Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	WATER SYSTEM DESIGN AND MANAGEMENT
COURSE CODE	:	BFC 35303
PROGRAMME	:	BFF
DATE	:	JULY 2022
DURATION	:	3 HOURS

1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS AN **ONLINE ASSESSMENT** AND CONDUCTED VIA **CLOSE BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 Sri Kinabalu Consult was appointed as consultant engineer for design of sewerage system by Tetuan Baha Ridzuan. This report was established for approval Jabatan Perkhidmatan Pembentungan, JPP refer to STP in site location which requirement by Majlis Perbandaran Kluang.

Project Description

This development proposal in one bungalow project and related infrastructure for community. The proposal as propose in table below:-

No.	Type of Development	No of Unit
1.	Bungalow	1

The sewerage system from this banglo is connected to existing sewerage system as available by developer which is get an approval from JPP. The calculation Population Equivalent, (P.E) for this project is propose: -

No	Type of Development	P.E/Unit	Unit	P.E
1.	Bungalow	5	1	5
	Total			5

Propose pipe for sewerage system is VCP Sewer Pipe, size 225 mm or 9 inch will flow the sewer using gravity flow for every connection, changing direction, changing size of pipe, changing slope for the maximum distance 90 m. All material, minimum depth, slope and sewage flow are referring to latest guideline by Malaysia Standard MS 1228.

Design Characteristics

1. Minimum velocity = 0.91 m/s
   Standard maximum velocity = 4.0 m/s
2. Average flow = 225 liter/ kapita / day
3. Type of Pipe - *VCP pipe* approve by JPP
   - Minimum pipe size 225 mm diameter (depth)
4. Pipe sewerage system design for fully flow.
5. Manning Formula use to identified maximum velocity:-

$$V = \frac{1R^{2/3}S^{1/2}}{N}$$

where V = Velocity (m / saat)
R = Area / Perimeter
S = Slope (Gradient)
n = Pipe Coefficient (0.014)

Identified design velocity and pipe capacity for this project.

(10 Marks)

Q2 Calculate a total water demand for the 50 acres of medium industrial area, 500 units of terrace house and 50 units of commercial lot by referring **TABLE Q2(a)** and **TABLE Q2(b)**;

(10 marks)

The following data are some of the recorded design:

Population	= 200,000 person
Domestic demand	=120 MGD
Other water demands	= 30% of domestic demand
Fire Hydrant	= 150 m^3/hr for 10hr duration
Effective lift for low lift pumping	= 10m
Effective lift for high lift pumping	= 60m
Pumping of treated water	= 8hr daily
Length of pipe from intake to WTP	= 500m
Length of pipe from WTP to an uphill reservoir	= 600m

Based on the above data, determine the followings; (State any assumptions used)

i) Size of the trunk mains from the WTP to the uphill reservoir

(5 marks)

ii) Amount of water required for fire fighting

(5 marks)

iii) Total amount of storage for the community

(5 marks)

iv) Power of the low lift pump at 85% efficiency

(5 marks)

Q3 Flood is on the common disaster that frequently occurred in Malaysia. Over the years, the flood prone areas in Malaysia were estimated around 10.1%, approximately 33,298 km^2 of the total area of Malaysia which is 330, 436 km^2. The flood damaged every year was predicted around RM 1.15 billion annually. The diversity of approached and strategy by the Department of Irrigation and Drainage (DID) Malaysia and holistic practiced was combined with the structural and non-structural approach to manage and overcome the flood issue. Johor had recorded 35 flood events in 2020 with Johor Bahru District recorded 10 flood events which were the highest flood events in Johor state.

Taman Damai Jaya which was located in Johor Bahru District have experienced several flood events in a year with the latest flood event was occurred on 5/7/2020 with flood depth 0.1 -0.5 m. **FIGURE Q3** show the catchment area of Taman Damai Jaya which was estimated around 66.7 ha. The drain length for section 1 to 2 is 175 m and section 3 to 4 is 300 m. Assume that the overland sheet flow path length for sub-catchment A is 600 m and sub-catchment B is 800 m. Slope of overland surface is 3 % for both sub-catchments.

(a) Based on **TABLE Q3(a), (b)** and **(c),** estimate the peak discharge for sub-catchment A with an area of 19.4 ha and sub-catchment B with an area of 47.3 ha. Assume that the storm duration is 3 hours and the design flow velocity in drain is 1 m/s.

(20 marks)

(b) **FIGURE Q3(b)** show the flooded location at Taman Damai Jaya with an area of 1.78 ha. Based on peak flow estimation in Q3(a), analyze the existing drainage conditions for section 1 to 2 and section 3 to 4 and if needed, upgrade the existing drainage conditions.

(20 marks)

(c) Briefly explain the causes of flood at Taman Damai Jaya and propose the mitigation measures.

(10 marks)

(d) Explain basic principles of erosion and sediment control and give suggestion for Erosion Sediment Control Plan for new project development

(10 marks)

-END OF QUESTIONS-

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TABLE Q2(a)

No.	TYPE OF PREMISES	Water Demand
1	Low Cost Terrace House /Flat	1135 lpd (250 gpd)
2	Single Storey Terrace / Low Medium & Medium Costs Flats	1360 lpd (300 gpd)
3	Double Storey Terrace House/High Cost Flats	1590 lpd (350 gpd)
4	Semi Detached House	1820 lpd (400 gpd)
5	Bungalow / Condominiums	2270 lpd (500gpd)
6	Shophouse (Single Storey)/ Gerai	2270 lpd (500gpd)
7	Shophouse (Double Storey)	2730 lpd (600 gpd)
8	Shophouse (Three Storey)	4090 lpd (900 gpd)
9	Light Industrial Workshop	1590 lpd (350 gpd)
10	Semi Detached / Bungalow Workshops	2730 lpd (600 gpd)
11	Heavy Industry	65,000 l/ha/day
12	Medium Industry	50,000 l/ha/day
13	Light Industry	33,000 l/ha/day
14	Office / Complex / Commercial (Domestic Usage)	1,200 lpd/100s.q.m
15	Hotels (with dining and laundry facility – Domestic Usage)	
	Hotel (3 star)	1360 lpd/room
	Hotel (5 star)	2000 lpd/room
16	Schools /Education Institutions	
	-Day School / Institution	55 lpd/student
	- Fully Residential	360 lpd/student
17	Hospitals (domestic usage)	1100 lpd/bed
18	Mosque (domestic usage)	135 lpd/person
19	Other place of worship	55 lpd/person
20	Wet Market	820 lpd/store
21	Petrol Kiosk	5000 lpd/service bay
22	Stadium	55 lpd/person
23	Golf Course	5500 lpd/hole

Notes:-
gpd = Gallon per day
lpd = Liter per day
l/ha/day = Liter/hectares/day

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TABLE Q2(b): FIRE RISK

	Average Total Flow (Litres) (Per Minute)	Spanning (Meters)	Maximum No. Of. Hydrant Outlets Used Simultaneously
Class A Risk Large buildings, shopping complexes, high rise buildings, large industrial estate, warehouse and ports.	4100	90	3@ 1370 lpm
Class B Risk Congested areas with buildings up to 5 storeys.	2700	90	2 @ 1370 lpm
Class C Risk Shophouse up to 3 storey, light industry	1370	90	1
Class D Risk Residential terrace house, detached, semi detached	1140	120-terrace 150-detached / semi detached	1
Class E Risk Others	680	180	1

Notes:-
lpm = Litre per minute

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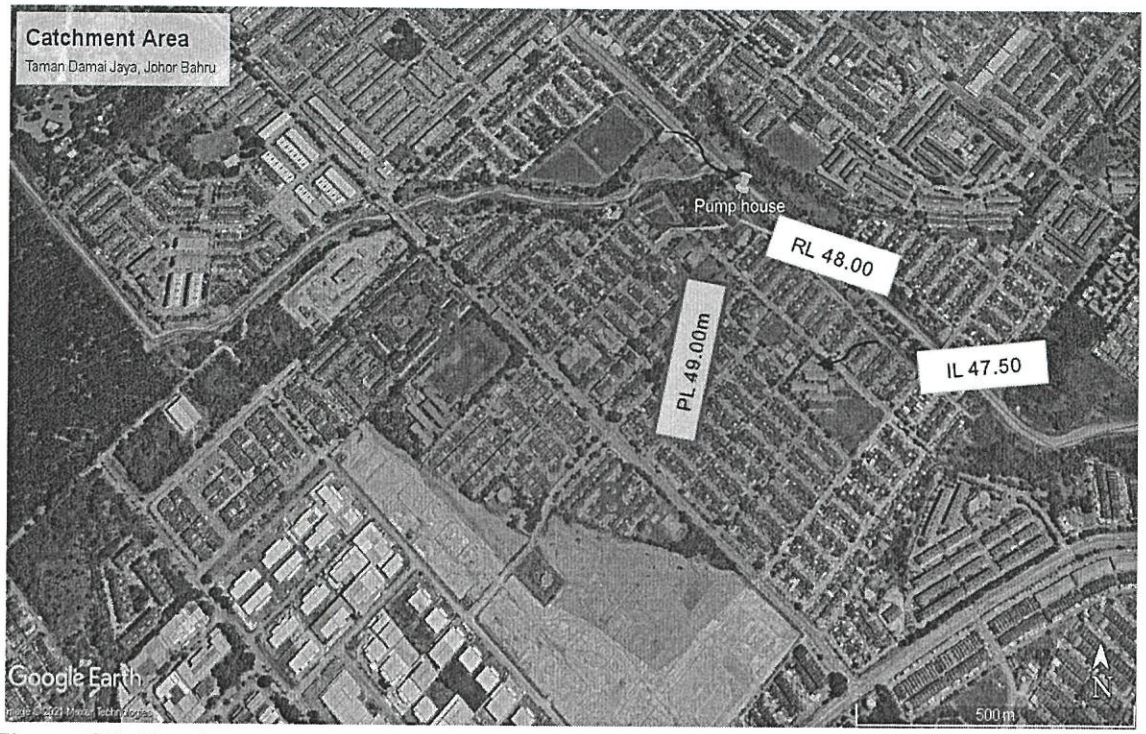

Figure Q3. Catchment area of Taman Damai Jaya.

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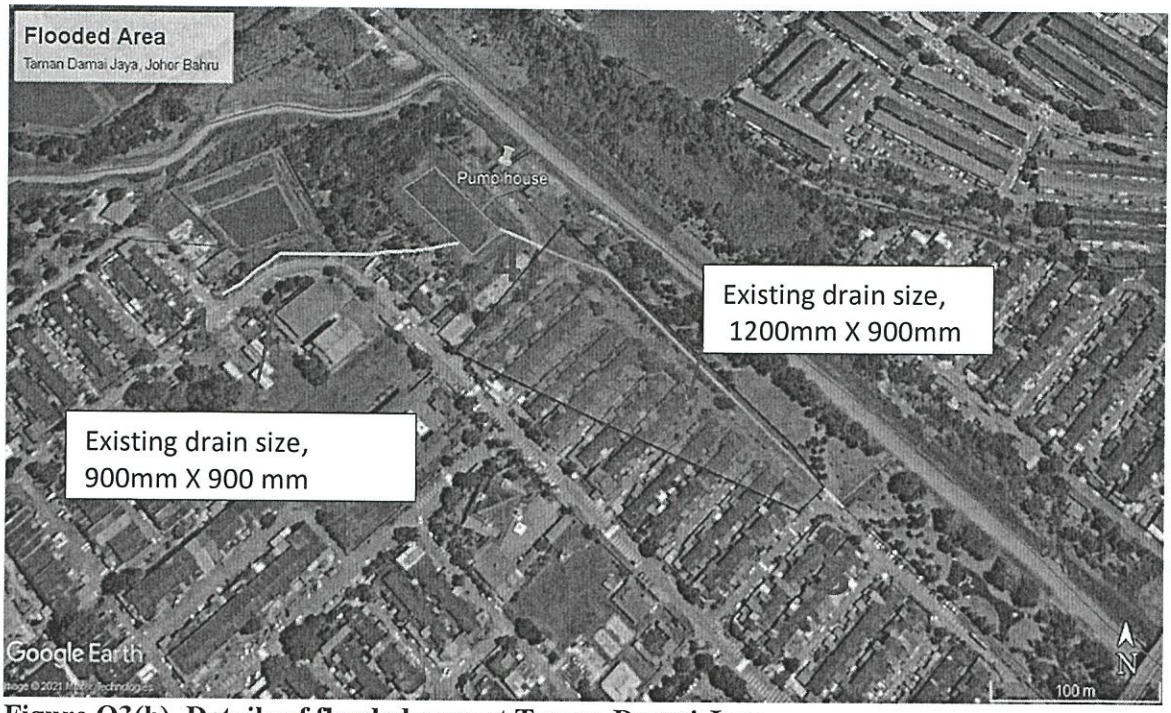

Figure Q3(b). Details of flooded area at Taman Damai Jaya

Table Q3(a). Fitting Constant for the IDF Empirical Equation for Selected Rainfall Stations in Johor State

State	No.	Station ID	Station Name	Constants			
				λ	κ	θ	η
Johor	1	1437116	Stor JPS Johor Bahru	59.972	0.163	0.121	0.793
	2	1534002	Pusat Kem. Pekan Nenas	54.265	0.179	0.100	0.756
	3	1541139	Johor Silica	59.060	0.202	0.128	0.660
	4	1636001	Balai Polis Kg Seelong	50.115	0.191	0.099	0.763
	5	1737001	SM Bukit Besar	50.554	0.193	0.117	0.722
	6	1829002	Setor JPS Batu Pahat	64.099	0.174	0.201	0.826
	7	1834124	Ladang Ulu Remis	55.864	0.166	0.174	0.810
	8	1839196	Simpang Masai K. Sedili	61.562	0.191	0.103	0.701
	9	1931003	Emp. Semberong	60.568	0.163	0.159	0.821
	10	2025001	Pintu Kaw. Tg. Agas	80.936	0.187	0.258	0.890
	11	2033001	JPS Kluang	54.428	0.192	0.108	0.740
	12	2231001	Ladang Chan Wing	57.188	0.186	0.093	0.777
	13	2232001	Ladang Kekayaan	53.457	0.180	0.094	0.735
	14	2235163	Ibu Bekalan Kahang	52.177	0.186	0.055	0.652
	15	2237164	Jalan Kluang-Mersing	56.966	0.190	0.144	0.637
	16	2330009	Ladang Labis	45.808	0.222	0.012	0.713
	17	2528012	Rmh. Tapis Segamat	45.212	0.224	0.039	0.711
	18	2534160	Kg Peta Hulu Sg Endau	59.500	0.185	0.129	0.623
	19	2636170	Setor JPS Endau	62.040	0.215	0.103	0.592

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Table Q3(b). Recommended Runoff Coefficients for Various Landuses (DID, 1980; Chow et. al., 1988; QUDM, 2007 and Darwin Harbour, 2009)

Landuse	Runoff Coefficient (C)	
	For Minor System (≤10 year ARI)	For Major System (> 10 year ARI)
Residential		
Bungalow	0.65	0.70
Semi-detached Bungalow	0.70	0.75
Link and Terrace House	0.80	0.90
Flat and Apartment	0.80	0.85
Condominium	0.75	0.80
Commercial and Business Centres	0.90	0.95
Industrial	0.90	0.95
Sport Fields, Park and Agriculture	0.30	0.40
Open Spaces		
Bare Soil (No Cover)	0.50	0.60
Grass Cover	0.40	0.50
Bush Cover	0.35	0.45
Forest Cover	0.30	0.40
Roads and Highways	0.95	0.95
Water Body (Pond)		
Detention Pond (with outlet)	0.95	0.95
Retention Pond (no outlet)	0.00	0.00

Note: The runoff coefficients in this table are given as a guide for designers. The near-field runoff coefficient for any single or mixed landuse should be determined based on the imperviousness of the area.

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Table Q3(c). Value of Horton's Roughness, n

Land Surface	n*
Paved	0.0150
Bare Soil	0.0275
Poorly Grassed	0.0350
Average Grassed	0.0450
Densely Grassed	0.0600

Table Q3(d). Manning's n roughness Coefficients.

Surface Type	Manning "n"
Short Grass (< 150mm)	0.0350
Tall Grass (>= 150mm)	0.0500
Concrete smooth finish	0.0150
Concrete rough finish	0.0180
Stone pitching dressed stone in mortar	0.0170
Stone pitching random stone in mortar or rubble masonry	0.0350
Rock riprap	0.0300
Brickwork	0.0200
Pipe, vitrified clay	0.0120
Pipe, Spun precast concrete	0.0130
Pipe, Fibre reinforced cement	0.0130
Pipe, upvc	0.0110