

HYDROLOGICAL PROCEDURE NO. 21

EVAPORATION DATA COLLECTION
USING U.S. CLASS 'A'
ALUMINIUM PAN

1981



JABATAN PENGAIRAN DAN SALIRAN
KEMENTERIAN PERTANIAN MALAYSIA

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BAHAGIAN PARIT DAN TALIAIR
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Price: \$5/-

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1. EQUIPMENT

The equipment consists of the following items:—

- (a) Evaporation pan 1210 mm dia. (internal) x 255 mm high, made from No. 20 gauge aluminium plate.
- (b) Fixed point gauge.
- (c) Graduated measuring can.
- (d) Storage tank of water for replacing water lost from the pan by evaporation.
- (e) A standard daily raingauge, and additionally in some cases, a tipping-bucket automatic recording gauge. The raingauge should be installed either north or south of the pan and be at least 1.5 m away from the pan. It must not be east or west of the pan as this will result in a shadow across the pan in early morning or evening.

2. INSTALLATION AND MAINTENANCE

- (i) The site chosen for evaporation station should satisfy the requirements of a rainfall station and should be fairly level, well grassed and also free from flooding.

At locations where the soil does not permit the maintenance of a grass cover, the ground cover should be maintained as nearly as possible to the natural cover common to the area. The evaporation pan must *never* be placed on a concrete slab, or over asphalt, or layer of crushed rock. Obstructions such as trees, buildings, and nearby shrubs should not be closer to the equipment than *four* times the height of the object above the pan. The exposure should be free from obstructions that cast shadows over the pan during any part of the day other than brief periods near sunrise and sunset. Weeds and grass in and around the enclosure, should be mowed often enough to keep them well below the level of the pan.

The station should be at least 5 m x 5 m and enclosed by a fence, adequate to protect the equipment, and to prevent animals from drinking the water. A chain-link fence four feet high, with angle iron posts set in concrete is recommended.

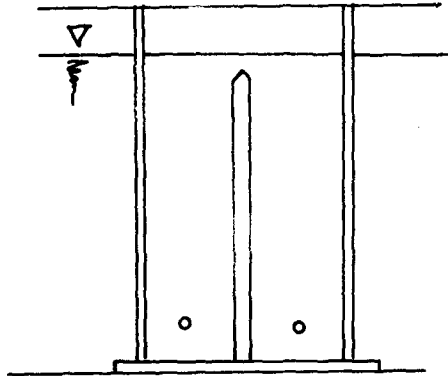
- (ii) 5 Nos. 100 mm x 100 mm x 1400 mm treated timbers are placed on the chosen site at 400 mm intervals (centre to centre), on which 9 Nos. 50 mm x 50 mm x 1800 mm treated timbers are nailed at 140 mm (centre to centre). Care should be taken to ensure that this platform is perfectly level. During inspections, the level of the platform must be checked and corrected if needed. The evaporation pan should be centred on the platform (see Fig. 1).
- (iii) The evaporation pan should be filled with fresh water, free from oil to the point of the brass rod of the fixed point gauge which is 64 mm below the rim of the tank.
- (iv) Regular inspection should be carried out to see that the evaporation pan is in good condition and the water is clear. Inspect the pans for leaks carefully *at least once a month*, since any leaks will render the measurements valueless. Report the finding of any leaks on the observation form for the month and report both the date the leak was discovered and the date the pan was repaired or replaced.
- (v) Clean the evaporation pan as frequently as necessary to keep it free from sediment, scum and oil films. An oil film will significantly reduce the rate of evaporation. It is recommended that the pan should be scrubbed clean and the water changed at least *once* a month. The pan must be emptied by siphoning and/or by bailing the water out. Under no circumstances is the pan to be lifted and emptied with any significant amount of water remaining in the pan.
- (vi) The storage tank of water should be also thoroughly cleaned at least once every six months. The water placed in the tank should be completely free of oil.

3. OBSERVATION PROCEDURE

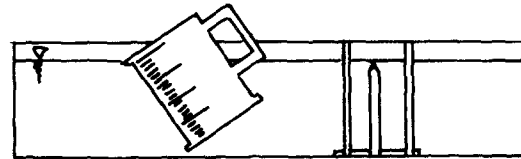
When the evaporation pan is first installed (or after cleaning the pan) the pan should be centred on the wooden platform and the level of the platform must be checked and corrected if needed. The fixed point gauge which consists of a pointed brass rod mounted with a 75 mm dia. brass cylinder should be placed about 300 mm from the *north* edge of the pan.

Water is poured into the evaporation pan up to the level of the tip of the fixed point gauge. This is the *zero datum* for all observations.

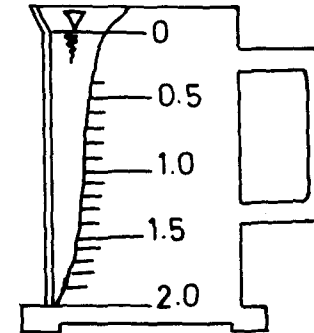
FIG. 4 USE OF THE FIXED POINT GAUGE
(Example 2, tip of the point gauge submerged)



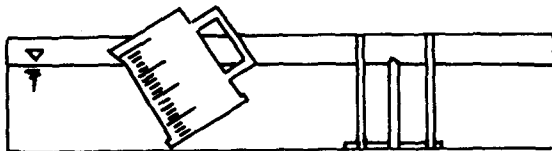
(1) The day's rainfall has exceeded the evaporation and the tip of the fixed point gauge is submerged.



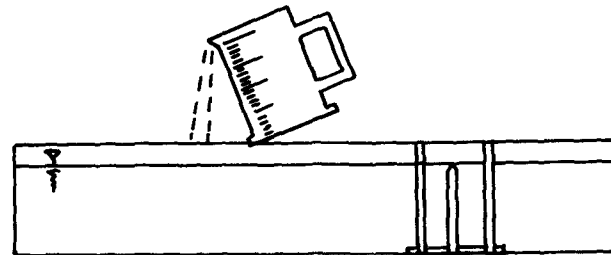
(2) Fill the measuring can from the water in the evaporation pan causing a drop in the water level of 2.0 mm. however, the tip is still submerged.



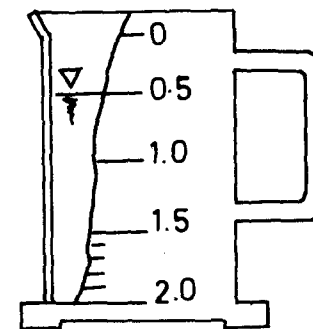
(3) The can must be filled only to the zero level and not to the very top of the can. Empty the can.



(4) Once again fill the measuring can from the water in the evaporation pan. This time the tip is exposed.



(5) The contents of the can are added slowly back into the pan while carefully noting the water level rising up to the exact tip of the point gauge.



(6) At this time the water level reading in the measuring can is 0.5mm. which means that 1.5mm. of water has been removed from the evaporation pan.

(7) The total amount of water removed from the evaporation pan is $2.0 + 1.5 = 3.5$ mm.

During the day, the water level will vary due to evaporation and rainfall, the first causing a reduction of level, the second a rise.

In order to obtain satisfactory information, reading must be taken in the following manner:—

(i) From the raingauge, read the amount of rainfall during the past 24 hours. Enter this amount in the evaporation return form against the date previous to the day of observation. For example, if you are reading the rainfall on the 10th of January, you must enter the figure against the 9th of January.

(ii) The rise or fall in water level in the evaporation pan must now be measured. If the level of the water in the pan is below the tip of the fixed point gauge, evaporation has been greater than rainfall and water must be added until the tip of the fixed point gauge coincides with the surface of the water in the well.

If the level is above the tip of the fixed point gauge, rainfall has been greater than evaporation and water must be *removed* to return the level to the tip of the fixed point gauge. As the water approaches the tip of the point gauge, pour slowly to prevent overflowing owing to the time required for water to flow into the well.

(iii) In either case, the graduated measuring can (see Fig. 2) is used to determine the accurate rise or fall of the water level. The measuring can is graduated in units equivalent to 0.1 mm variation in water level in the 1210 mm. diameter pan, and its capacity is 2.0 mm.

When water must be added, fill the measuring can to the *zero mark* before pouring into the evaporation pan and the amount added is read directly from the graduations. (If there is no rainfall, the can will typically have to be refilled once or twice to bring the water level back to the tip of the point gauge.

When water must be removed, care must be taken in determining the amount. The measuring can should be filled from the water in the evaporation pan (but only up to the zero mark, and not the lip of the can) and if the tip of the point gauge is still submerged, further can-fulls have to be removed. As the water approaches the tip of the point gauge, the can should still be filled from the pan thus exposing the tip. Then using the same full can, the water should be slowly added back to the pan until the tip coincides with the surface of the water in the pan.

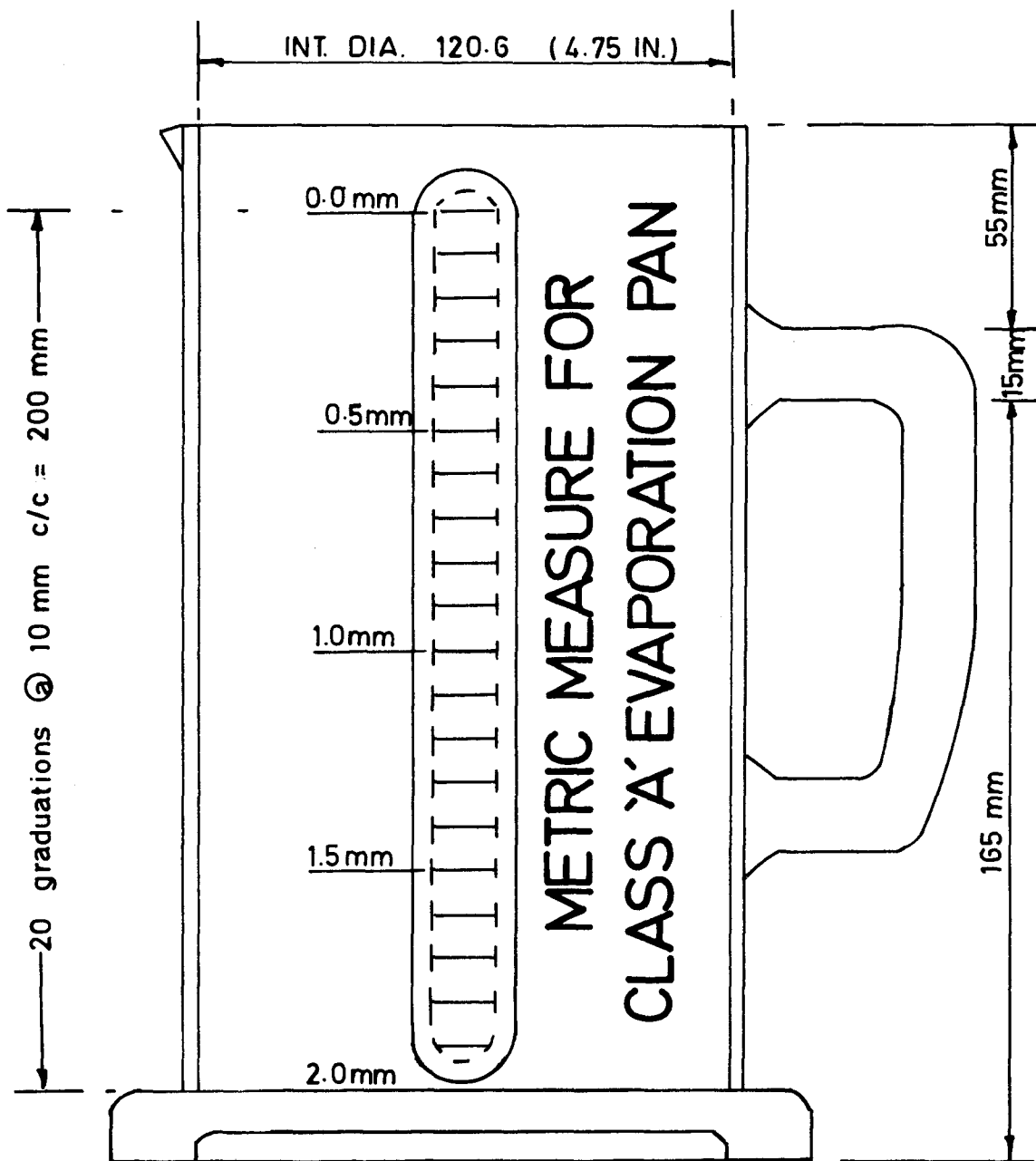


FIG. 2

METRIC MEASURE FOR US CLASS 'A'
EVAPORATION PAN

The amount remaining in the can must be *subtracted* from the full can capacity (2.0 mm) to give the amount removed from the pan.

Example 1

At the time of measurement, the tip of the point gauge is exposed. The rainfall amount is read first. The measuring can is filled to the zero mark and added to the water level in the pan and the tip remains exposed. A second full can is added and still the tip is above the water level in the pan. As the contents of the third can are slowly added the water level reaches exactly the tip of the point gauge and the water level in the can is read as 1.2 mm. This means that the total increase of water level in the pan is:—

$$2.0 + 2.0 + 1.2 = 5.2 \text{ mm (see Fig. 3)}$$

Example 2

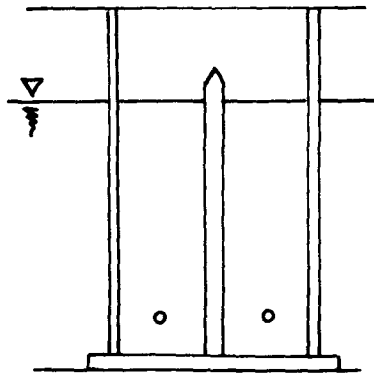
At the time of measurement the tip of the point gauge is submerged. The rainfall amount is read first. The measuring can is filled, up to the *zero mark*, with water from the pan but still the tip is submerged. After emptying the contents, the can is filled again with water from the pan, this time exposing the tip. The water in the can is carefully added back until the water in the pan is the same as the tip of the point gauge, and the can reading is 0.5 mm. Since this has been a full can (2.0 mm capacity) bailed from the pan, the actual water removed is $2.0 - 0.5 = 1.5$ mm.

Since there was one full can of water removed earlier, then the total amount of water removed is:—

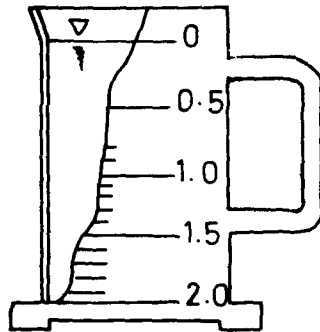
$$2.0 + 1.5 = 3.5 \text{ mm (see Fig. 4)}$$

- (iv) The quantity of water added or removed is then entered on the evaporation return form in the same way as the rainfall, that is against the date previous to the day when the reading is taken. Therefore, if the reading is made on the 10th of January, the entry is noted against the 9th of January on the form.
- (v) When the rainfall exceeds 38 mm the column under "evaporation" should be left blank since the reading of the amount of water removed from the pan may not be a true reading owing to splash from the pan and the reading is thus rejected.

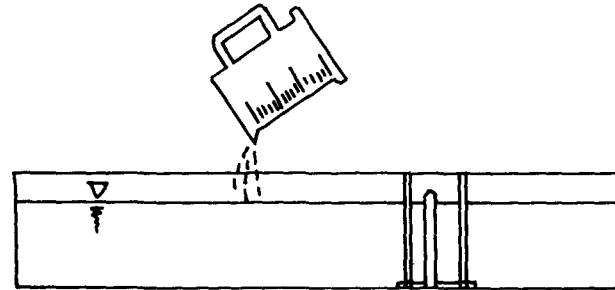
FIG. 3 USE OF THE FIXED POINT GAUGE (Example 1, tip of the point gauge exposed)



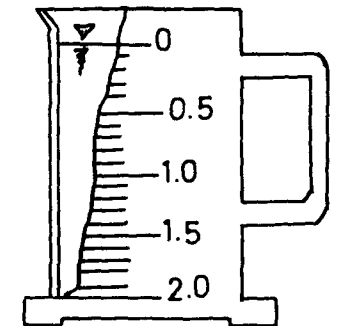
(1) Evaporation has exceeded any rainfall, therefore the tip of the fixed point gauge is exposed.



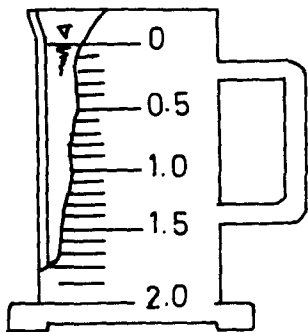
(2) Fill, from the storage tank, the measuring can up to zero level (not to the very top of the can).



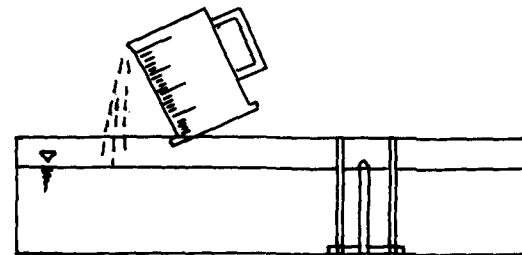
(3) The water is poured into the evaporation pan, raising the water level by 2.0 mm., but the point gauge is still exposed.



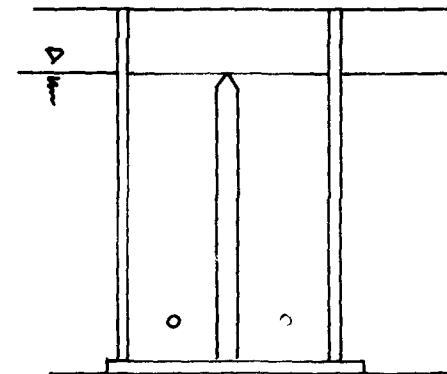
(4) The measuring can is refilled and added to the pan increasing the water level by a further 2.0 mm. however, the tip is still above the water level.



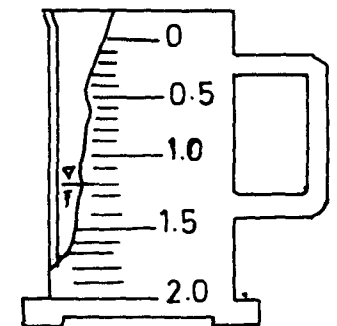
(5) The measuring can is filled a third time up to the zero level



(6) The contents of the measuring can are added slowly to the pan while carefully noting the water level relative to the point gauge.

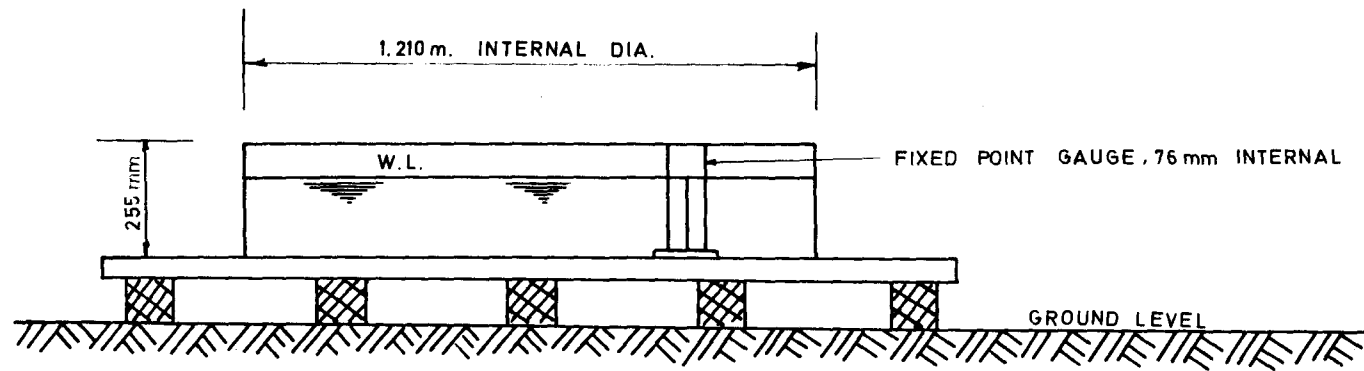


(7) The water level in the point gauge cylinder is at the tip.

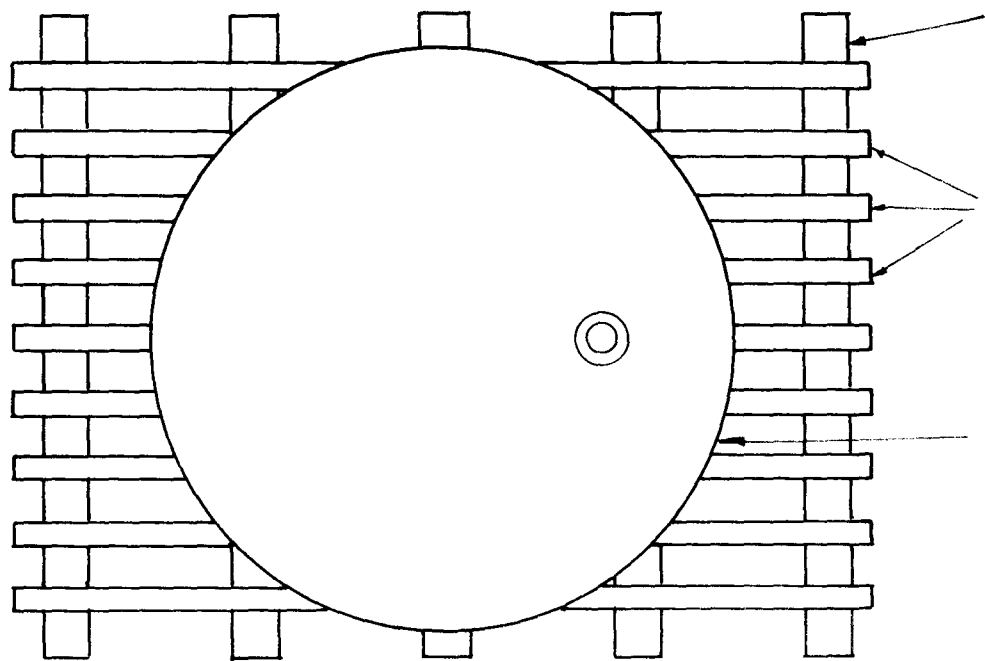


(8) At this time the water level reading in the measuring can is 1.2 mm.

(9) Total amount added to the evaporation pan is $2.0 + 2.0 + 1.2 = 5.2$ mm.



ELEVATION



PLAN

100 mm. x 100 mm. x 1.40 m. TREATED TIMBERS

Ⓐ 400 mm CENTRES

50 mm x 50 mm x 1.80 m TREATED TIMBERS

Ⓑ 140 mm CENTRES

No. 20 GAUGE ALUMINIUM PAN (UNPAINTED)

FIG.1

EVAPORATION PAN

CLASS 'A' ALUMINIUM PAN

4. PROCEDURE FOR SUBMISSION OF RECORDS

(a) *Check that the following entries have been made:—*

- * Station number
- * Year
- * Month
- * Location
- * Grid reference
- * Daily rainfall, water added and water removed
- * Evaporation for the day
- * Name of reader
- * Name of checker.

(b) *See that the following checks are carried out:—*

- * Figures entered are legible and clear
- * Readings given to one place of decimal
- * Look out for habitual or suspicious entries

(c) *General*

- * Ensure the use of the same station name and station number throughout unless the station has been resited in which case proper remarks should be given.
- * All evaporation forms should bear the chop of the "Pengarah Parit dan Taliair Negeri" concerned.

- * Put "NR" against the dates if no daily observations are carried out. If there is no recording done for the whole month, print "TIADA REKOD" on the form and give reasons.
- * Put appropriate remarks when daily rainfall is greater than 38 mm.
- * To check the evaporation calculations under column "Cairwapan" inspect the two columns under "Air tambah" and "Air buang". Readings should not appear simultaneously in these two columns for the same day, i.e. if there is reading in one, the other should be "-" and vice versa. It is possible of course that both columns show "-".

If there is a reading under "Air tambah", add this reading to the reading under "Hujan" to obtain the evaporation reading which is entered under "Cairwapan". If there is a reading under "Air buang", subtract this reading from the reading under "Hujan" to obtain the evaporation reading.

- * If both the readings under "Air buang" and "Air tambah" show "-", the reading under "Hujan" is taken as the evaporation reading.

JABATAN PARIT DAN TALIAIR
PENYATA CAIRWAPAN BULANAN

Tempat: Pejabat JPT. Sg. Besar
Rujok Grid: VD 636447
Bulan: JUN

No. SETESEN
TAHUN
BULAN

3609313	
1977	
6	Tulis Angka sahaja

Hari-bulan	Sukat Suhu °F			Hujan (mm)	Air tambah (mm)	Air buang (mm)	Cairwapan (mm)	Catetan
	8 pagi	tengah-hari	6 petang					
1				-	5.5	-	5.5	
2				-	6.1	-	6.1	
3				-	6.3	-	6.3	
4				-	4.0	-	4.0	
5				23.0	-	20.0	3.0	
6				-	4.8	-	4.8	
7				-	3.5	-	3.5	
8				10.5	-	7.1	3.4	
9				2.0	4.0	-	6.0	
10				-	4.1	-	4.1	
11				-	5.2	-	5.2	
12				-	5.4	-	5.4	
13				-	5.0	-	5.0	
14				-	6.7	-	6.7	
15				-	6.3	-	6.3	
16				-	7.1	-	7.1	
17				-	5.5	-	5.5	
18				-	5.0	-	5.0	
19				1.5	2.3	-	3.8	
20				3.0	2.0	-	5.0	
21				46.0	-	40.0	/	REJECTED
22				-	5.2	-	5.2	
23				-	5.3	-	5.3	
24				-	6.1	-	6.1	
25				-	6.0	-	6.0	
26				-	5.6	-	5.6	
27				3.0	2.8	-	5.8	
28				-	5.4	-	5.4	
29				9.0	-	5.3	3.7	
30				-	5.0	-	5.0	
31				/	/	/	/	
JUMLAH:					JUMLAH:		149.8	$149.8 \times \frac{30}{29} = \underline{155.0}$

Penyukat di-buat oleh:-	Pengiraan cair-wapan di buat oleh:-	Pengiraan di-semak oleh:-
Tarikh:	Tarikh:	Tarikh:

HYDROLOGICAL PROCEDURES PUBLISHED

			<i>Price</i>
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