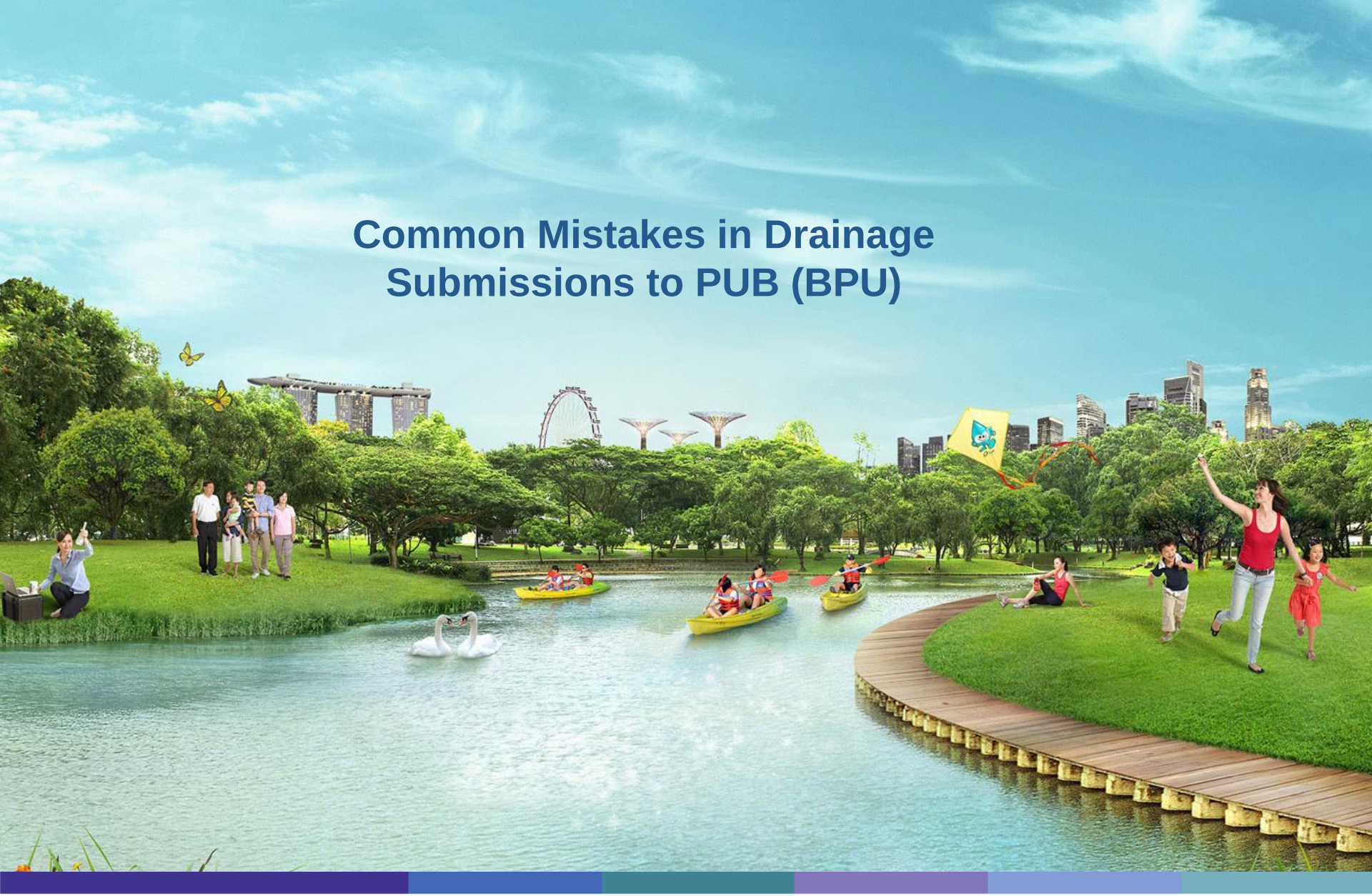
Common Mistakes in Drainage Submissions to PUB (BPU)



Choong Wai Yee
Centralised Services Department (Building Plan Unit)

PUB SINGAPORE'S NATIONAL WATER AGENCY

Agenda

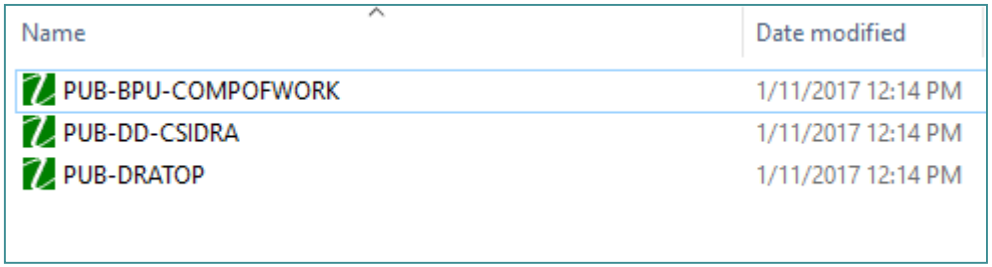
- Commonly made mistakes with Drainage Submissions
- Recap on Useful links on Drainage Design Guides and Submission Requirement
  - Details required for TOP submission
  - Submission for CSC Application with External Drainage Works

Most Commonly made mistakes with Drainage Submissions

- Submission without Cover letter and wrong CORENET form
- Wrong classification of drainage works
- Incomplete submission
  - Missing endorsement DC/ DP/ TOP/ CSC
  - Incomplete details in DC/DP plans
    - Requirement for Development with Detention tank
  - Submission of As-Built Plans for TOP/ CSC submission

Most Commonly Made Mistakes

Submissions without cover letter



Submissions with wrong form

Types of Form/Submission	Form to be Used
• **Application for Development Control Clearance (DC)**	PUB-DCCLR
• **Application for Detailed Plan Clearance (Minor Drainage Work)**	PUB-DPCLR
• **Application for Detailed Plan Clearance (Other Drainage Work)**	PUB-DPCLR
• **Application for Drainage Clearance for TOP**	PUB-DRATOP
• **Application for Drainage Clearance for CSC**	PUB-DD-CSIDRA

**ESS-CORR form shall not be used for making new ES submission

Submission of Amendments to approved DC/DP

- **highlight area/ scope of changes in Cover letter & amendment shall be clouded in plan**

Building Plan unit
PUB
40, Scotts Road, #15-01
Environment Building
Singapore 228231

Dear Sir/Madam,

[PROJECT REF. NO.: A1744-00038-2017-BP02]
PROPOSED AMENDMENT TO APPROVED NEW COVERED LINKWAY FROM EXISTING COVERED LINKWAY

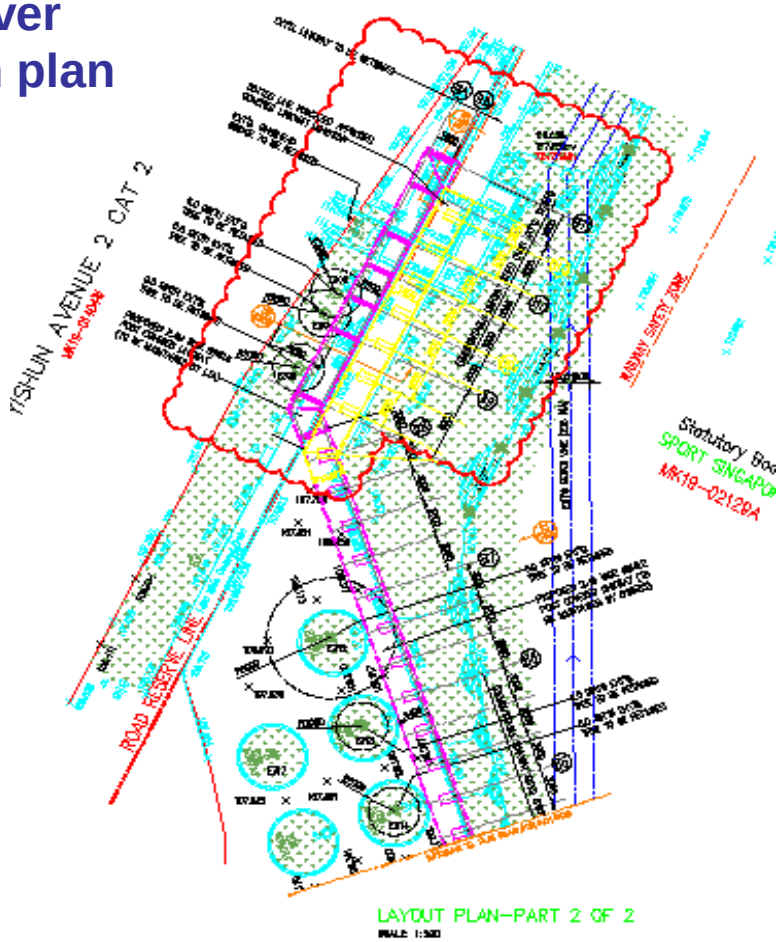
- APPLICATION FOR CLEARANCE CERTIFICATE

1. We thank you for your BP Clearance CA20180208-59133 dated 08 February 2018.

2. Please be informed that our covered linkway was shifted from grid line C1-C4/CA near to the carriageway such that it is within LTA road reserve line.

3. On behalf of our Client, M/s Land Transport Authority, we are pleased to submit the following document and building plan for the above project for your consideration and approval:-

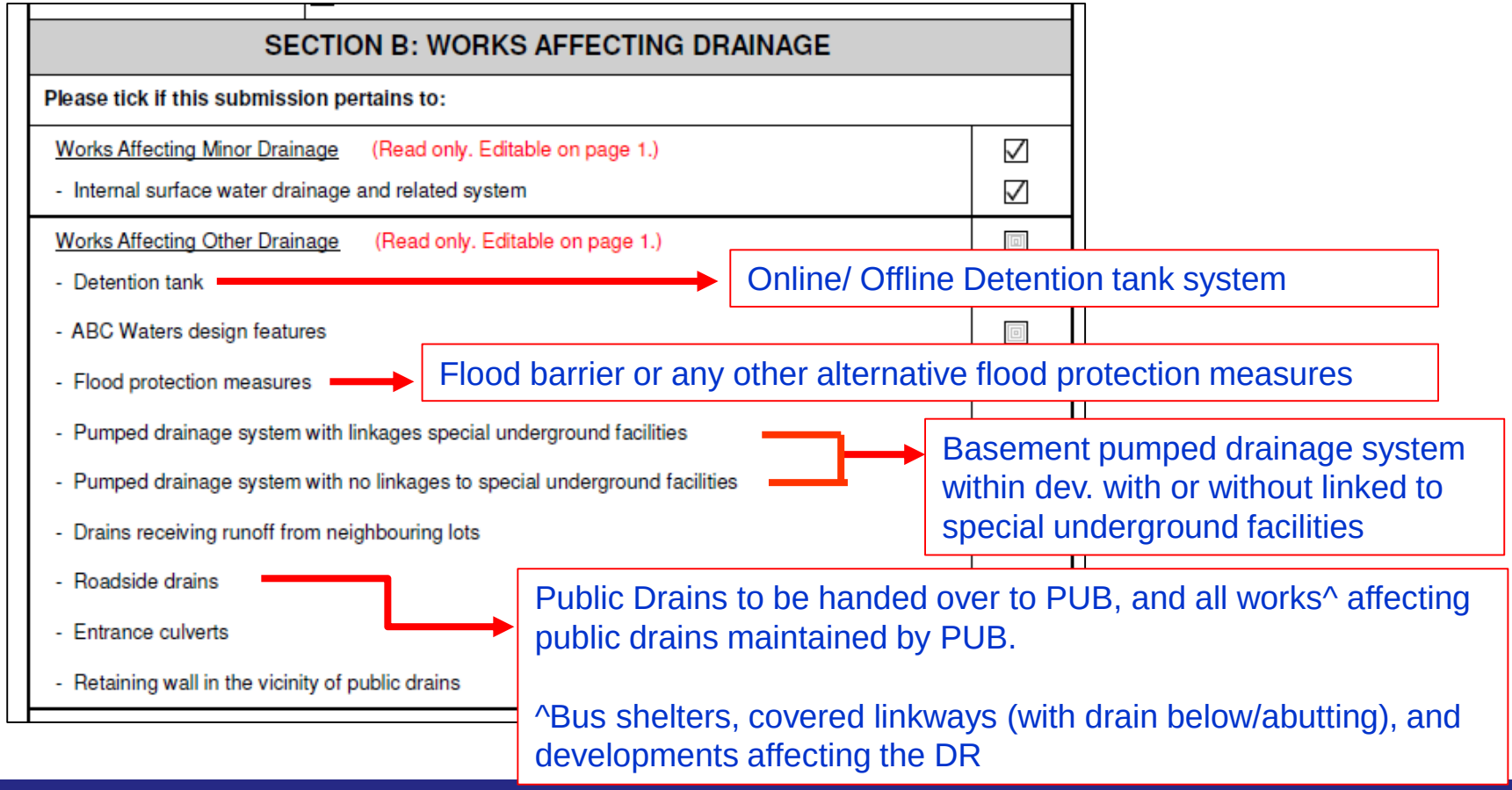
   a) A set of Building Plan (Total of 07 AutoCAD files)
   b) A copy of Form PUB-DPCLR.xfd
   c) A copy of BP Clearance
   d) A copy of Architectural Drawing List.



CLASSIFICATION OF DRAINAGE WORKS

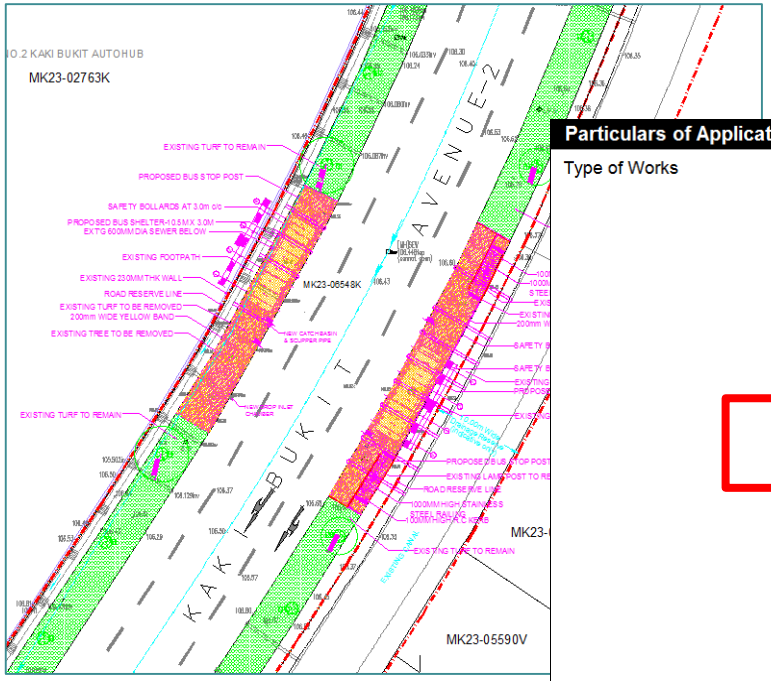
Classification of Drainage Works

- Works Affecting Minor Drainage – for internal drainage system **within** development plot, **within** HDB estate etc.
- Works Affecting Other Drainage – see definition below



Covered Linkway, Bus shelter within RR – submitted as Works Affecting Minor Drainage

- Should be submitted under Works Affecting Other Drainage – **Roadside Drain**



Particulars of Application

Type of Works

- ☐ Simplified Submission
  - **For A&A Works**
  - A&A works to an existing building involving only the construction of additional floors without reconstructing the first storey and where there are no linkages to special underground facilities.
  - **For External Structures e.g. Linkway, bus shelter, POB**
  - External structures that are:
    - not affecting public drain (i.e. at least 300mm away from drain wall) or;
    - not within DR or;
    - not affected by drain receiving runoff from neighbouring lots
- ☐ Works Affecting Minor Drainage
  - ☐ Internal surface water drainage and related system
- ☐ Works Affecting Other Drainage
  - ☐ Detention Tank
  - ☐ ABC Waters Design Features
  - ☐ Flood protection measures
  - ☐ Pumped drainage system with underground facilities
  - ☐ Drains receiving runoff from neighbouring lots
  - ☐ Roadside drains
  - ☐ Entrance culverts
  - ☐ Retaining wall in the vicinity of public drains

X

Particulars of Application

Type of Works

- ☐ Simplified Submission
  - **For A&A Works**
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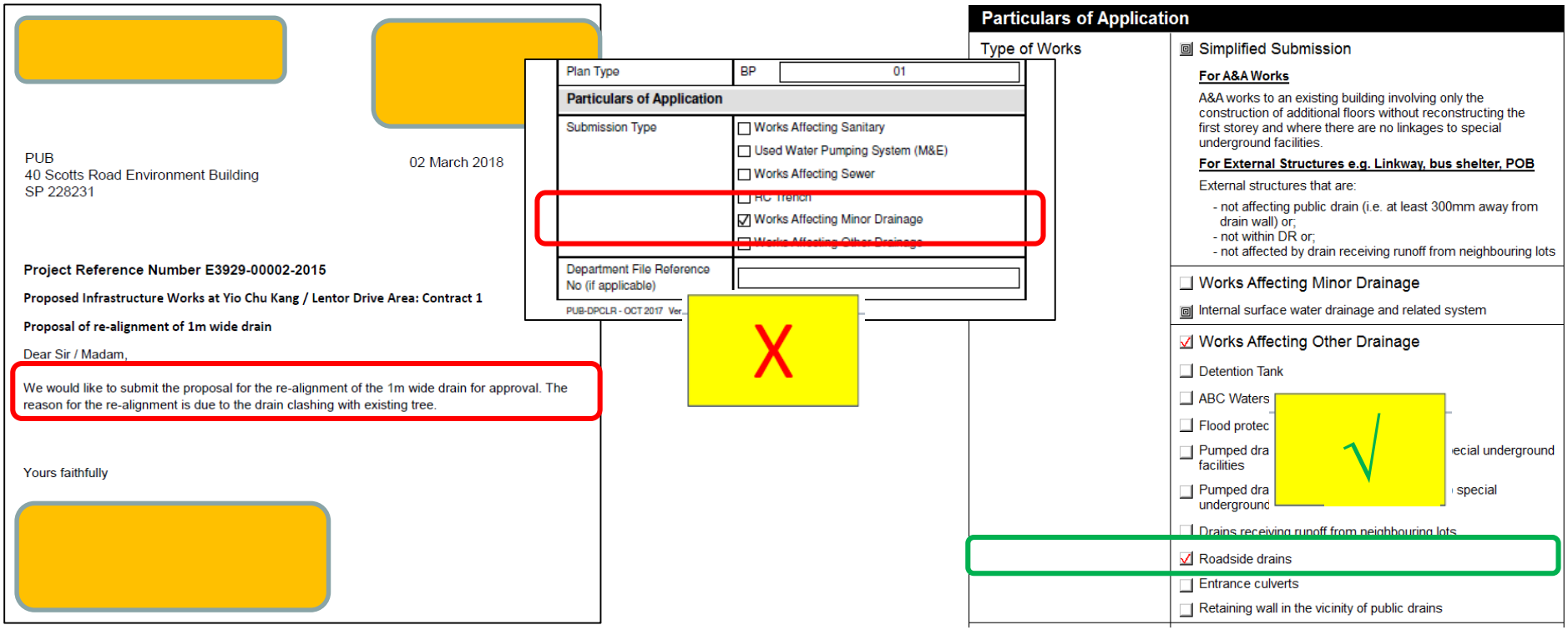
- ☐ Works Affecting Minor Drainage
  - ☐ Internal surface water drainage and related system
- ☑ Works Affecting Other Drainage
  - ☐ Detention Tank
  - ☐ ABC Waters Design Features
  - ☐ Flood protection measures
  - ☐ Pumped drainage system with li facilities
  - ☐ Pumped drainage system with no underground facilities
  - ☐ Drains receiving runoff from neighbouring lots
  - ☑ Roadside drains
  - ☐ Entrance culverts
  - ☐ Retaining wall in the vicinity of public drains

√

Infra submission – submitted as Works Affecting Minor Drainage

- Should be submitted under Works Affecting Other Drainage – **Roadside Drain**



PUB
40 Scotts Road Environment Building
SP 228231

02 March 2018

Project Reference Number E3929-00002-2015

Proposed Infrastructure Works at Yio Chu Kang / Lentor Drive Area: Contract 1

Proposal of re-alignment of 1m wide drain

Dear Sir / Madam,

We would like to submit the proposal for the re-alignment of the 1m wide drain for approval. The reason for the re-alignment is due to the drain clashing with existing tree.

Yours faithfully

Plan Type	BP 01
Particulars of Application	
Submission Type	☐ Works Affecting Sanitary ☐ Used Water Pumping System (M&E) ☐ Works Affecting Sewer ☐ RC Trench ☑ Works Affecting Minor Drainage ☐ Works Affecting Other Drainage
Department File Reference No (if applicable)	

PUB-DPCLR - OCT 2017 Ver...

X

Particulars of Application

Type of Works

☐ Simplified Submission

For A&A Works

A&A works to an existing building involving only the construction of additional floors without reconstructing the first storey and where there are no linkages to special underground facilities.

For External Structures e.g. Linkway, bus shelter, POB

External structures that are:

- not affecting public drain (i.e. at least 300mm away from drain wall) or;
- not within DR or;
- not affected by drain receiving runoff from neighbouring lots

☐ Works Affecting Minor Drainage

☐ Internal surface water drainage and related system

☑ Works Affecting Other Drainage

☐ Detention Tank

☐ ABC Waters

☐ Flood protec

☐ Pumped dra facilities ecial underground

☐ Pumped dra underground special

√

☐ Drains receiving runoff from neighbouring lots

☑ Roadside drains

☐ Entrance culverts

☐ Retaining wall in the vicinity of public drains

- Missing Endorsement – DC/ DP/ TOP/ CSC

SUBMISSION PLANS

DC Planning Endorsement

shall be submitted separately to PUB for record during Detailed Planning stage	
21. Source catchment area with surface runoff leading into the pumped drainage system is clearly indicated	○ Yes ◉ No
22. The location, size, inlet and outlet connections of the rainwater pump sump for the proposed pumped drainage system are clearly indicated	○ Yes ◉ No
(I)	
23.	

Page 7 of PUB-DCCLR Form – to be endorsed on the plans

I hereby confirm and endorse that I have complied with the above items and Guidelines on Submission of DC Plans.

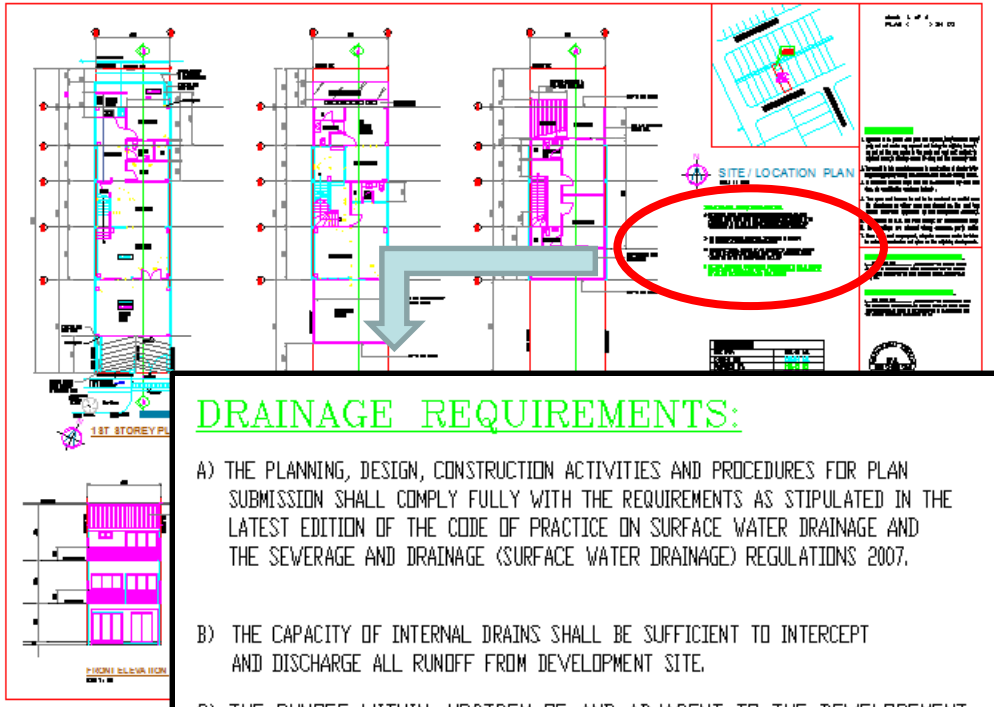
I hereby certify that the standard endorsement below will also be certified on the plans:-

(a) The planning, design, construction activities and procedures for plan submission shall comply fully with the requirements as stipulated in the latest edition of the Code of Practice on Surface Water Drainage and the Sewerage and Drainage (Surface Water Drainage) Regulations 2007.

(b) The capacity of internal drains shall be sufficient to intercept and discharge all runoff from the development site.

(c) The runoff within, upstream of and adjacent to the development lot can be effectively drained away without causing flooding within the lot or in areas outside the lot.

* Public Utilities Board (PUB) reserves the right to report any false declaration of information to the relevant professional bodies for action in accordance to the Act/ethnics governing all the Qualified Professional.*

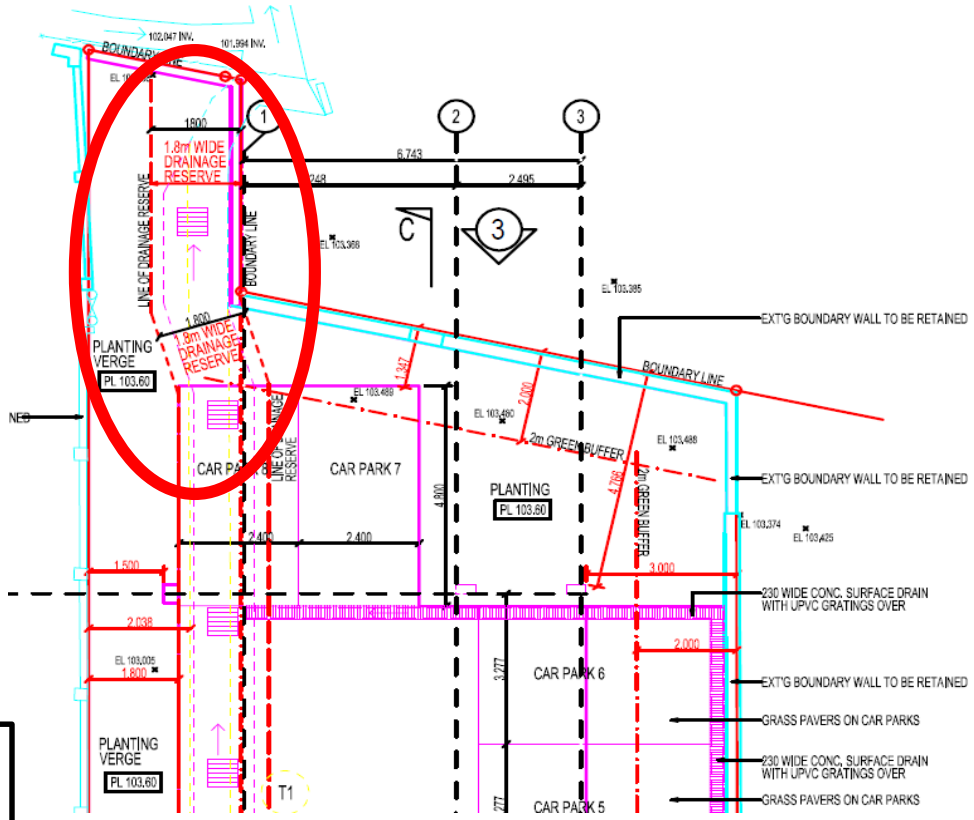


Use of DR Endorsement

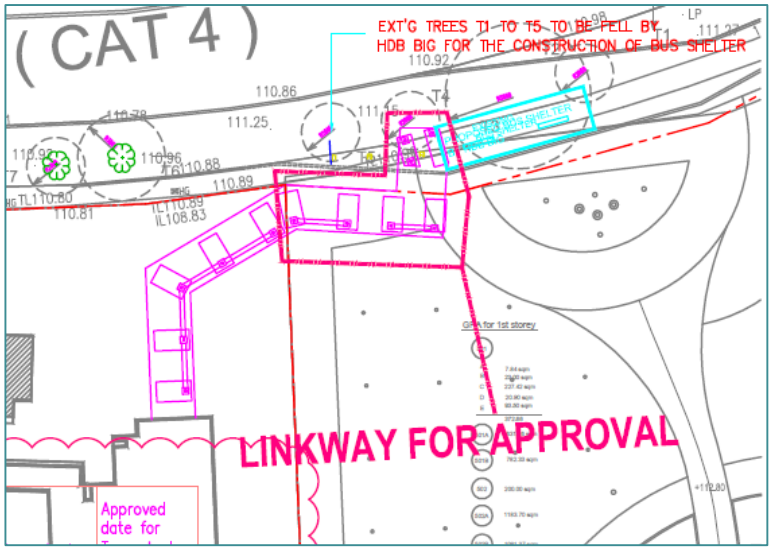
CONDITIONS FOR USE OF DRAINAGE RESERVE

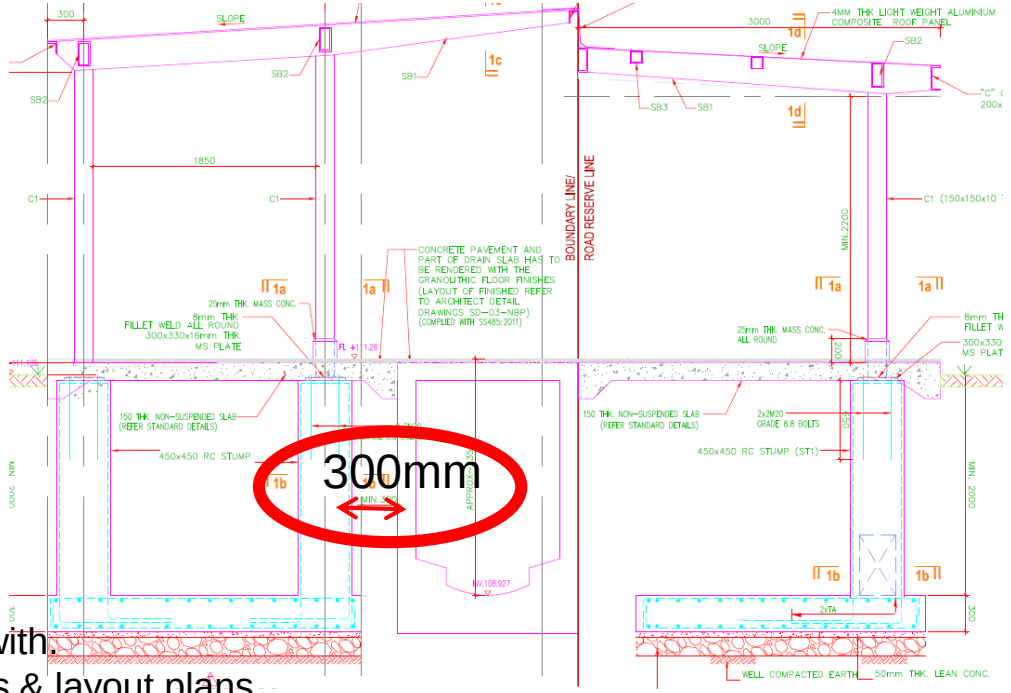
1. THE DEVELOPER / LAND OWNER SHALL ALLOW PUBLIC UTILITIES BOARD (THE BOARD) OR HIS AGENT ACCESS TO CARRY OUT DRAINAGE WORKS WITHIN THE DRAINAGE RESERVE AS AND WHEN NECESSARY ;
2. THE DEVELOPER / LAND OWNER SHALL NOT CONSTRUCT ANY STRUCTURES OR FACILITIES ON, OVER OR UNDER THE DRAINAGE RESERVE WITHOUT THE PRIOR APPROVAL OF THE BOARD ;
3. THE DEVELOPER / LAND OWNER SHALL BE RESPONSIBLE FOR THE PHYSICAL MAINTENANCE OF THE LAND WITHIN THE DRAINAGE RESERVE ;
4. THE DEVELOPER / LAND OWNER SHALL BE RESPONSIBLE FOR SAFEGUARDING THE STRUCTURAL INTEGRITY OF THE DRAINS WITHIN THE PORTION OF DRAINAGE RESERVE TO BE FENCED-IN ;
5. THE DEVELOPER / LAND OWNER SHALL BE RESPONSIBLE FOR THE STRUCTURAL MAINTENANCE OF THE DRAINS WITHIN THE DRAINAGE RESERVE ;
6. THE DEVELOPER / LAND OWNER SHALL TAKE MEASURES TO ENSURE PUBLIC SAFETY WITHIN THE DRAINAGE RESERVE ;
7. THE DEVELOPER / LAND OWNER SHALL AT ALL TIMES INDEMNIFY AND KEEP INDEMNIFIED THE GOVERNMENT AND THE PUBLIC UTILITIES BOARD FULLY AND COMPLETELY AGAINST ALL LIABILITIES OF WHATSOEVER NATURE OR DESCRIPTION WHICH MAY BE INCURRED OR SUFFERED BY THE GOVERNMENT AND THE PUBLIC UTILITIES BOARD IN CONNECTION WITH OR ARISING OUT OF THE USE OF THE DRAINAGE RESERVE BY THE DEVELOPER / LANDOWNER AND AGAINST ALL ACTIONS, PROCEEDINGS, CLAIMS, COSTS AND EXPENSES THEREFORM; AND
8. ALL FACILITIES OTHER THAN THE APPROVED DRAINAGE FACILITIES WITHIN THE DRAINAGE RESERVE SHALL BE REMOVED AT THE DEVELOPER'S / LAND OWNER'S COSTS, AS AND WHEN REQUIRED BY THE BOARD.
9. DETAILED PLANS FOR THE PROPOSED DRAIN WITHIN THE DR SHALL BE SUBMITTED SEPARATELY BY P.E. FOR APPROVAL.

Drainage Reserve affecting the site shall be clearly dimensioned and indicated on the plans.



Covered Linkways/ Bus Shelters Endorsement





1. Conditions in endorsement shall be complied with.
2. Clear indication of the clearance on all sections & layout plans.
3. IF proposed supports/ footings **<u>< 300mm</u>** hor. clearance, QP shall clarify the reasons to justify why the minimum clearance can't be met.
    - CL shall be constructed as independent structure from drainage structures and QP shall confirm that the foundations shall be stable when excavation up to 1m below the invert of affected drain.
4. IF supports/footings were to be mounted on the top slab of extg. covered rdside drain, PE shall submit structural analysis report confirming extg. drain structures are in satisfactory cond. and capable to withstand the intended loadings. Otherwise, the extg. drain shall be reconstructed.

Any Other Endorsement

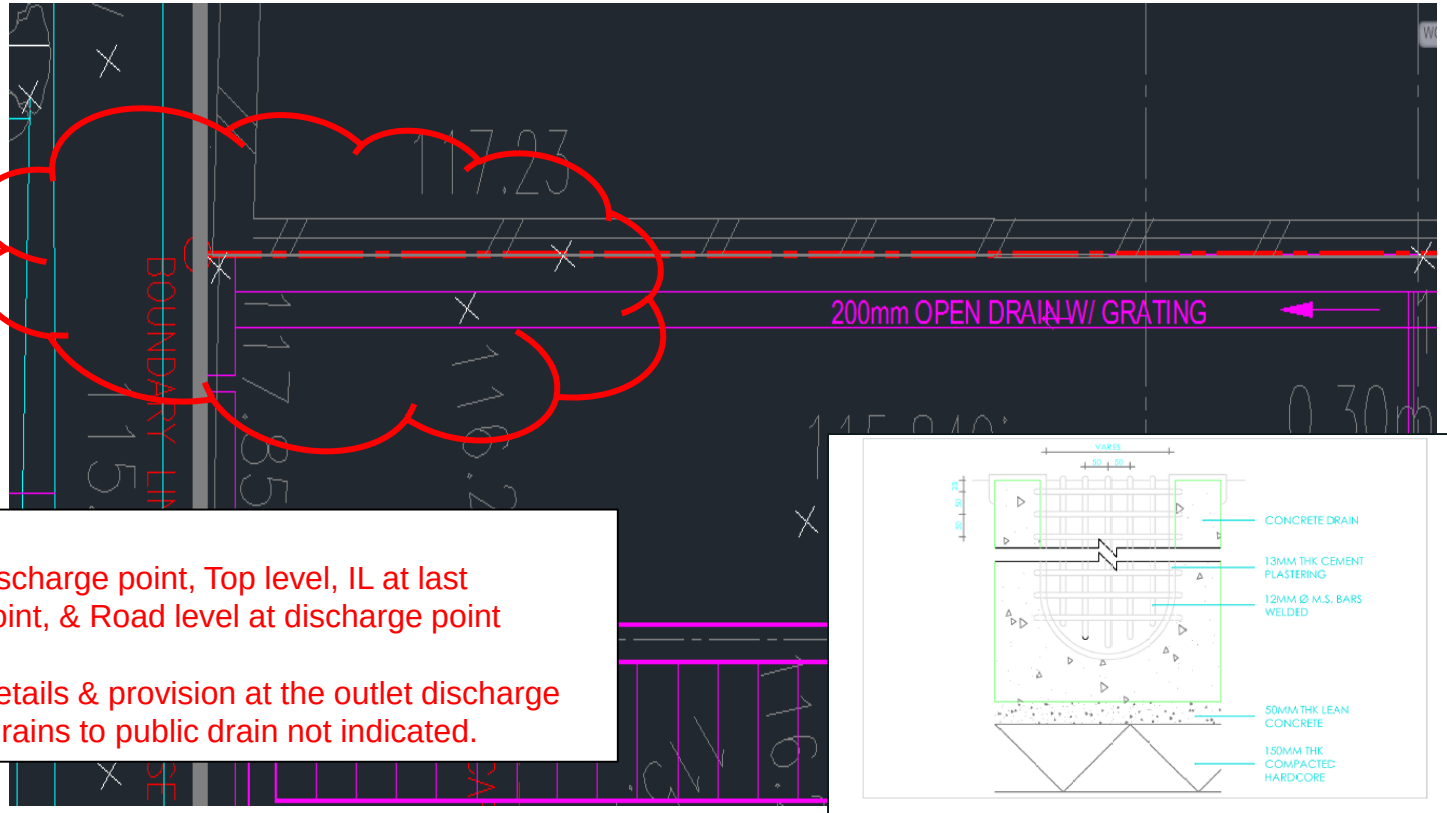
- Park Connector Network (PCN) within DR
- Use of DR as Footpath
- Use of DR as Cycling track
- Taxi stand over Drain

All necessary endorsement shall be clearly shown in the Site plans for all DC/ DP/ TOP/ CSC stage

- Incomplete Details in DC/DP Plans

SUBMISSION PLANS

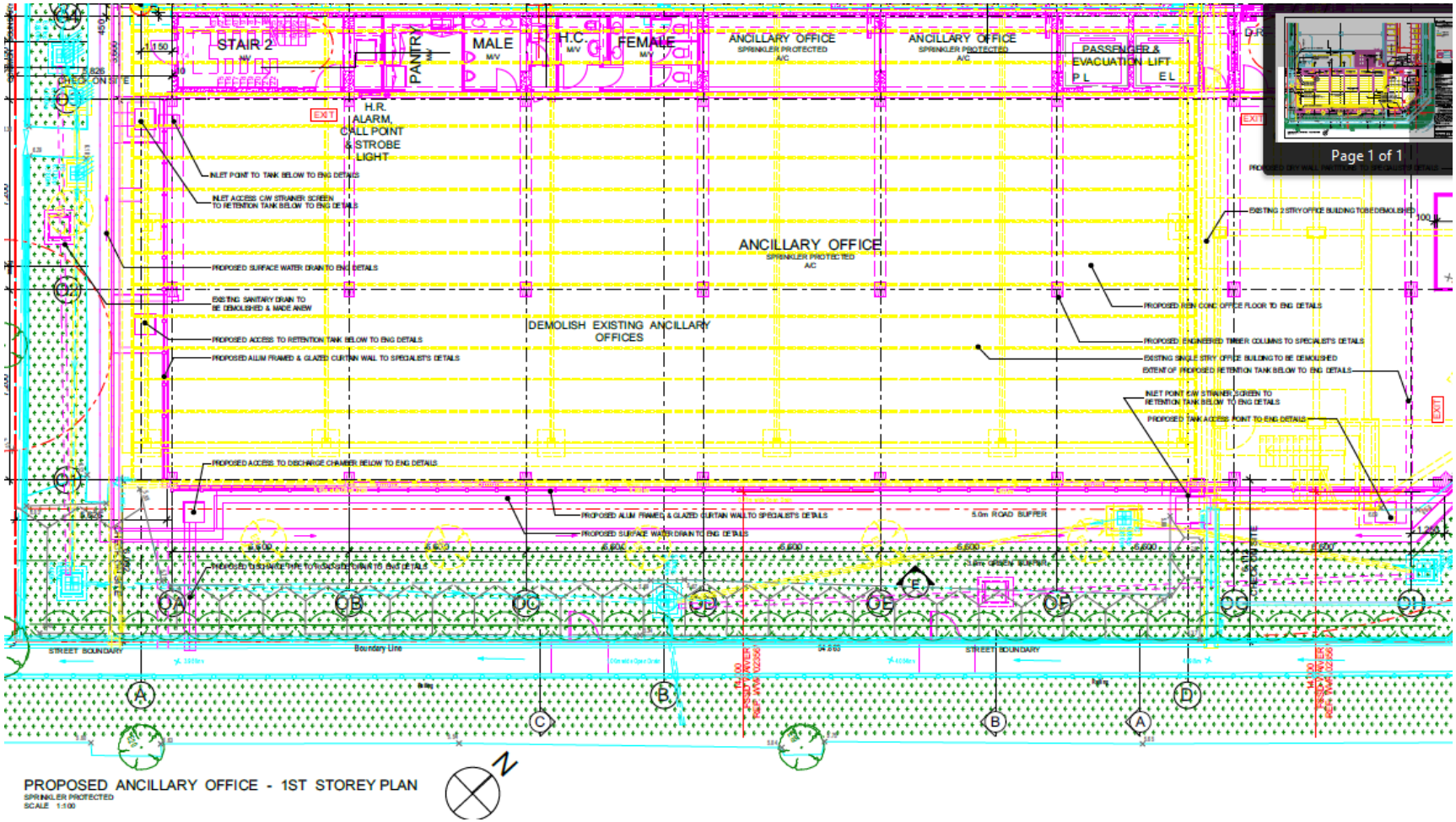
Incomplete discharge point details



- Missing:
  Proposed discharge point, Top level, IL at last discharge point, & Road level at discharge point

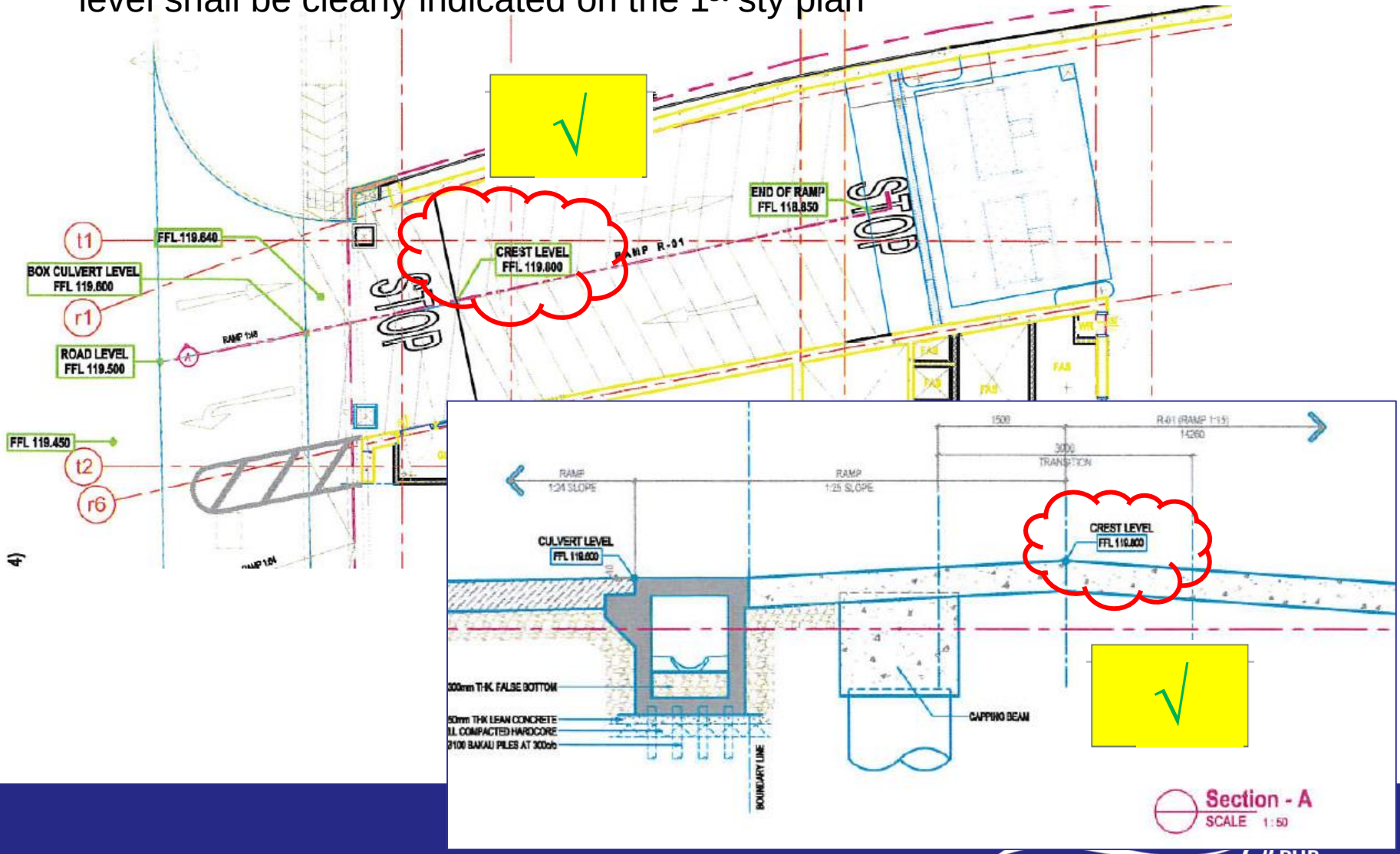
- Vertical grating details & provision at the outlet discharge point of internal drains to public drain not indicated.

No Indication of Platform levels



An example of Clear indication of Crest Levels

- For development with basement, crest level and swan neck (if applicable) level shall be clearly indicated on the 1st sty plan



New/ A&A Proposal with site area > 0.2ha with Detention tank

Is there basement?	○ Yes ◉ No
Area of development	6.7464 ha
DR in the development	○ Yes ◉ No
Proposed MIN PLATFORM LEVEL	10.55 mRL
Max Adjacent Road	9.70 mRL
Any linkage to MRT	○ Yes ◉ No
Drainage Catchment Please refer to catchment maps here	9

Works Affecting Other Drainage

- Detention Tank ☑
- ABC Waters design features ☐
- Flood protection measures ☐
- Pumped drainage system with linkages special underground facilities ☐
- Pumped drainage system with no linkages to special underground facilities ☐
- Drains receiving runoff from neighbouring lots ☐
- Roadside drains ☐
- Entrance culverts ☑
- Retaining wall in the vicinity of public drains ☐

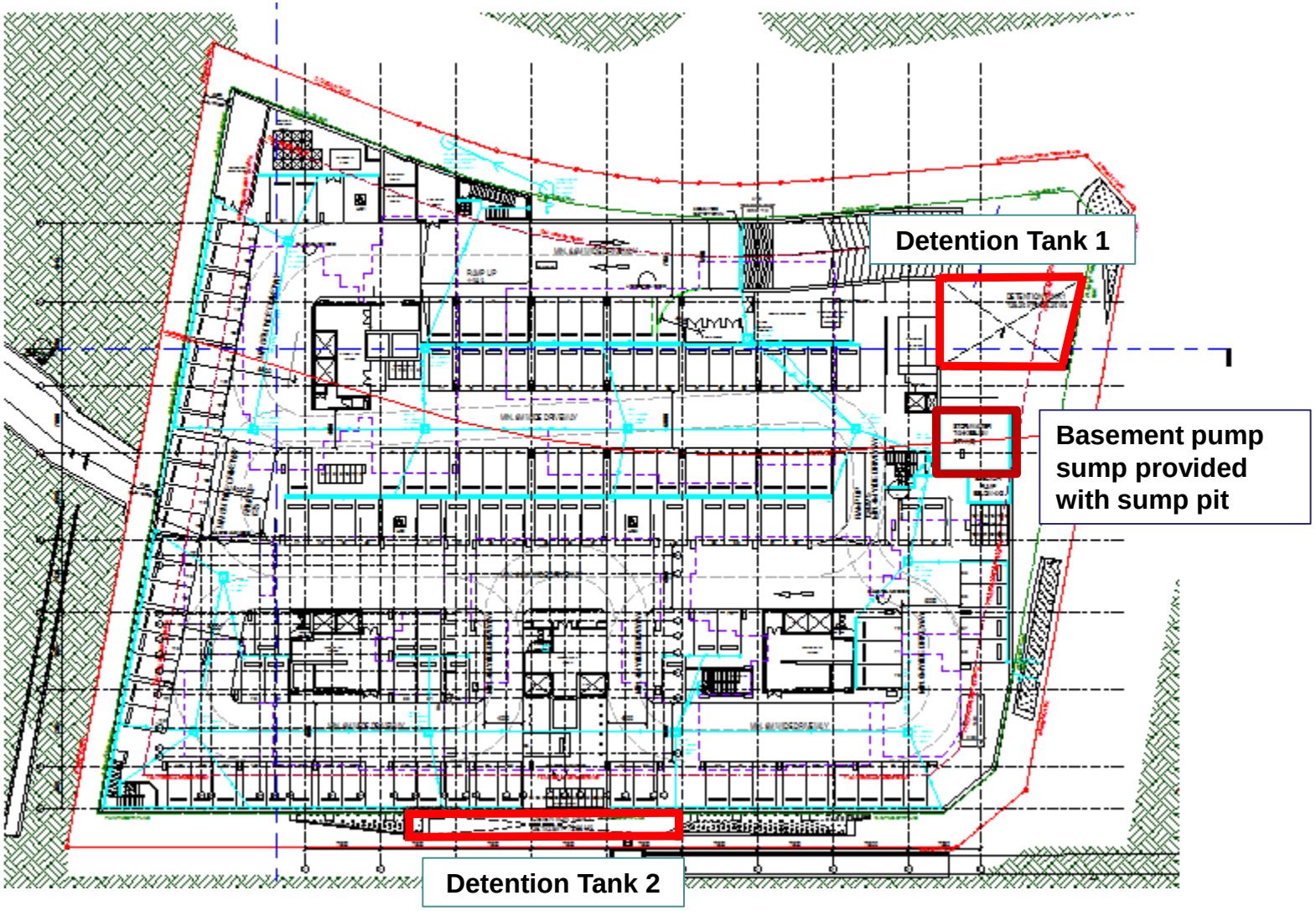
***** Design calculations for detention tank shall be submitted***

Recap: Submission Requirements for Development with Detention tank – Drainage DC/ DP Submission

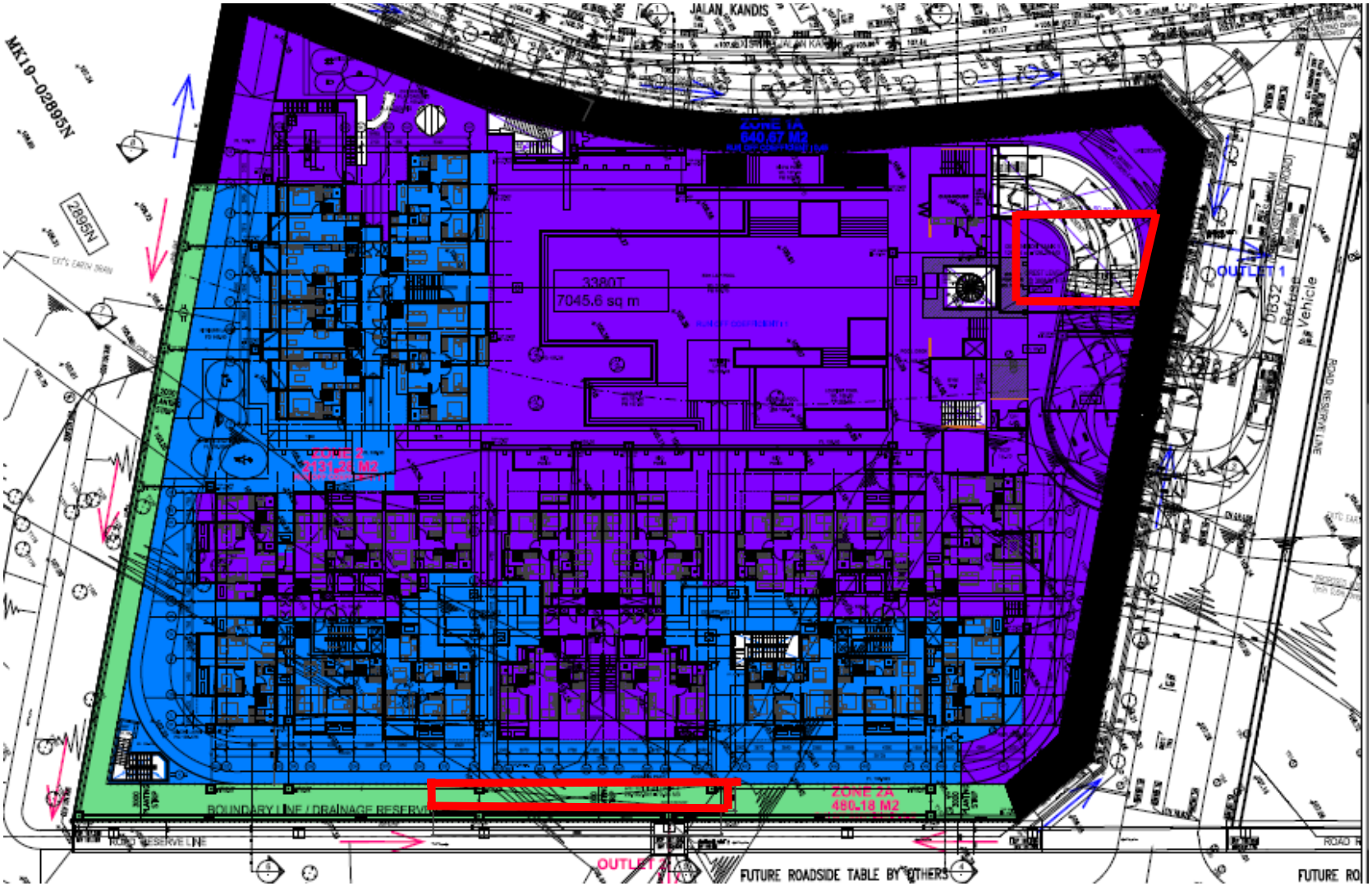
For all industrial, commercial, institutional and residential developments greater than or equal to 0.2ha with detention tank systems, the following documents, endorsed by a QP, shall be submitted:-

- Catchment & sub-catchment plans clearly indicating catchment for each tank (if more than one tank is required) and outlet discharge point of internal drainage system to the public drain
- Site analysis with corresponding runoff coeffs for controlled/ non-controlled catchment
- Design calculations or modelling results that will be adopted to control the peak runoff discharge
- Clear site layout plans indicating location and footprint of the detention tank (s) or pumping facilities
  - Effective depth of detention tank, connection point to the internal drainage system, swan neck crest level at the 1st sty level shall be clearly indicated

Proposal with Basement Pumped Drainage & Detention tank



Catchment plan – Clear Indication of sub-catchment served by each DT, controlled/ uncontrolled catchments & outlet discharge points



PE Calculation For Detention System

Project:
Subject: On-Site Stormwater Detention Tank Design (Zone 1)



Catchment Description

Land Use	Area		Runoff Coefficient
Impervious Surfaces	3849	m2	1
Pervious Surfaces	381	m2	0.45

Step 1: Identify peak discharge from site and target peak discharge

Step	Description	Equation				Remarks
1a	Site Area	A (ha)	=	0.423	ha	
1b	Weighted runoff coefficient of site	Cpost	=	0.95		Equation 3.1.2
1c	Time of concentration	tc (min)	=	5	min	Equation 3.1.2
1d	Average rainfall intensity for 10yr storm event	i10 (mm/hr)	=	217	mm/hr	Equation 3.1.3
1e	Peak discharge from site	Qpost (m3/s)	=	0.243	m3/s	Equation 3.1.4
1f	Target runoff coefficient	Ctarget	=	0.55		
1g	Target peak discharge	Qtarget (m3/s)	=	0.140	m3/s	

Step 2: Determine requried detention volume

Step	Description	Equation				Remarks
2a	Calculate K1	K1	=	597		Equation 3.4.2
2b	Calculate K2	K2	=	173		Equation 3.4.2
2c	Calculate K3	K3	=	41		Equation 3.4.2
2d	Calculate txmax	txmax (min)	=	30	min	Equation 3.4.2
2e	Calculate txlimit	txlimit (min)	=	30	min	Equation 3.4.3
2f	Select txcritical	txcritical (min)	=	30	min	Compare txmax and txlimit and select smaller of the values
2g	Required detention volume	Vt (m3)	=	126	m3	Equation 3.4.4

Step 3: Determine detention system configuration

Step	Description	Equation				Remarks
3a	Effective tank depth	dt (m)	=	1	m	Check site boundary conditions. Effective tank depth is the depth between the invert of inlet drain and discharge orifice. The tank, orifice and discharge pipe/drain inverts shall allow free flow discharge into the public drain.
3b	Tank bottom area	At (m2)	=	126	m2	

Step 4: Sizing of detention tank discharge control

Step	Description	Equation				Remarks
	Maximum head to centre of orifice	H0 (m)	=	0.875	m	
4a	Orifice discharge	Q0 (m3/s)	=	0.140	m3/s	Equation 3.5.1
	Q0=Qtarget	Qtarget (m3/s)	=	0.140	m3/s	Using a circular orifice
	Solve for orifice diameter	d0 (m)	=	0.259	m	
	Adopted orifice diameter	d0 (m)	=	0.250	m	

Project:
Subject: On-Site Stormwater Detention Tank Design (Zone 2)



Catchment Description

Land Use	Area		Runoff Coefficient
Impervious Surfaces	2231	m2	1
Pervious Surfaces	381	m2	0.45

Step 1: Identify peak discharge from site and target peak discharge

Step	Description	Equation				Remarks
1a	Site Area	A (ha)	=	0.2612	ha	
1b	Weighted runoff coefficient of site	Cpost	=	0.92		Equation 3.1.2
1c	Time of concentration	tc (min)	=	5	min	Equation 3.1.2
1d	Average rainfall intensity for 10yr storm event	i10 (mm/hr)	=	217	mm/hr	Equation 3.1.3
1e	Peak discharge from site	Qpost (m3/s)	=	0.145	m3/s	Equation 3.1.4
1f	Target runoff coefficient	Ctarget	=	0.55		
1g	Target peak discharge	Qtarget (m3/s)	=	0.087	m3/s	

Step 2: Determine requried detention volume

Step	Description	Equation				Remarks
2a	Calculate K1	K1	=	357		Equation 3.4.2
2b	Calculate K2	K2	=	107		Equation 3.4.2
2c	Calculate K3	K3	=	41		Equation 3.4.2
2d	Calculate txmax	txmax (min)	=	29	min	Equation 3.4.2
2e	Calculate txlimit	txlimit (min)	=	28	min	Equation 3.4.3
2f	Select txcritical	txcritical (min)	=	28	min	Compare txmax and txlimit and select smaller of the values
2g	Required detention volume	Vt (m3)	=	72	m3	Equation 3.4.4

Step 3: Determine detention system configuration

Step	Description	Equation				Remarks
3a	Effective tank depth	dt (m)	=	1	m	Check site boundary conditions. Effective tank depth is the depth between the invert of inlet drain and discharge orifice. The tank, orifice and discharge pipe/drain inverts shall allow free flow discharge into the public drain.
3b	Tank bottom area	At (m2)	=	72	m2	

Step 4: Sizing of detention tank discharge control

Step	Description	Equation				Remarks
	Maximum head to centre of orifice	H0 (m)	=	0.9	m	
4a	Orifice discharge	Q0 (m3/s)	=	0.087	m3/s	Equation 3.5.1
	Q0=Qtarget	Qtarget (m3/s)	=	0.087	m3/s	Using a circular orifice
	Solve for orifice diameter	d0 (m)	=	0.204	m	
	Adopted orifice diameter	d0 (m)	=	0.200	m	

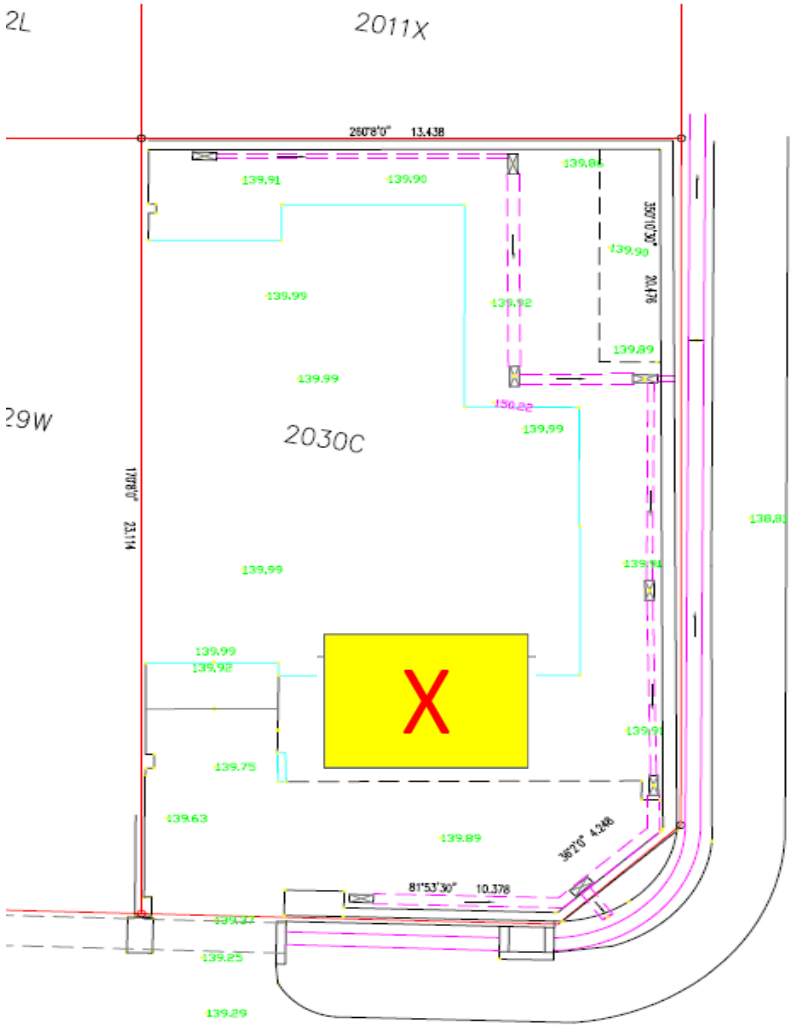
Good practises

- Detention tank can only be assessable from the 1st Storey
- Overflow facilities should be provided for the detention tank
- Outlet from the Detention tank shall be channeled to a sump/ the internal drain before discharging to roadside drain

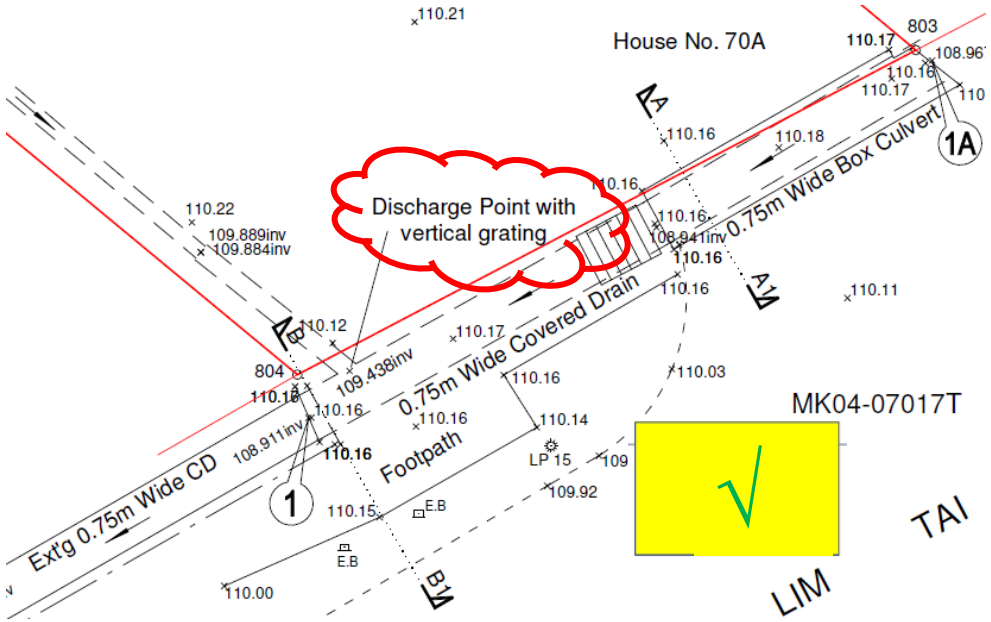
- Incomplete Details in As-Built Plans for TOP/ CSC

SUBMISSION PLANS

Incomplete Info in As-Built Survey plan



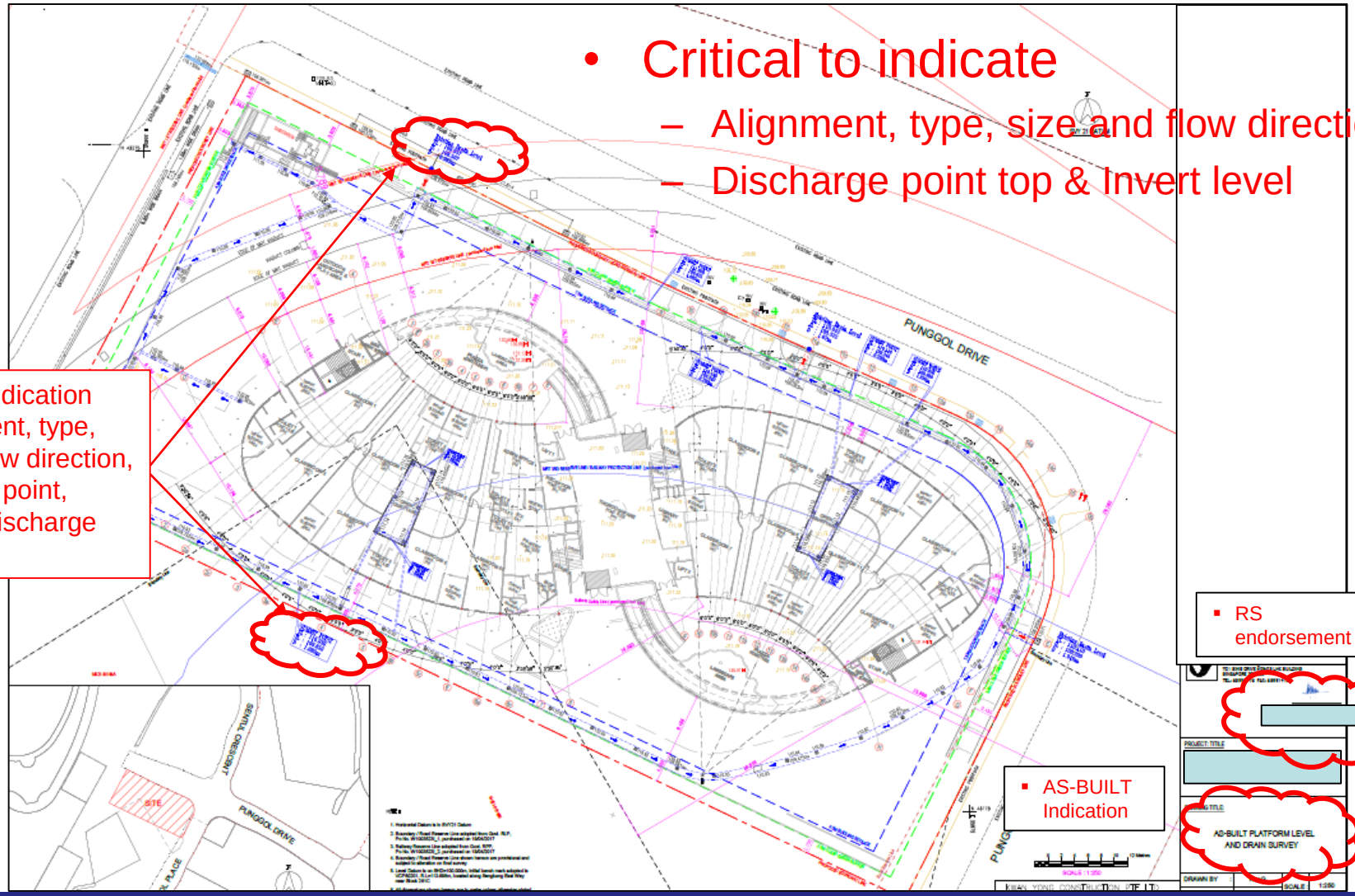
- Critical to indicate
  - Outlet discharge point Top & Invert level
  - Rd level at discharge point
  - Details of vertical grating
  - Vertical grating @ discharge pt



Swan neck crest level at 1st level on As-Built Plans (for Basement pumped drainage)



Good example of RS endorsed As-Built Survey Plans for TOP submission with Offline DT system



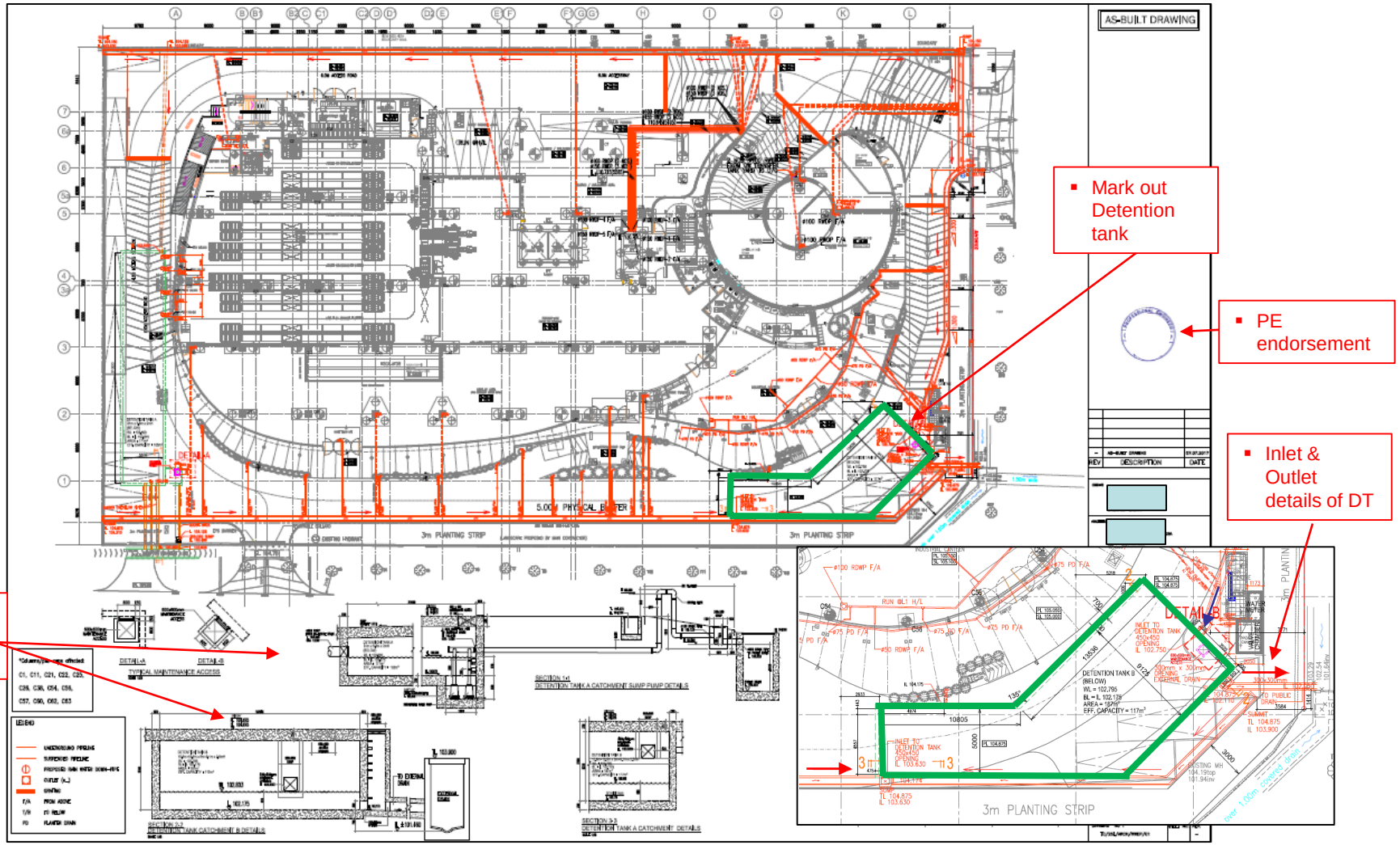
- Critical to indicate
  - Alignment, type, size and flow direction
  - Discharge point top & Invert level

- Clear indication alignment, type, size, flow direction, summit point, outlet discharge point

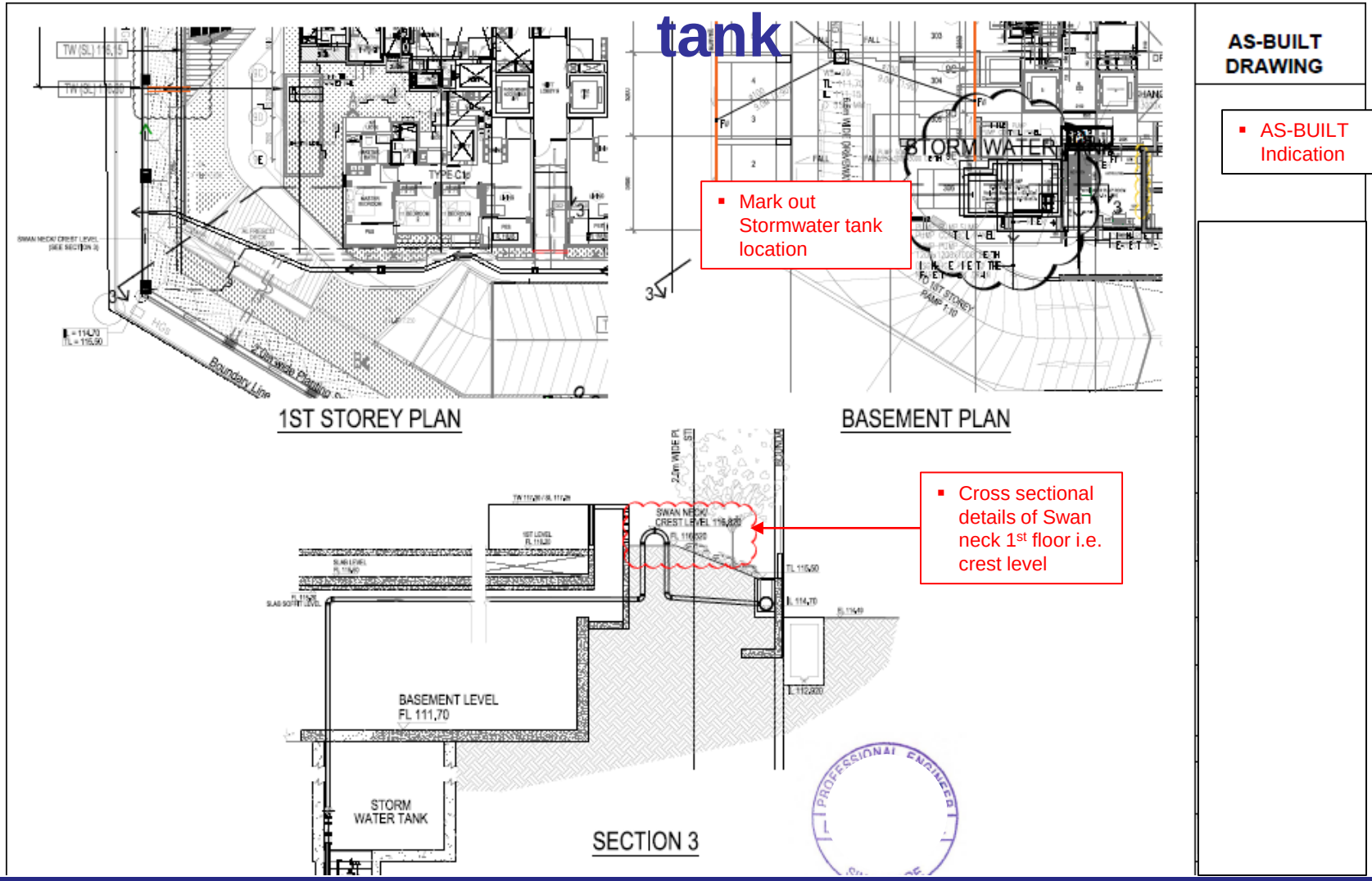
- RS endorsement

- AS-BUILT Indication

Good example of QP endorsed As-Built Drawings for TOP submission with Detention tank



Good example of QP endorsed As-Built Drawings for TOP submission with Detention tank



USEFUL LINKS ON DRAINAGE DESIGN GUIDES AND SUBMISSION REQUIREMENT

Useful link

- Useful drainage design guidelines can be found in the following www.pub.gov.sg/compliance/qualifiedpersonsportal/cop
  - ➢ COP on Surface Water Drainage
  - ➢ Drainage
    - Drainage Handbook on Managing Urban Runoff
    - Technical Guide on On-site Stormwater Detention Tank Systems
  - ➢ Alternate Sources of Water
    - Rainwater Harvesting
  - ➢ ABC Waters Design Features

➢ www.pub.gov.sg/compliance/qualifiedpersonsportal/quicksubmissionguides
- DC, DP, CSC submission guides

Recap- Items for Drainage TOP submission

	Items to be included	Remark
a.	As-built Survey plan* indicating platform levels, crest level, adj. road level, and flood protection levels etc. (*to comply with SWD COP Cl.11*)	
b.	i. As-built Drawing* with detention tank details (inlet & outlet levels, cross sectional views, swan neck/crest level) and final design calculations* *(On-Site DT Systems guide 6.4 (iii))* ii. Standard Operating Procedures* *(SWD COP Cl. 10.3)* iii. PE written confirmation & Declarations on the following: - Inspection, testing and commissioning of Detention tank and pumps (if applicable) *(SWD COP Cl. 13.2)* - Max. stormwater discharge from development is in compliance with max allowable peak runoff as stipulated in COP *(SWD COP Cl. 7.1.5; On-Site DT Systems guide 6.4 (i))* - Liaised with Developer/ Owner to undertake SOP in item b(ii) (countersigned by Developer/ Owner/ MA/ MCST) *(SWD COP Cl. 10.4; On-Site DT Systems guide 6.4 (i))* iv. Letter of undertaking from Developer/ Owner/ MCST/ MA *(SWD COP Cl.13.2.1)* - to declare on crest levels in compliance to COP on SWD <u>every 3 yrs</u> upon obtaining TOP v. Letter of undertaking from Developer/ Owner/ MCST/ MA *(SWD COP Cl.13.2.2)* - to submit Certificate of Inspection on pumped drainage system <u>annually</u> upon obtaining TOP	For Dev. with Detention tank or basement pumped drainage
c.	i. Standard Operating Procedures* *(SWD COP App 2)* ii. Manual Flood barrier, **<u>on-site</u>** leak test report *(SWD COP Cl 13.2; SWD COP App 2)*	For Dev. with Flood barrier

** To be endorsed by QP/ RS, whichever applicable*

** Reference: BPU Newsletter Issue 6 Dec 2017*

Submission for CSC/ DLP Application with External Drainage Works

- Submit together with Handing Over form to facilitate site inspection

Submission Checklist (Continue)

Works Affecting Other Drainage (Read only. Editable on page 1.) ☐

I have supervised, inspected and certify that the works affecting other drainage are executed in accordance with the approved building/project plans and attach the necessary documents.
In particular, I certify that:

PUB CSIDRA FORM

	Yes	N.A.	Remarks
1. Drainage works fully completed and constructed according to approved plan	☐	☐	
2. No unauthorised slab-crossing / fence-in over public drain / drain which is receiving runoff from the neighbouring lots	☐	☐	
8. Handing over of completed drainage works is submitted Click here to download form.	☐	☐	

*** There shall not be any hardcopy for filling in on site anymore*

HANDING OVER OF COMPLETED DRAINAGE WORKS

PROJECT : _____

_____

This is to confirm the following works under the above project to be handed over to Catchment & Waterways Department for maintenance

S/No	Brief description of drainage works. (excluding pedestrian bridge, pedestrian footpath over drain which are **NOT** to be handed over to Catchment And Waterways Department)		Remarks
1	Open drains [Length *(m)* x Width *(m)* x Depth *(m)*]		
2	Closed drains [Length *(m)* x Width *(m)* x Depth *(m)*]		
3	Drop Inlet Chambers *(number)*		
4	Closed Scuppers [Length *(m)*]		
5	Opened Scuppers [Length *(m)*]		
6	Construction Cost *($)*		
7	Other items to be handed over		

Handed over by : _____

Project Officer : _____

Signature : _____

Date : _____

THANK YOU