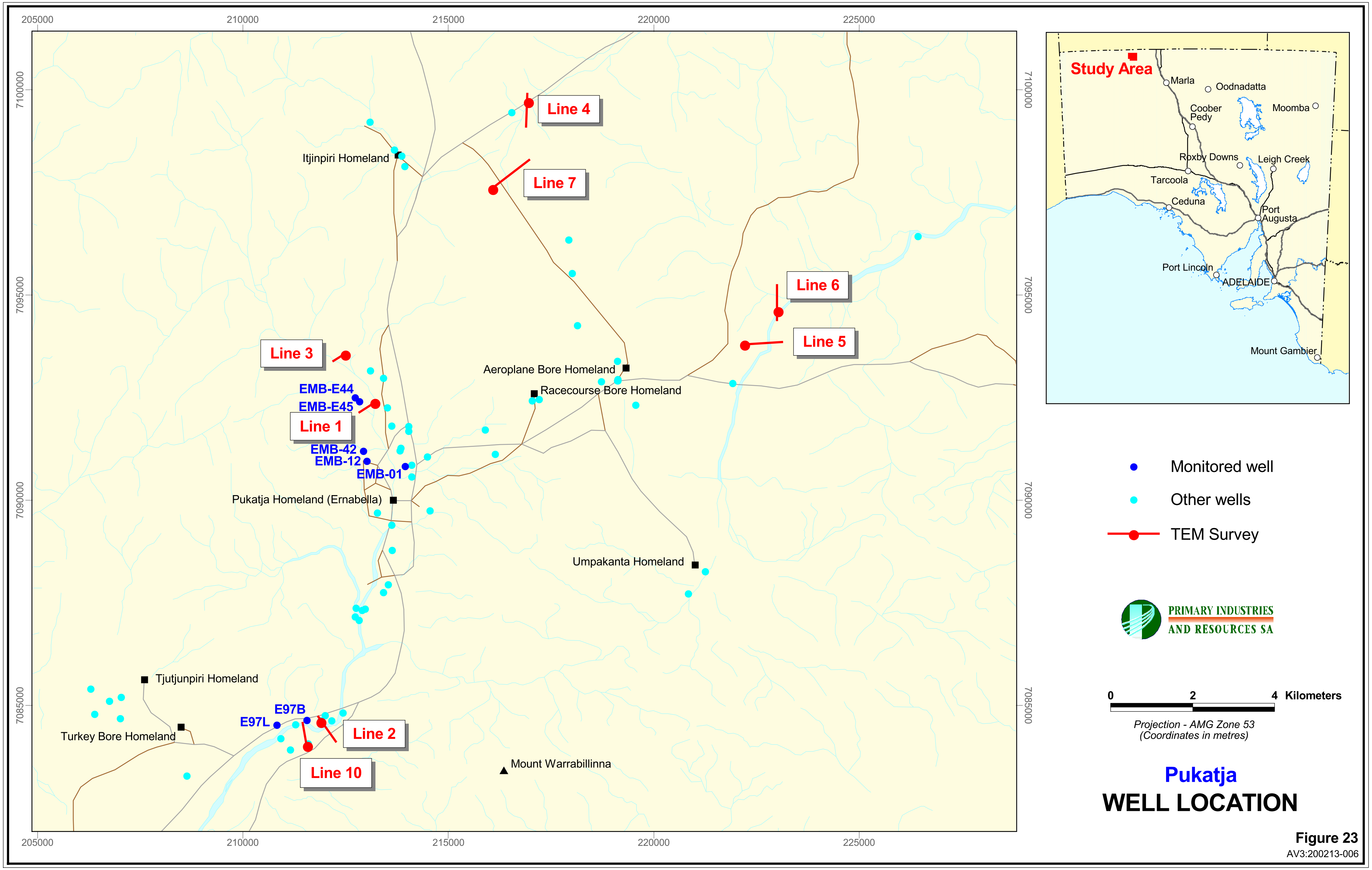


Figure 22 *Kenmore Park KP-7; Hourly SWL and Pump Rate*



205000
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215000
220000
225000
7100000
7095000
7090000
7085000
Line 4
Line 7
Line 6
Line 5
Line 3
Line 1
Line 2
Line 10
Itjinpiri Homeland
Aeroplane Bore Homeland
Racecourse Bore Homeland
Pukatja Homeland (Ernabella)
Umpakanta Homeland
Tjutjunpiri Homeland
Turkey Bore Homeland
Mount Warrabillinna
EMB-E44
EMB-E45
EMB-42
EMB-12
EMB-01
E97B
E97L
Study Area
Marla
Oodnadatta
Coober Pedy
Moomba
Roxby Downs
Leigh Creek
Tarcoola
Ceduna
Port Augusta
Port Lincoln
ADELAIDE
Mount Gambier
Monitored well
Other wells
TEM Survey
PRIMARY INDUSTRIES AND RESOURCES SA
0 2 4 Kilometers
Projection - AMG Zone 53
(Coordinates in metres)
Pukatja
WELL LOCATION
Figure 23
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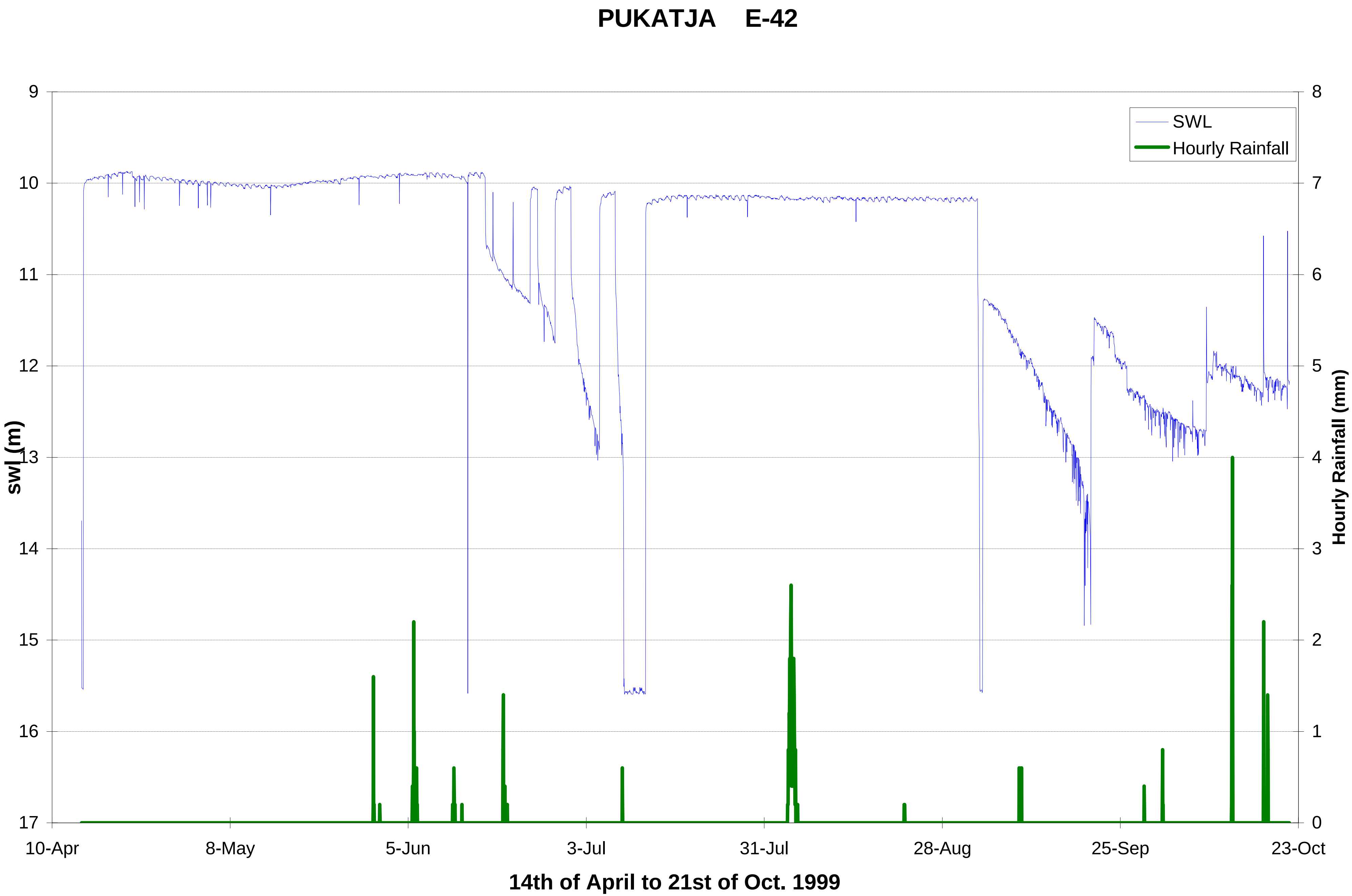


Figure 24 *Pukatja Rainfall - April to October 1999*

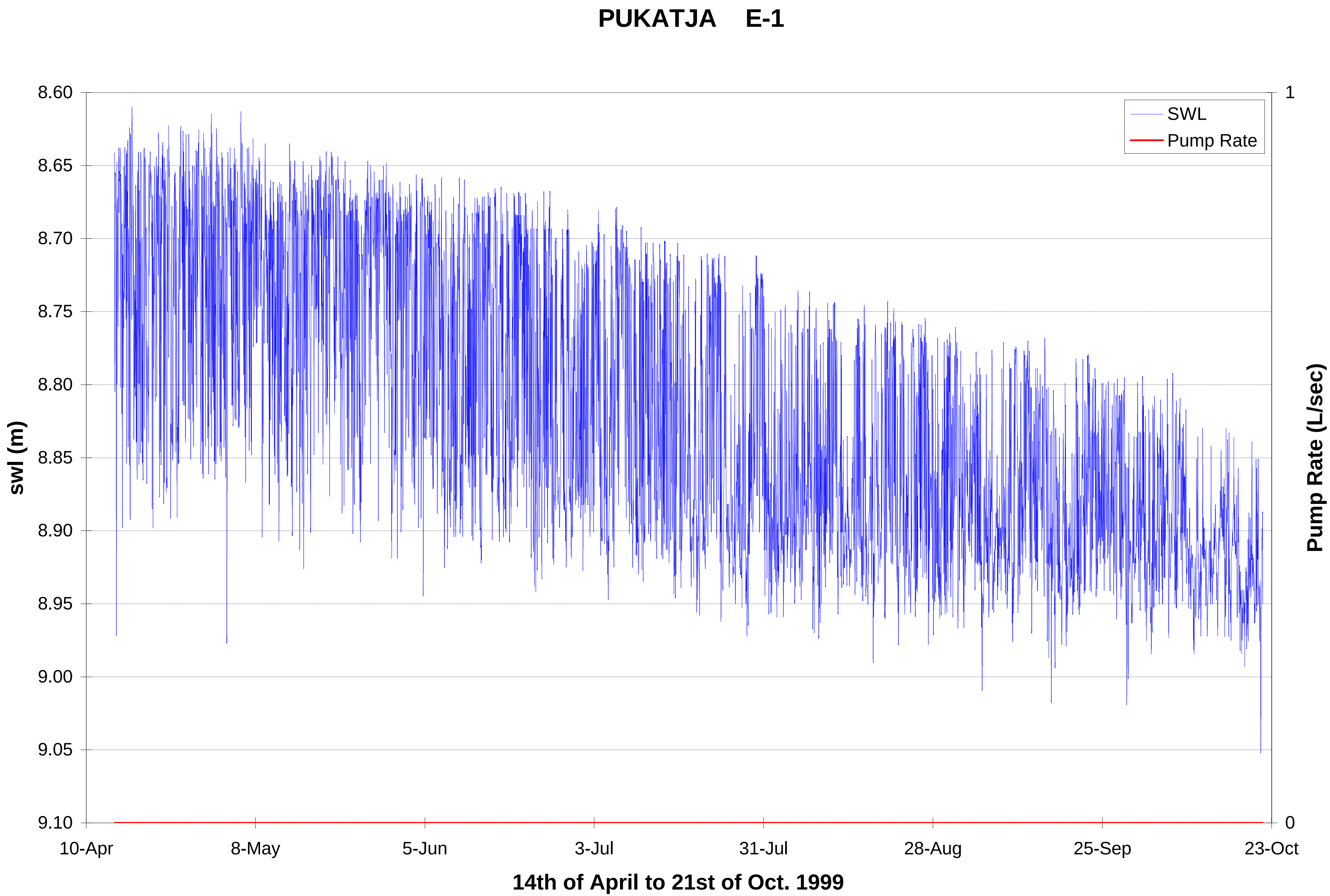


Figure 25 *Pukatja E-1; Hourly SWL and Pump Rate*

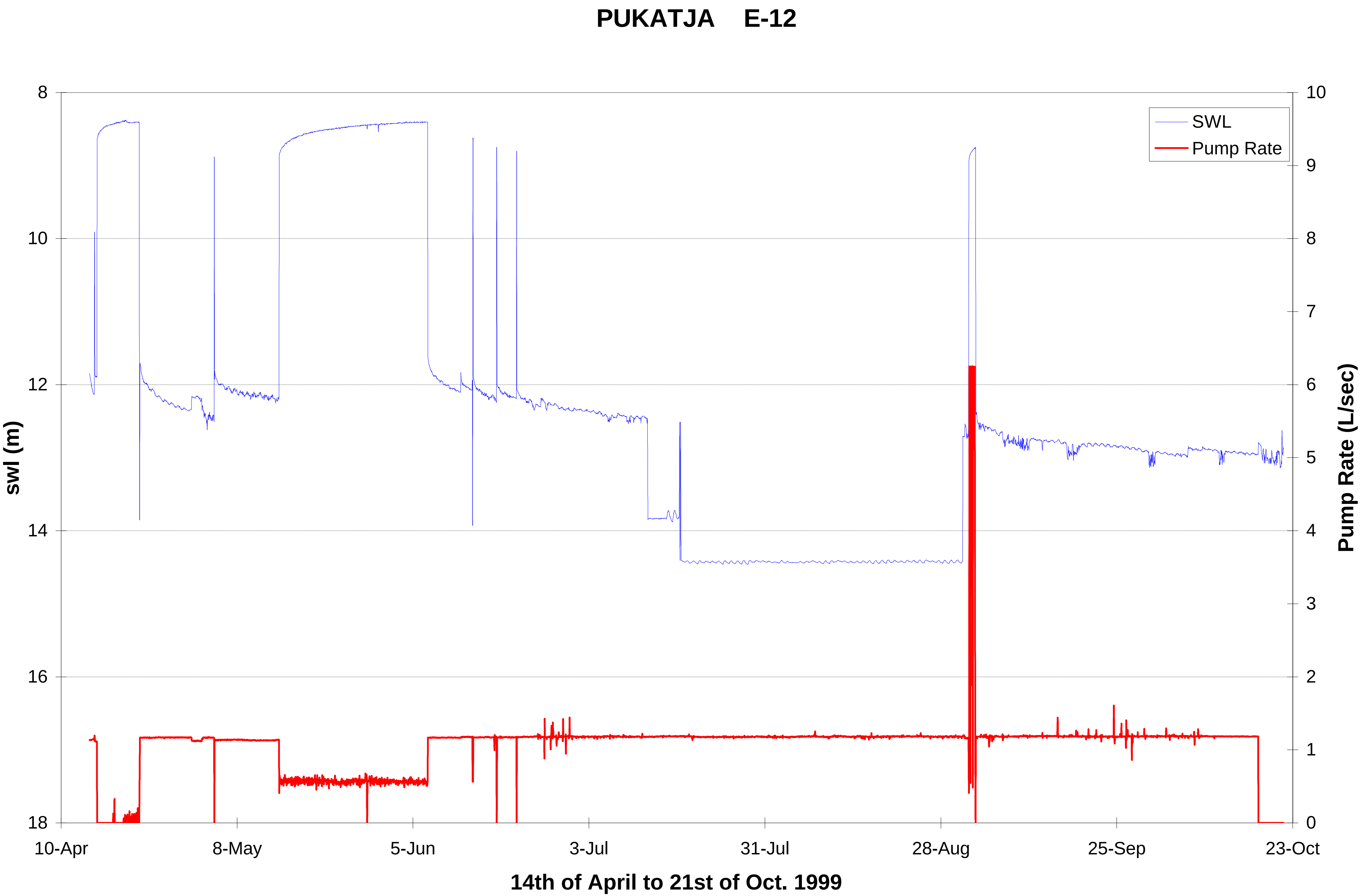


Figure 26 *Pukatja E-12; Hourly SWL and Pump Rate*

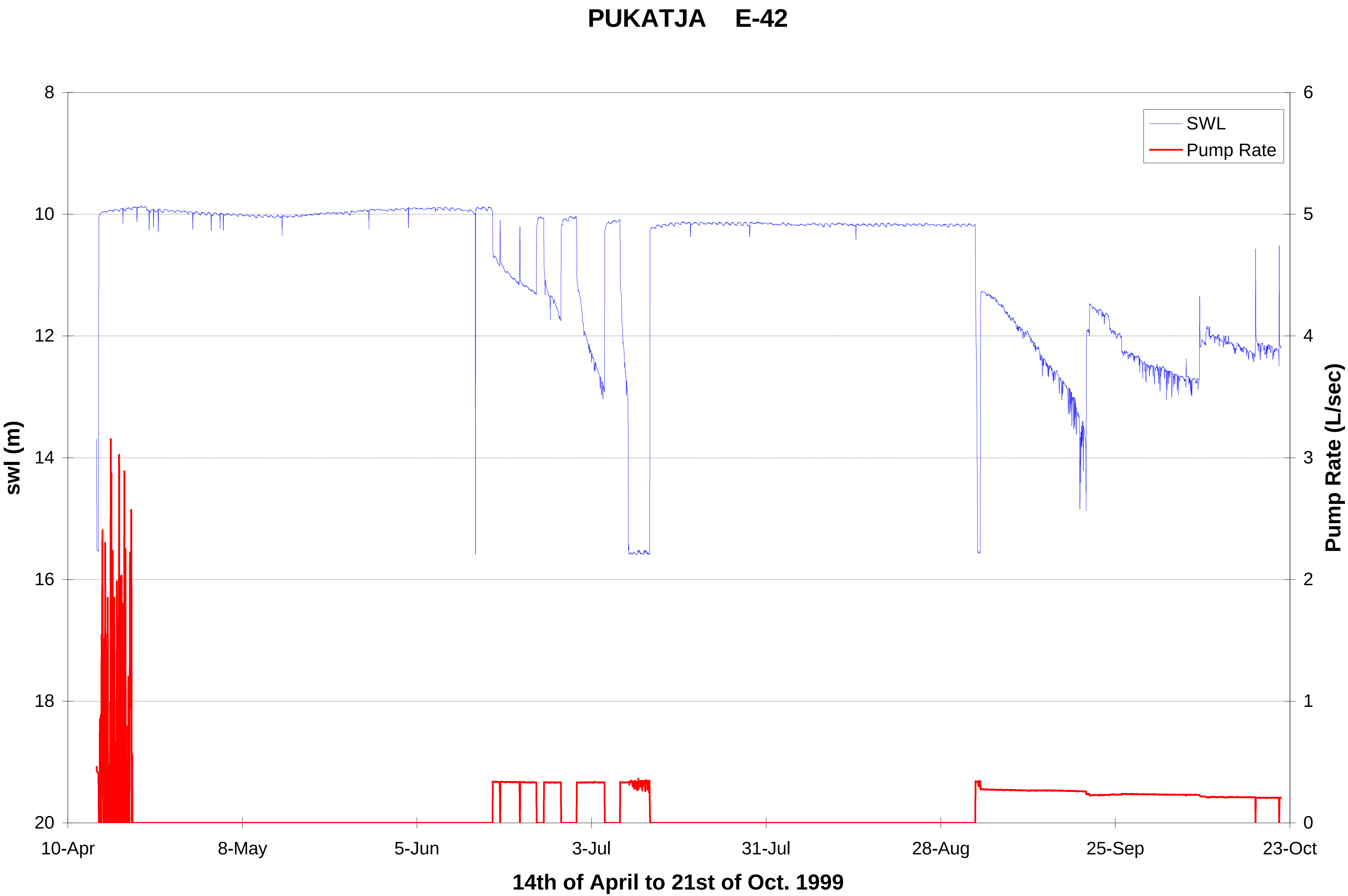


Figure 27 *Pukatja E-42; Hourly SWL and Pump Rate*

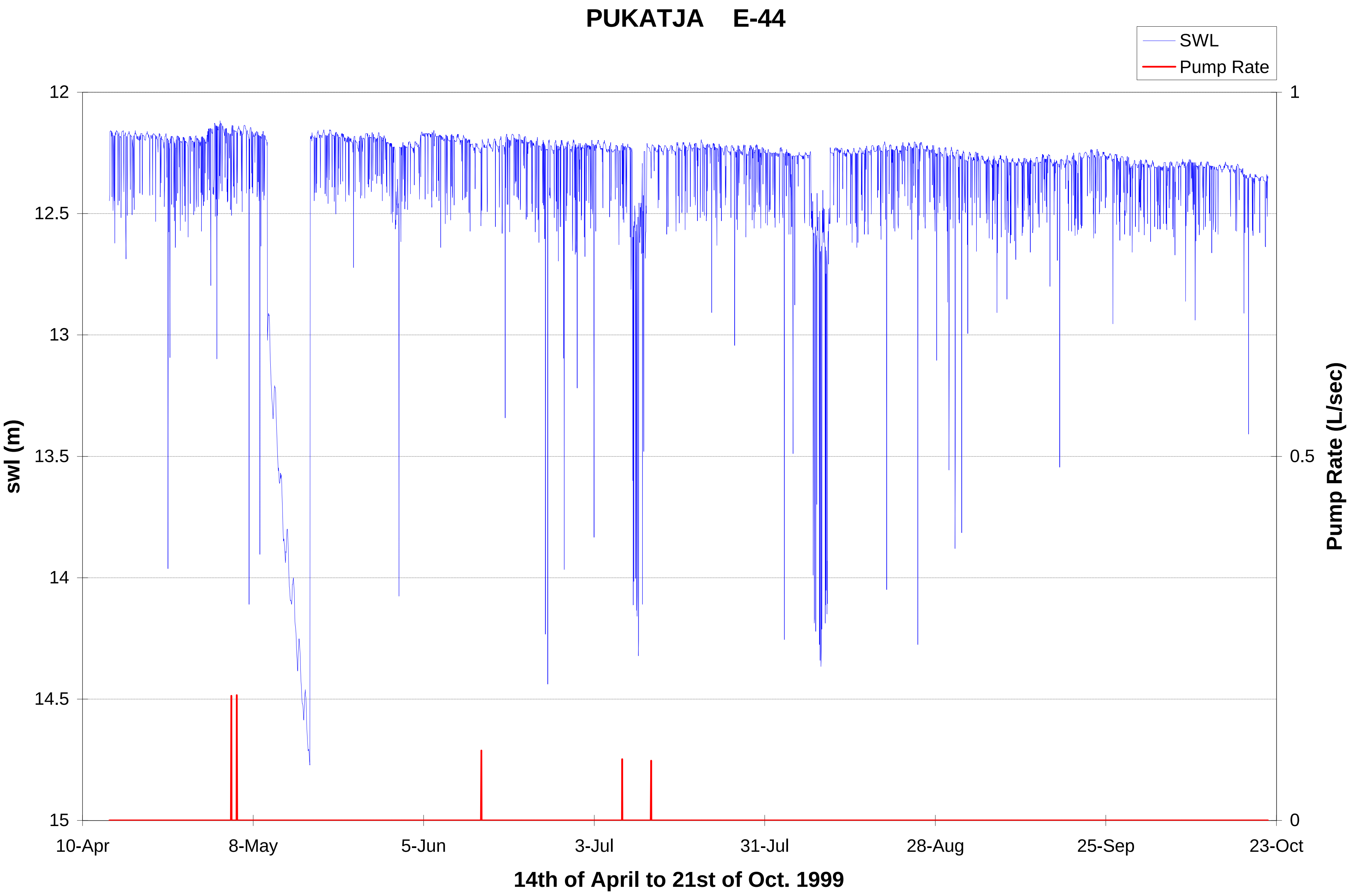


Figure 28 *Pukatja E-44; Hourly SWL and Pump Rate*

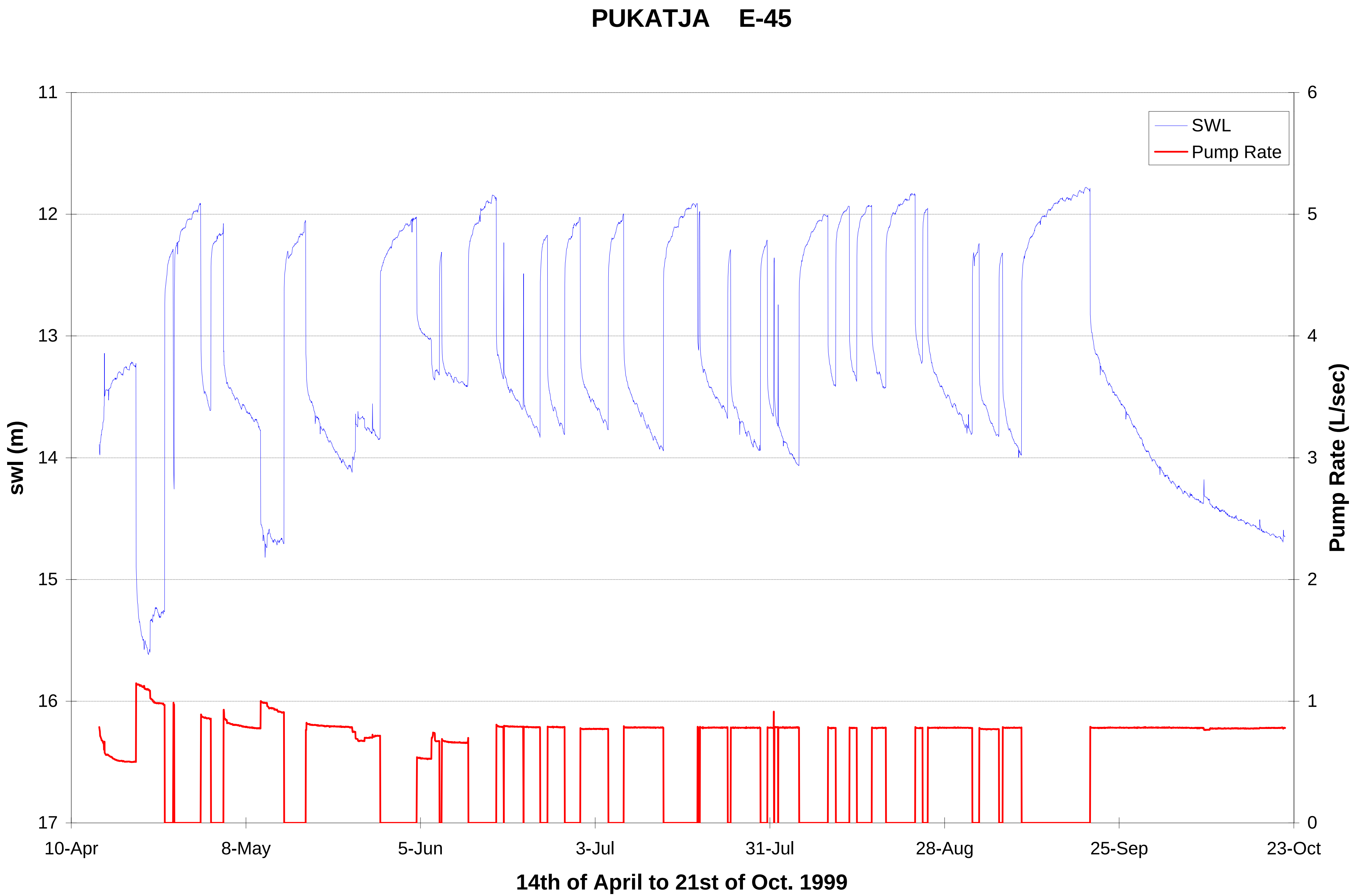


Figure 29 *Pukatja E-45; Hourly SWL and Pump Rate*

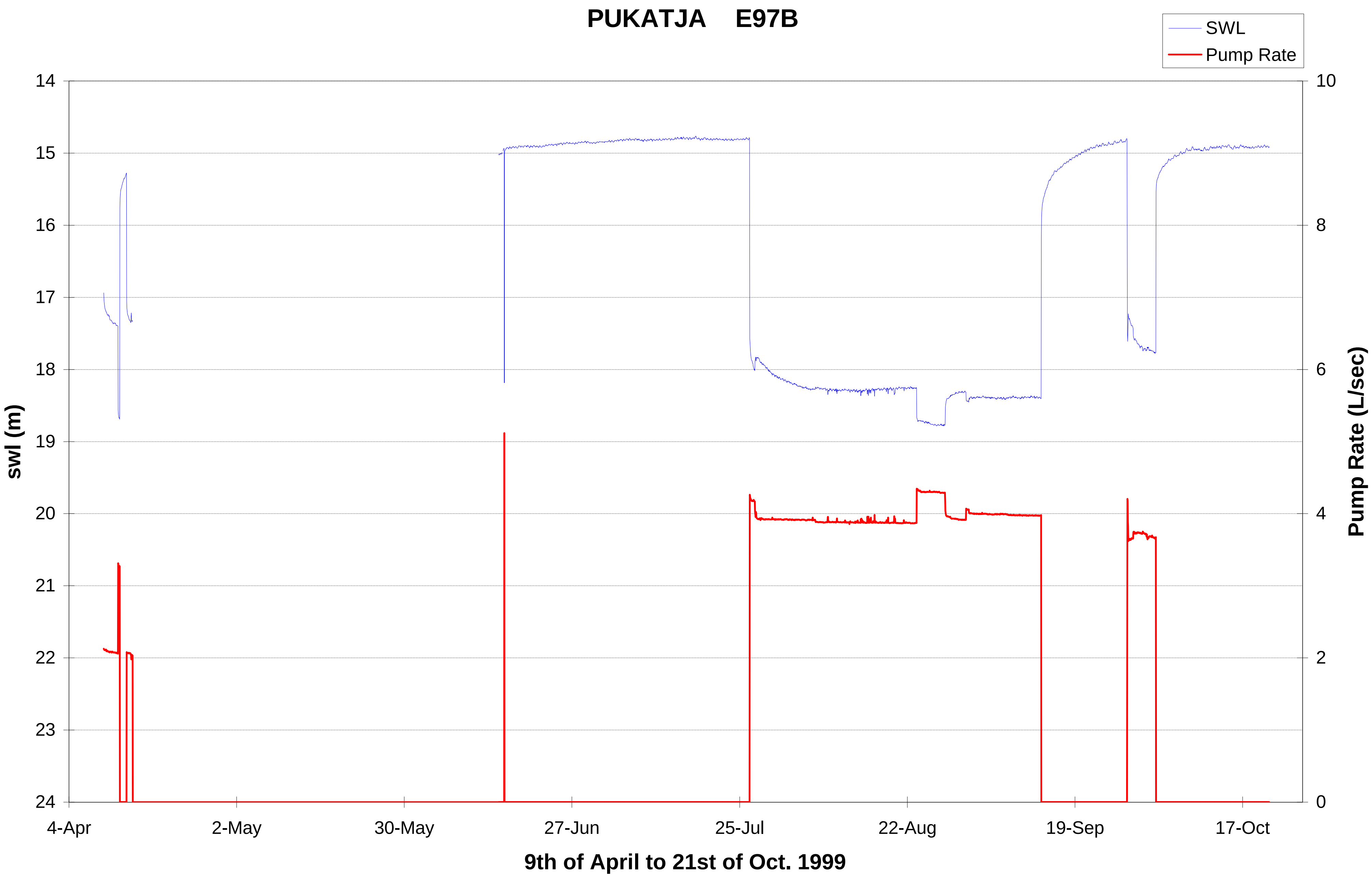


Figure 30 *Pukatja E-97B; Hourly SWL and Pump Rate*

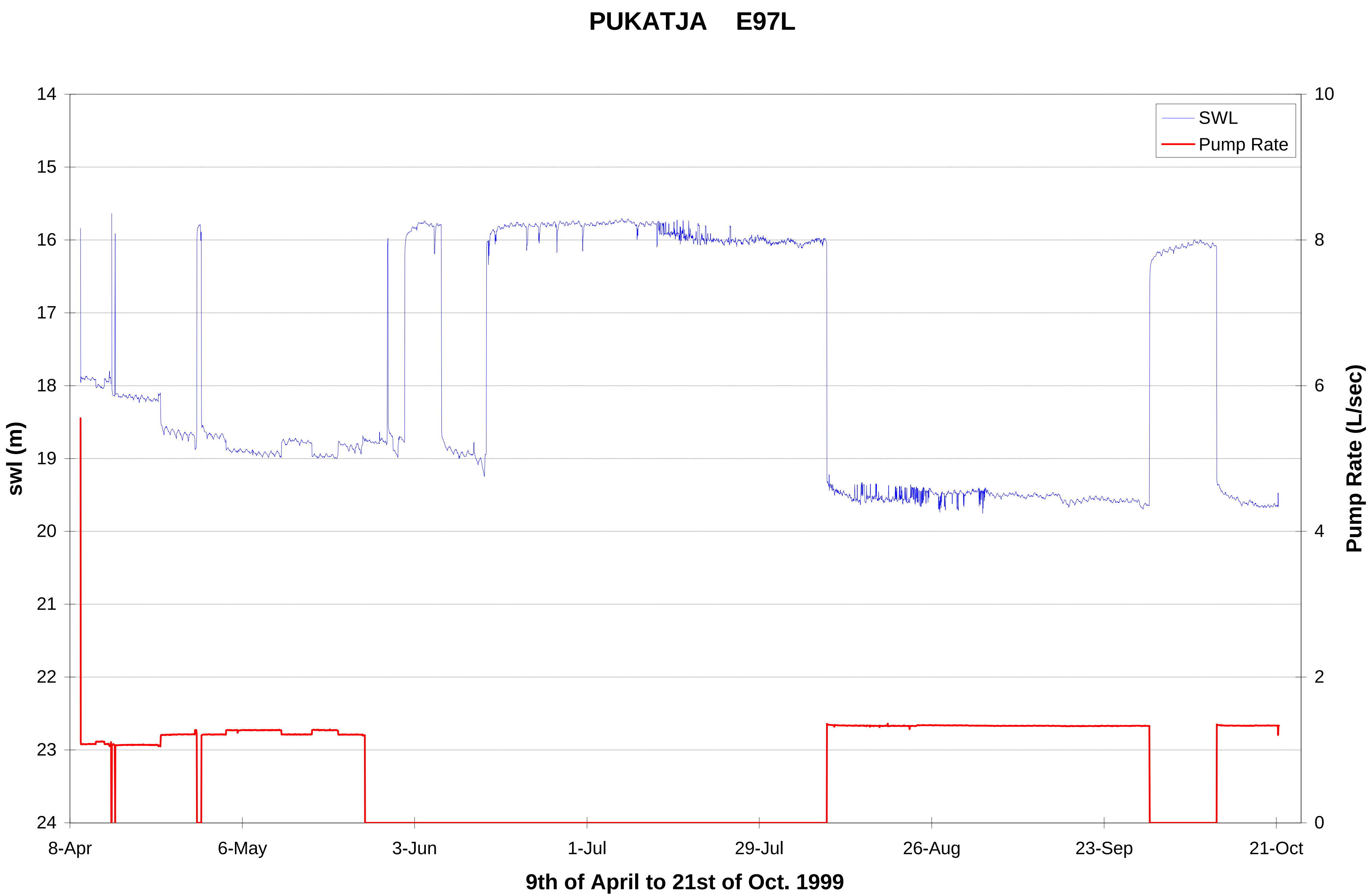
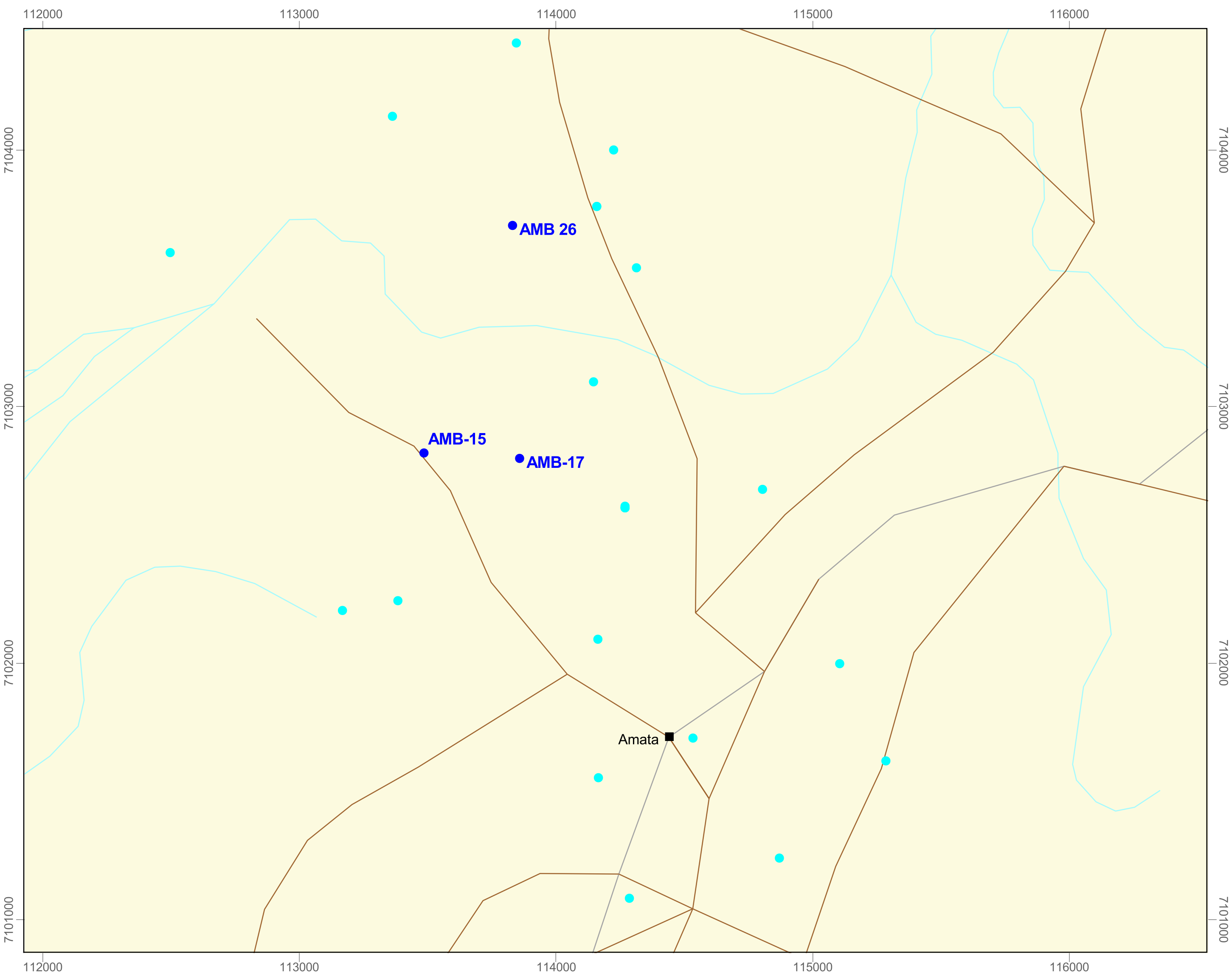


Figure 31 *Pukatja E-97L; Hourly SWL and Pump Rate*



Monitored well

Other wells

PRIMARY INDUSTRIES AND RESOURCES SA

0 500 1000 Meters

Projection - AMG Zone 52
(Coordinates in metres)

Amata
WELL LOCATION

Figure 32

AV3:200213-007

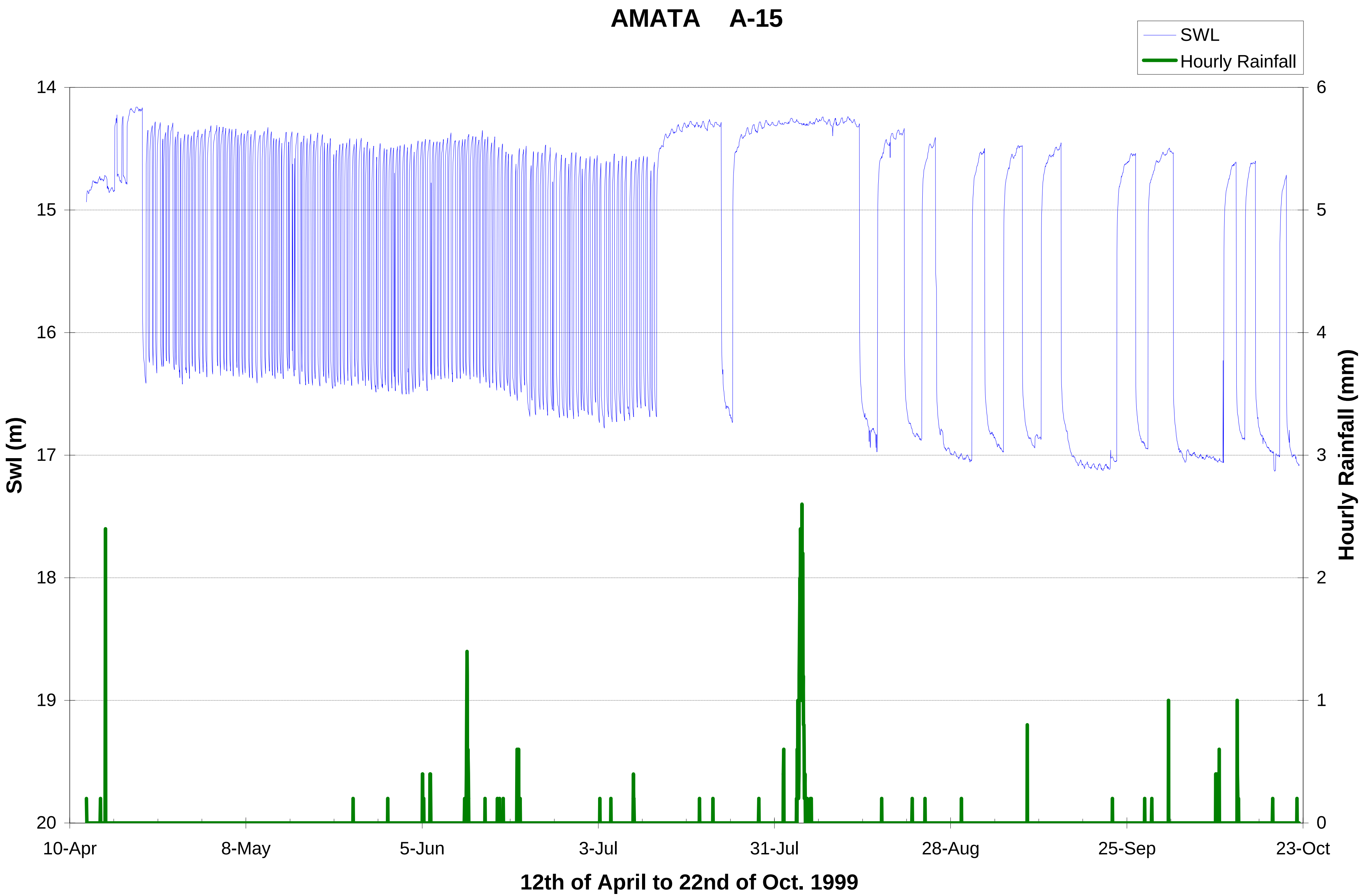


Figure 33 *Amata Rainfall - April to October 1999*

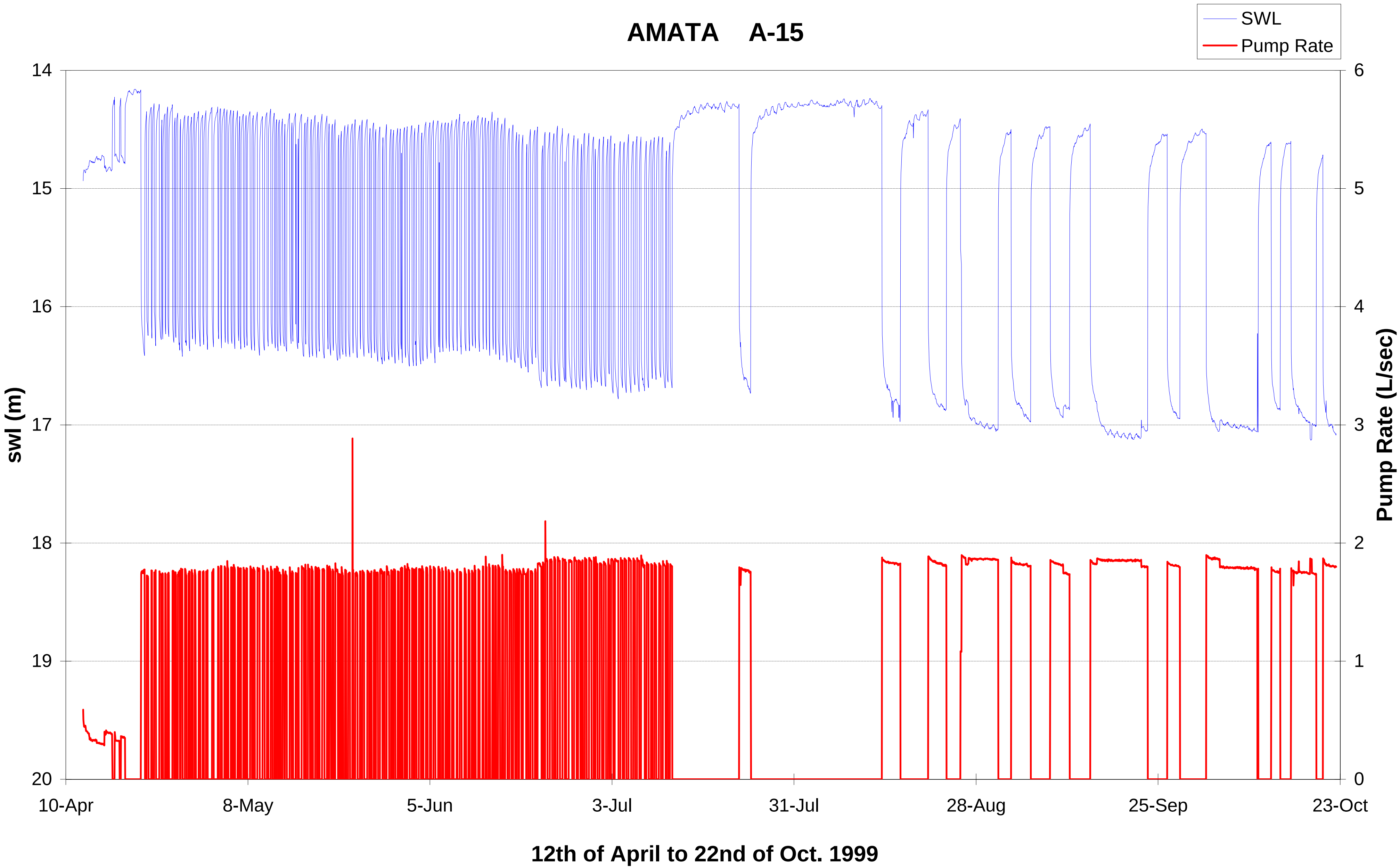


Figure 34 *Amata A-15; Hourly SWL and Pump Rate*

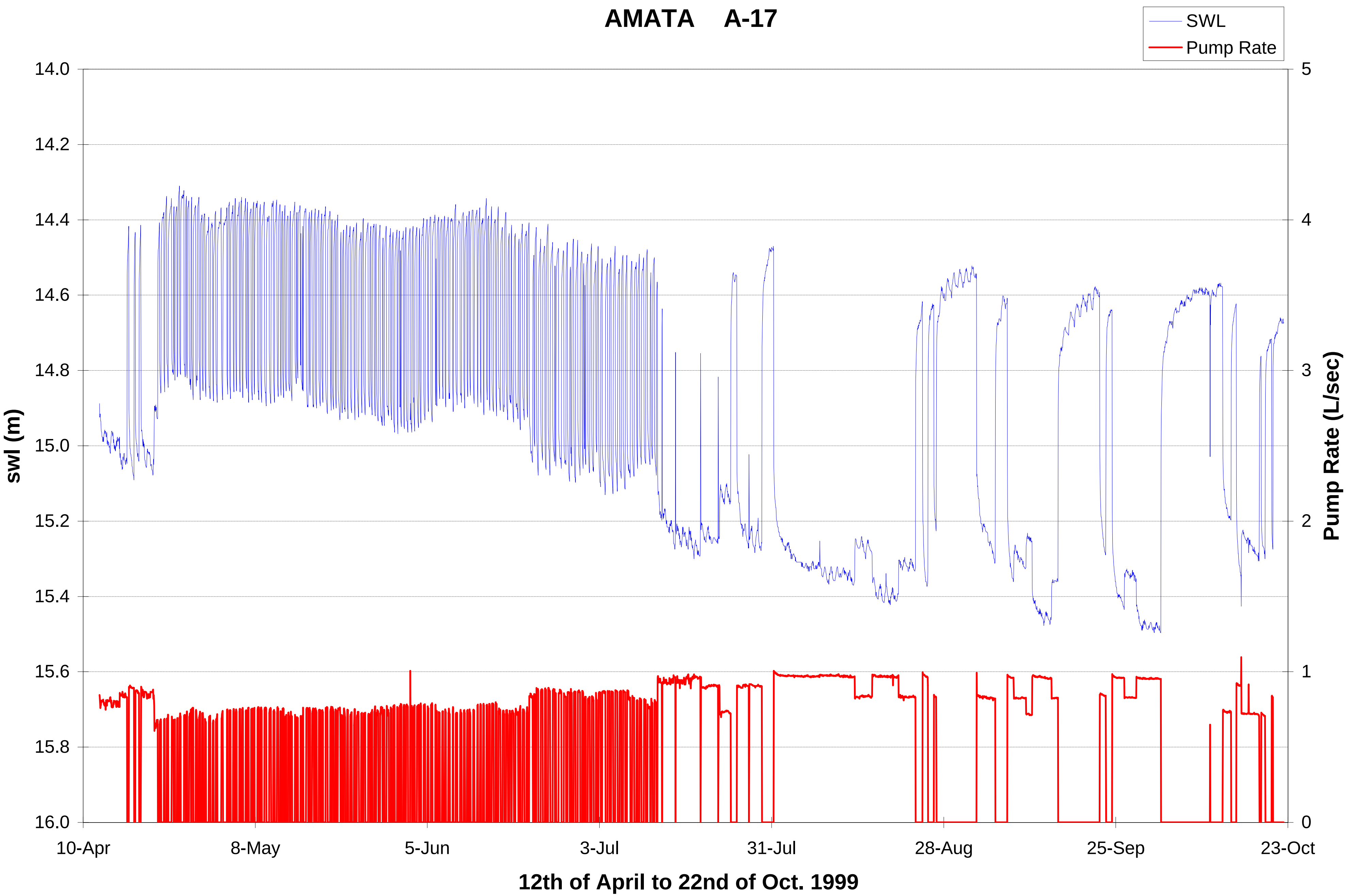


Figure 35 *Amata A-17; Hourly SWL and Pump Rate*

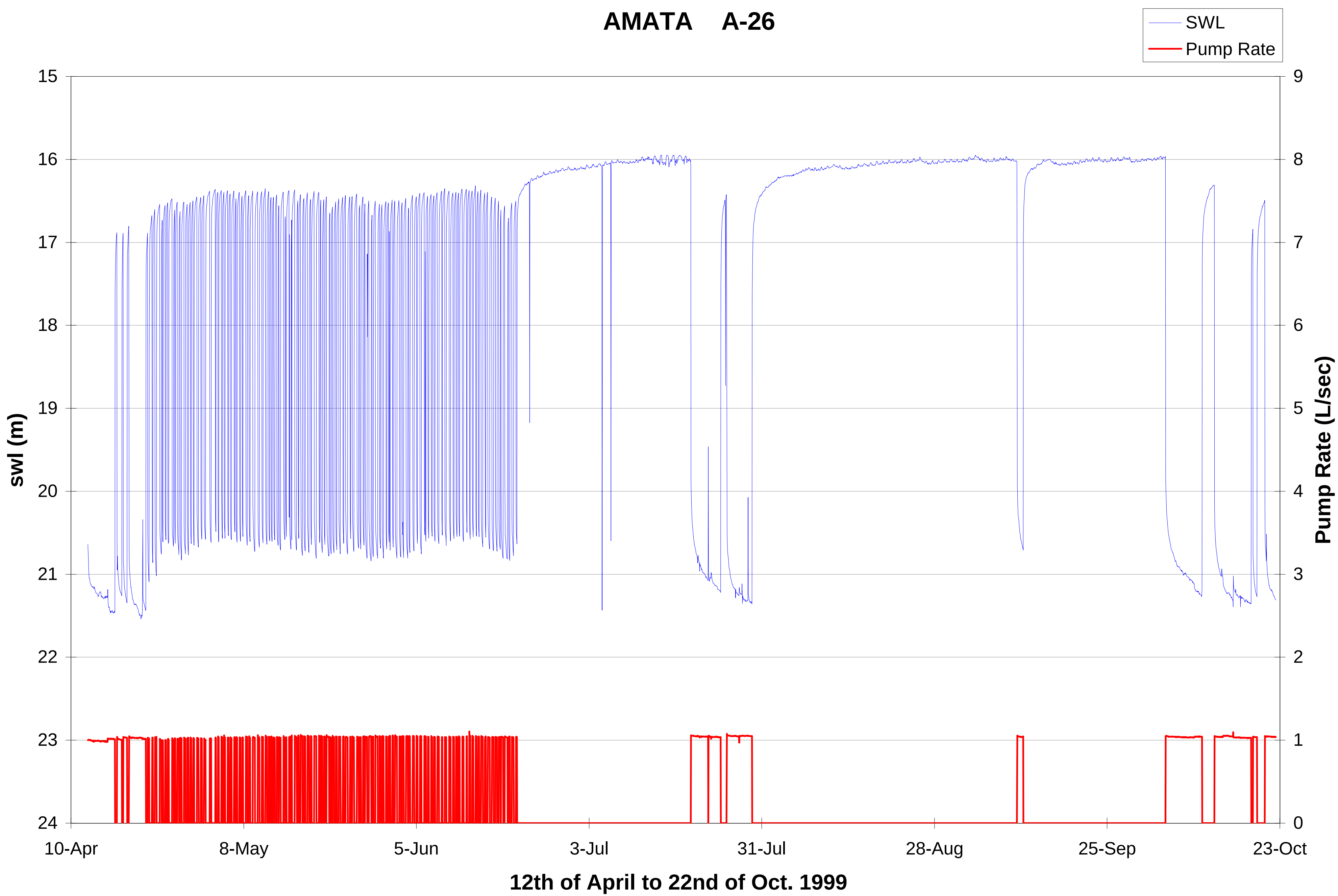
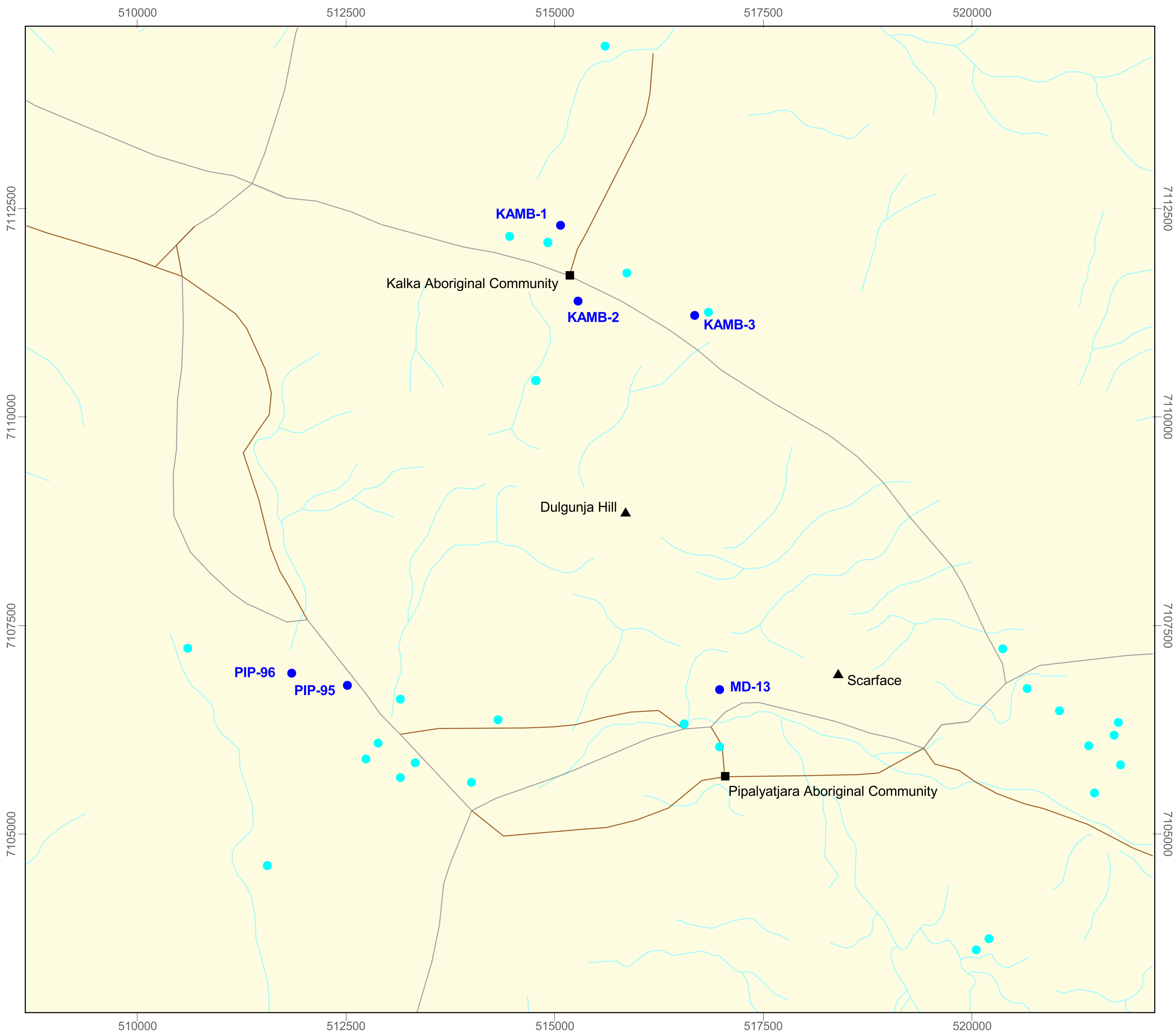


Figure 36 *Amata A-26; Hourly SWL and Pump Rate*



● Monitored well

● Other wells

PRIMARY INDUSTRIES AND RESOURCES SA

0 1 2 Kilometers

Projection - AMG Zone 52
(Coordinates in metres)

Kalka and Pipalyatjara

WELL LOCATION

Figure 37
AV3:200213-008

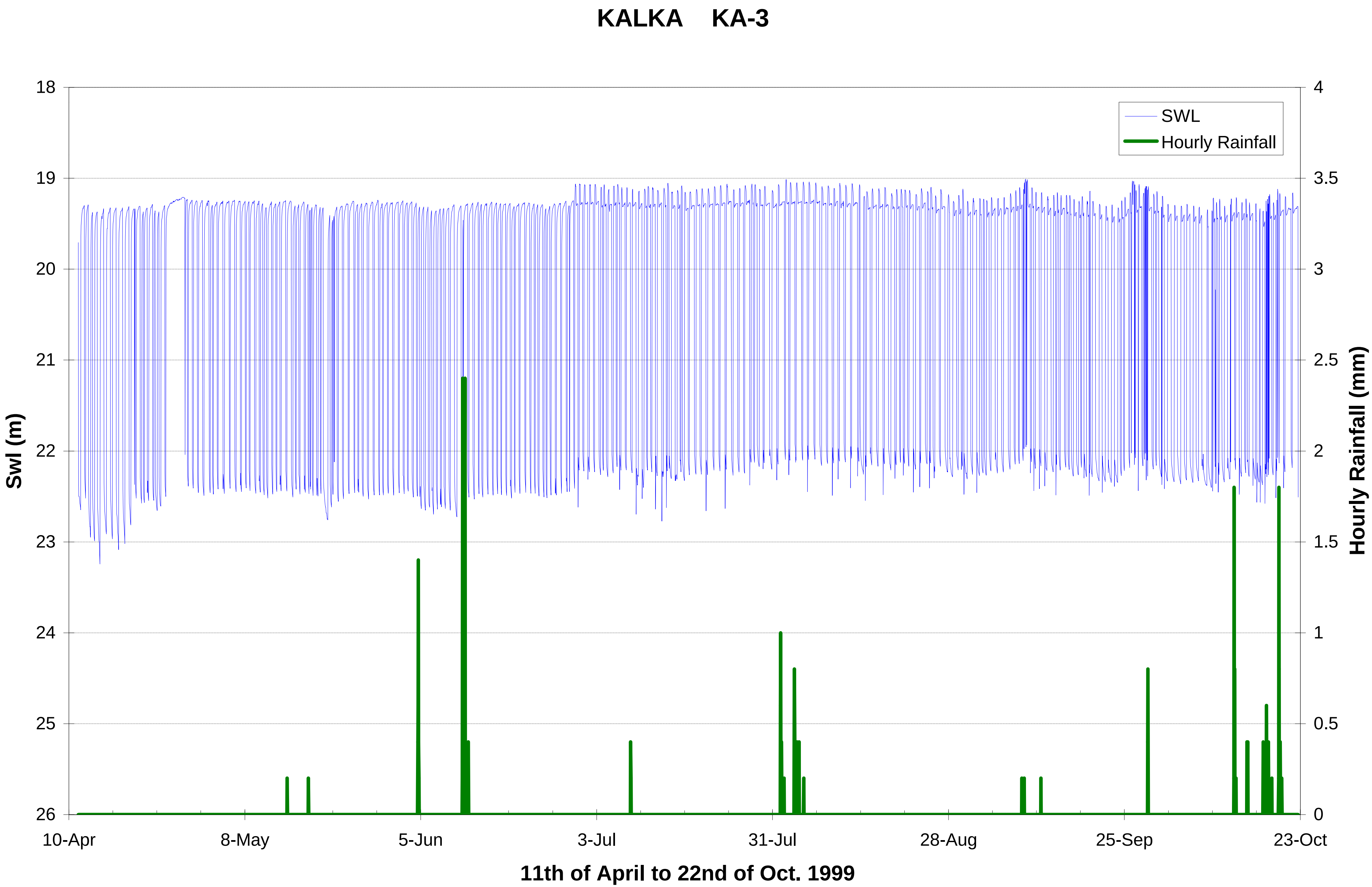


Figure 38 *Kalka Rainfall - April to October 1999*

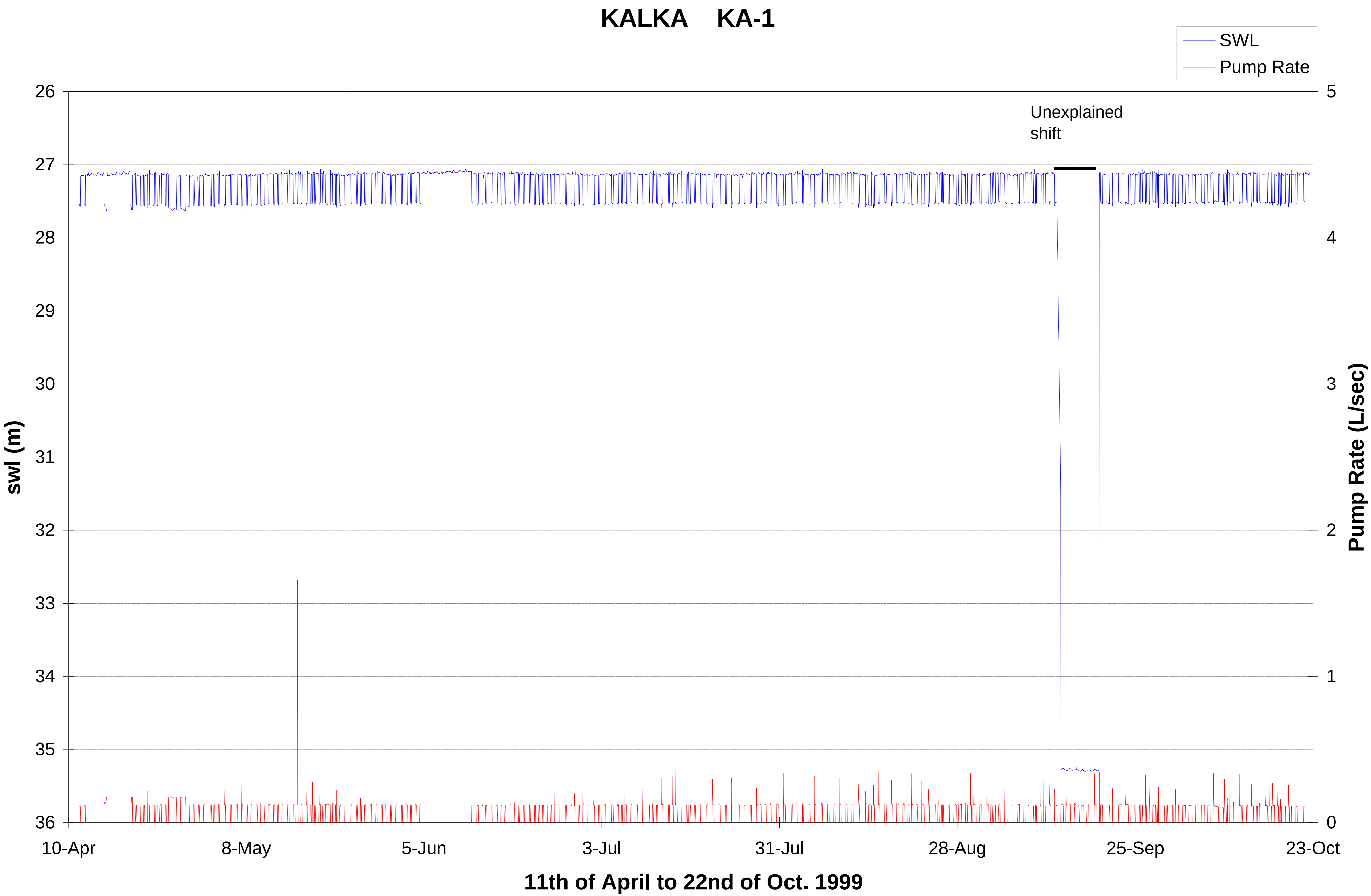


Figure 39 *Kalka KA-1; Hourly SWL and Pump Rate*

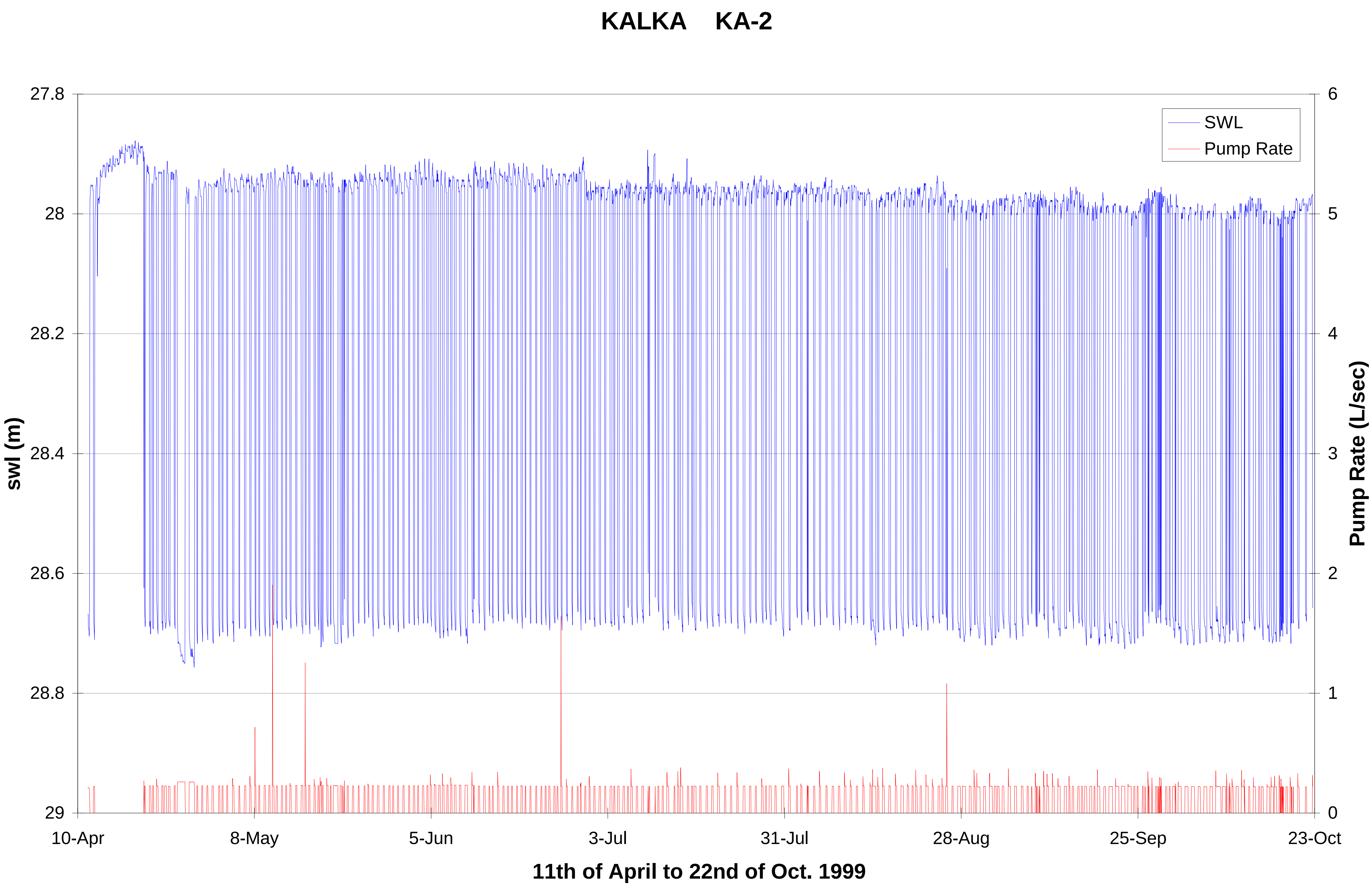


Figure 40 *Kalka KA-2; Hourly SWL and Pump Rate*

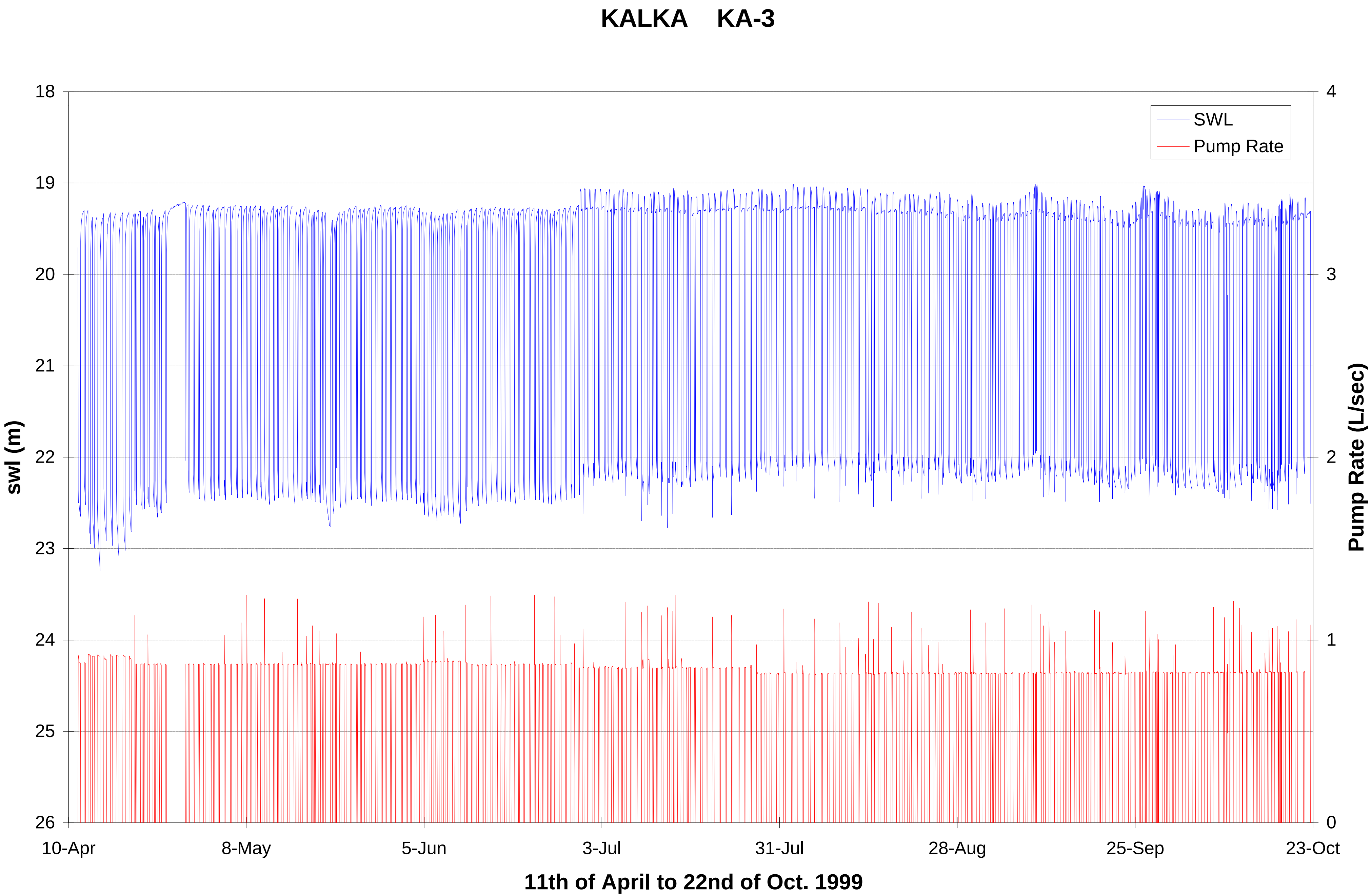


Figure 41 *Kalka KA-3; Hourly SWL and Pump Rate*

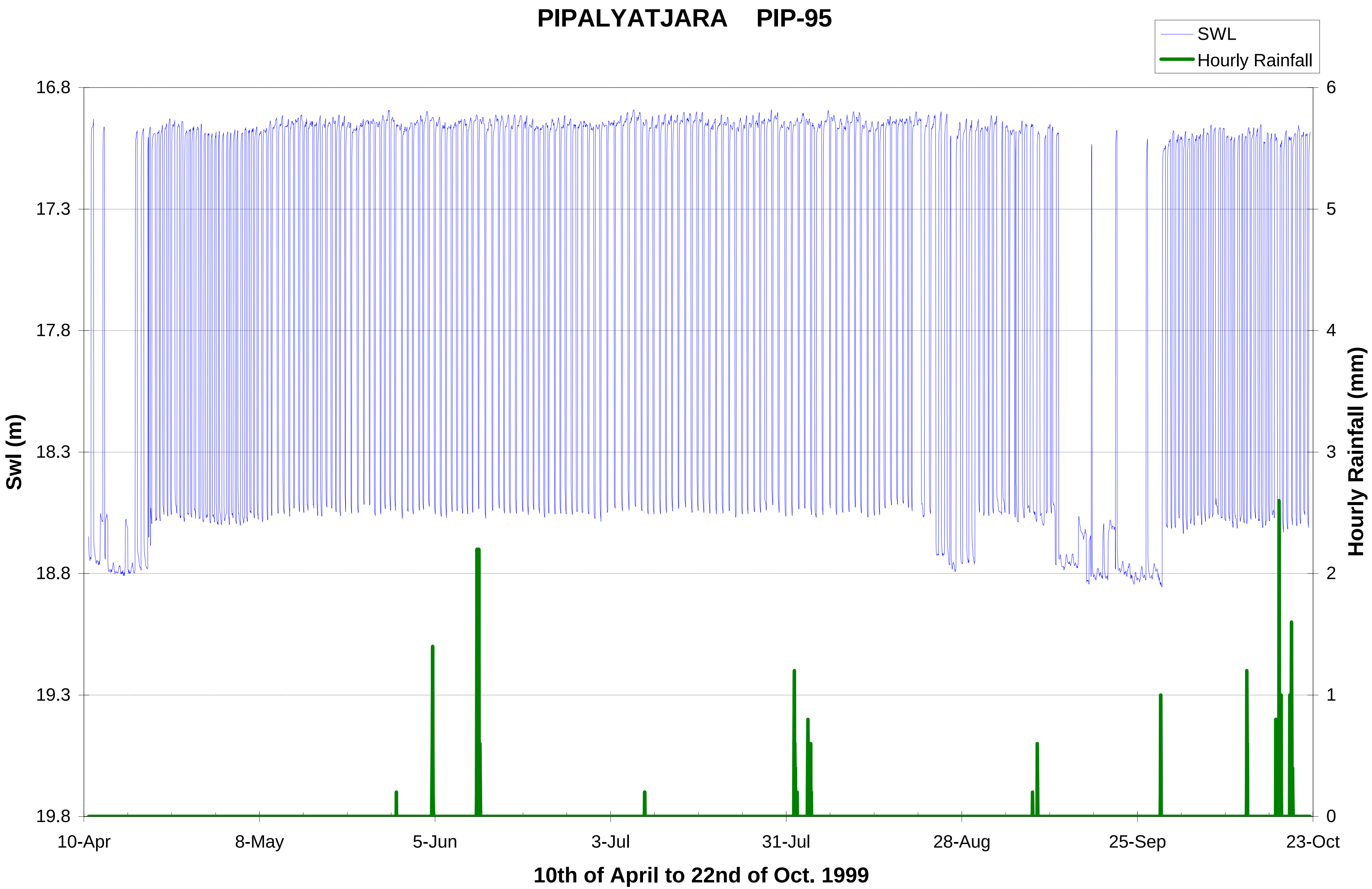


Figure 42 *Pipalyatjara Rainfall - April to October 1999*

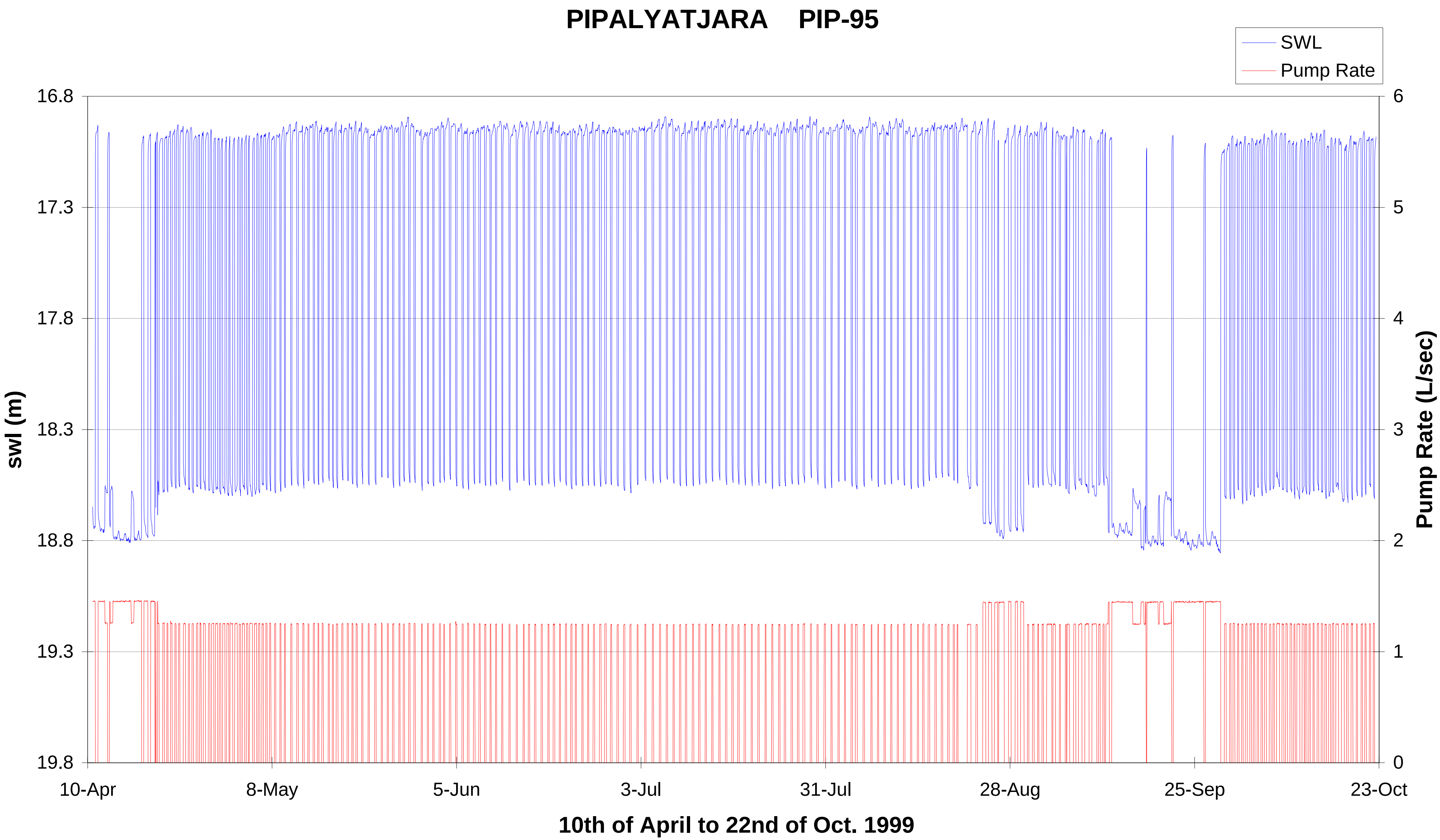


Figure 43 *Pipalyatjara PIP-95; Hourly SWL and Pump Rate*

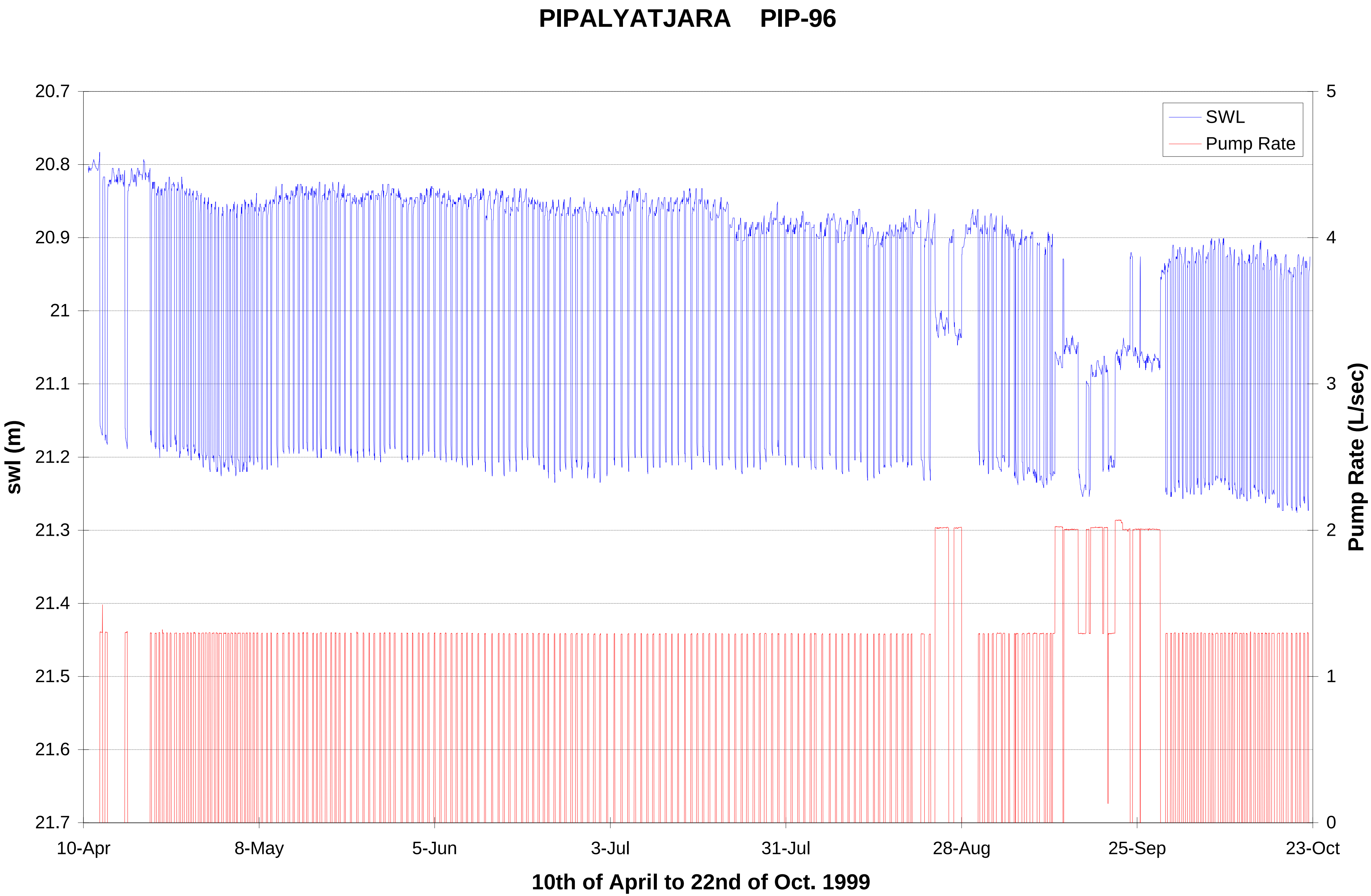


Figure 44 *Pipalyatjara PIP-96; Hourly SWL and Pump Rate*

Appendix A

Operational Report

B.J. Traeger

To:- J. Alvey, M. Goodchild, S. Dodds.
From:- B. Traeger
Date:- 29 October, 1999
SUBJECT:- N.W. Aboriginal Lands Data loggers.

The following report relates to results down loaded in October 1999.

INDULKANA (20 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
19	16.660	N/A	0.352	990.89
19A	31.435	31.460	N/A	2159
25	12.375	N/A	0.525	3367.0
26	Flowing	0.220	0.25	2815.966
27	32.850	N/A	N/A	787.75
IR1	37.415			
IR2	55.485			

Notes:-
Accumulated flow for all Indulkana bores was from 15 April 1999 to 20 October 1999.
Rain gauge reading at bore 19 was 41.6 mm for the same period.
All data loggers were software upgraded and are now Y2K compliant.

Inputs were transferred from channels 1 & 2 to 3 & 4.
There is a block of false SWL data from 7 Oct. to 9 Oct. which cannot be explained.

25 The step in the SWL data during the period 9 Oct. to 11 Oct. corresponds exactly with a step change in the flow data. However the SWL shows greater draw down while the flow data shows reduced flow which is not the predicted response. This anomaly way be due to a fault in the data logger and data from this site will require greater scrutiny during the next site visit.
The pressure transducer 2100P was found to be faulty, reading 0.00 metres head of water.
S/N 210 362 failed on the 9 Sept. and was removed and replaced with S/N 210 359.

27 Water level in the bore was unable to be measured and a flow was unable to be established to check the flowrate.

IR1 & IR2 have been fitted with a set of data logging equipment. There was a substantial difference between the proposed control circuit diagram and that which was installed, which raises a point of concern. There was no way of being able to control power to the inductive flow meter so that power would only be applied while the pump was running and the flow meter chamber was filled. As a result the flow meter can have power applied while the flow chamber is empty, which will result in spurious readings and may cause permanent damage to the instrument.

MIMILI (20 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
M1	16.050	16.050	1.65	6480.73
M3	10.840	10.837	N/A	3319

Notes:-
Accumulated flow for all Mimili bores was from 18 April to 20 October 1999
Rain gauge reading at bore M3 was 49.2 mm for the same period.
All data loggers were software upgraded and are now Y2K compliant.

M1 Data errors due to 2100P valve sticking.

M3 The pressure transducer 2100P was found to be faulty, reading 0.00 metres head of water and the unit S/N 210 353 was removed for repair and replaced by S/N 210 354.
An error in reading between that of the flow meter and the logger value was corrected by resetting the flow meter Q 100% value from 13.57 m^3/hr to 15.00 m^3/hr. This correction percentage would have to be applied to the accumulated flow values recorded at this bore.

FREGON (20/21 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
FRG 1	N/A	10.10	N/A	11676
FRG E4	10.515	10.515	2.03	9803.71
FRG 7	10.155	10.167	2.36	4845.92
FRG 14	10.995	10.995	2.53	7430.86

Notes:-
Accumulated flow for all Fregon bores was from 18 April 1999 to 20/21 October 1999.
Rain gauge reading at bore FRG 14 was 41.2 mm for the same period.

FRG 1 SWL was unable to be read due to the re-growth of tree roots in the bore.
The flow rate error noticed in April was not addressed and will remain on the list for the next trip.
The logger software was upgraded.

FRG E4 Data logger software was NOT upgraded. The anomaly in the SWL data on the 19 May was possibly due to a sticking valve in the 2100P, but the slow reacting response is not characteristic of that type of fault. The non return valve at this site is leaking.

FRG 7 The logger software was upgraded.

FRG 14 Data logger software was NOT upgraded. The spike in the data of the flow meter on the 24 April is a false reading and should be ignored.

KENMORE PARK (23 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
KP 6	15.225	15.340	1.685	4767
KP 7	11.305	11.312	1.33	798.616
KP 98	10.785			

Notes:-
Accumulated flow for all Kenmore Park bores was for the period 13 April 1999 to 23 October 1999.
Rain gauge reading at bore KP 7 was 78.6 mm.
The software upgrade was unable to be made at Kenmore Park.

KP7 The flow data does not fully correspond with the variations in the SWL data. There maybe an error in the wiring for the powering of the flow meter and will need to be checked during the next site visit.

KP 6 SWL readings were taken while the pump was running. SWL datum reset by 0.115 m.

KP98 536.02 hours at 23 October 1999
473.89 hours at 13 April 1999
62.13 hours total use.

ERNABELLA (21 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
E01	8.860	8.90	0	NIL
E12	12.415	12.461	1.090	16193
E42	12.000	12.220	0.206	15 63.19
E44	12.370	N/A	0.105	7.185
E45	14.440	14.647	0.783	18 007.0
E97B	15.335	14.910	N/A	91 310.0
E97L	19.390	19.663	1.33	7200.54

Notes:-

Accumulated flow for all other Ernabella bores was from 14 April 1999 to 21 October 1999.

Rain gauge reading at bore E42 was 69.0 mm

None of the data loggers at Ernabella were able to have the software upgrade.

E01 The bore has not been used since 19 March 1998.
All data logging equipment has been removed from this site, for spares after consultation with Mr. S. Dodds it is envisaged to be re-installed during the next visit.

E12 SWL. readings were taken while the pump was running.
The flow meter S/N A97 79247 was unable to be read and was replaced with S/N A97 79248.
The accumulated flow was taken from that recorded in the bore log book 16 193 m^3 was recorded on the 11 October 1999.

E42 SWL. readings were taken while the pump was running.
SWL datum reset by 0.220. There was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering.
The flow data shows an anomaly of high flow rates spikes during the period 15 April to 20 April, the only explanation is that the flow meter was being powered while the pump was not operating, however there is no evidence to confirm this event. The second anomaly is the recovery steps in the SWL data during the periods 20 Sept. and 8 Oct. when there appears to be a SWL recovery during a continuos pumping period. This is of some concern as it may indicate a problem developing in the 2100P transducer, which will need further scrutiny during the next site visit.

E44 The SWL data has an anomaly during the period 10 May to 17 May which may be due to a sticking or leaking valve in the 2100P. The flow data is inconsistent with the SWL data in that no flow was recorded when the SWL recorded draw down. This bore is irregularly used and the flow chamber of the meter may need to be cleaned at the next site visit.

E45 SWL. readings were taken while the pump was running.
SWL datum reset by 0.207 mm. As for E42, there was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering.

E97B SWL datum reset by 0.425 mm. As for E42 and E44, there was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering. The bore flow meter could not be checked due to a power failure at the site.
The data loss between 14 April and the 14 June is unable to be explained other than the data logger did not record any data. This will be taken to the manufacturer for explanation.

E97L SWL. readings were taken while the pump was running.

SWL datum reset by 0.273 mm. As for the other bores, there was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering. The bore flow meter could not be checked due to a power failure at the site.

The flow meter failed on the 25 May and was reported by the ESO enabling it to be replaced by Bruce Hewitson on 15 June 1999, the replacement is S/N A97 79237.

AMATA (22 October 1999)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
A15	16.925	17.081	1.800	12853
A17	14.680	14.67	0.673	8150.68
A26	N/A	N/A	N/A	N/A

Notes:-
Accumulated flow for Amata bores was from 12 April 1999 to 22 October 1999.
Rain gauge reading at bore A15 was 61.2 mm.
The data loggers were not able to have the software upgrade.

A15 SWL. readings were taken while the pump was running.
SWL datum was reset by 0.156 m.
A17 SWL datum was reset by 0.010 m
A26 The down load sheet for this bore has been misplaced.

KALKA (16 October 1998)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
KA 1	N/A	27.073	0.120	676.25
KA 2	28.350	28.680	0.222	1216.17
KA 3	21.710	22.019	0.829	4710.739

Notes:-
Accumulated flow for all Kalka bores was from 11 April 1999 to 22 October 1999.
Rain gauge reading at bore KA 2 was 37 mm for the same period.
The data loggers were not able to have the software upgrade.

KA 1 SWL was not able to read and the logger was restarted at its present value.
Data errors due to 2100P valve sticking from 12 Sept. to 19 Sept.
KA 2 SWL. readings were taken while the pump was running.
SWL datum reset by 0.330 mm. As for the other bores, there was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering. The spikes seen in the flowmeter data are recordings taken at the beginning of the pump cycle before pipe back pressure is established and high flow rates are common.
KA 3 SWL. readings were taken while the pump was running.
SWL datum reset by 0.309 mm. As for the other bores, there was no apparent reason for the offset and was probably introduced at the previous trip when the logger was started while the bore was still recovering. The bores non return valve started leaking toward the end of June.

PIPALYATJARA (16 October 1998)

BORE	SWL(Actual)	SWL(logger)	Flowrate	Accumulated Flow m^3
PMB 95	16.950	16.980	1.253	8335.262
PMB 96	20.895	20.926	1.49	8475.132
MD 13	14.945	N/A	N/A	

Notes:-
Accumulated flow for all Pipalyatjara bores was from 10 April 1999 to 22 October 1999.
Rain gauge reading at bore PMB 95 was 42.2 mm.
The data loggers were not able to have the software upgrade.

PMB95 SWL datum was reset by 0.030 m. The data logger was found to have an intermittent fault with values on channel #2, and varied the battery volts from 12.98 to 4.15. The logger S/N 311193 was removed and replaced with S/N 311207.

PMB96 SWL datum was reset by 0.031 m. The bore has been used to supply water to contractors for community road upgrades.

MD13 SWL was measured and a note of hours run meter read

9770.98 hours at 22 October 1999

9193.37 hours at 10 April 1999

577.61hours total use.

CONCLUSIONS AND OBSERVATIONS

The down load trip was generally successful in that all sites were down loaded and data was retrieved for the period April 1999 to October 1999.

Generally the monitoring equipment is operating extremely well, there were a few situations worth mentioning. Equipment failures resulted in some lost data at:

Indulkana 26 required the 2100P pressure transducer to be replaced which failed on the 9 Sept 1999.

Mimili M3 also required the 2100P pressure transducer to be replaced which failed during testing.

Ernabella E12 required the flow meter to be replaced due to the display being unable to be read. The accumulated flow was only able to be retrieved from the last value entered in the bore log book. It appears the output of the flow meter was operating until the 17 October 1999.

Pipalyatjara 95 required the data logger to be replaced due to an intermittent fault on the flow meter channel, but all data was down loaded.

A number of sites had variations of SWL between the logged values and the actual measured values. This was probably due to the major disturbance during the April trip when all bores had pumps removed and reinstated after geophysical logging.

With the increasing number of sites, the number of backup spares will have to be revised. During this trip the equipment at Ernabella E01 was removed to ensure sufficient spares would be available for the remainder of the trip. Equipment at this site can be re-instated during the next trip if the spare equipment numbers are increased.

Unfortunately the attempt to upgrade the software at each site to make all loggers the same throughout the installations did not proceed to plan. This upgrade was also to address a Y2K problem with the older systems. I have received assurance from Mindata that no data will be lost if the upgrades are not completed. However at the next down load the data file will have to be viewed to two parts that is prior, to midnight of the 31 December, and after. It is expected that the data point at midnight will be lost and that the date for the new year will be logged as 1990 rather than 2000, this can then be edited after down loading. During the next trip this upgrade will have to be completed, and additional resources will be taken to ensure that this will be achieved.

The sites at Indulkana Range IR1 and IR2 were fitted with a set of data logging equipment. As mentioned earlier in this report the current situation as it exists is not acceptable and needs to be corrected as soon as possible before permanent damage to the instruments.

Appendix B

Table of Wells and Equipment

Dates and Locations of Well monitoring equipment - Anangu Pitjantjatjara Lands									
Appendix 2. Table of Wells and Equipment									
						Date of Installation			
Area	**Well Identification**	**Well Unit Number**	**Depth (metres)**	**Latitude (South)**	**Longitude**	**Flowmeter**	**SWL transducer and logger**	**Logger Format**	**Comments**
Indulkana	IMB-19	5544-101	68	26.9848	133.2898	Dec-1997	Dec-1997	1	Also raingauge
	IMB-19A	5544-132	79	26.986	133.2927	Dec-1997	Dec-1997	2	
	IMB-25	5544-157	30	26.9903	133.293	pre-97	pre-97	2	
	IMB-26	5544-158	48	26.9863	133.287	Dec-1997	Dec-1997	2	
	IMB-27	5544-159	40	26.9837	133.2762	Dec-1997	Dec-1997	2	
	IR-1	5544-172	72	26.988	133.2811	Oct-1999	Oct-1999	2	
	IR-2	5544-169	90.7	26.9892	133.2764	Oct-1999	Oct-1999	2	
	IR-3	5544-170		26.9921	133.2729				
Pukatja	E-01	5345-06	18.3	26.2738	132.1358	Dec-1997	Dec-1997	2	
	E-12	5345-12	22.9	26.2725	132.1265	Dec-1997	Oct-1998	2	
	E-42	5345-33	21	26.2703	132.1257	Dec-1997	Dec-1997	1	Raingauge
	E-44	5345-85	16.5	26.2585	132.124	Dec-1997	Dec-1997	2	
	E-45	5345-84	30	26.2593	132.125	pre-97	pre-97	2	Transducer replaced 12/97
	E97B	5345-114	42.5	26.3291	132.1104	Apr-1998	Apr-1998	2	
	E97L	5345-124	31	26.33	132.1031	Apr-1998	Apr-1998	2	
Kenmore Park	KP-6	5345-67	30	26.3225	132.4393	pre-97	pre-97	2	
	KP-7	5345-68	36	26.322	132.4375	Dec-1997	Dec-1997	1	Raingauge
	KP-98	5345-98	30	26.3007	132.4242				Pump hours recorded
Mimili	M-1	5443-25	35	27.0235	132.6733	Jan-1998	Jan-1998	2	
	M-3	5443-28	60	27.1422	132.6925	pre-97	pre-97	1	Transducer replaced 12/97
									Raingauge
Fregon	FRG-01	5344-09	18.6	26.7668	132.0378	pre-97	pre-97	2	Transducer replaced 12/97
	FRG-07	5344-31	48	26.7573	132.0387	Jan-1998	Jan-1998	2	
	FRG-14	5344-47	30	26.7593	132.0402	Jan-1998	Jan-1998	1	Raingauge
	FRG-E4	5344-19	35	26.7545	132.036	Jan-1998	Jan-1998	2	
Amata	A-15	5145-55	35.8	26.1422	131.135	pre-97	pre-97	1	Raingauge
	A-17	5145-84	34.5	26.1425	131.1387	Jan-1998	Jan-1998	2	
	A-26	5145-19	39	26.1343	131.1387	Jan-1998	Jan-1998	2	
Pipalyatjara	PIP-95	4745-95	36.8			Jan-1998	Jan-1998	1	Raingauge
	PIP-MD13	4745-92	43	26.1587	129.1698	Jan-1998	NONE		Rarely used - run for 31 hours Mar-Oct/98
	PIP-96	4745-96	36.8			pre-97	pre-97	2	
Kalka	KA-1	4745-78	40.5	26.1085	129.1507	Jan-1998	Jan-1998	2	
	KA-2	4745-94	60	26.1167	129.1528	Jan-1998	Jan-1998	2	
	KA-3	4745-85	40	26.1182	129.1668	Jan-1998	Jan-1998	1	Raingauge