Rainwater Harvesting & Greywater Recycling

Case Study on Menara Kerja Raya (KKR2)

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IEM Mechanical & Electrical Forum
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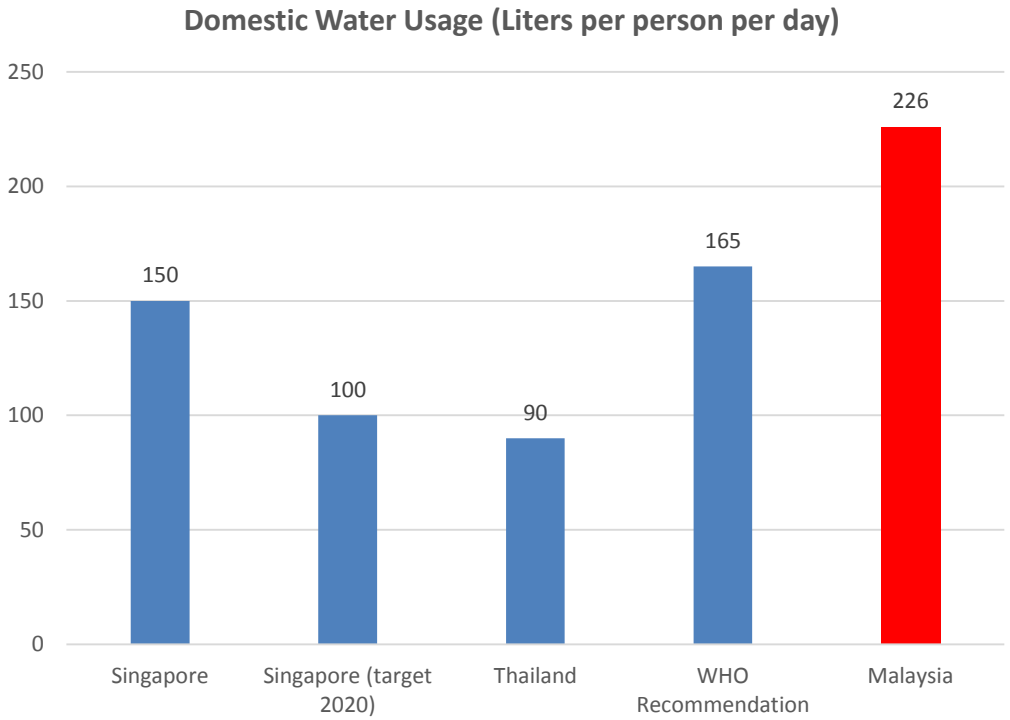
How wasteful we are when it comes to water

Average domestic water consumption per capita (based on 2011 data)



Comparison of Water Usage – Government Office

Water Efficiency Goals

Comparison of Water Usage – Government Office

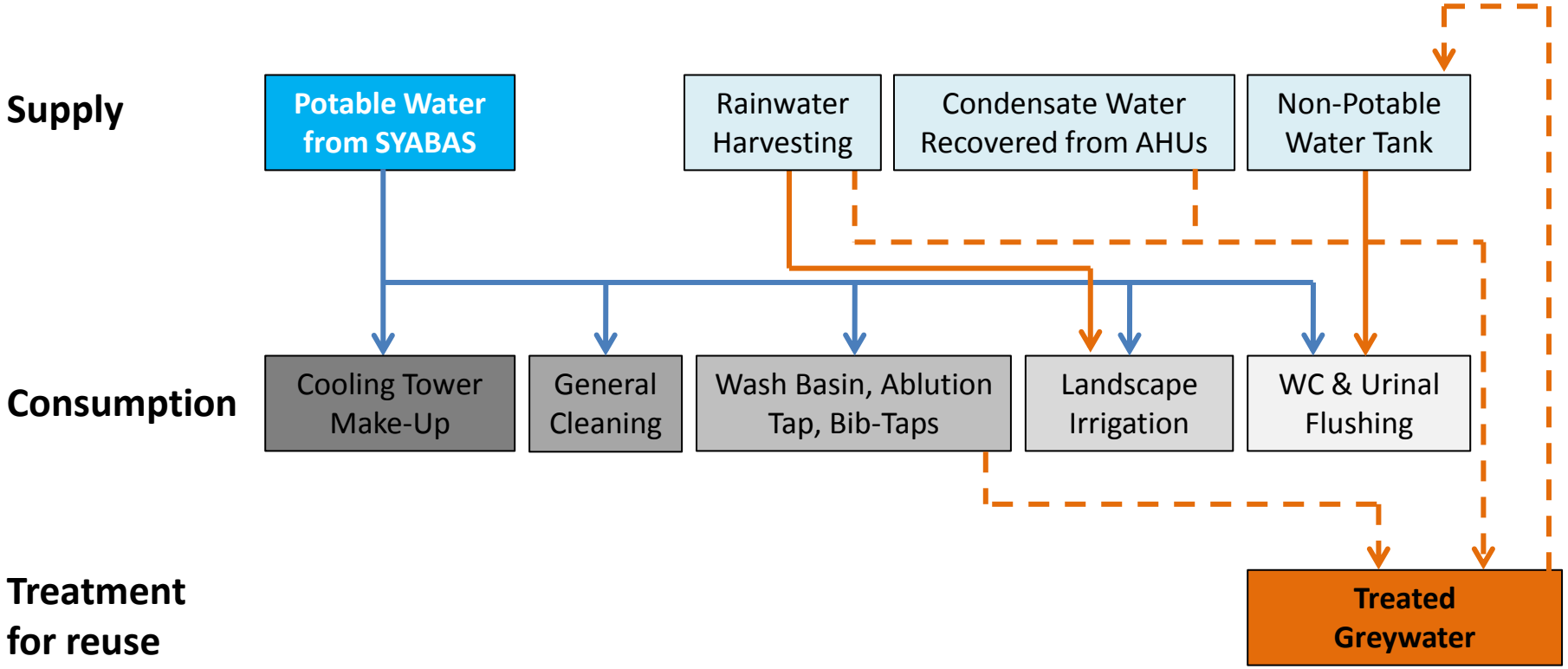
Block G (KKR2) – Water Efficiency (WE) targets under green building certification (GBI)

PART	CRITERIA	ITEM	Max Points	DA Cert Score	CVA Claim Score	CVA Cert Score
5	WE	WATER EFFICIENCY				
	WE1	Rainwater Harvesting	2	2	2	2
	WE2	Water Recycling	2	2	2	2
	WE3	Water Efficient - Irrigation/Landscaping	2	2	2	2
	WE4	Water Efficient Fittings	2	2	2	2
	WE5	Metering & Leak Detection System	2	2	2	2
	WE TOTAL		10	10	10	10

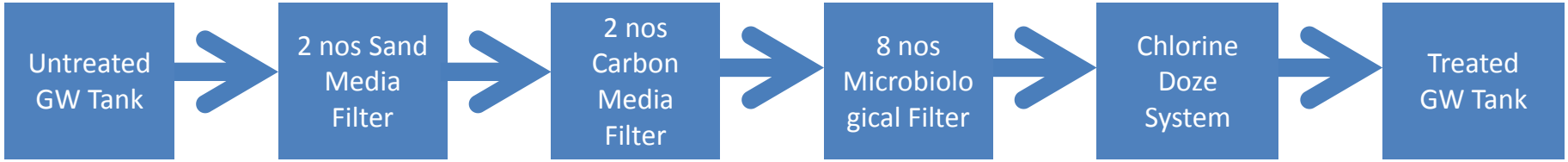
Scoring all the water efficiency credits

The Water Distribution System

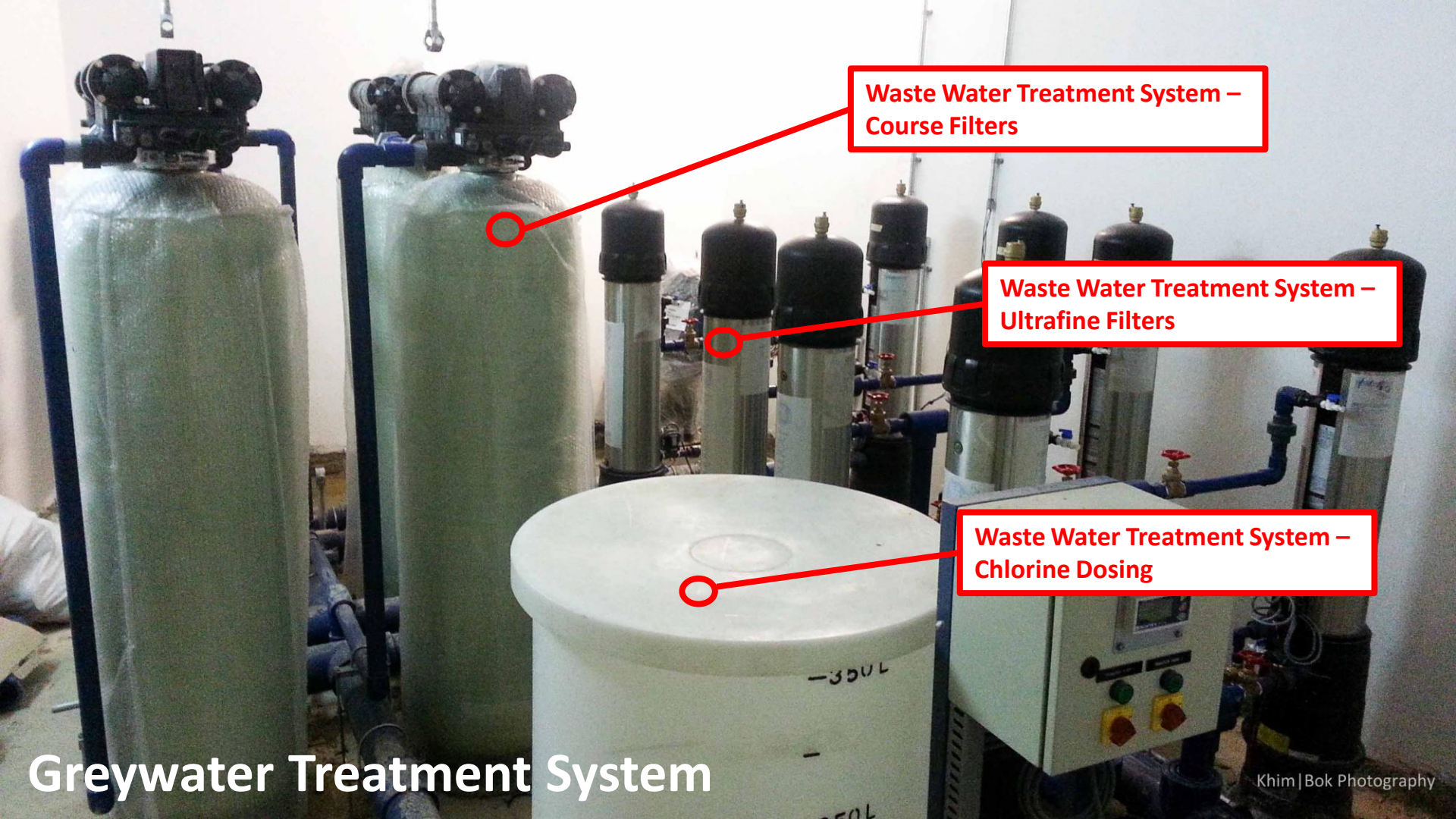
Water Usage Diagram of Menara Kerja Raya



Greywater Recycling System

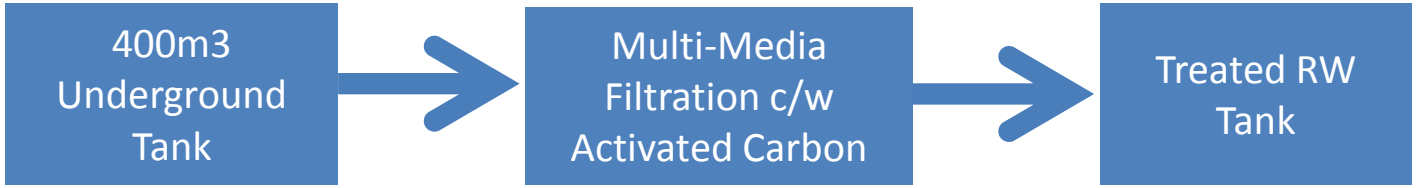


1. The untreated GW is first treated thru the sand filter. This is to remove any pollutants larger than 50 microns.
2. Followed by the high capacity Activated Carbon filter, it is capable of removing large amount of odour/ smell. Carbon also has the function of neutralising large amount of chemical such as detergent or any cleaning agent that has peroxide content found in the water source.
3. With the microbiological filter in place, the filtration efficiency goes down to 0.02 micron. This is the heart of the system whereby even the smallest bacteria and viruses are being removed entirely.
4. The final stage is a chlorine dozing with 2ppm of concentration into the treated water source to hold the water quality for storage purposes and also the final disinfection.

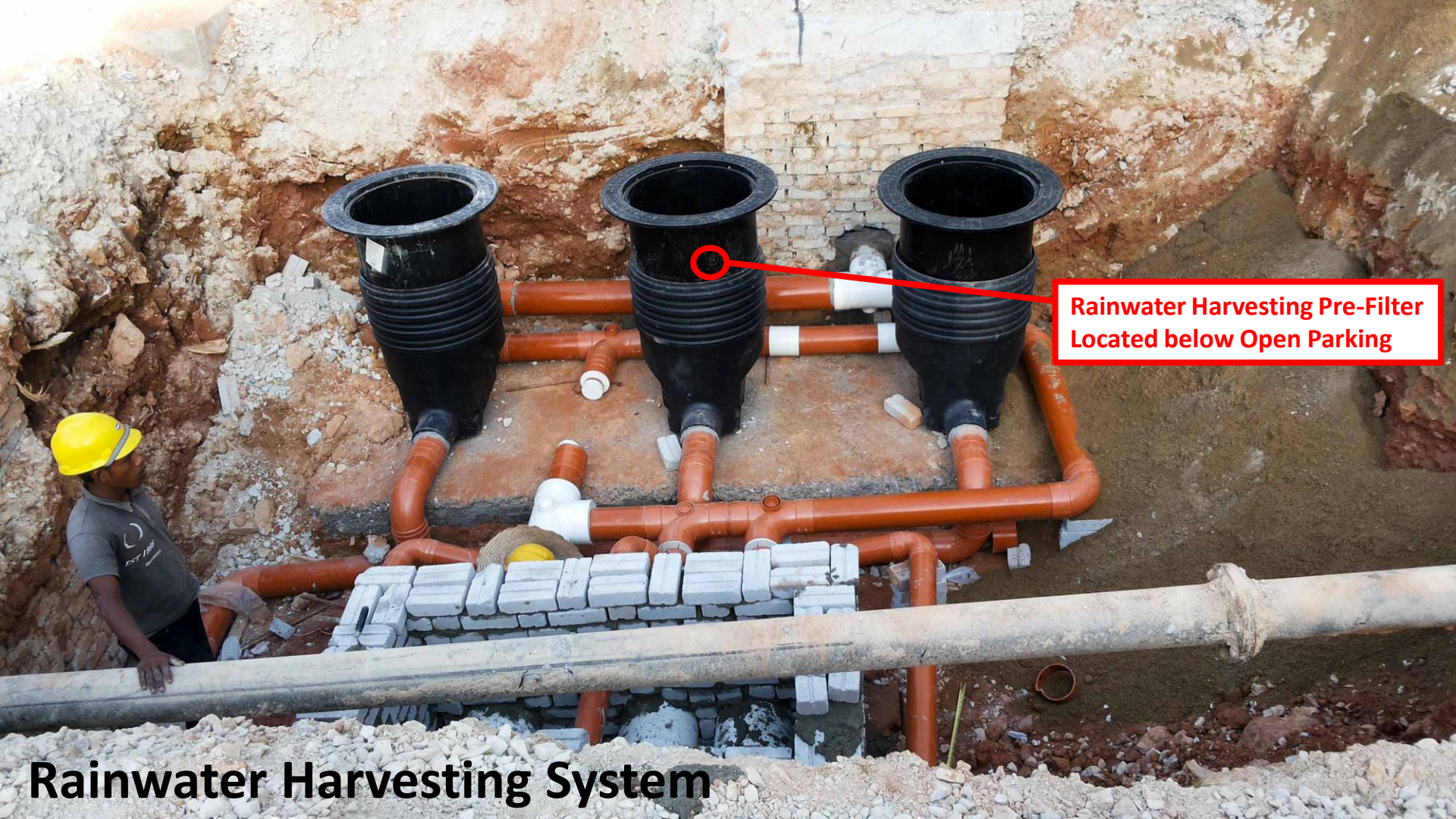


Greywater Treatment System

Rainwater Harvesting System

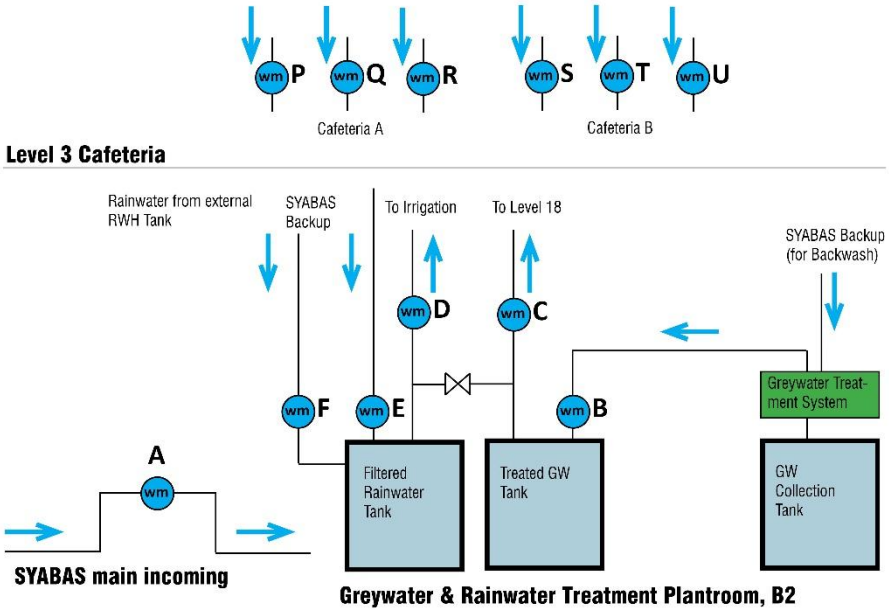


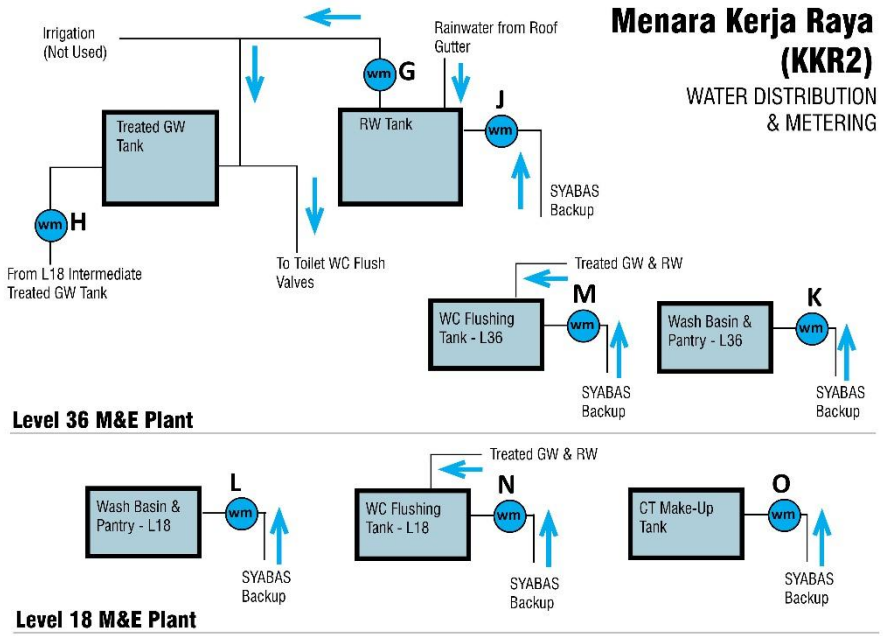
1. Continuing from the Underground RW Tank, it is filtered by a multi media water treatment system.
2. The sand filter has a 50 micron filtration efficiency, therefore the turbidity level should be reduced < 20 NTU.
3. It also contains Activated Carbon to significantly reduce any unwanted smell / odour from the raw water.
4. Under the Malaysia Water Quality and DOE guidelines, irrigation water is classified as Class V, therefore high level of Total Suspended Solids up to 300mg/lit can be suitable (approximately 225 – 250 NTU).



Rainwater Harvesting System

Schematic Diagram Showing Water Sub-Metering System





Water sub-meters labeled A to U

The Results

1 year building operation

Comparison of Water Usage – Government Office

Block F (Ibu Pejabat JKR)

GFA – **25,500m2**
Normalized BEI – **180kWH/m2*year**
(including data center)

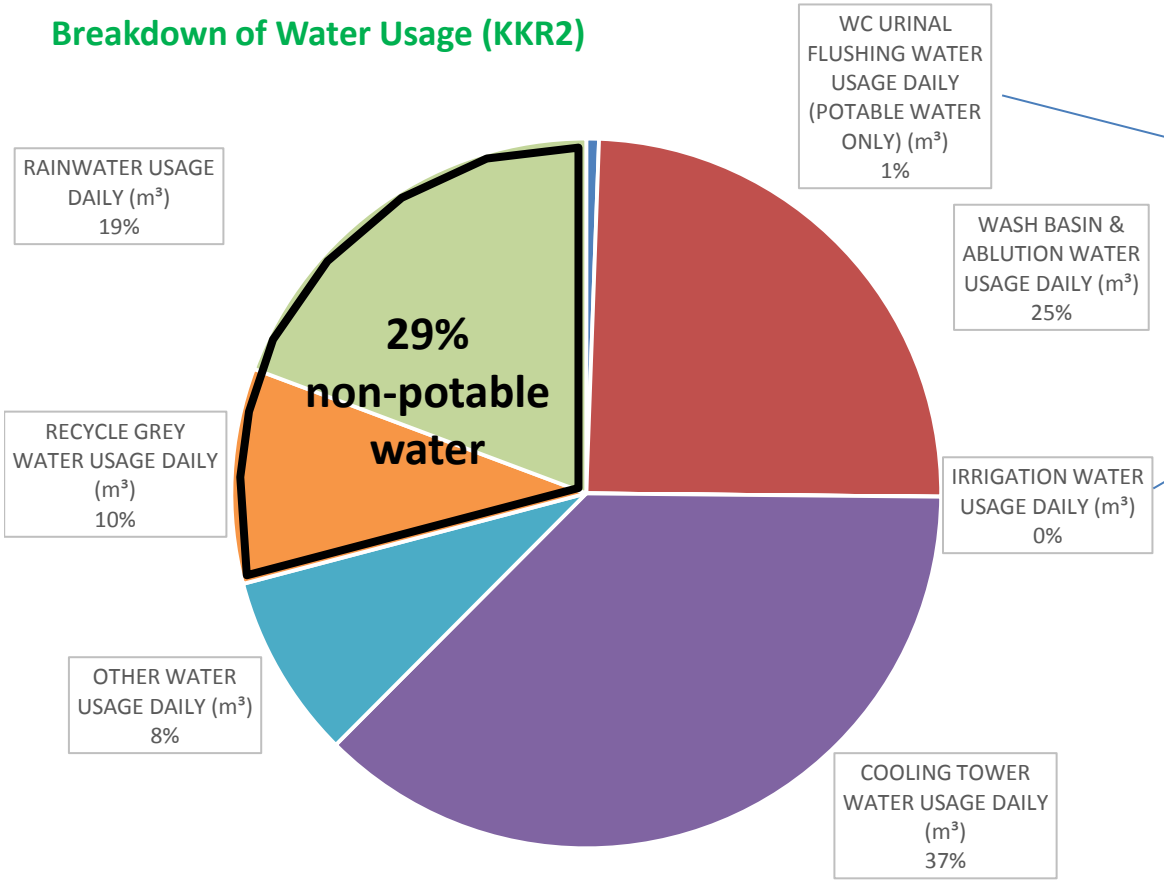
Previous Reading Date	Current Reading Date	No. of Days	SYABAS Water Consumption (m3)
12-Jan-15	5-Feb-15	24	4483
5-Feb-15	5-Mar-15	28	5686
7-Apr-15	7-May-15	30	4567
7-May-15	5-Jun-15	29	4322
5-Jun-15	6-Jul-15	31	4271
6-Aug-15	7-Sep-15	32	4957
If based on Jan to Sept Data			
Total Days			174
Total Consumption			28,286
Predicted Annual Consumption (365 days)			59,336
Average Consumption per m2 GFA (L/year)			**2,326.89**

Block G (Menara Kerja Raya)

GFA – **52,272m2**
Normalized BEI – **80.9kWH/m2*year**
(excluding data center & carpark)

Previous Reading Date	Current Reading Date	No. of Days	SYABAS Water Consumption (m3)
6-Aug-15	7-Sep-15	32	4790
7-Sep-15	7-Oct-15	30	6980
7-Oct-15	6-Nov-15	30	5514
6-Nov-15	7-Dec-15	31	3537
7-Dec-15	7-Jan-16	31	2854
7-Jan-16	5-Feb-16	29	2956
If based on Aug to Feb Data			
Total Days			183
Total Consumption			26,631
Predicted Annual Consumption (365 days)			53,116
If based on Oct to Feb Data (RWH & GWR System Running)			
Total Days			121
Total Consumption			14,861
Predicted Annual Consumption (365 days)			44,829
Average Consumption per m2 GFA (L/year)			**857.60**

Breakdown of Water Usage (1month)



COMMENTS

Low potable water consumption, because the bulk is supplied from recycled water (grey water or rainwater)

For this month, the pumps were waiting to be repaired, hence, the consumption atypically reads zero

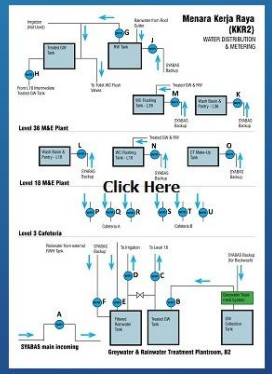
Water Metering & Leakage Warning System

Home | Back | ENERGY SUMMARY | OFFICE ENERGY USAGE (LOW ZONE) | OFFICE ENERGY USAGE (HIGH ZONE) | MAX DEMAND | BEI TRENDING | PARAMETERS | CHART | ENERGY USAGE SUMMARY

WATER LEAK DETECTION SYSTEM

WATER USAGE	MINIMUM FLOW RATE SETPOINT (m3/hr)	CONSUMPTION DETECTED AT 1AM TO 2AM (m3/hr)	POSSIBLE LEAKAGE WARNING
A) P4a Syabas Main Incoming	0.5 m³/hr	0.3 m³/hr	NORMAL
B) B2 Incoming to Treated GW Tank	0.5 m³/hr	0.3 m³/hr	NORMAL
C) B2 Outgoing from Treated GW Tank To Level 18	0.5 m³/hr	0.0 m³/hr	NORMAL
D) B2 To Irrigation	0.5 m³/hr	0.0 m³/hr	NORMAL
E) B2 From Rainwater External RWH Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
F) B2 Syabas Backup To Rainwater Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
G) L36 Outgoing RW Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
H) L36 From L18 GW Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
J) L36 Syabas Backup To RW Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
K) L36 Wash Basin & Pantry Tank	0.5 m³/hr	0.0 m³/hr	NORMAL

WATER USAGE	MINIMUM FLOW RATE SETPOINT (m3/hr)	CONSUMPTION DETECTED AT 1AM TO 2AM (m3/hr)	POSSIBLE LEAKAGE WARNING
L) L18 Wash Basin & Pantry Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
M) L36 WC Flushing Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
N) L18 WC Flushing Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
O) CT Make Up Tank	0.5 m³/hr	0.0 m³/hr	NORMAL
P) P8 Cafeteria A1	0.5 m³/hr	0.0 m³/hr	NORMAL
Q) P8 Cafeteria A2	0.5 m³/hr	0.0 m³/hr	NORMAL
R) P8 Cafeteria A3	0.5 m³/hr	0.0 m³/hr	NORMAL
S) P8 Cafeteria B1	0.5 m³/hr	0.0 m³/hr	NORMAL
T) P8 Cafeteria B2	0.5 m³/hr	0.0 m³/hr	NORMAL
U) P8 Cafeteria B3	0.5 m³/hr	0.0 m³/hr	NORMAL



Time Range ? to ?

Open Alarm Sources — 0 Sources / 0 Alarms

Timestamp	Source State	Ack State	Source	Alarm Class	Priority	Message Text

Acknowledge | Hyperlink | Notes | Silence | Filter | Review Video

Water leakage system provides daily updated warnings if water consumption for another of the 19 water meters are outside of the “normal” range.

This system has quite a few times provided early leakage warning allowing maintenance team to isolate & repair.

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Lessons Learnt

Lessons Learnt / Areas for Improvement

User / Occupant attitude & respect of the system is important

1. Greywater filtration system can be quickly clogged if oily waste is washed down the wash basins
2. Water usage is still high due to occupant behavior – occupants are known to flush multiple times per usage

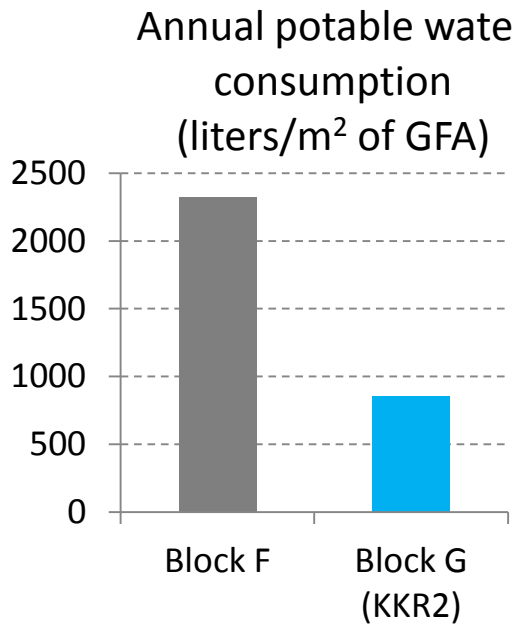
Greywater collected for recycling should be treated as soon as possible (ideally within 24hrs). If greywater stays in tank too long, it will turn septic.

Provide adequate and proper ventilation to greywater treatment plantroom

Chlorine dosing system for the greywater treatment plant needs to be fine tuned. Low dosing of chlorine will lead to inadequate disinfection whilst over dosing will result in a much higher operational cost.

The domestic water consumption (basin, wc, urinal etc) is almost double of what is predicted using GBI's water usage calculation method, which is based on a certain number of usage per person per day. Only the cooling tower make-up water consumption was accurately predicted.

KKR2 is targeting to achieve GBI Platinum certification



Thank you

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