



**Ministry of Water Resource  
And Meteorology**

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**Japan International  
Cooperation Agency**

**River Basin Water Resources Utilization Project  
(RBWRU)**

**MANUAL ON  
RAINFALL AND WATER LEVEL  
OBSERVATIONS**

**SEPTEMBER 2015**

**Prepared by  
KODAMA Masayuki  
(Short-term Expert)**

THE RIVER BASIN WATER RESOURCES UTILIZATION PROJECT  
(Support to Improvement and Reinforcement in Meteorological  
and Hydrological Observation Network)

**MANUAL ON  
RAINFALL AND WATER LEVEL OBSERVATIONS**

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### **References**

- Ref. 1    Technical Criteria for River Works: Practical Guide for Survey, Ministry of Land, Infrastructure, Transport and Tourism
- Ref. 2    Hydrological Observation Illustration – Japanese version”, Chubu Construction Incorporated Association

Ref. 3 Manual on Stream Gauging Volume I-Field Work, World Meteorological Organization WMO-No.1044

Ref.4

**គោលការណ៍នៃការនាំសំរាប់ការ សង្កេតកំពស់ទឹក កក្កដា ១៩៩៨**  
**នាយកដ្ឋាន ជលសាស្ត្រ អគ្គនាយកដ្ឋាន បរិស្ថានសាស្ត្រ ឧតុនិយម និង ជលសាស្ត្រ**

(Temporary English interpretation: Principle for Water Gauge Survey July 1998, Department of Hydrology, General Department of Irrigation, Meteorology and Hydrology)

## **CHAPTER I GENERAL**

### **1.1 Authority, Objective and Notification**

This manual has been prepared by Kodama Masayuki, a short-term expert to the River Basin Water Resources Utilization Project under Japan International Cooperation Agency in the Ministry of Water Resources and Meteorology in Cambodia. The manual has prepared aiming to reinforce the capacity of Cambodian counterpart personnel in carrying out observation of rainfall and water level at the target observation stations, and maintenance of the target stations.

This manual has been made referring to the publications and documents listed in the last part of table of contents in this manual.

### **1.2 Target Rainfall and Hydrological Stations**

#### **1.2.1 Target River Basins**

The project of River Basin Water Resources Utilization (herein after called as “the Project”) aims to improve and reinforce in meteorological and hydrological observation network in the following six river basins, i.e. Sangkae, MOUNG RUSSEI, PURSAT, BORIBO, PREK THNOT and SLAKOU River Basins. These rivers are located in Battambang, Pursat, Kompong Chhnang, Kompong Speu, Kandal, and Takeo provinces.

Rainfall and hydrological stations have been constructed in those river basins by the Project based on the Plan for Improvement and Reinforcement of Hydrological Network prepared in September 2014 by the Project. The plan proposed to construct water level and rainfall stations in Sangkae, MOUNG RUSSEI and PURSAT river basins for the first step of the implementation.

#### **1.2.2 Target Rainfall and Hydrological Stations**

Three automatic rainfall stations and 15 hydrological stations have been constructed by the Project in 2015 in the Sangkae, MOUNG RUSSEI and PURSAT river basins. The construction work has been substantially completed in August 2015.

The stations can be classified into two types i.e. called in this manual as AUTO station and MANUAL station. The AUTO station has recorder instruments. Daily observation, record and transmission are performed by instruments, not by manpower. The MANUAL station has staff gauges only which are installed at river/channel side. The daily observation has to be carried out by man power.

Tables 1-1 and 1-2 summarized main information of rainfall and hydrological stations constructed by the Project in 2015. Further, some 18 hydrological stations will be constructed by the Project in 2016 and 2017.

**Table 1-1 Target Rainfall Stations of the Project in 2015**

No.	Name of station	East	North	River basin	Province	District	Commune	Village	Name of observer	Telp. No.	Type of station	Brand name of gauges	Data record & transmission
1	Samlot	268266	1411436	Sangkae	BTB	Somlout	Mean Chey	Sre Sdao	Suon Cheat	92752017	Auto/Manual	RG600	LOGGER & TEME
2	Chrang Khpos	314166	1388184	Moung Russei	BTB	Rokha Kiri	Bassa	Chrang Kpos	Kom Thoet	89617969	Auto	RG600	Logger & TEME
3	Ta Lou	353453	1383181	Svay Dankeo	Pursat	Bakan	Ta Lou	Prey Tao	Sim Yam	92993103	Auto	RG600	Logger & TEME

Note: ARG: Automatic Rain Gauge

AUTO: Automatic water level sensor and rain gauge with data logger

AWL: Automatic Water Level Gauge

LOGGER & TEME: Data logger iLOGS46, Masermic, and sent by GPRS (General Packet Radio Service)

MANUAL: Reading and writing by human

RG600: Rain gauge, Global Water

SMS: Short message services

STG: Staff gauges

WL450: Watre level sensor, Global Water

**Table 1-2 Target Hydrological Stations of the Project in 2015**

No.	Name of station		East	North	River/ stream	Province	District	Commune	Village	Name of observer	Telp. No.	Type of station	Brand name of gauges	Data recording & trans- mission
1	Andaek Herb		279091	1420160	Sangkae	BTB	Ratanak Mondul	Ornderk Heb	Thvak	Hang Heng	088 9666767 / 092 442720	AUTO	WL450, RG600	LOGGER & TEME
2	Bassac Dam	Reservoir	318121	1389897	Moung Russei	BTB	Rokha Kiri	Bassac	Bassac	You Ras	092 548911	AUTO	WL450, RG600	LOGGER & TEME
3		Spillway	318151	1389977								AUTO	WL450	LOGGER & TEME
4	Prek Chik Left Canal		324982	1398220	Moung Russei	BTB	Rokha Kiri	Prek Chik	Prek Chik			MANUAL	STG	Manual writing
5	Prek Chik Right Canal		325448	1398381	Moung Russei	BTB	Rokha Kiri	Prek Chik	Prek Chik			MANUAL	STG	Manual writing
6	Prek Am		329953	1410653	Moung Russei	BTB	Moung Russei	Robos Mongkol	Kon Ka enk pi	You Sokhoeun	017 478997	AUTO	WL450, RG600	LOGGER & TEME
7	Prek Am Canal		329882	1410972	Moung Russei	BTB	Moung Russei	Robos Mongkol	Kon Ka enk pi	You Sokhoeun	017 478997	MANUAL	STG	Manual writing
8	Tades		354882	1360537	Pursat	Pursat	Phnum Kravanh	Som Raong	Tades			AUTO	WL450, RG600	LOGGER & TEME
9	Bak Trakoun		364762	1366129	Pursat	Pursat	Phnum Kravanh	Prongil	Ou Bak Tra	Choeung Chan	097 2483032	AUTO	WL450, RG600	LOGGER & TEME
10	Khum Veal		384090	1388529	Pursat	Pursat	Kandieng	Veal	Kracher badach	Sok Makara	092 927727	MANUAL	STG	Manual writing
11	Charek Left Canal		390148	1394343	Pursat	Pursat	Kandieng	Sya	Kompong Sambour	Sam Yoeun	097 5082229	MANUAL	STG	Manual writing
12	Ptes Kor Canal		389851	1392666	Pursat	Pursat	Kandieng	Onlong Verl	Beng Chhouk			MANUAL	STG	Manual writing
13	Peam		360645	1357558	Steung Arai	Pursat	Phnom Krovanh	Somraong	Peam Hav	Kry Marady	096 6556647	MANUAL	STG	Manual writing
14	Santre		372418	1355284	Prey Khloug	Pursat	Phnom Kravanh	Santre	Kaset borey			MANUAL	STG	Manual writing
15	Svay Daun Keo	In the Damnak Ampil canal	351574	1389524	Svay Don Keo	Pursat	Bakan	Ta Lou	Thmey			MANUAL	STG	Manual writing
		Inlet at gate, Damnak Ampil side	351574	1389524								MANUAL	STG	Manual writing
		Gate, Damnak Ampil side	351574	1389524								MANUAL	STG	Manual writing
		Overflow crest of spillway	351596	1389514								MANUAL	STG	Manual writing
		Inlet at gate, Prek Chik side	351596	1389514								MANUAL	STG	Manual writing
		Gate, Prek Chik side	351508	1389550								MANUAL	STG	Manual writing

Note: refer to the note in Table 1-1



### 1.2.3 Facilities of the Stations

#### (1) Rainfall Stations

The principal facilities of a rainfall station consists of net fence, an automatic rain gauge (ARG), a data logger and a solar panel which are constructed at site altogether. Standard design is presented in Appendix-5.

Principal instrument of each rainfall station is summarized as follows. There is a manual rainfall gauge at Samlot rainfall station which was installed by Dept. of Meteorology, MOWRAM under the UNDP's project a few years ago.

**Table 1-3 Instruments of Rainfall Stations**

No.	Name of station	Instruments (the figure after x means quantity of instruments)
1	Samlot	Data Logger, ARG, Solar panels, Battery 26Ah (for ARG), Manual rain gauge (installed by Dept. Meteorology)
2	Chrang Khpos	Data Logger, ARG, Solar panels, Battery 26Ah (for ARG)
3	Ta Lou	Data Logger, ARG, Solar panels, Battery 26Ah (for ARG)

Note: refer to the note in Table 1-1

#### (2) Hydrological Stations

There are two types of hydrological station. One type is expressed as "AUTO" in Table 1-2. The AUTO station has automatic instruments such as a water level sensor (AWL), a data logger powered by a solar panel, recorder's house and staff gauges (STG). The data logger is stored in the recorder's house. Of 15 hydrological stations, six stations are classified into AUTO stations. However, Bassac Dam Spillway station does not have a data logger since the station shares data logger with Bassac Dam Reservoir station. AUTO station has staff gauges at river/channel side. Five AUTO stations have an automatic rainfall gauge (ARG).

The other type is MANUAL stations in Table 1-2. It has staff gauges only which are installed at river/channel side. The water level is observed and recorded on the data sheet by an observer. Nine stations are classified by MANUAL stations.

##### (i) Instruments

Principal instruments of the hydrological stations are presented as follows:

**Table 1-4 Instruments of Hydrological Stations**

No.	Name of station		Instruments
1	Andaek Herb		Data Logger, AWL, ARG, Solar panels, Batteries 26Ah (for ARG)+ 12Ah(for AWL & DL). STG (0-9m)
2	Bassac Dam	Reservoir	Data Logger, AWLs x2 (Cable:180F), ARG, Solar panels, Batteries 26Ah (for ARG)+ 26Ah(for 2AWLs, DL), STG (0-6m)
3		Spillway	
4	Prek Chik Left Canal		STG (0-4m)
5	Prek Chik Right Canal		STG (0-6m)
6	Prek Am		Data Logger, AWL, ARG, Solar panels, Batteries 26Ah (for ARG)+ 12Ah (for AWL, DL), STG (0-
7	Prek Am Canal		STG (0-6m)
8	Tades		Data Logger, AWL (Cable:234F), ARG, Solar panels, Batteries 26Ah (for ARG)+ 12Ah (for AWL & DL), STG (0-16m)
9	Bak Trakoun		Data Logger, AWL, ARG, Solar panels, Batteries 26Ah (for ARG)+ 12Ah (for AWL & DL), STG (0-8m)
10	Khum Veal		STG (0-7m)
11	Charek Left Canal		STG (0-3m)
12	Ptes Kor Canal		STG (0-3m)
13	Peam		STG (0-8m)
14	Santre		STG (0-6m)
15	Svay Daun Keo	In the Damnak Ampil canal	Staff gauge #1 (0-3m)
		Inlet at sluice gate, Damnak Ampil side	Staff gauge #2 (0-1.3m)
		Sluice gate, Damnak Ampil side	Staff gauge #3 (0-1m)
		Overflow crest of spillway	Staff gauge #4 (0-2m)
		Inlet at sluice gate, Prek Chik side	Staff gauge #5 (0-1.3m)
		Sluice gate, Prek Chik side	Staff gauge #6 (0-1m)

Note: refer to the note in Table 1-1

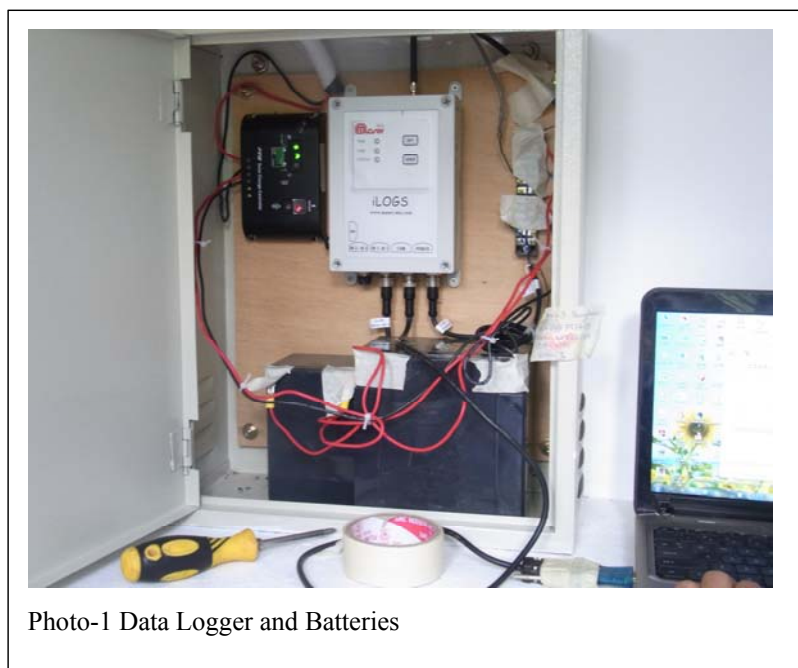
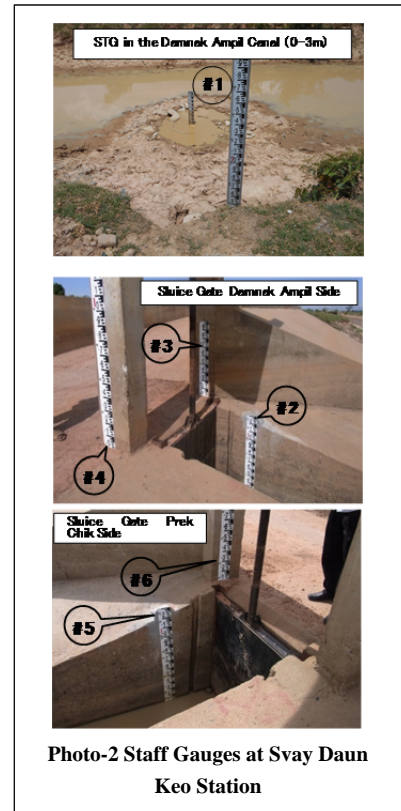


Photo-1 Data Logger and Batteries

Svay Daun Keo station has staff gauges at six locations nearby. Running numbers have been given to avoid confusion as shown in the Photo-2.

**(ii) Benchmarks**

A benchmark (BM) has been installed by the contractor in accordance with the contract. Coordinate and elevation have been surveyed by him too. The results are presented in Table 1-5.



**Table 1-5 List of Benchmarks**

No. of BM	Station name	Coordinate and Elevation		
1	Damnak Ampil Left Main Canal	370337.071	1380714.4	20.155
2	O Rokar Canal	371121.097	1379747.7	19.529
3	Tades	354879.22	1360575.9	33.771
4	Bak Trakoun	364764.114	1366125.6	27.826
5	Bassac	318150.748	1389950.4	41.119
6	Prek Chik Left Canal	324959.844	1398250	28.167
6A	Prek Chik Right Canal	325471.006	1398174	28.629
7	Santre	372378.316	1355283.3	43.366
8	Steung Arai (New Peam)	360641.926	1357561.1	30.885
9	Khum Veal	384041.028	1388553.4	13.84
10	Charek left Canal	390147.846	1394351.5	9.602
11	Ptes Kor Canal	389869.119	1392652.9	10.648
12	Svay Don Keo (Upstream of Spillway)	351603.579	1389504.7	11.704
13	Andaek Herb	279129.328	1420101.7	32.136
14	Prek Am Canal	329863.614	1410963.3	13.392
14A	Prek Am	329929.432	1410664.6	13.346

Surveyed by the Contractor

**(iii) Cross Section of River/canal at Station**

Cross section of rivers/canals at each hydrological station was surveyed and presented by the

## 1.3 Purpose of Rainfall and Water Level Observations

### 1.3.1 General

To study and develop models of rainfall and river runoff is one of the outputs of the project. The models will be used for estimation of water resources. To know the amount of water taken for irrigation is an important factor to manage water resource in the region. To provide data of rainfall and water level is one of the basic activities to support the said studies. Therefore, observation of rainfall and water level is an essential activity of the project.

Records of water level are followed by calculation of discharge. The calculation of discharge is discussed in another manual i.e. “Manual on Discharge Measurements by Current Meter and Floats”.

### 1.3.2 Target of Observations

Table 1-6 shows target of observation at each station.

**Table 1-6 Target of Observation at Each Station**

No.	Name of station		Target of observation
<b>Rainfall Stations</b>			
1	Samlot		Rainfall at the station
2	Chrang Khpos		Rainfall at the station
3	Ta Lou		Rainfall at the station
<b>Hydrological Stations</b>			
1	Andaek Herb		Discharge in the Sangkae River, Rainfall at the station
2	Bassac Dam	Reservoir	Volume of water stored in the reservoir, Rainfall at the station
3		Spillway	Discharge to the Moug Russei River
4	Prek Chik Left Canal		Water taken from Moug Russei River for irrigation
5	Prek Chik Right Canal		Water taken from Moug Russei River for irrigation
6	Prek Am		Discharge in the Moug Russei River, Rainfall at the station
7	Prek Am Canal		Water taken from Moug Russei River for irrigation
8	Tades		Discharge in the Pursat River, Rainfall at the station
9	Bak Trakoun		Discharge in the Pursat River Rainfall at the station
10	Khum Veal		Discharge in the Pursat River
11	Charek Left Canal		Water taken from Pursat River for irrigation
12	Ptes Kor Canal		Water taken from Pursat River for irrigation
13	Peam		Discharge in the Arai River
14	Santre		Discharge in the Prey Khlong River
15	Svay Daun Keo	SDK#1; In the Damnak Ampil canal	Water depth in the upstream (below overflow crest)
		SDK#2; Inlet at gate, Damnak Ampil side	Water depth in front of the sluice gate
		SDK#3; Opening of gate, Damnak Ampil side	Opening of the sluice gate
		SDK#4; Overflow crest of spillway	Overflow depth on the broad-crested weir
		SDK#5; Inlet at gate, Prek Chik side	Water depth in front of the sluice gate
		SDK#6; Opening of gate, Prek Chik side	Opening of the sluice gate

As shown above, river discharges are to be observed at nine stations i.e. Andaek herb, Bassac Dam Spillway, Prek Am, Tades, Bak Trakoun, Khum Veal, Peam, Santre, Svay Daun Keo. At Svay Don Keo hydrological station staff gauges have been installed at six sites (SDK#1-SDK#6) aiming to observe discharge in the Svay Don Keo River including water supplied by Damnak Ampil main canal and Prek Chik Canal. They are located within 100 m and thus counted to be one station. Bassac Dam Reservoir Station aims to know amount of water stored in the reservoir.

Five stations i.e. named Prek Chik Left Canal, Prek Chik Right Canal, Prek Am Canal, Charek Left Canal, Ptes Kor Canal have been constructed to know intake water from river to irrigation canal.

### **1.3.3 Record and Transfer of Data**

#### **(1) AUTO stations**

A data logger is installed at three rainfall stations each. Rainfall is recorded every 15 minutes and sent to the master PC in the office of THE PROJECT by GPRS (General Paket Radio Service) modem.

Each hydrological station also has a data logger except for Bassac Dam Spillway station which the data logger is shared by Bassac Dam Reservoir station. The data (water level and rainfall) are recorded every 15 minutes and sent to the master PC in the main office of the Project by GPRS modem.

Immediately after receiving data from data loggers, there is practically a time lag, the master PC sends all data to two computers named the sub-master PC by GPRS.

#### **(2) MANUAL stations**

The water level at a MANUAL station which has only staff gauges is observed and recorded by an observer at 7:00 am and 7:00 pm every day. He records the data in the data sheet and be collected by the Project every month. The staff gauges at an AUTO station is also observed and recorded by an observer in the same way as mentioned above.

There is a manual rain gauge at Samlot rainfall station. An observer measures and records the rainfall every day. The data sheet of rainfall is delivered by the Project and filled by the observer.

## **CHAPTER II OBSERVATION OF RAINFALL AND WATER LEVEL**

### **2.1 Rainfall**

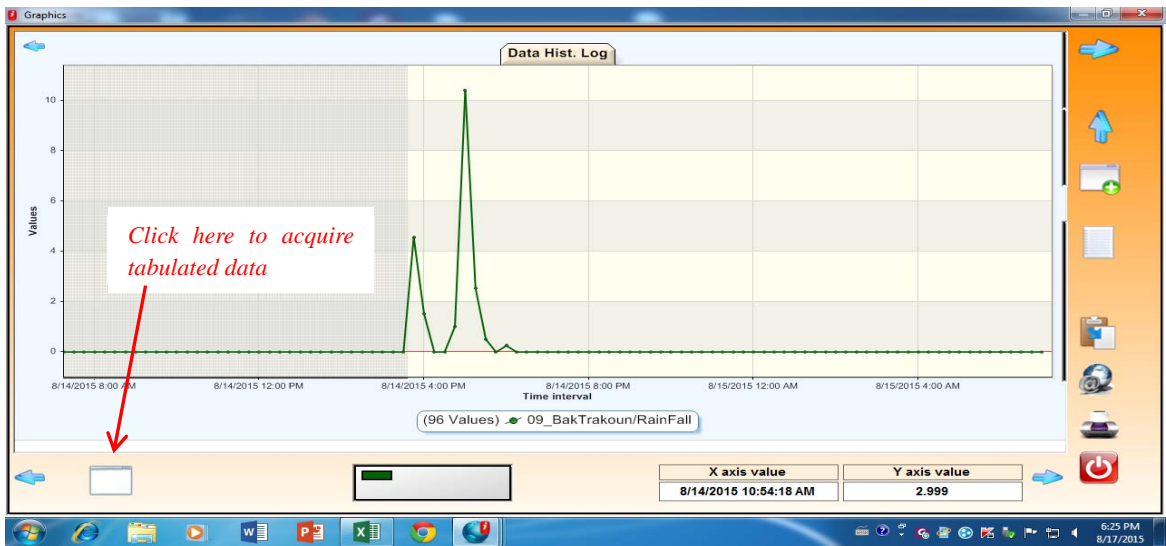
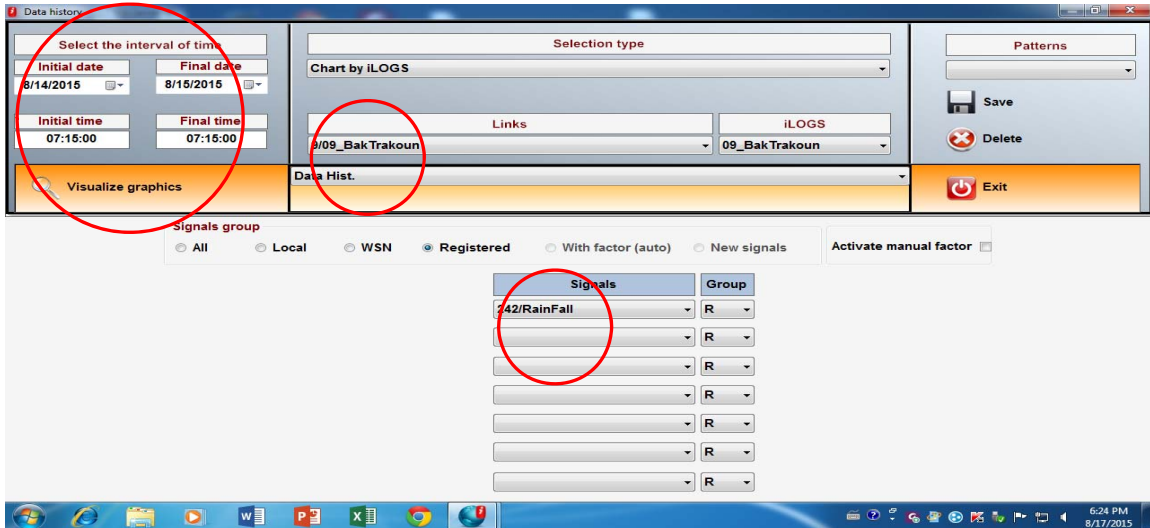
#### **2.1.1 Rainfall Recorder**

##### **(1) Conversion of Data**

As shown in Tables 1-1 and 1-2 there are eight rainfall recorders (RG600) in the project. The recorder contains a tipping bucket and lead switch which generates a pulse every 0.25 mm of rainfall. The pulse is sent to the data logger (iLOGS46 mad by Masermic). The data logger counts the number of pulse and sums up every 15 minutes. The logger converts the summed pulse to a depth of rainfall in 15 minutes and stores. The records of 15-minute rainfall are sent to the master PC of the Project every one hour. So, the master PC receives four records in one hour.

The rainfall records received in the master PC can be presented in the display in the master PC through the following procedure. The result is shown in Figure 2-1.

Start iSOFT → Data History → Links → Select a station “Bak Trakoun” e.g. → Signals “Rainfall” → Initial date 8/14/2015 → Final date 8/15/2015 → Initial time 07:15:00 → Final time 07:15:00 → Click “Visualize graphics” → to acquire the tabulated data Click another icon at left bottom.



Click here to back to the graph

Click here to convert the file to csv format

Date	ID	Site	Signal	Value
8/14/2015 07:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 07:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 07:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 08:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 08:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 08:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 08:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 09:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 09:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 09:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 09:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 10:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 10:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 10:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 10:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 11:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 11:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 11:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 11:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 12:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 12:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 12:30:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 12:45:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 13:00:01	09_BakTrakoun	09_BakTrakoun	RainFall	0
8/14/2015 13:15:01	09_BakTrakoun	09_BakTrakoun	RainFall	0

Graphic initial date: 8/14/2015 7:15:00 AM, Graphic final date: 8/15/2015 7:15:00 AM

Figure 2-1 (1/3, 2/3 & 3/3) Visualizing and Tabulating Rainfall Record

The 15-minute rainfall tabulated in Figure 2-1 (3/3) can be converted to Figure 2-2 in EXCEL format through the following procedure.

Following to the above procedure, Click an icon "Export data table" → Click "Yes" → Select desktop e.g. → Input the file name 20150814bb e.g. → Save as "CSV Files (\*.csv)" → Click "Save" → Confirm the information shows "Data exported correctly" → Close iSOFT,

Excel-Select blank Workbook → File-Open → Specify "All Files" → File name "20150814bb" → Open → Text Import Wizard - Step 1 of 3 → Click "Delimited" → Click "Next" → Click "Semicolon" → "Comma" → "Space" → Click "Next" → To confirm the continuous data is divided by type of data i.e. Date, ID (time), Site, Signal, Value, etc. → Click "General" & "Finish", File name "20150814", Save as type "Excel workbook". The Excel file converted is presented in Table 2-1.



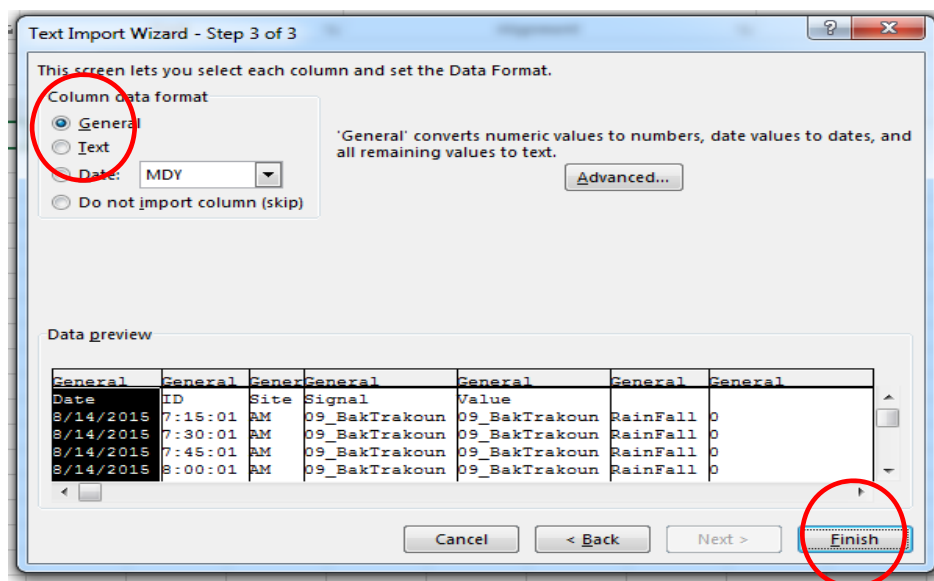
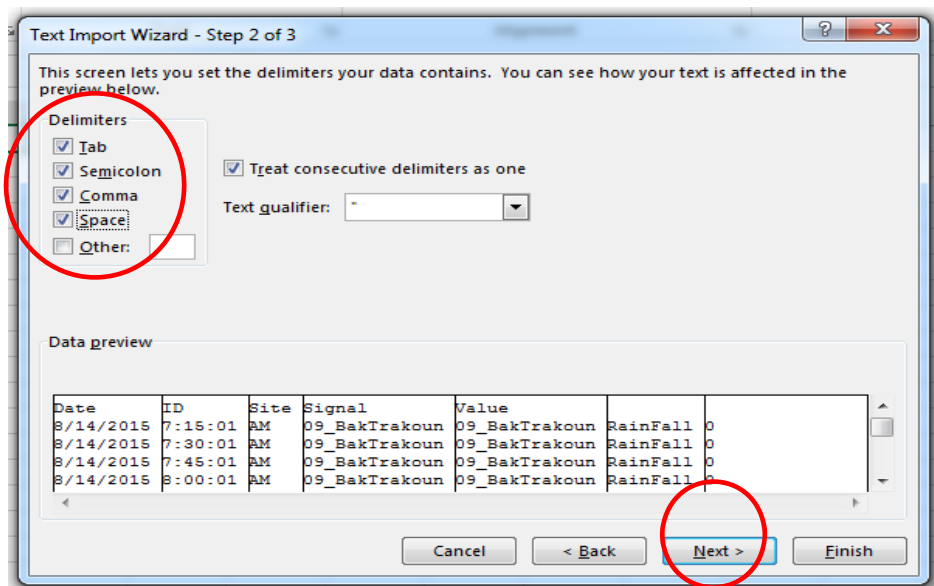
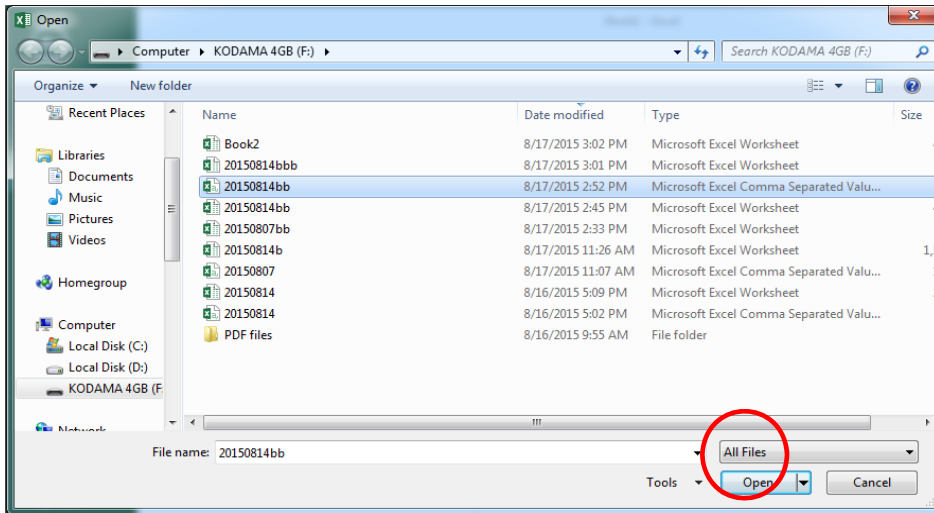


Figure 2-2 (1/3, 2/3, 3/3) Conversion of Rainfall Record from iSOFT to Excel File

**Table 2-1 Spreadsheet Converted from iSOFT to Excel Format (FORM-12)**

Date	ID	Site	Signal	Value		
2015/8/14	7:15:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	7:30:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	7:45:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	8:00:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
	■					
	■					
	■					
2015/8/14	3:45:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	4.572
2015/8/14	4:00:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	1.524
2015/8/14	4:15:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	4:30:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	4:45:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	1.016
2015/8/14	5:00:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	10.414
2015/8/14	5:15:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	2.54
2015/8/14	5:30:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	0.508
2015/8/14	5:45:01	PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
	■					
	■					
	■					
2015/8/15	6:15:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:30:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:45:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	7:00:01	AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
<b>Total/One day rainfall (mm)</b>						<b>20.828</b>
<b>Maximum 15-minute rainfall (mm)</b>						<b>10.414</b>

The two rows should be added at the bottom to the FORM-12 by manual as discussed in the following paragraph.

**(2) Calculation of Daily Rainfall**

Using Table 2-1 i.e. FORM-12 a daily rainfall can be calculated by sum up the 15-minute rainfall from 7:00 am on the previous day until 7:00 am next day provided that the data logger is set to reset its counter every 15 minutes. Two rows have to be added at the bottom of FORM-12. Two functions of summation and maximum should be inserted to the bottom of the table. The value obtained should be recorded as the rainfall on the previous day in accordance with the standard of MOWRAM.

A total rainfall in 24 hours (irrespectively change of the date) has to be calculated by examining rainfall in two continuous days. This value and 15-minute rainfall will be used in the Depth-Duration-Area analysis (DDA analysis) in the flood runoff analysis. Therefore Table 2-1 or FORM-12 should be kept in the nominated PC for future use after changing the file name e.g. <Form-12\_20150815.xlsx>.

The important values can be seen from the above table as follows:

**Table 2-2 Important Daily Rainfall Values**

Description	Unit	Value	Remarks
Daily rainfall	mm		The definition of daily rainfall is the summation of all rainfall observed from 7:00 am on the previous day to 7:00am on the next day. The value should be regarded as the rainfall on the previous day in accordance with the standard of MOWRAM.
Maximum rainfall in 15 minutes	mm		The definition of the maximum rainfall intensity is the maximum value of 15-minute rainfall in a day.
24-hour rainfall	mm		The definition of 24-hour rainfall is the total rainfall between the beginning and end of rainfall in 24 hours (irrespectively change of the date) because a rain frequently continues extending in two days.  A Meteo/hydrologist has to look all daily rainfall data in FORM-1 every month through and to calculate 24-hour rainfall.

The calculated daily rainfall should be input to the FORM-15 as presented in Table 2-3.

Observation of Rainfall FORM-15													
Table 2-3 Daily Rainfall Record													
River:						Station:						E:	
Year:						District:						N:	
Input by:						Province:						Alt.(amsl):	
												(Unit: mm)	
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1													
2													
3													
4													
			■										
			■										
14			■					20.83					
			■										
			■										
			■										
27													
28													
29													
30													
31													
<b>Total</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.83	0.00	0.00	0.00	0.00	
<b>Max.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.83	0.00	0.00	0.00	0.00	
<b>Rainy days R<sub>≥0.5mm</sub></b>	0	0	0	0	0	0	0	1	0	0	0	0	
<b>Annual rainfall:</b>	20.8		mm	<b>Annual max. daily rainfall:</b>			20.83		mm	<b>Annual max. 24-hour rainfall:</b>			

The cells not shadowed are for input daily rainfall data. Attention has to be paid not to change unnecessarily the cells shadowed which contain functions. Spread sheets of the FORMs are available in the server computer.

### **(3) Calculation of Monthly and Annual Values**

Adding a few functions in MSExcel to the bottom of each column of month in FORM-15 (colored cells), i.e.

“=SUM(C9:C39)”

“=MAX(C9:C39)”

“=COUNTIF(C9:C39,”>=0.05”)”

(a) monthly rainfall, (b) monthly maximum daily rainfall, rainy day (e.g.  $R \geq 0.5\text{mm}$ ) can be obtained.

The important following values should be calculated in FORM-15, by adding other functions in MSExcel.

(c) “=SUM(C40:N40)” to calculate annual rainfall – The total of all daily rainfall for the year;

(d) “=MAX(C41:N41)” to calculate annual maximum daily rainfall – The highest daily rainfall for the year.

(e) “=SUM(C42:N42)” to calculate total rainy days in a year (e.g.  $R \geq 0.5\text{mm}$ )

### **2.1.2 Manual Rainfall Gauge**

#### **(1) Recording in Data Sheet**

There is only one manual rainfall gauge installed by Dept. of Meteorology at Samlot station. An observer is expected to continue measuring and recording rainfall two times in a day i.e. at 7:00 am and 7:00 pm in accordance with the standard of MOWRAM. The data sheet of manual rainfall gauge has been made by the Rproject in accordance with standard form of MOWRAM, and has been delivered to all observers of which the station has a manual rainfall gauge as shown Figure 2-3 (FORM-11).

#### **(2) Calculation of Daily Rainfall from Data Sheet**

Inputting all recorded data to FORM-11 a daily rainfall can be calculated by sum up the two data i.e. 7:00 am to 7:00 pm and 7:00 pm to 7:00 am. FORM-11 has a same style with FORM-11b is used for calculation of a daily rainfall by inputting rainfall data recorded in FORM-11 by an observer.

Since the Samlot station has an automatic rainfall gauge the result has to be collated with the daily rainfall obtained from data logger as discussed in the previous sections.

In collation, there will be a difference between two data of rainfall recorder (AUTO) and of MANUAL. In the checking, the actual time of observation of MANUAL should be

confirmed because the observer will frequently observe the rainfall at not the ruled time (7:00 pm and 7:00 am) due to several reasons. On the other hand the AUTO works very punctual. One day rainfall may not same with each other by this or other reason. Accordingly it is necessary to collate rainfall not only sole day but also continuous two or three days as a whole.

If the rainfall record was not much difference from the data obtained by AUTO, the data by AUTO can be regarded as the daily rainfall at Samlot.

If the rainfall record was not obtained by data logger due to some reason, the daily rainfall data obtained by MANUAL can be used as the data at Samlot.

**(3) Calculation of Monthly and Annual Values**

If the data by MANUAL is used as the record at Samlot, the calculated daily rainfall should be input to the FORM-15. Further process should be performed as discussed in the previous section.

**Royal Kingdom of Cambodia**  
**FORM-11**  
**Rainfall**

Ministry of Water Resources and Meteorology  
 ក្រសួងធនធានទឹក និងអាកាសធាតុ

Nadon Religion King  
 ជាតិ ព្រះមហាក្សត្រ

Japan International Cooperation Agency  
 River Basin Waste Resources Utilization Project  
 គម្រោងប្រើប្រាស់ធនធានទឹក និងអាកាសធាតុ

Station: ទីស្ថាន  
 Capital City of Province: រាជធានី  
 North: ឦសាន  
 East: ឦសាន  
 Month: ខែ  
 Year: ឆ្នាំ  
 Type of Season: ប្រភេទរដូវ

Elevation in meter: មែត្រ

Date ថ្ងៃ ខែ	Measurement សម្រាប់ការវាស់ Time: 07:19	Total (24hr) សរុប (មធ្យម)	Descriptions (1) (Storm and Suggested Rainfall) ពិពណ៌នា (1) (រដូវភ្លៀង និង ភ្លៀងស្មើសរុប)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Sub-total សរុប			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
Sub-total សរុប			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
Sub-total សរុប			
Total/Month សរុបខែ			

Numbers of Rainfall Days  
 ចំនួនថ្ងៃភ្លៀង

(2) (R) < 1.0mm.....  
 (R) < 10.0mm.....  
 (R) < 30.0mm.....  
 (R) < 50.0mm.....

Total រួមសរុប

Note/ព័ត៌មានបន្ថែម  
 (1) Type of Rainfall Thunder, etc.  
 (2) Grade of rainfall  
 (3) ប្រភេទភ្លៀង  
 (4) កម្រិតភ្លៀង

Seen and approved  
 បានឃើញ និង បានអនុម័ត

Meteorology Chief Office:  
 គ្រឹះស្ថានអាកាសធាតុ

Date: ថ្ងៃ ខែ ឆ្នាំ  
 Chief of Rainfall Collector:  
 ប្រធានប្រតិបត្តិ

**Royal Kingdom of Cambodia**  
**FORM-21**  
**Gauge Height**

Ministry of Water Resources and Meteorology  
 ក្រសួងធនធានទឹក និងអាកាសធាតុ

Nadon Religion King  
 ជាតិ ព្រះមហាក្សត្រ

Japan International Cooperation Agency  
 River Basin Waste Resources Utilization Project  
 គម្រោងប្រើប្រាស់ធនធានទឹក និងអាកាសធាតុ

Station: ទីស្ថាន  
 Capital City of Province: រាជធានី  
 North: ឦសាន  
 East: ឦសាន  
 Month: ខែ  
 Year: ឆ្នាំ  
 Type of Season: ប្រភេទរដូវ

Elevation in meter: មែត្រ

Date ថ្ងៃ ខែ	Time	H. (m) កម្រិតទឹក នៅកម្រិត	H. average (m) កម្រិតទឹក មធ្យមប្រចាំថ្ងៃ	Phenomena ប្រភេទ
1	07:00			
	19:00			
2	07:00			
	19:00			
3	07:00			
	19:00			
4	07:00			
	19:00			
5	07:00			
	19:00			
6	07:00			
	19:00			
7	07:00			
	19:00			
8	07:00			
	19:00			
9	07:00			
	19:00			
10	07:00			
	19:00			
11	07:00			
	19:00			
12	07:00			
	19:00			
13	07:00			
	19:00			
14	07:00			
	19:00			
15	07:00			
	19:00			
16	07:00			
	19:00			
Observer/អ្នកវាស់				

Checked by:  
 បានឃើញ

Figure 2-3 FORM-11 and FORM-21 for Recording Daily Rainfall and Staff Gauge Height by an Observer

### 2.1.3 Filing Structure for Rainfall Record

The electronic files of rainfall record have to be saved in the master PC of Team-1 of the Project/MOWRAM. Name of folders and files have to contain name of station, year, month, date so that users can retrieve record at the target station and target period can find out easily. On the contrary the name of folders and files should be short to ease creating/retrieving the name of the folder/file. A temporary code is given to each station to shorten the name of folders and Excel files as shown in Table 2-4. The structure for folders and file name for rainfall record in the master PC is proposed as Figure 2-4.

In this context, the date of record is recommendable to be contained in the following order i.e. yyyymmdd (year, month, date in 8 figures, e.g. 20150815) so that the files can be sorted in order of date.

**Table 2-4 Temporary Code of Rainfall Stations**

Name of station	Code
Samlot	SAM
Chrang Khpos	CHK
Ta Lou	TAL
Andaek Herb	ADH
Bassac Dam Reservoir	BAR
Prek Am	PRA
Tades	TAD
Bak Trakoun	BKT

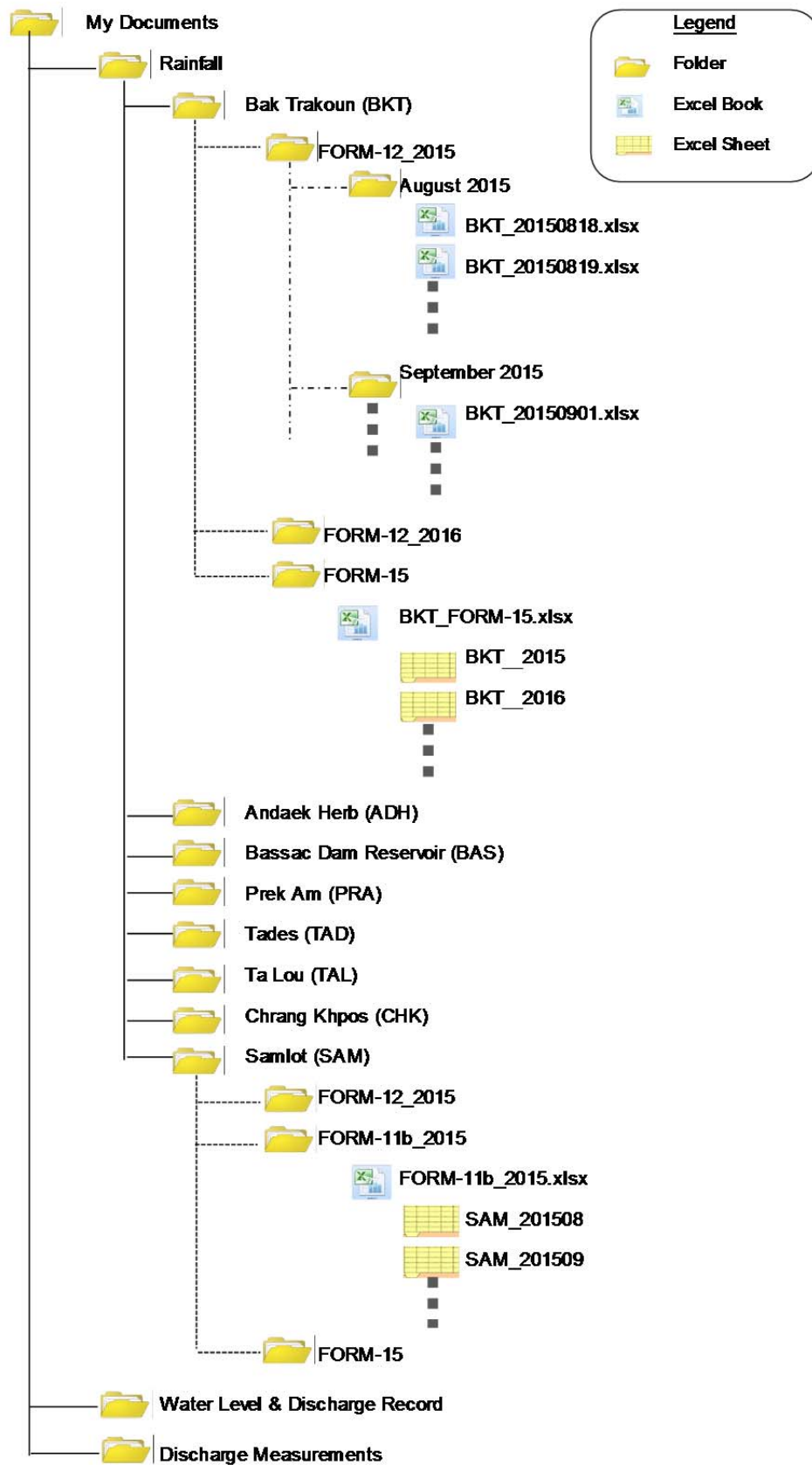


Figure 2-4 Filing Structure for Rainfall Data



## 2.2 Water Level

### 2.2.1 Water Level Recorder

#### (1) Conversion of Data

As shown in Table 1-2 there are six water level sensors (WL450) installed by the Project. A water level sensor reads water level every 15 minutes. The value is stored in data logger (iLOGS). The data stored are sent to the master PC of the Project in Phnom Penh every one hour. So, the master PC receives four records in one hour.

The water level records received by the master PC can be presented in the display in the master PC through the following procedure. The process and result is shown in Figure 2-5.

Start iLOG → Data History → Links → Select a station “Bak Trakoun” e.g. → Signals “WaterLevel” → Initial date 8/10/2015 → Final date 8/11/2015 → Initial time 07:15:00 → Final time 07:15:00 → Click “Visualize graphics” → to acquire the tabulated data Click another icon at left bottom.

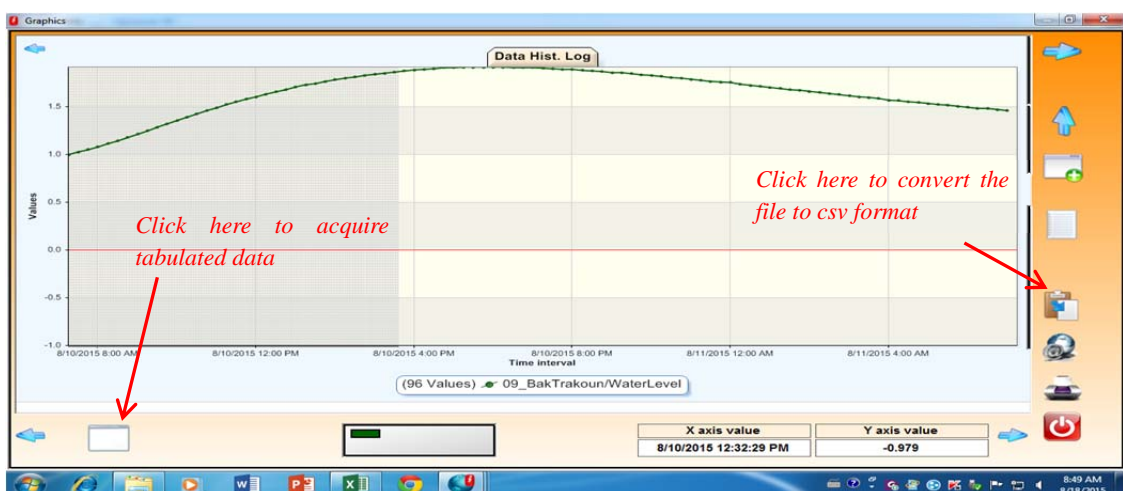
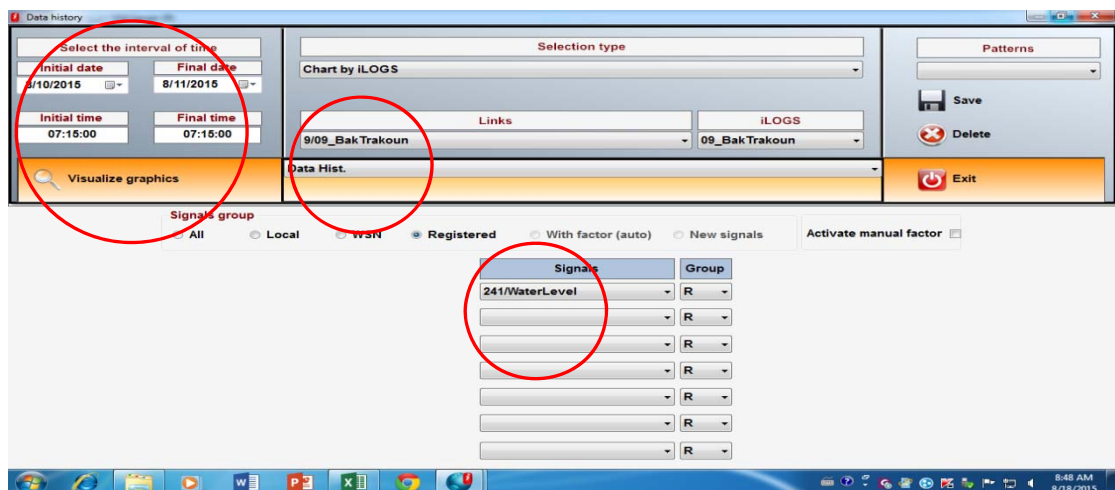


Figure 2-5 (1/5 & 2/5) Visualizing and Tabulating Water Level Record

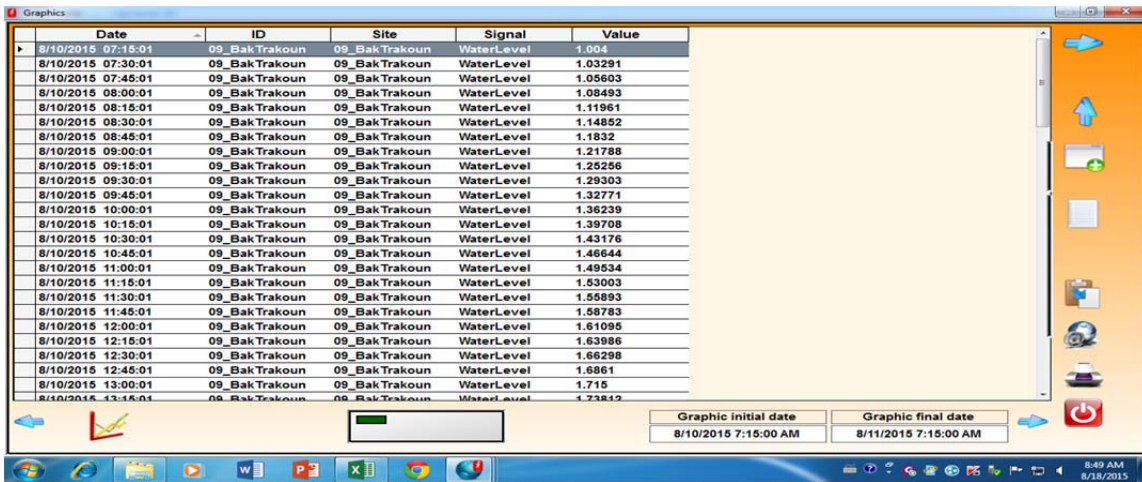


Figure 2-5 (3/5) Visualizing and Tabulating Water Level Record

If you need to look the record during the long continuous days, input Initial date 8/07/2015 and Final date 8/18/2015 e.g. → “Visualize graphics”.

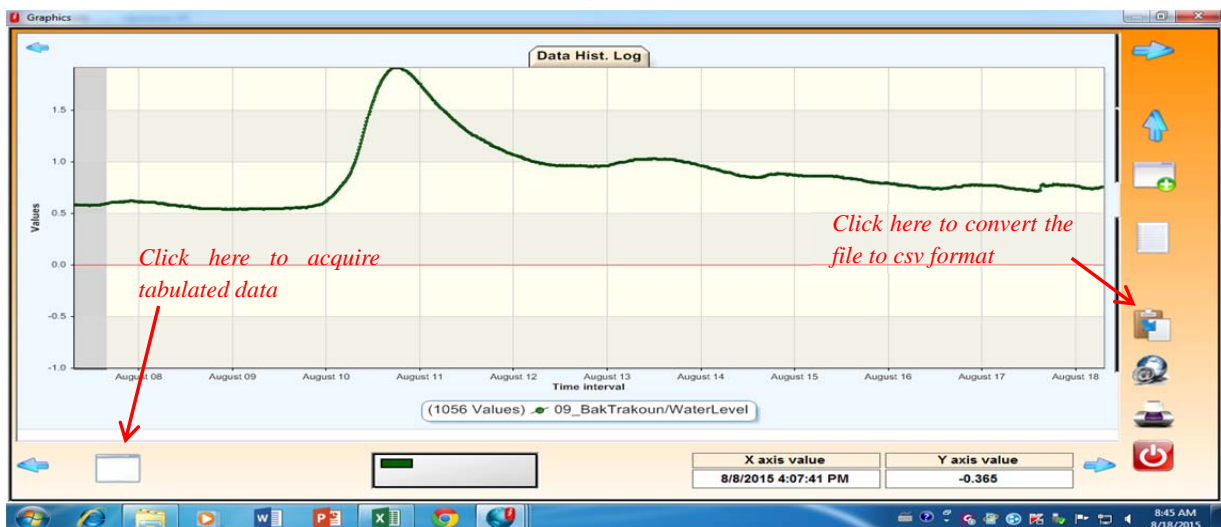
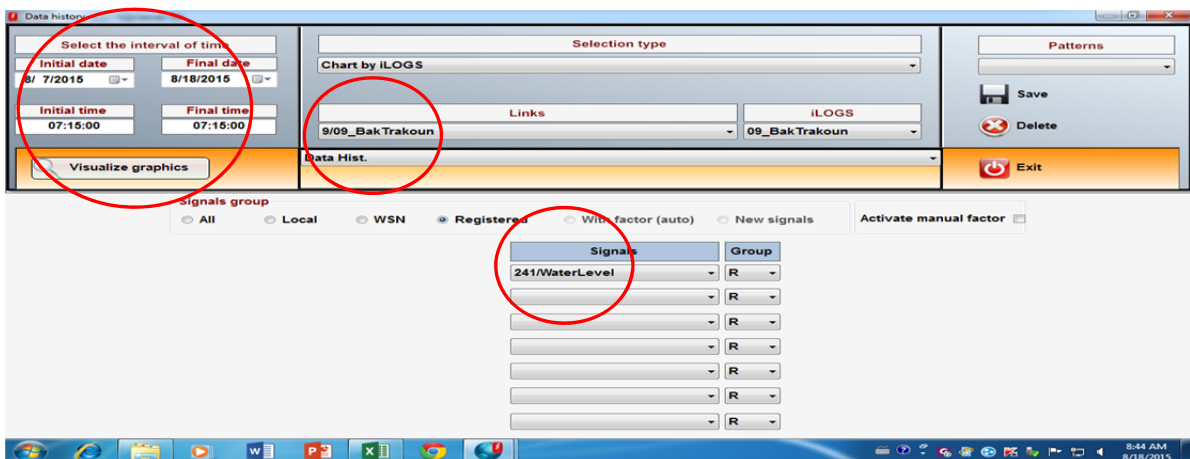


Figure 2-5 (4/5 & 5/5) Visualizing and Tabulating Water Level Record

The records by water level recorder have to be checked as follows:

(i) Visual check

The consistency or variation of water level has to be checked by eyes first time. The water level usually rises and falls with a smooth line not a zigzag line. Figure 2-5 (5/5) shows a smooth line except that on 17<sup>th</sup> August. A zigzag line means data missing due to some reasons such as the sensor does not work well, transmission was not made due to internet disconnection, etc.

The water level record shown in Figure 2-5 (3/5) can be converted to Table 2-5 (FORM-21, MSEXCEL format) by the following procedure.

Following to the above procedure, Click an icon "Export data table" → Click "Yes" → Select desktop e.g. → Input the file name 20150810 e.g. → Save as "CSV Files (\*.csv)" → Click "Save" → Confirm the information shows "Data exported correctly" → Close iSOFT,

Excel-Select blank Workbook → File-Open → Specify "All Files" → File name "20150810" → Open → Text Import Wizard - Step 1 of 3 → Click "Delimited" → Click "Next" → Click "Semicolon" → "Comma" → "Space" → Click "Next" → To confirm the continuous data is divided by type of data i.e. Date, ID (time), Site, Signal, Value, etc. → Click "General" & "Finish", File name "20150814", Save as type "Excel workbook". The Excel file converted is presented in Table 2-5 (FORM-21).

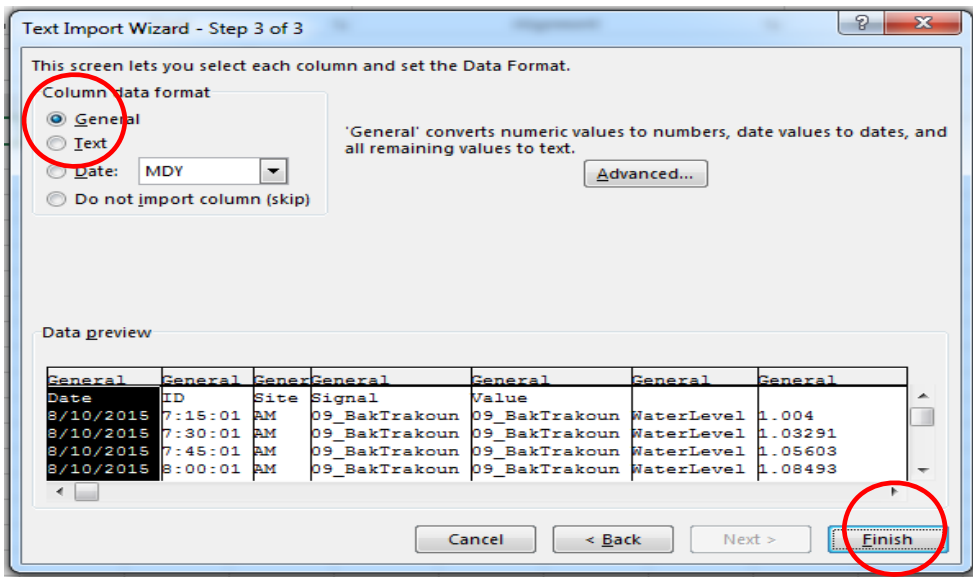
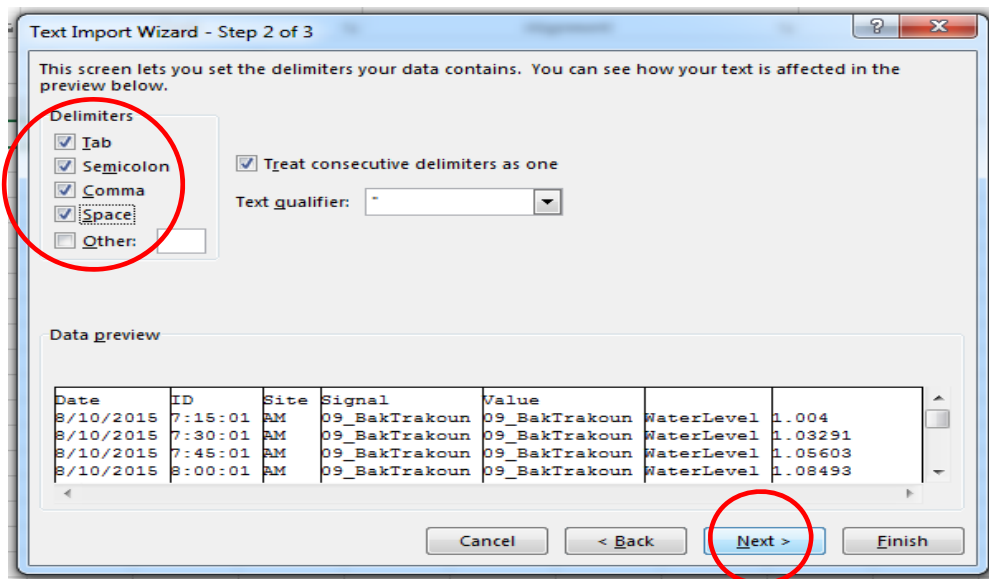
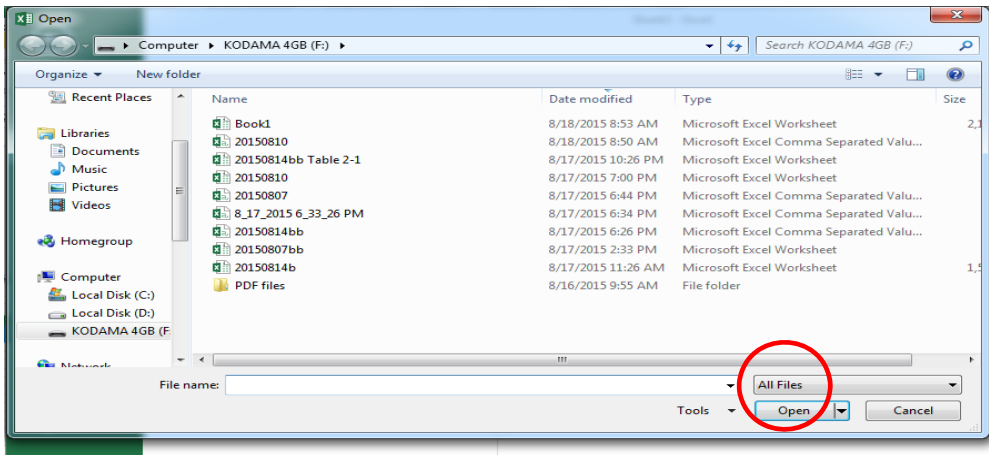


Figure 2-6 (1/3, 2/3 & 3/3) Conversion of Water Level Record from iSOFT to Excel File

**Table 2-5 Calculation of Daily Mean Water Level (FORM-22)**

Date	ID	Site	Signal	Value		
2015/8/10	7:15:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.004
2015/8/10	7:30:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.03291
2015/8/10	7:45:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.05603
2015/8/10	8:00:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.08493
2015/8/10	8:15:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.11961
2015/8/10	8:30:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.14852
2015/8/10	8:45:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.1832
2015/8/10	9:00:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.21788
2015/8/10	9:15:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.25256
2015/8/10	9:30:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.29303
2015/8/10	9:45:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.32771
	■					
	■					
	■					
2015/8/11	5:30:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.52425
2015/8/11	5:45:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.51268
2015/8/11	6:00:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.50112
2015/8/11	6:15:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.48956
2015/8/11	6:30:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.48956
2015/8/11	6:45:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.478
2015/8/11	7:00:01	AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.46644
					<b>Average</b>	<b>1.660</b>
					<b>Maximum</b>	<b>1.923</b>
					<b>Minimum</b>	<b>1.004</b>

The three rows are to be added at the bottom of the table by the operator in manual as discussed in the following paragraph.

**(2) Calculation of Daily Mean Water Level**

Using FORM-22 a daily mean water level can be calculated by average the 15 minute’s water level from 7:00 am on the previous day until 7:00 am next day. Three rows have to be added at the bottom of FORM-22 in order to calculate and find out mean water level, maximum water level and minimum water level in the relevant day.

The important values can be seen from the above table as follows:

**Table 2-6 Important Daily Water Level Values**

Description	Unit	Value	Remarks
Daily mean water level	m	1.660	The definition of daily mean water level is the arithmetic mean of all water levels in the relevant day
Daily maximum water level	m	1.923	The definition of daily maximum water level is the maximum value of all water levels in the relevant day
Daily minimum water level	m	1.004	The definition of daily minimum water level is the minimum value of all water levels in the relevant day

The calculated daily mean water level should be input to the FORM-25 to ease calculation of daily mean discharge by applying H-Q curve(s) as discussed in the Manual of Discharge Measurement by Current Meter and Floats”.

The FORM-22 has to be kept in the nominated PC for further process. The name of electronic file should be <Form-22\_20150810.xlsx>. The file should be stored in the folder which is named by station. The structure of folders and files is discussed in the following sections.

Observation of Rainfall FORM-25												
Table 2-7 Daily Mean Water Levels												
River:	Station:							E:				
Year:	District:							N:				
Input by:	Province:							Alt.(amsl):				
												(Unit: m)
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
			■									
			■									
			■									
10			■					1.660				
			■									
			■									
27												
28												
29												
30												
31												
<b>Average</b>	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.66	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
<b>Max.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.66	0.00	0.00	0.00	0.00
<b>Min.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
<b>Annual mean:</b>	1.7		Mar	<b>Annual max.:</b>			1.66 m		<b>Annual min.:</b>		0.00 m	

## 2.2.2 Water Level Recorded by Staff Gauge

### (1) Reading Staff Gauge

All AUTO stations and nine MANUAL stations have staff gauges at river/canal bank. The water level is expected to be read by an observer at each station two times in a day and recorded in the data sheet as shown in Figure 2-3 (FORM-21).

The proper way and matters that require attention in the reading staff gauge are shown in Figure 2-7.

### (2) Record of Staff Gauge at AUTO Stations

The records of staff gauges at AUTO station are used to check and collate with the record by water level sensor. If there is a large difference between two records in time and or in water level, the Project staff has to request the observer to read staff gauge and send it to him by sms so that he can get water level data from staff gauge and from sensor in real time. The data have to be collated and the causes of difference have to be clarified. After clarification of the causes, the Project will adjust values in the data logger or go to the field for repair as discussed in the following Chapter.



Should the record from data logger is missing due to internet condition or other causes, the record in the data sheet should be used for interpolation.

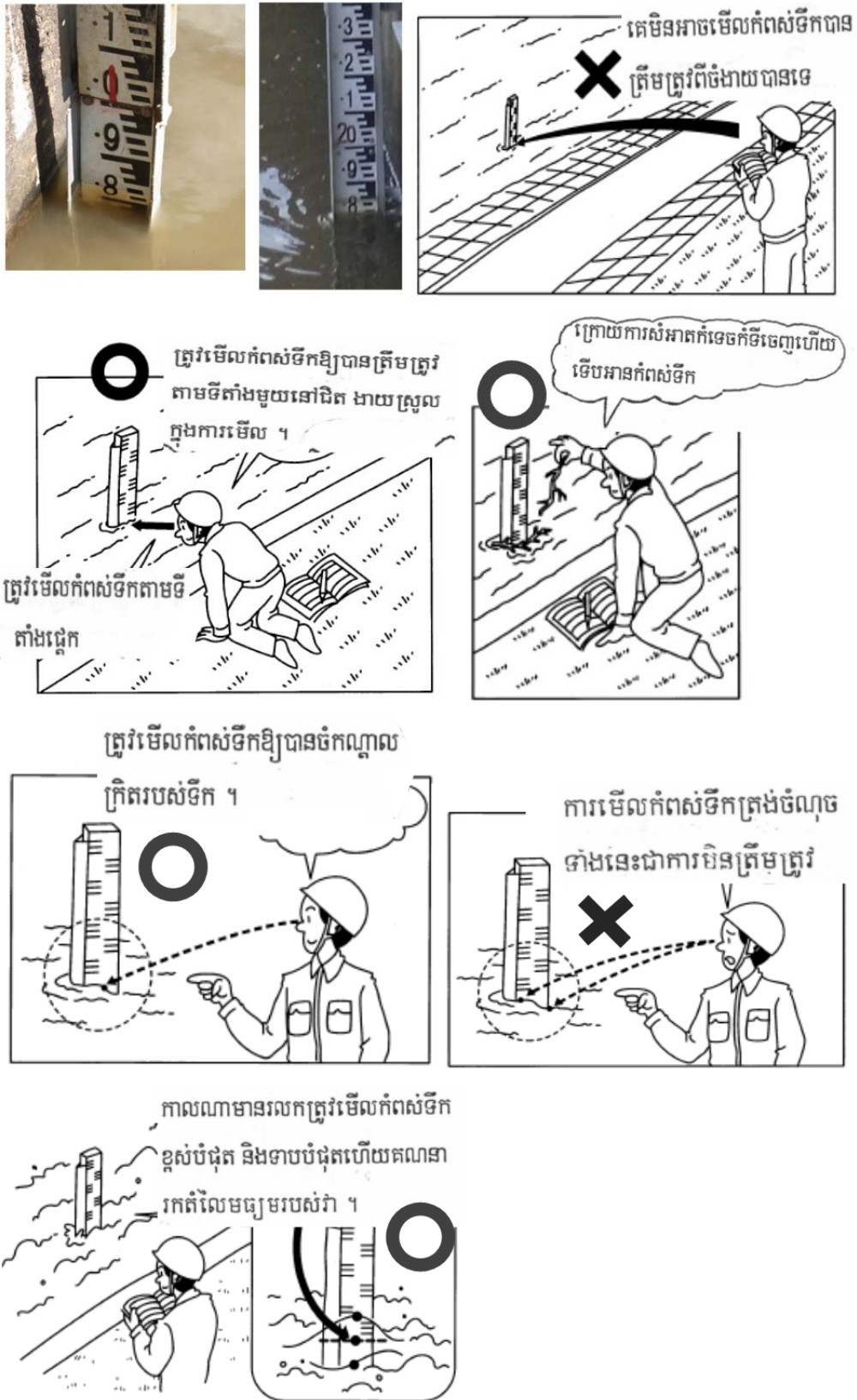


Figure 2-7 Proper Way for Reading Staff Gauge and Matters Require Attention

### (3) Record of Staff Gauge at MANUAL Stations

The records at MANUAL station have to be input to FORM-21b for calculation of daily mean value every day.

(i) Visual check

The consistency of record has to be checked by eyes at first (refer to 2.2.1 (1)). FORM-21b can prepare a water level curve for visual check.

(ii) Calculation of daily mean water level

A daily mean water level can be obtained by average of two records i.e. at 7:00 am and 7:00 pm in FORM-21b in the relevant month. The result should be input FORM-25 (Table 2-7).

(iii) Saving FORM-21b in the nominated PC

The FORM-21b should be stored in the nominated PC. The file name should be <"Station code"\_FORM-21b.xlsx>.

### 2.2.3 Filing Structure for Water Level Record

The electronic files of water level record have to be saved in the master PC of Team-1. Name of folders and files have to contain name of station, year, month, date so that users can retrieve record at the target station and target period can find out easily. On the contrary the name of folders and files should be short to ease creating/retrieving the name of folder/file. A temporary code is given to each station to shorten the name of folders and Excel files as shown in Table 2-8. The structure for folders and file name for rainfall record in the Master PC is proposed as Figure 2-8.

Name of station		Code
Andaek Herb		ADH
Bassac Dam Reservoir		BAR
Bassac Dam Spillway		BAS
Prek Chik Left Canal		PCL
Prek Chik Right Canal		PCR
Prek Am		PRA
Prek Am Canal		PAC
Tades		TAD
Bak Trakoun		BKT
Khum Veal		KHV
Charek Left Canal		CLC
Ptes Kor Canal		PKC
Pearm		PEA
Santre		SAN
Svay Daun Keo	In the Damnak Ampil canal	SDK#1
	Inlet at sluice gate, Damnak Ampil side	SDK#2
	Opening of sluice gate, Damnak Ampil side	SDK#3
	Overflow crest of spillway	SDK#4
	Inlet at sluice gate, Prek Chik side	SDK#5
	Opening of sluice gate, Prek Chik side	SDK#6



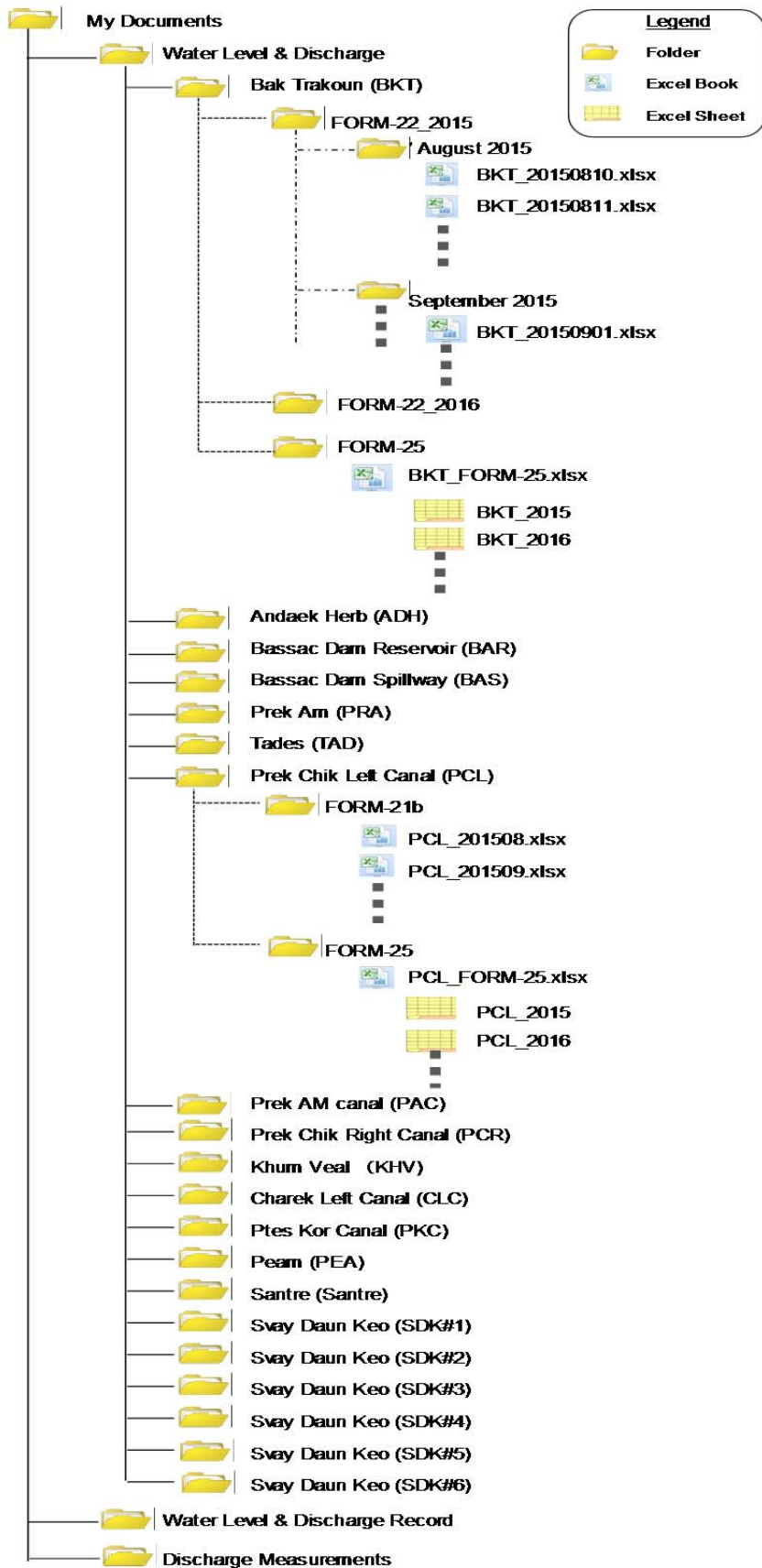


Figure 2-8 Filing Structure for Water Level Data

## **CHAPTER III OPERATION AND MAINTENANCE OF STATIONS**

### **3.1 Automatic Water Level and Rain Gauge Stations**

#### **3.1.1 Work by Observers**

The daily work to operate and maintain a station such as reading staff gauge and rainfall gauge, cleaning gauges, and so on requires someone who stays near the station and has an easy access to the station. The Project contracts an observer at each station to entrust the following works. A few observers cover more than two stations if stations are located closely.

- i) To read and record water level at staff gauge at 7:00 and 19:00 every day;
- ii) To measure and record manual rain gauge(s), if any, at 7:00 and 19:00 every day;
- iii) To keep the data sheets of water level and rainfall in the safety place;
- iv) To present and submit data sheets to the Project/MOWRAM every month or at the time as requested by the Project/MOWRAM;
- v) To keep staff gauges in secure and clean condition all the time, to remove any debris stuck on the staff gauge, to clean stains on the staff gauge, if any;
- vi) To check rainfall gauge, solar panel and data logger, and to remove any objects/debris on these instruments;
- vii) To check if cables which run from rain gauge, solar panel, lightning to the recorder's house are in secure condition;
- viii) To cut branch(s) of tree if it covers or makes shadow the rainfall gauge or solar panel;
- ix) To keep the station(s) as a whole in secure and clean condition;
- x) To inform promptly to the Project/MOWRAM, if any work appears to exceed his ability;
- xi) To participate in executing discharge measurement and other work by the Project/MOWRAM such as cleaning water level sensor, removing sediment/debris/garbage from the sensor well, and so on.

Some principal works to be executed by observers are illustrated as follows:



**Figure 2-9 Some Principal Works to be Performed by Observers**

In this regards Dept. of Hydrology and River Works has a booklet “Principle for Water Survey”. Some part of the booklet is still useful to guide observers in executing maintenance work at hydrological stations as attached in Appendix- 5.

### **3.1.2 Work By The Project/MOWRAM**

The office of the Project/MOWRAM has to conduct the following works.

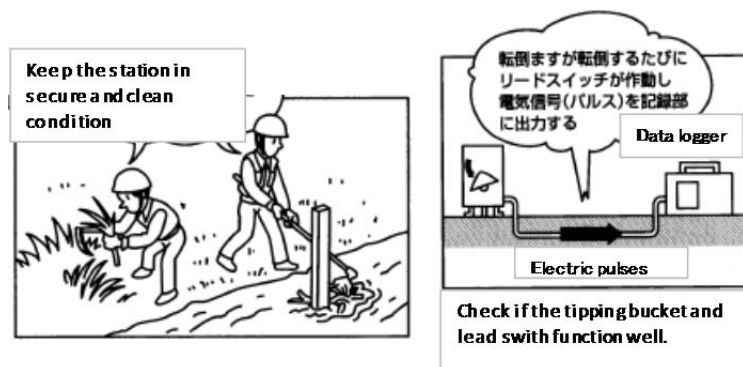
#### **(1) Daily Work**

- i) To acquire the received data in MSEXCEL format and process it as described in Chapter II every day, and to check if the data observed is reasonable or not;
- ii) To process data in data sheets as described in the previous chapter;
- iii) To check if acquired data shows unusual situation, to take necessary action to improve or repair the automatic gauges, if there is trouble;

#### **(2) Regular and Irregular Work**

- i) To dispatch staff regularly to collect data sheets filled by observers and to check the condition of stations;
- ii) To do necessary action to improve or repair the instruments and surrounding conditions of stations, including checking if the tipping bucket and reed switch function well; this work should be executed before a start of rainy season;

- iii) To check and clean rainfall gauge, staff gauges and recorder's house, to cut grass and trees, if any, before start of rainy season as shown below;



**Figure 2-10 Cleaning the Station and Checking Rainfall Recorder before Rainy Season by the Project/MOWRAM**

- iv) To conduct discharge measurement and other work such as cleaning water level sensor, removing sediment/debris/garbage from the sensor well, and so on;

Discharge measurements should be carried out at various water levels so that various discharge data can be obtained. The number of discharge measurements at automatic stations is tentatively proposed as follows. However, it does not limit the number of measurements.

One time at least in a month in five stations i.e. Andaek Herb, Bassac Dam Spillway, Prek Am, Tades and Bak Trakoun.

### 3.2 Manual Water Level Stations

#### 3.2.1 Work by Observers

The daily work to operate and maintain a manual station such as reading staff gauge and, cleaning gauges, and so on requires someone who stays near the station and has an easy access to the station. The Project contracts an observer at each station to entrust the following works. A few observers cover more than two stations if stations are located closely.

- i) To read and record water level at staff gauge at 7:00 and 19:00 every day;
- ii) To keep the data sheets of water level in the safety place;
- iii) To present and submit data sheets to the Project/MOWRAM every month or at the time as requested by THE PROJECT/MOWRAM,
- iv) To keep the staff gauge in secure and clean condition all the time, to remove any debris stuck on the staff gauge, to clean stains on the staff gauge, if any,

- v) To keep the station(s) as a whole in secure and clean condition,
- vi) To inform promptly to the Project/MOWRAM, if any work appears to exceed his ability,
- vii) To participate in executing discharge measurement and other work by the Project/MOWRAM.



**Remove objects/debris from staff gauge  
Figure 2-11 Cleaning Staff Gauges  
by an Observer**

### 3.2.2 Work by the Project/MOWRAM

The office of the Project/MOWRAM has to conduct the following works regularly or occasionally.

- i) To dispatch staff regularly to collect data sheets filled by observers and to check the condition of stations;
- ii) To do necessary action to improve or repair the staff gauges surrounding conditions of stations;
- iii) To conduct discharge measurement and other works such as cleaning, repair, replace staff gauges, and so on.



**Figure 2-12 Cleaning Staff Gauges by  
the Project/MOWRAM**

The number of discharge measurements at manual station is tentatively proposed as follows. However, it does not limit the number of measurements as discussed in the previous section.

One time at least in a month in three stations i.e. Santre, Peam and Khum Veal;

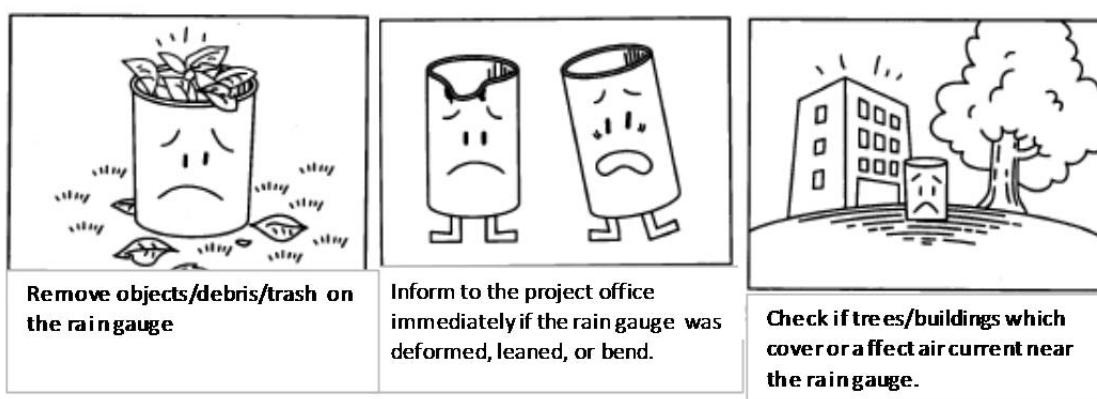
Three times at least in a year in six stations i.e. Prek Chik Left Canal, Prek Chik Right Canal, Preka Am Canal, Charek Left Canal, Ptes Kor Canal and Svay Daun Keo (downstream several ten meters from overflow spillway in the Svay Daun Keo River).

## 3.3 Rain Recorder Stations

### 3.3.1 Work by Observers

- i) To check rainfall gauge, solar panel and data logger, and to remove any objects/debris on these instruments;
- ii) To check if cables which run from rain gauge, solar panel, lightning to the recorder's house are in secure condition;
- iii) To cut branch(s) of tree if it covers or makes shadow the rainfall gauge or solar panel;

- iv) To keep the station(s) as a whole in secure and clean condition;
  - v) To inform promptly to the Project/MOWRAM, if any work appears to exceed his ability;
- (The followings are to be applied to the station which has a manual rain gauge e.g. Samlot);
- vi) To measure and record manual rain gauge, if any, at 7:00 and 19:00 every day;
  - vii) To keep the data sheets of manual rainfall gauge in the safety place;
  - viii) To present and submit data sheets to the Project/MOWRAM every month or at the time as requested by the Project/MOWRAM.



**Figure 2-13 Some Principal Works by an Observer at Rain Recorder Stations**

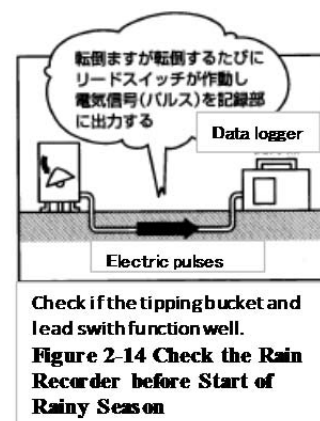
### 3.3.2 Work by the Project/MOWRAM

#### (1) Daily Work

- i) To acquire the received data in MSEXCEL format and process it as described in Chapter II every day, and to check if the data observed is reasonable or not;
- ii) To process data in data sheets as described in the previous chapter;
- iii) To check if acquired data shows unusual situation, to take necessary action to improve or repair the automatic gauges, if there is trouble;

#### (2) Regular or Irregular Work

- i) To dispatch staff regularly to collect data sheets filled by observers and to check the condition of stations;
- ii) To do necessary action to improve or repair the instruments and surrounding conditions of stations.



# FORMS

**Royal Kingdom of Cambodia**  
**ព្រះរាជាណាចក្រកម្ពុជា**

Nation Religion King  
ជាតិ សាសនា ព្រះមហាក្សត្រ

Ministry of Water Resources and  
Meteorology

ក្រសួងធនធានទឹក និងខតុនិយម

Japan International Cooperation  
Agency  
River Basin Water Resources  
Utilization Project

គម្រោងការប្រើប្រាស់ធនធានទឹក  
នៅតាមអាងស្ទឹង

# **Rainfall Book**

សៀវភៅកត់ត្រាបរិមាណទឹកភ្លៀង



**FORM-11  
Rainfall**

បរិមាណទឹកភ្លៀង

Station:  
ស្ថានីយ

North:  
ខ្សែស្របខាងជើង:

East:  
ខ្សែស្របខាងកើត:

Elevation in meter:  
កំពស់:

Capital City of Province:  
រាជធានី-ខេត្ត

Month:  
ខែ

Year:  
ឆ្នាំ

Type of Season:  
ប្រភេទនៃវស្សាមាត្រ

Observer/អ្នកពិនិត្យ:

Date ថ្ងៃទី	Measurement បរិមាណទឹកភ្លៀងវាស់		Total (24hr) បូករួម (២៤ម៉ោង)	Descriptions (1) (Started and Stopped Rainfall) សេចក្តីកត់ហេតុផ្សេងៗនៃបាតុភូតដែលមាន(១) (ម៉ោងចាប់ផ្តើម និងម៉ោងបញ្ចប់)
	Time: 07-19	Time: 19-07		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Sub-total បូករួម				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Sub-total បូករួម				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Sub-total បូករួម				
Total/Month បូករួមក្នុងខែ				

Number of Rainfall Days  
ចំនួនថ្ងៃដែលភ្លៀង

- (2) ( R ) ≤ 1.0mm.....
- ( R ) ≤ 10.0mm.....
- ( R ) ≤ 30.0mm.....
- ( R ) > 50.0mm.....

Total/បូករួម:

Note/កំណត់ចំណាំ

- (1) Type of Rainfall Thunder, etc.
- (១) ប្រភេទនៃភ្លៀង ផ្កា  
រន្ទះ ផ្លេកបន្ទោរ...។ល។

- (2) Grade of rainfall  
(២) បរិមាណទឹកភ្លៀង

Seen and approved  
បានឃើញ និងឯកភាព

Date: ថ្ងៃទី      Month: ខែ      Year: ឆ្នាំ២០

Meteorology Chief Office:  
ប្រធានការិយាល័យ ឧតុនិយម

Chief of Rainfall Collector:  
ប្រធានប៉ុស្តិ៍

បរិមាណទឹកភ្លៀង

Station:  
ស្ថានីយ

North:  
ខ្សែស្របខាងជើង:

East:  
ខ្សែស្របខាងកើត:

Elevation in meter:  
កម្ពស់:

Capital City of Province:  
រាជធានី-ខេត្ត

Month:  
ខែ

Year:  
ឆ្នាំ

Type of Season:  
ប្រភេទនៃរដូវវស្សា

Observer:  
អ្នកពិនិត្យ

Date ថ្ងៃទី	Measurement បរិមាណទឹកភ្លៀងវាស់		Total (24hr) បូករួម (២៤ម៉ោង)	Descriptions (1) (Started and Stopped Rainfall) សេចក្តីកត់ហេតុផ្សេងៗនៃបាតុភូតដែលមាន(១) (ម៉ោងចាប់ផ្តើម និងម៉ោងបញ្ចប់)
	Time: 07-19	Time: 19-07		
1			0.0	
2			0.0	
3			0.0	
4			0.0	
5			0.0	
6			0.0	
7			0.0	
8			0.0	
9			0.0	
10			0.0	
Sub-total បូករួម	0.0	0.0	0.0	
11			0.0	
12			0.0	
13			0.0	
14			0.0	
15			0.0	
16			0.0	
17			0.0	
18			0.0	
19			0.0	
20			0.0	
Sub-total បូករួម	0.0	0.0	0.0	
21			0.0	
22			0.0	
23			0.0	
24			0.0	
25			0.0	
26			0.0	
27			0.0	
28			0.0	
29			0.0	
30			0.0	
31			0.0	
Sub-total បូករួម	0.0	0.0	0.0	
Total/Month បូករួមក្នុងខែ	0.0	0.0	0.0	

Number of Rainfall Days  
ចំនួនថ្ងៃដែលភ្លៀង

- (2) ( R ) ≤ 1.0mm.....
- ( R ) ≤ 10.0mm.....
- ( R ) ≤ 30.0mm.....
- ( R ) > 50.0mm.....

Total/បូករួម:

Note/កំណត់ចំណាំ

- (1) Type of Rainfall Thunder,...etc.
- (១) ប្រភេទនៃភ្លៀង ផ្កុះ  
រន្ទះ ផ្កេកបន្ទោរ...។ល។

- (2) Grade of rainfall  
(២) បរិមាណទឹកភ្លៀង

Seen and approved  
បានឃើញ និងឯកភាព

Date: ថ្ងៃទី      Month: ខែ      Year: ឆ្នាំ២០

Meteorology Chief Office:  
ប្រធានការិយាល័យ ឧតុនិយម

Chief of Rainfall Collector:  
ប្រធានប៉ុស្តិ៍



2015/8/14	11:15:01 PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	11:30:01 PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/14	11:45:01 PM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	12:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	12:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	12:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	12:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	1:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	1:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	1:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	1:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	2:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	2:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	2:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	2:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	3:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	3:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	3:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	3:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	4:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	4:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	4:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	4:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	5:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	5:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	5:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	5:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:15:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:30:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	6:45:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
2015/8/15	7:00:01 AM	09_BakTrakoun	09_BakTrakoun	RainFall	0
<b>Total/One day rainfall (mm)</b>					<b>20.828</b>
<b>Maximum 15-minute rainfall (mm)</b>					<b>10.414</b>

**Observation of Rainfall FORM-15**  
**Daily Rainfall Record**

River: \_\_\_\_\_ Station: \_\_\_\_\_ E: \_\_\_\_\_  
 Year: \_\_\_\_\_ District: \_\_\_\_\_ N: \_\_\_\_\_  
 Input by: \_\_\_\_\_ Province: \_\_\_\_\_ Alt.(amsl): \_\_\_\_\_

(Unit: mm)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14								20.83				
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
<b>Total</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.83	0.00	0.00	0.00	0.00
<b>Max.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.83	0.00	0.00	0.00	0.00
<b>Rainy days R&gt;=0.5mm</b>	0	0	0	0	0	0	0	1	0	0	0	0
<b>Annual rainfall:</b>	20.8 mm		<b>Annual max. daily rainfall:</b>				20.83 mm		<b>Total rainy days (R&gt;=0.5mm)</b> 1			

**Royal Kingdom of Cambodia**  
**ព្រះរាជាណាចក្រកម្ពុជា**

Nation Religion King  
ជាតិ សាសនា ព្រះមហាក្សត្រ

Ministry of Water Resources and  
Meteorology

ក្រសួងធនធានទឹក និងឧតុនិយម

Japan International Cooperation  
Agency

River Basin Water Resources  
Utilization Project

គម្រោងការប្រើប្រាស់ធនធានទឹក  
នៅតាមអាងស្តុន

**HYDROLOGICAL OBSERVATION BOOK - GAUGE HEIGHT IN  
METERS**

សៀវភៅសង្កេតពិនិត្យជលសាស្ត្រ ~ កំពស់ទឹកជាម៉ែត្រ

**Royal Kingdom of Cambodia**

ព្រះរាជាណាចក្រកម្ពុជា

Ministry of Water Resources and  
Meteorology

ក្រសួងធនធានទឹក និងឧតុនិយម

**Nation Religion King**

ជាតិ សាសនា ព្រះមហាក្សត្រ

Japan International Cooperation Agency

River Basin Water Resources Utilization Project

គម្រោងការប្រើប្រាស់ធនធានទឹកនៅតាមអាងស្ទឹង

**HYDROLOGICAL OBSERVATION BOOK - GAUGE HEIGHT IN METERS (FORM-21)**

សៀវភៅសង្កេតពិនិត្យជលសាស្ត្រ ~ កំពស់ទឹកជាម៉ែត្រ

Month:

Year:

ខែ

ឆ្នាំ

River:

Station:

Zero G.H.:

M.S.L.

ទន្លេ-ស្ទឹង

ស្ថានីយ

រយៈកំពស់នៃសុន្យក្តារម៉ែត្រ

ធៀបនឹងនិរ្ទេសមុន្រ

Date	Time	H. (m)	H. average (m)	Phenomena	Date	Time	H. (m)	H. average (m)	Phenomena
ថ្ងៃទី	ម៉ោង	កំពស់ទឹក ជាម៉ែត្រ	កំពស់ទឹក មធ្យមប្រចាំ ថ្ងៃ	បាតុភូតផ្សេងៗ	ថ្ងៃទី	ម៉ោង	កំពស់ទឹក ជាម៉ែត្រ	កំពស់ទឹក មធ្យមប្រចាំ ថ្ងៃ	បាតុភូតផ្សេងៗ
1	07:00				17	07:00			
	19:00					19:00			
2	07:00				18	07:00			
	19:00					19:00			
3	07:00				19	07:00			
	19:00					19:00			
4	07:00				20	07:00			
	19:00					19:00			
5	07:00				21	07:00			
	19:00					19:00			
6	07:00				22	07:00			
	19:00					19:00			
7	07:00				23	07:00			
	19:00					19:00			
8	07:00				24	07:00			
	19:00					19:00			
9	07:00				25	07:00			
	19:00					19:00			
10	07:00				26	07:00			
	19:00					19:00			
11	07:00				27	07:00			
	19:00					19:00			
12	07:00				28	07:00			
	19:00					19:00			
13	07:00				29	07:00			
	19:00					19:00			
14	07:00				30	07:00			
	19:00					19:00			
15	07:00				31	07:00			
	19:00					19:00			
16	07:00					07:00			
	19:00					19:00			

Observer:

អ្នកពិនិត្យ

Checked by:

បានឃើញ

Royal Kingdom of Cambodia

ព្រះរាជាណាចក្រកម្ពុជា  
Ministry of Water Resources and  
Meteorology  
ក្រសួងធនធានទឹក និងខ្យល់ច្របូកច្របល់

Nation Religion King

ជាតិ សាសនា ព្រះមហាក្សត្រ  
Japan International Cooperation Agency  
River Basin Water Resources Utilization Project  
គម្រោងការប្រើប្រាស់ធនធានទឹកនៅតាមអាងស្ទឹង

HYDROLOGICAL OBSERVATION BOOK - GAUGE HEIGHT IN FORM-21b

សៀវភៅសង្កេតទិន្នន័យស្ទឹង - កំពស់ទឹកជាម៉ែត្រ

Month: \_\_\_\_\_ Year: \_\_\_\_\_

ខែ \_\_\_\_\_ ឆ្នាំ \_\_\_\_\_

River: \_\_\_\_\_ Station: \_\_\_\_\_

ទន្លេ-ស្ទឹង

ស្ថានីយ៍

Zero G.H.: \_\_\_\_\_ M.S.L.

រយៈកំពស់នៃសុទ្ធក្នុងម៉ែត្រ

ធៀបនឹងស្រទាប់

Graph of records

Calculation daily mean WL

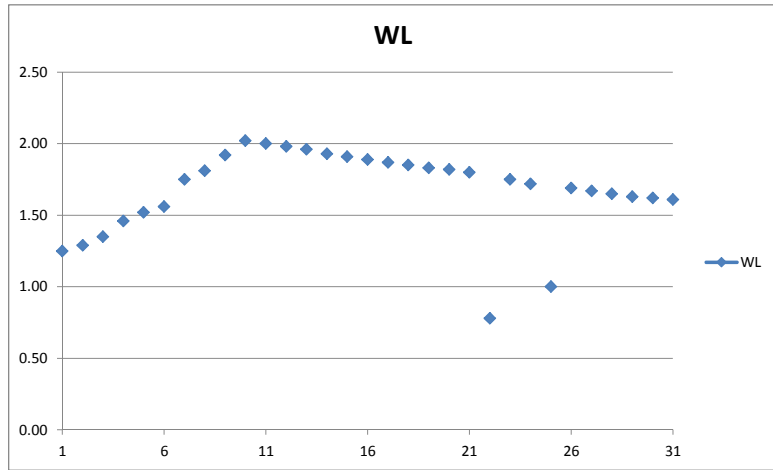
Date	Time	H. (m)	H. average (m)	Phenomena	Date	Time	H. (m)	H. average (m)	Phenomena
ថ្ងៃទី	ម៉ោង	កំពស់ទឹកជាម៉ែត្រ	មធ្យមកំពស់ទឹកជាម៉ែត្រ	បញ្ហាផ្សេងៗ	ថ្ងៃទី	ម៉ោង	កំពស់ទឹកជាម៉ែត្រ	មធ្យមកំពស់ទឹកជាម៉ែត្រ	បញ្ហាផ្សេងៗ
1	07:00	1.25			17	07:00	1.87		
	19:00	1.26				19:00	1.86		
2	07:00	1.29			18	07:00	1.85		
	19:00	1.29				19:00	1.84		
3	07:00	1.35			19	07:00	1.83		
	19:00	1.48				19:00	1.83		
4	07:00	1.46			20	07:00	1.82		
	19:00	1.52				19:00	1.8		
5	07:00	1.52			21	07:00	1.8		
	19:00	1.53				19:00	1.79		
6	07:00	1.56			22	07:00	0.78		
	19:00	1.71				19:00	1.76		
7	07:00	1.75			23	07:00	1.75		
	19:00	1.79				19:00	1.73		
8	07:00	1.81			24	07:00	1.72		
	19:00	1.85				19:00	1.71		
9	07:00	1.92			25	07:00	1		
	19:00	2.01				19:00	1.7		
10	07:00	2.02			26	07:00	1.69		
	19:00	2.01				19:00	1.68		
11	07:00	2			27	07:00	1.67		
	19:00	1.99				19:00	1.66		
12	07:00	1.98			28	07:00	1.65		
	19:00	1.97				19:00	1.64		
13	07:00	1.96			29	07:00	1.63		
	19:00	1.95				19:00	1.63		
14	07:00	1.93			30	07:00	1.62		
	19:00	1.92				19:00	1.62		
15	07:00	1.91			31	07:00	1.61		
	19:00	1.9				19:00	1.61		
16	07:00	1.89				07:00			
	19:00	1.88				19:00			

Observer: ម្នាក់ទឹក

Checked by: បានឃើញ

Date	WL
1	1.25
	1.26
2	1.29
	1.29
3	1.35
	1.48
4	1.46
	1.52
5	1.52
	1.53
6	1.56
	1.71
7	1.75
	1.79
8	1.81
	1.85
9	1.92
	2.01
10	2.02
	2.01
11	2.00
	1.99
12	1.98
	1.97
13	1.96
	1.95
14	1.93
	1.92
15	1.91
	1.90
16	1.89
	1.88
17	1.87
	1.86
18	1.85
	1.84
19	1.83
	1.83
20	1.82
	1.80
21	1.80
	1.79
22	0.78
	1.76
23	1.75
	1.73
24	1.72
	1.71
25	1.00
	1.70
26	1.69
	1.68
27	1.67
	1.66
28	1.65
	1.64
29	1.63
	1.63
30	1.62
	1.62
31	1.61
	1.61

No.	Date	H
1	2015/8/1	1.255
2	2015/8/2	1.290
3	2015/8/3	1.415
4	2015/8/4	1.490
5	2015/8/5	1.525
6	2015/8/6	1.635
7	2015/8/7	1.770
8	2015/8/8	1.830
9	2015/8/9	1.965
10	2015/8/10	2.015
11	2015/8/11	1.995
12	2015/8/12	1.975
13	2015/8/13	1.955
14	2015/8/14	1.925
15	2015/8/15	1.905
16	2015/8/16	1.885
17	2015/8/17	1.865
18	2015/8/18	1.845
19	2015/8/19	1.830
20	2015/8/20	1.810
21	2015/8/21	1.795
22	2015/8/22	1.270
23	2015/8/23	1.740
24	2015/8/24	1.715
25	2015/8/25	1.350
26	2015/8/26	1.685
27	2015/8/27	1.665
28	2015/8/28	1.645
29	2015/8/29	1.630
30	2015/8/30	1.620
31	2015/8/31	1.610
Average		1.707
Max.		2.015
Min.		1.255





Date	ID	Site	Signal	Value		
2015/8/10	7:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.004
2015/8/10	7:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.03291
2015/8/10	7:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.05603
2015/8/10	8:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.08493
2015/8/10	8:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.11961
2015/8/10	8:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.14852
2015/8/10	8:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.1832
2015/8/10	9:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.21788
2015/8/10	9:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.25256
2015/8/10	9:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.29303
2015/8/10	9:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.32771
2015/8/10	10:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.36239
2015/8/10	10:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.39708
2015/8/10	10:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.43176
2015/8/10	10:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.46644
2015/8/10	11:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.49534
2015/8/10	11:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.53003
2015/8/10	11:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.55893
2015/8/10	11:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.58783
2015/8/10	12:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.61095
2015/8/10	12:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.63986
2015/8/10	12:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.66298
2015/8/10	12:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.6861
2015/8/10	1:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.715
2015/8/10	1:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.73812
2015/8/10	1:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.74968
2015/8/10	1:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.77281
2015/8/10	2:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.79015
2015/8/10	2:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.80749
2015/8/10	2:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.81905
2015/8/10	2:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.83639
2015/8/10	3:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.84795
2015/8/10	3:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.85951
2015/8/10	3:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.87107
2015/8/10	3:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.88264
2015/8/10	4:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.8942
2015/8/10	4:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.89998
2015/8/10	4:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.90576
2015/8/10	4:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91732
2015/8/10	5:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91732
2015/8/10	5:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.9231
2015/8/10	5:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.9231
2015/8/10	5:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.9231
2015/8/10	6:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.9231
2015/8/10	6:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.9231
2015/8/10	6:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91732
2015/8/10	6:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91732
2015/8/10	7:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91732
2015/8/10	7:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.91154
2015/8/10	7:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.90576
2015/8/10	7:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.89998
2015/8/10	8:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.89998
2015/8/10	8:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.88842
2015/8/10	8:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.88264
2015/8/10	8:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.87685
2015/8/10	9:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.86529
2015/8/10	9:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel		1.86529

2015/8/10	9:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.85373
2015/8/10	9:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.84217
2015/8/10	10:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.83639
2015/8/10	10:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.82483
2015/8/10	10:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.81327
2015/8/10	10:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.80749
2015/8/10	11:00:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.79593
2015/8/10	11:15:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.78437
2015/8/10	11:30:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.77281
2015/8/10	11:45:01 PM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.76702
2015/8/11	12:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.76124
2015/8/11	12:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.7439
2015/8/11	12:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.73234
2015/8/11	12:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.72078
2015/8/11	1:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.70922
2015/8/11	1:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.69766
2015/8/11	1:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.6861
2015/8/11	1:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.68032
2015/8/11	2:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.66876
2015/8/11	2:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.6572
2015/8/11	2:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.64564
2015/8/11	2:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.63408
2015/8/11	3:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.62251
2015/8/11	3:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.61095
2015/8/11	3:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.60517
2015/8/11	3:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.59361
2015/8/11	4:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.57627
2015/8/11	4:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.57049
2015/8/11	4:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.55893
2015/8/11	4:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.55315
2015/8/11	5:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.54159
2015/8/11	5:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.53003
2015/8/11	5:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.52425
2015/8/11	5:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.51268
2015/8/11	6:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.50112
2015/8/11	6:15:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.48956
2015/8/11	6:30:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.48956
2015/8/11	6:45:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.478
2015/8/11	7:00:01 AM	09_BakTrakoun	09_BakTrakoun	WaterLevel	1.46644

				<b>Average</b>	<b>1.660</b>
				<b>Maximum</b>	<b>1.923</b>
				<b>Minimum</b>	<b>1.004</b>

**Observation of Rainfall FORM-25**  
**Daily Mean Water Levels**

River: \_\_\_\_\_  
 Year: \_\_\_\_\_  
 Input by: \_\_\_\_\_

Station: \_\_\_\_\_  
 District: \_\_\_\_\_  
 Province: \_\_\_\_\_

E: \_\_\_\_\_  
 N: \_\_\_\_\_  
 Alt.(amsl): \_\_\_\_\_

(Unit: m)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1												
2												
3												
4												
5												
6												
7												
8												
9												
10								1.66				
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
<b>Average</b>	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1.66	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
<b>Max.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.66	0.00	0.00	0.00	0.00
<b>Min.</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
<b>Annual mean:</b>	1.7	Mar	<b>Annual max.:</b>		1.66	m	<b>Annual min.:</b>		0.00	m		