SUStoM

SARAWAK URBAN STORMWATER MANAGEMENT GUIDELINE

3rd Edition (2022)

DEPARTMENT OF IRRIGATION AND DRAINAGE SARAWAK

FOREWORD

Sarawak Urban Stormwater Management Guideline (SUStoM) is an adaptation of the Urban Stormwater Management Manual for Malaysia (MSMA). The concept of stormwater management control in SUStoM is a paradigm shift from the traditional drainage practices based on rapid disposal.

Stormwater management using "control-at-source" approach involves the development and implementation of a combination of structural measures and best management practices (BMPs) to minimise nuisance flooding as well as improve the quality of urban stormwater runoff prior to its discharge to receiving waters.

Our urban streams and rivers need to be recognised as valuable resources and planned as open space drainage corridors with amenities for public access and recreational activities.

SUStoM will provide a common and consistent guideline to all regulators, planners, designers, developers and contractors who are involved in physical development planning and stormwater management.

DID Sarawak welcome all comments and suggestions for the continuous improvement of this guideline.

(Ir. AHMAD DENNEY BIN HAJI AHMAD FAUZI)
Director,
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SARAWAK

SARAWAK URBAN STORMWATER MANAGEMENT (SUStoM) GUIDELINE

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Abbreviations

DID	Department of Irrigation and Drainage
L&S	Land and Survey Department
EPC	Engineering Plan Committee
MSMA	Manual Saliran Mesra Alam Malaysia
BMP	Best Management Practice
ESCP	Erosion and Sediment Control Plan
ARI	Average Recurrence Interval
OSD	On Site Detention
BRSO	Borneo Rectified Skewed Orthomorphic (Datum : Timbalai 1948)

1.0 INTRODUCTION

This guideline has been prepared by DID Sarawak for the Drainage Plan Approval based on Sarawak Urban Stormwater Management (SUStoM). SUStoM was approved by the State Cabinet on 28th January 2016 as a planning standard for development control to incorporate stormwater management into the design to minimize environmental degradation and improve aesthetic as well as recreational appeal of areas in Sarawak.

It is a guideline to establish a uniform technical standards for the developers, engineers, consultants, planners, architects, Local Authorities and Government Agencies in submitting the SUStoM Planning Submission, Earthwork Plan and Erosion and Sediment Control Plan (ESCP) and Stormwater Management Plan.

Its objective is to assist the applicants or project proponent to submit a complete and comprehensive SUStoM Planning Submission, Earthwork Plan and Erosion and Sediment Control Plan (ESCP) and Stormwater Management Plan that is in accordance with SUStoM requirements.
This publication emphasizes on 3 main development processes whereby DID is involved as follows:-

i) SUStoM Planning Submission,
ii) Earthwork Plan & Erosion Sediment Control Plan Submission and
iii) Stormwater Management Plan Submission (Engineering Plan).

This guideline is read in conjunction with Manual Saliran Mesra Alam (MSMA) 1st Edition, 2000; Manual Saliran Mesra Alam (MSMA) 2nd Edition,

2012 and Guideline for Erosion and Sediment Control Plan (ESCP) in Malaysia 2010.

The needs and requirement in this book is subjected to amendment and updates whenever deemed necessary.

2.0 PRINCIPLES AND OBJECTIVES

The incidence of flash floods in urban areas is becoming more severe from year to year. This is partly due to the encroachment into the river corridor/river reserve which serves as **natural space for water**.

Currently, in order to mitigate such nuisance flash floods, conventional drainage systems were designed to provide the fastest possible disposal of stormwater runoff out of the catchments into the receiving water bodies.

In the past, the design of conventional drainage systems used to be based on the first urban drainage manual, **"Planning and Design Procedure No. 1: Urban Drainage Design Standards and Procedures for Peninsular Malaysia"** published in 1975 by the Department Of Irrigation and Drainage (DID) Malaysia. This manual was in use for 25 years in Peninsular Malaysia whereas in Sarawak, the same manual have been in used for more than 40 years. According to the aforesaid manual, the drainage system is designed based on **"rapid disposal"** which unfortunately has led to the increase of flash flooding occurrences at the downstream of catchments due to the increase in surface runoff, peak discharges and shorter time of concentration. Thus, this rapid disposal approach is no longer effective and efficient in tackling flooding woes as more and more development takes place.

The main focus of SUStoM is to manage the stormwater by using an environmental friendly approach based on "**control-at-source**" techniques, which include control water quantity and quality as well as erosion and sediment control. This method utilises detention or retention (to store water temporarily), infiltration to reduce runoff, and purification to improve the water quality upon reaching the river system. Thus, the quantity and quality of the stormwater runoff from a developed area can be retained to its pre-development condition.

SUStoM is also to provide **easy guidance to all regulators, planners and designers who are involved in stormwater management implementation.** This is to ensure that the administration of the planning, design and maintenance of stormwater system is consistent across all the authorities and the professions of urban development, environmental, water resources, civil engineering and landscape architecture.

3.0 SUStoM PLANNING SUBMISSION

3.1 General

As a technical department, DID Sarawak has been entrusted by the government to provide technical advice on stormwater management. DID Sarawak will look into the need to preserve and safeguard river or stream reserve, drain reserve, detention or retention pond reserve, coastal reserve requirement and so on. This is to ensure that ample space is made available as buffer to control riverbank erosion, for flood plain and bankfull discharge zone, as access to carry out operation and maintenance works along the river, as a platform to carry out flood mitigation and riverbank protection infrastructures (i.e. flood mitigation pumping station, bunds, tidal gates, river wall, ditch, dykes, etc.), as space for river conservation and improvement (i.e. river dredging, desilting, deepening and widening works), and for aesthetic and recreational activities.

Thus, fulfilling a requirement for a sustainable development from the flood management perspective within the intergrated water resources management.

3.2 Types of Development

All development and all redevelopment projects shall comply with SUStoM planning submission requirement.

For individual residential development which is **less than 0.50 acres**, the compliance is encouraged but not compulsory.

3.3 Processing Of SUStoM Planning Submission to DID Sarawak

All Consultants must complete and submit the Checklist for SUStoM Planning Submission to DID Sarawak. Details on the checklist are as below:

A Plan Features

- Plans submitted must be complete, organized and neatly folded into A4 size
- The paper size must be A1 drawing size
- The title must be located at the top when the plan is folded

B Digital Locality Plan Use Google Earth Pro for digital locality (in kmz file) - 2 copies

Scale : 1 : 25, 000 or scale required by the Assistant Director of Stormwater Management Division/Divisional Engineer
The information that need to be shown / indicated:

i) All the important properties such as main roads, trunk drains, cable trail, water mains, elements of topography and other cables if any
ii) Show with detail and thoroughly on the plan, the sheet numbers, district, and regional scale and the north point.

C Key Plan - 2 copies

Scale : 1 : 25,000

The information that need to be shown / indicated

i) The entire catchment area that are involved in the area to be developed
ii) The lines of the existing land border for the related lots and the surrounding lots of adjoining land within 10 km.

If the overall development has been planned in phases, the conceptual plan for the entire area must be submitted. Overall drainage main drains must be identified and the overall drainage masterplan must be submitted.

D Site Layout Plan cover whole site – 2 copies

DID Sarawak may request layout plan in appropiate scale if required. The information that need to be shown / indicated. All elements, features and main dimensions of the existing development and proposed development including:

i) The proposed layout for building sites, roads reserve, drain / stream / river reserve and others.
ii) The proposed platform level for building sites.
iii) The proposed drain / stream flowing out from residential areas to existing drain / stream / river.

iv) Final discharge point (for areas to be developed) that connects to any existing natural river or main trunk drain to be shown clearly.

v) Incoming discharge value for the discharge points (river/main trunk drain) before the proposed development.

vi) Catchment plan and catchment area to be clearly indicated. (submission must be from reliable sources)

vii) River/stream/drainage alignment and reserve to be indicated clearly.

viii) Location and area of suitable reservoir/detention pond/retention pond in the open space.

ix) Types of SUStoM facilities. As recommended,

- For development less than 1 ha – On-Site Detention (OSD) facilities at suitable area
- For development more than 1 ha – OSD facilities / detention or retention pond within the open space.

E Topographical Survey Plan (in digital format and georeferenced) – 2 copies

Scale to cover the whole site and to be endorsed by Lisenced Surveyor with detail of adjacent areas. DID Sarawak may request layout plan in appropiate scale if required.

The information that need to be shown / indicated

i) Plan should be endorsed by a licensed surveyor.

ii) Contour and spot level of the proposed development area.

F Aerial View Photographs – 2 copies

Pertinent information that need to be shown / indicated

i) Photos indicating existing water bodies, site overview, existing infrastructure and utilities.

If topography survey plan is in georeferenced format, then its not required.

G Historical Infromation (for areas to be developed)

The information that need to be shown / indicated

i) List of flood event for the area to be developed
ii) Highest flood level to be clearly indicated
iii) Tidal Information (if applicable)
iv) Water Polution (if applicable)

4.0 EARTHWORK PLAN & EROSION SEDIMENT CONTROL PLAN SUBMISSION

4.1 General

Before the commencement of earthworks, the developers through their consulting engineers with Professional Engineer with Practising Certificate shall submit the earthworks plan and ESCP Plan directly to relevant DID Divisional office.

DID will also review the necessary requirements such as the size of sedimentation control structure so that **NO** sediment will be discharged to the downstream areas.

4.2 Processing of Earthwork Plan & Erosion Sediment Control Plan (ESCP)

All consultants must complete and submit the checklists for Earthwork Plan & Erosion Sediment Control Plan (ESCP) to DID Sarawak. (Refer to Form B)

A. Plan Features

i) Plans submitted must be complete sign and certified by the Consultant with Professional Engineer with Practising Certificate and Developer, organized and neatly folded into A4 size.
ii) The drawing paper size must be A1.
iii) The title must be shown at the top when the plan is folded.

B. Layout Plan – 3 copies

The information that need to be shown / indicated are:
Earthwork Plan Superimposed with the Contour plan

Scale : 1 : 500 (area<1ha)
1 : 1000 (area>1ha)

i) Show / highlight the clear detail of cut & fill area,
ii) Proposed platform level,
iii) Slope protection measures,
iv) Surface runoff flow direction,
v) Location of proposed stockpile of top soil,
vi) Indicate the position of Best Management Practices (BMP) to control erosion and sedimentation and outlet to main drain or existing river. For example, silt trap, perimeter drain wash

through, temporary earth drain, check dam, interceptor drain, sediment basin, temporary crossing, silt fences and etc.

vii) Show all drains flowing to the proposed BMP.

- Maintenance Schedule for BMP by the Consultant/ Developer
- Undertaking letter from developer/consultant to maintain all BMPs.
- Quarterly Progress Report for ECSP by Consultant/Developer include photograhic evidence (aerial view & other photographs with date stated)

Please refer to Form B (Checklist for Earthwork Plan & Erosion Sediment Control Plan Submission) for detail checklist.

4.3 Conditions To Support Approval For ESCP

In addition to the information already stated, the developer / applicant must comply with the following conditions:

i) **NO** rivers, drains, streams and existing channels shall be backfilled, closed, interrupted or diverted except with the permission of the Director of Department of Irrigation and Drainage Sarawak. Any diversion of the river, the existing trench should be included in the plan design and shown clearly.

ii) **NO** construction works and earthworks shall be carried out until the earthworks and stormwater management plan (Engineering Plan) have been approved by the Engineering Plan Committee (EPC).

iii) **NO** drainage outlet shall be constructed prior to obtaining written consent from land owners if it encroaches into private land. This is in line with Land and Survey requirement.

4.4 Best Management Practices

Land development activities will disrupt the natural environment. Site clearing and earthworks activities that are not regulated properly would have a negative impact on the environment, such as erosion, river sedimentation and slope failure. Best Management Practices acts as a guideline for developers and contractors to minimize the effects of erosion and sedimentation on site.

Erosion and Sediment Control Plan (ESCP) is designed to control erosion and trap sediment generated from land clearing activities, earthworks and construction work.

Detailed information is available in the following guidelines;

i) Guideline for Erosion and Sediment Control Plan in Malaysia 2010
ii) Refer to Chapter 12 (ESCP) of MSMA 2nd Edition 2012.

5.0 STORMWATER MANAGEMENT PLAN SUBMISSION

5.1 General

All Stormwater Management Plan shall be directly submitted through qualified Professional Engineer with Practising Certificate to the relevant DID Divisional Office.

DID will check Form C submitted by the qualified Professional Engineer with Practising Certificate that must emphasize on the drainage plan, such as main trunk drain, internal drains, ponds, rivers or other pertinent issues.

A. Plan Features

i) Plans submitted must be complete, organized and neatly folded into A4 size,

ii) The drawing paper must be A1 drawing size,

iii) The title must be located at the top when the plan is folded.

B. Layout Plan – 3 copies

Minimum Scale 1:500

The information that need to be shown / indicated are:

i) Provide Description on Proposed Drainage Plan and Mitigation Measures:

- Plan indicating location and overall flow path of the proposed drainage system (i.e. location and size of drains, main drains, retention/detention facilities (pond / OSD) and water quality control facilities, as necessary).

C. Design Calculation (Refer to MSMA 2nd Edition)

i) Design rainfall (Location, coefficients, table, intensity, depth, Hyetograph)

- Minor System (5/10 years)
- Major System (50/100 years)

(Q_{-Pre} 100 year ARI to be shown in the plan)

ii) Pre-Development Discharge

Hydrology

- Catchment delineation and drainage network
- Parameter values used (Length, Slope, % Pervious, Minimum Infiltration of soil)

Hydraulics

- Type, Length, Size of Drains/Ponds
- Manning Roughness Coefficient

Hydrographs

- Minor System (hydrograph, Peak Q_5 (Pre-dev)
- Major System (Hydrograph, Peak Q_{50} (Pre-dev)

iii) Post-Development Discharge

Hydrology

- Catchment delineation and drainage network
- Parameter values used (length, slope, percentage of pervious and impervious, infiltration rate of soil)

Hydraulics

- Type, Length, Size of Drains/Ponds
- Manning Roughness Coefficient

Hydrographs

- Minor System (hydrograph, Peak Q5 (Post-dev)
- Major System (Hydrograph, Peak Q50 (Post-dev)

Note: For pond design – show hydrographs for rainfall duration greater than t_c

- Mitigation Measures

a. Describe in words how the engineer addressed the increase in post-development minor and major system discharge,
b. Describe how the internal drainage system will function when subjected to the major system storm. Highlight the mitigation measures that the engineer has taken into account in the design.

D. Drainage Facilities

List and describe the type of drainage facilities used within the project (Location and typical drawings). For example - Detail of each drain (lined drain / grassed swale drain / main drain / detention / retention pond facilities).

E. Others Relevant Document

i) Undertaking letter from developer to maintain detention pond at own cost until date of handing over to the Sarawak Government,

ii) Undertaking letter from developer to repair damages to the drainage and river embankment at own cost until the date of handing over to the Sarawak Government,

iii) Undertaking letter from developer to submit DOMM (Designer's', Operation & Maintenance Manual) during the handing over to the Sarawak Government, and

iv) Undertaking letter from developer to submit three (3) sets of As-built Drawing of detention pond and the relevant drainage system for the gazette of their drain reserves by the Sarawak Government (i.e. where it is deemed necessary).

5.2 Conditions To Support Approval For Stormwater Management Plan

In addition to the information already stated, the developer / applicant must comply with the following conditions:

i) **NO** rivers, drains, streams and existing channels shall be backfilled, closed, diverted, or blocked except with the permission of the Director of Department of Irrigation and Drainage Sarawak. If the diversion of the river become absolutely necessary, the existing trench should be included and shown clearly in the design plan,

ii) **NO** construction works and earthworks shall be carried out until the earthworks and stormwater management plan (Engineering Plan) have been approved by the Engineering Plan Committee (EPC),

iii) **NO** drainage outlet shall be constructed prior to obtaining written consent from land owners if it encroached into private land. This is in line with Land and Survey Department's requirement.

5.3 Submission of As-bulit Drawing Upon Completion of Civil Engineering Works

As-built drawing should be submitted before the Engineering works inspection.

Among the details to be included in the As-built drawing are as follows:

i) All As-Built drawings submitted to be endorsed by a qualified Licensed Surveyor.

ii) To indicate clearly all the existing utilities within the area of development.

iii) To provide spot levels of all the constructed drainage system, relevant dimension of the structures and invert levels of the all the drainage infrastructure and relevant drainage system.

5.4 Under strata title development, it shall be the responsibility of the property owner to provide for, and maintain private stormwater management facilities serving the property and to prevent and correct any conditions interfering with, or impeding, the management of stormwater including the accumulation of debris that interferes with drainage function of a water body.

6.0 GUIDELINES FOR DETENTION / RETENTION POND

6.1 General

Flooding is among the major problems that threaten a large number of residents who live in the low lying area of the river and coastal area. The frequency of flooding and its impending damage increases every year. This phenomenon is further exuberated by the conversion of land use from forest to agriculture to urban development.

In urban areas flooding occurrence is due to the overflow of rivers or streams flowing through the urban areas. Sometimes flooding is also a result of inadequate urban drainage infrastructure and also bottlenecks (i.e. due to utilities, choking from indiscriminate dumping of solid waster or debris, and construction of illegal structures) of the drainage system.

Rapid growth in the urban areas has resulted in the inability of the existing drainage to cater for the development, thus causes flooding. A large number of problems especially during the development process were caused by the negative impact of the rapid development of the catchment area.

6.2 "Control-At-Source" Approach In the Cause of Development

The peak flow of new development areas should be reduced. This can be achieved through the following steps:-

i) Use of the on-site-detention (OSD) methods such as the rainwater harvesting tank at home, underground rainwater storage and etc.

ii) Reduce the rate of runoff by increasing the usage or introduction of porous pavement in parking, footpath, parks and others in the commercial and residential areas.

iii) Ponds can be included in the development plan for residential and commercial area. The pond size required only up to three (3) to five (5) percent of total development area. During heavy downpour, the storm water runoff will flow into the pond without flowing directly to the river to reduce the peak flow of the river. Besides that, this pond can be used as recreational area.

iv) This three to five percent (3% - 5%) can be included in the ten percent (10%) reserve as green area of the required 10% of the development.

6.3 Criteria and Conditions of Detention / Retention Pond

i) The pond area only requires 3%-5% of the development area, which is part of the 10% open space requirement,
ii) The pond area can be considered as part of the green area,
iii) The pond can be in the form of wet pond or dry pond and can be used as recreational area for boating, fishing, picnicking, and football/sports field,
iv) Scheduled regular maintenance shall be carried out by the developer until the development is vested and surrendered to the Sarawak Government,
v) The maintenance for private areas that are not vested and surrendered to the Sarawak Government shall be carried out regularly by the developer,
vi) The developer shall submit land acquisition plan to DID for gazette (if any).

7.0 SPECIFIC REQUIREMENTS

7.1 River Reserve (Natural River)

i) Natural river channel as well as other natural or existing channels which run across or beside the said land, must be provided with the necessary reserve to accommodate the increased in runoff due to the change in land use. Adequate storage or buffer zone should be provided.

ii) The left and right banks should also be allocated as river reserve or overflow storage channel. The minimum river and stream reserve width to cater for the aforesaid requirements shall be as tabulated below:-

River Width (m)	Minimum Stream and River Reserve Width at each bank (m)
> 40	50*
30 – 40	40*
20 – 30	30*
10 – 20	20
5 – 10	10
< 5	5

* Subject to hydraulic and hydrological analysis to be submitted by the project proponent or consultant.

Note : The river reserve is measured from the river highest water level to the banks on each side. River reserve on the downstream side shall not be less than the river reserve in the upstream channel.

iii) For development planning along a river for which a master plan is not yet available, a drainage reserve width shall be estimated based on the premise that the design storm flow will be catered for by a grassed channel. This premise ensures that sufficient land will be available for the design of the engineered channel when carried out in conjunction with detailed landuse planning at a later stage.

iv) Engineered channels shall be provided along alignment of existing rivers and drainage depressions. Diversion of rivers away from their natural paths will only be permitted in exceptional circumstances.

v) Continuous designated overland flow paths shall be provided from the top of the catchment through the entire urban area.

vi) Engineering channels shall be designed to cater for flows up to and including the major system design ARI.

vii) Wherever possible, landuse within river corridors should be designated as public open space.

7.2 Drain Reserve

For drain reserve, the table below indicates the minimum reserve requirement for a specific size of drain;

Top Width of Engineered Channel (m)	Minimum Requirement for Maintenance Access
W≤ 6	One side 3.7 m, other side 1.0 m
W> 6	Both sides 3.7 m

Note: Width of river / drainage reserve including the width of the channel (top width) and area for future expansion and maintenance.

7.3 Control of Soil Erosion and Sediment Load

i) Effective action should be made possible to control soil erosion of the stated land, and to control the amount of silt in the drainage water that is discharged into the drainage system and rivers, resulting from the conversion of land use and the stated development,

ii) The surface of the land cannot be left exposed and need to be protected from the effects of rain. For permanent protection, grass planting is recommended. Plastic cloth or other suitable materials are to be used as temporary covers,

iii) Temporary silt trap shall be constructed and maintained from time to time. A special site for the storage of accumulated silt loads must be provided. Any plans to use this silt load or pond as a landscape or the

like should be clearly stated. Calculations should be based on "Manual Saliran Mesra Alam" (MSMA 2nd Edition),

iv) Earthwork plan showing the activities of land and erosion control activities should be submitted for review by the Department of Irrigation and Drainage Sarawak.

7.4 Definition of Reserve Area

The neighbouring lots which are allocated as reserves shall be measured and marked clearly on the topographical survey plan certified by a Licensed Surveyor.

7.5 Proposed Technical and Professional Consultants

All technical proposals and related information shall be prepared and submitted by a qualified Professional Engineer with Practising Certificate, and all topographical survey information should be provided and certified by a Licensed Surveyor.

7.6 The Work, Systems and Standard

All technical proposals and relevant information must be prepared and submitted by the Professional Engineer with Practicing Certificate and the relevant survey information must be prepared and certified by Licensed Surveyor.

7.7 Returning of Plans/Drawings To The Project Proponent

The department reserves the right to return all the reports and plans submitted, if the information is incomplete and does not comply with the stipulated terms and conditions set forth by the Department.

7.8 Development in Peat Area

Any proposal for development within deep peat area shall be supported by detailed study report and to be submitted by the project proponent/consultant for approval.

7.9 Public Health, Safety and Welfare

Protection of the public health safety and welfare shall be a primary consideration in the design of all stormwater management facilities.

i. Minimum Proposed Platform Level (PPL)

General Development	Flood Prone Areas
300mm above the highest recorded flood level/100-year ARI flood level, whichever higher	600mm above the highest recorded flood level/100-year ARI flood level, whichever higher

ii. Post-Development Discharge (Q_{post}) and Pre-Development Discharge (Q_{pre})

General Development	Development within Flood Prone Catchment
$Q_{post} \leq Q_{pre}$	$Q_{post} \leq 0.7\ Q_{pre}$

FORM A

APPLICATION FOR SUStoM PLANNING SUBMISSION

FORM A 3rd Edition (2022)

CHECKLIST FOR SUStoM PLANNING SUBMISSION

GENERAL INFORMATION

Project Title :

Coordinate (main entrance at construction site) :
N:_____
E:_____

Proposed Development Area (Ha):

Developer :

File Name :

Consultant Firm :

No.	Detailed Checklist	Yes	No	N/A	Remarks
1.0	**PLAN SUBMISSION REQUIREMENT**				
1.1	**Digital Locality Plan with Geo-reference**				
1.2	***Key Plan with scale 1 : 25,000 or scale required by the Divisional Engineer**				
1.3	****Conceptual Plan covering the whole site with scale 1 : 500 (area <1Ha) & 1 : 1000 (area >1Ha)**				
1.4	****Topography survey plan covering the whole site and endorsed by licensed surveyor with details of adjacent areas**				
1.5	**Photographs showing site condition or aerial photographs of any water infrastructure such as R.C. drain, culverts, water pipeline and etc. within the proposed project area or its vicinity**				

*If the overall development has been planned in phases, the conceptual plan for the entire area must be submitted. Overall drainage main drains must be identified and the overall drainage masterplan must be submitted.

** All the plans to be submitted through hardcopy and softcopy with geo-reference.

No.	Detailed Checklist	Yes	No	N/A	Remarks

2.0 DRAINAGE PLANNING REQUIREMENT

2.1 Drainage

2.1.1	Location of final discharge point (for areas to be developed) that connects to any existing natural river and main trunk drain to be shown clearly	☐	☐	☐	
2.1.2	Flow direction from upstream to downstream.	☐	☐	☐	
2.1.3	To include historical flood events, highest water level & other tide information (if applicable) and water pollution (if applicable)	☐	☐	☐	
2.1.4	To indicate Proposed Platform Level (PPL)	☐	☐	☐	

2.2 River

2.2.1	River/stream/drainage alignment and reserve to be indicated clearly	☐	☐	☐	
2.2.2	River/stream/drainage reserve size to follow SUStoM requirement [refer to Clause 7.1 (ii) SUStoM 2nd Edition (2017)]as follows:				

River Width (m)	Minimum Stream and River Reserve Width at each bank (m)
> 40	50*
30 – 40	40*
20 – 30	30*
10 – 20	20
5 – 10	10
< 5	5

*Subject to hydraulic and hydrological analysis to be submitted by the project proponent or consultant.

2.2.3	To ensure river/stream/drainage diversion have no 90° bends to avoid accumulation of flow.	☐	☐	☐	

No.	Detailed Checklist	Yes	No	N/A	Remarks

3.0 DRAINAGE CONCEPTUAL PLAN REPORT

3.1 Catchment Plan

3.1.1	To include catchment plan indicating any surface run-off/waterways from the upper catchment/surrounding areas which contribute all the discharge into the proposed development project (from reliable sources)	☐	☐	☐	

3.2 Calculations

3.2.1	Incoming discharge value from the upper or surrounding catchment into the proposed development area (Q_{pre}) – SUStoM facility adopted (Q_{post}) shall be equal or less than the pre-development value.	☐	☐	☐	
3.2.2	Capacity of river/stream diversion (if any) to be equal or more than the existing river/stream	☐	☐	☐	
3.2.3	Location and area of suitable detention/retention (*OSD/wet pond/dry pond*) **MUST** be in the green & park area together with the cross-section relative to surroundings	☐	☐	☐	
3.2.4	Types of detention/retention (*OSD/wet pond/dry pond*) adopted including calculation	☐	☐	☐	

4.0 Deep Peat area

	Identify if area is considered deep peat (Deep peat: Average depth of peat <1.5m)	☐	☐	☐	

Submitted by the Consultant	**Checked by DID Sarawak:**	
	Checked by	Verified by
Signature:	Signature:	Signature:
Name:	Name:	Name:
Stamp:	Stamp:	Stamp:
Date:	Date:	

Reminder: Comments and application is valid up to **two (2) years** from this date of checking

FORM B

APPLICATION FOR EARTHWORK PLAN & EROSION SEDIMENT CONTROL PLAN SUBMISSION(ESCP)

FORM B 3rd Edition (2022)

CHECKLIST FOR EARTHWORK PLAN & EROSION SEDIMENT CONTROL PLAN SUBMISSION

General information

Project name :

Coordinate (The access gate to the Site) :
N: _____ E: _____

Proposed Development Area (Ha):

Developer :

File No. :

Consultant :

No.	Checklist	Yes	No	Remark
1.0	**BASIC REQUIREMENT**			
1.1	All drawing of engineering works/ earthworks/ ESCP	☐	☐	
1.2	ESCP Report (applicable for EIA submission)	☐	☐	
2.0	**EARTHWORK PLAN**			
2.1	Plans are signed and certified by the Consultant and Developer	☐	☐	
2.2	Clear detail of cut/fill (including the neighbouring lots)	☐	☐	
	2.2.1 Cross section	☐	☐	
	2.2.2 Long section	☐	☐	
2.3	Proposed platform level	☐	☐	
2.4	Slope protection measures	☐	☐	
2.5	Earthworks implemented by phases according to the site condition	☐	☐	
3.0	**EROSION SEDIMENT CONTROL PLAN (ESCP)**			
3.1	Plans are signed and certified by the Consultant and Developer	☐	☐	
3.2	Surface runoff flow directions are shown and marked	☐	☐	
3.3	Location of stockpile top soil	☐	☐	
3.4	Best Management Practices (BMP)			
	3.4.1 Silt trap	☐	☐	

No.	Checklist	Yes	No	Remark
3.0	**EROSION SEDIMENT CONTROL PLAN (ESCP)**			
	3.4.2 Perimeter drain, dykes	☐	☐	
	3.4.3 Wash Through	☐	☐	
	3.4.4 Temporary earth drain	☐	☐	
	3.4.5 Check Dam	☐	☐	
	3.4.6 Interceptor Drain	☐	☐	
	3.4.7 Sediment basin	☐	☐	
	3.4.8 Temporary crossing	☐	☐	
	3.4.9 Silt Fence	☐	☐	
	3.4.10 Other BMPs Please specify	☐	☐	
4.0	**MAINTENANCE SCHEDULE**			
4.1	Maintenance Schedule (refer to SUStoM as adopted from MSMA) or as required under EMP/EIA.	☐	☐	
5.0	**OTHERS**			
5.1	Undertaking letter from the developer/consultant to maintain all BMPs to ensure that everything is well functioned and submit quarterly progress report for ECSP Shall include photographic evidence (aerial view & other photographs with date)	☐	☐	

Submitted by the Consultant :	**Checked by DID Sarawak:**	
	Checked by	Verified by
Signature:	Signature:	Signature:
Name:	Name:	Name:
Stamp:	Stamp:	Stamp:
Date:	Date:	

Reminder: Comments and application is valid up to **two (2) years** from this date of approval.

FORM C

APPLICATION FOR STORMWATER MANAGEMENT PLAN SUBMISSION

FORM C 3rd Edition (2022)

CHECKLIST FOR STORMWATER MANAGEMENT PLAN SUBMISSION

GENERAL INFORMATION

Project Title :

Coordinate (main entrance at construction site) :
N:_____
E:_____

Proposed Development Area (Ha):

Developer :

File Name :

Consultant Firm :

SPA Drawing No. :

No.	Detailed Checklist	Yes	No	Remarks
1.0	**SUBMISSION REQUIREMENT**			
1.0.1	3 sets of Proposed Drainage Plan and Topographical Survey Plan attached with softcopy (CAD File with Borneo Rectified Skewed Orthomorphic (BRSO) with datum: Timbalai Datum 1948)			
1.0.2	3 sets of Hydrology and Hydraulic Design Calculation on the proposed drainage system			
1.0.3	Plans must be signed and endorsed by client/developer and Professional Engineer with Practising Certificate (PEPC) on all sheets			
1.0.4	Layout Plan Enclosed with a copy of the SPA approval plan			
1.1	**Locality Plan with appropriate scale.**			
1.2	**Trunk Drainage System Plan**			
1.2.1	Min. Scale 1:500			
1.2.2	Overall Drainage Master Plan to be submitted if the proposed development is to be carried out in phases			
1.2.3	All the plans are coloured coding and described in the Legend			
1.2.4	Drainage Plan is tally with the Subdivision / development plan approved by SPA			
1.2.5	Conform to the Hydrological and Hydraulic Design Calculation			
2.0	**CHECKLIST OF TECHNICAL REQUIREMENT**			
2.1	Drainage flow paths from upstream to downstream are clearly shown on the plan			
2.2	All internal drainage must be discharged to the pond/OSD (control at source)			
2.3	All the invert levels for the drains and sumps are clearly indicated			

No.	Detailed Checklist	Yes	No	Remarks
2.4	Proposed cross section and longitudinal of main drainage system with design invert level, sizing and level Q_5 and Q_{100}	☐	☐	
2.5	Type and sizing of the culvert is clearly indicated	☐	☐	
2.6	Location and area of the pond / OSD confirm with the detailed design calculation	☐	☐	
2.7	Level and pond/OSD size complete with cross section	☐	☐	
2.8	Inlet and outlet details of the proposed pond / OSD with primary, secondary and spillway outlet levels must be shown	☐	☐	
2.9	Location and type of debris trap/Gross Pollutant Trap is clearly shown / indicated	☐	☐	
2.10	GI Railing/Guard Rail/Covered Drain to be provided for drain depth exceeding 1.2m	☐	☐	

3.0 HYDRAULIC DESIGN CALCULATION (REFER TO MSMA 2ND EDITION)

3.1 General Requirement

3.1.1	Size of pervious and impervious area	☐	☐	
3.1.2	C, runoff coefficient calculation	☐	☐	
3.1.3	Peak Discharge $Q_{\text{-Pre}}$ 100 ARI. To be shown and recorded on the plan	☐	☐	
3.1.4	Need for water runoff quantity control $\sum Q_{post} \leq Q_{pre}$ to be shown and recorded on the plan	☐	☐	

3.2 On Site Detention (OSD)

3.2.1	Detailed cross section of proposed OSD	☐	☐	
3.2.2	Design based on 10 years ARI	☐	☐	
3.2.3	Design storm levels are clearly indicated	☐	☐	
3.2.4	Invert levels are clearly indicated	☐	☐	
3.2.5	Determine the Permissible Site Discharge (PSD) and Site Storage Requirement (SSR); Refer Chapter 5, MSMA 2nd Edition	☐	☐	
3.2.6	Size of the storage is indicated/shown in the plan	☐	☐	

No.	Detailed Checklist	Yes	No	Remarks
3.2.7	Drainage outlet level and finished surface levels are clearly indicated on the plan	☐	☐	
3.2.8	OSD outlet shown clearly on the plan * (Refer to Chapter 5 MSMA 2nd Edition) (**low flow drain/trickle flow* to be provided)	☐	☐	
3.3	**Internal Drain - Lined Drain**			
3.3.1	Details and cross section of the drain with the proposed slope gradient	☐	☐	
3.3.2	Detailed design of the internal drain (Refer Table 1.1 MSMA 2nd Edition)	☐	☐	
3.3.3	Design of covered drain adjacent to the footpath shall take into consideration the live load	☐	☐	
3.3.4	Minimum velocity shall be V=0.6m/s to prevent sedimentation and growth of vegetation *Gradient (1:300)	☐	☐	
3.3.4	**Manholes** to be provided at 3 meter interval or as required by the local authorities *Council	☐	☐	
3.3.5	Sump at every culvert / drain intersection	☐	☐	
3.4	***Grassed swale* drain type**			
3.4.1	Drain details and cross section to be indicated/shown	☐	☐	
3.4.2	Width of reserve to be clearly indicated	☐	☐	
3.4.3	Side slope of the drain should be gentler than 1V:1.5H	☐	☐	
3.4.4	Minimum freeboard: 50mm to be clearly indicated	☐	☐	
3.4.5	Levels of design storm to be clearly indicated	☐	☐	
3.4.6	Invert levels to be clearly indicated	☐	☐	
3.4.7	Infiltration trenches combined with swale (composite system)	☐	☐	

No.	Detailed Checklist	Yes	No	Remarks

3.5 Main Drain (Serve Catchment Area > 40 ha)

3.5.1	Longitudinal section along main drain	☐	☐	
3.5.2	Details and cross section of main drain	☐	☐	
3.5.3	Width of reserve to be surrendered to the government as drain reserve shall be clearly indicated	☐	☐	
3.5.4	Side slope shall be gentler than 1V:1.5H and vegetated (For Earth Drain/Swale)	☐	☐	
3.5.5	Maintenance area shall be sufficient on left and right hand side of drain embankment to be prepared and marked (min. 4m depending on the site requirements)	☐	☐	
3.5.6	*Design storm* shall be clearly indicated. (Q_5, Q_{50}, Q_{100})	☐	☐	
3.5.7	Invert level and size to be specified	☐	☐	
3.5.8	*Minimum freeboard*: 300mm shall be clearly indicated	☐	☐	
3.5.9	Railing shall be installed at the border of drain reserve or drain side for safety	☐	☐	
3.5.10	Topographical survey plan of the approved existing drainage outlet is to be provided by licensed surveyor.	☐	☐	

3.6 Detention/Retention Pond

3.6.1	Runoff shall be discharged into detention pond before flowing into a final discharge point	☐	☐	
3.6.2	Steepness of detention pond edge shall be gentler than 1V:4H	☐	☐	
3.6.3	Maintenance area shall be sufficient on left and right hand side of drain embankment to be prepared and marked (min. 5m depending on the site requirements)	☐	☐	
3.6.4	Minimum *freeboard* of 300mm shall be clearly indicated	☐	☐	

No.	Detailed Checklist	Yes	No	Remarks
3.6.5	Maximum height/depth of detention pond from pond bed to the emergency spillway must be less than 3m	☐	☐	
3.6.6	Outlet control structure* *'Primary outlet' for 'minor design storm', Q_2 *'Secondary outlet' for 'major design storm', Q_{50} *'Emergency spillway', Q_{100}.	☐	☐	
3.6.7	Detail and cross section of primary outlet	☐	☐	
3.6.8	Detail and cross section of emergency spillway	☐	☐	
3.6.9	Detail of outlet control structure	☐	☐	
3.6.10	All invert level and measurement shall be clearly indicated	☐	☐	
3.6.11	Ensure that there is no backwater flow from trench channel to the detention pond. Back water analysis to be submitted if necessary	☐	☐	
3.6.12	Access road for the maintenance of detention / retention pond	☐	☐	
3.6.13	Ramp details / maintenance path for access of maintenance vehicles / machineries for maintenance of sediment fore bay. GPT / trash screen shall be clearly indicated. Floor level shall be higher than flood level and freeboard shall not be less than 300mm (if necessary)	☐	☐	
3.6.14	Drainage pipe/cascading drain from berm drain entering into detention pond (if necessary)	☐	☐	
3.6.15	Slope protection for detention pond	☐	☐	
3.6.16	Stick gauge installed near outlet control structure	☐	☐	
3.6.17	Trash screen installed at inlet of detention pond (to provide standard details)	☐	☐	
3.6.18	Screw down gate to dry out detention pond	☐	☐	
3.6.19	Warning signage	☐	☐	
3.6.20	Cross section of detention pond to be prepared	☐	☐	
3.6.21	Minimum Embankment	☐	☐	

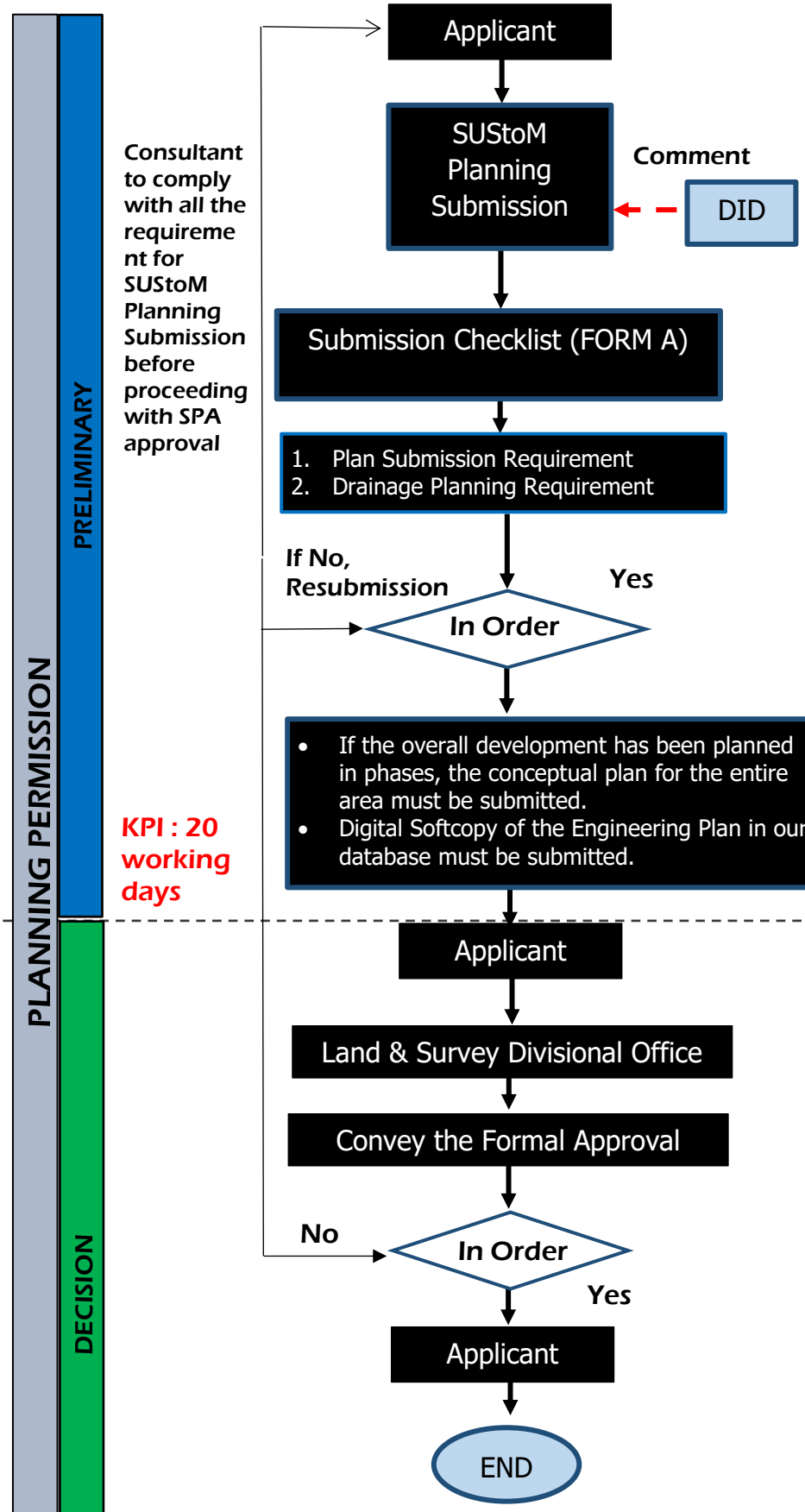
No.	Detailed Checklist	Yes	No	Remarks
3.7	**Drainage Outlet**			
3.7.1	Cross section of drain outlet submitted			
3.7.2	Side slope shall be gentler than 1V:2H			
3.7.3	Design storm levels marked (Q_2,Q_5,Q_{100}) on the plan			
3.8	**Outfall structure**			
3.8.1	Details and cross section of outfall structure and main drain/river			
3.8.2	Invert level outfall structure and main drain/existing stream is marked			
3.8.3	Slope protection design that suits site condition along river bank if development is beside a river			
3.8.4	Front outfall structure marked on plan			
3.8.5	Upstream of the outfall structure shown on plan			
3.8.6	Downstream of the outfall structure shown on plan			
4.0	**OTHERS**			
4.1	Undertaking letter from developer to maintain detention pond at own cost until date of handing over to Local authority / State Government			
4.2	Undertaking letter from developer to repair any damages of drainage and river embankment at own cost until date of handing over to Local authority/State Government			
4.3	Undertaking letter from developer to submit DOMM (Designer's', Operation & Maintenance Manual) during the handing over to Local authority/State Government			
4.4	Undertaking letter from developer to submit 6 sets of As-built Plan			
4.5	Undertaking letter from developer for SUStoM Facilities not surrendered to Government			

Submitted by the Consultant	**Checked by DID Sarawak:**	
	Checked by	Verified by
Signature:	Signature:	Signature:
Name:	Name:	Name:
Stamp:	Stamp:	Stamp:
Date:	Date:	

Reminder: Comments and application is valid up to **two (2) years** from this date of checking

APPENDIX A

FLOW CHART SUStoM IN THE PLANNING PROCESS



APPLICANT TASKS :

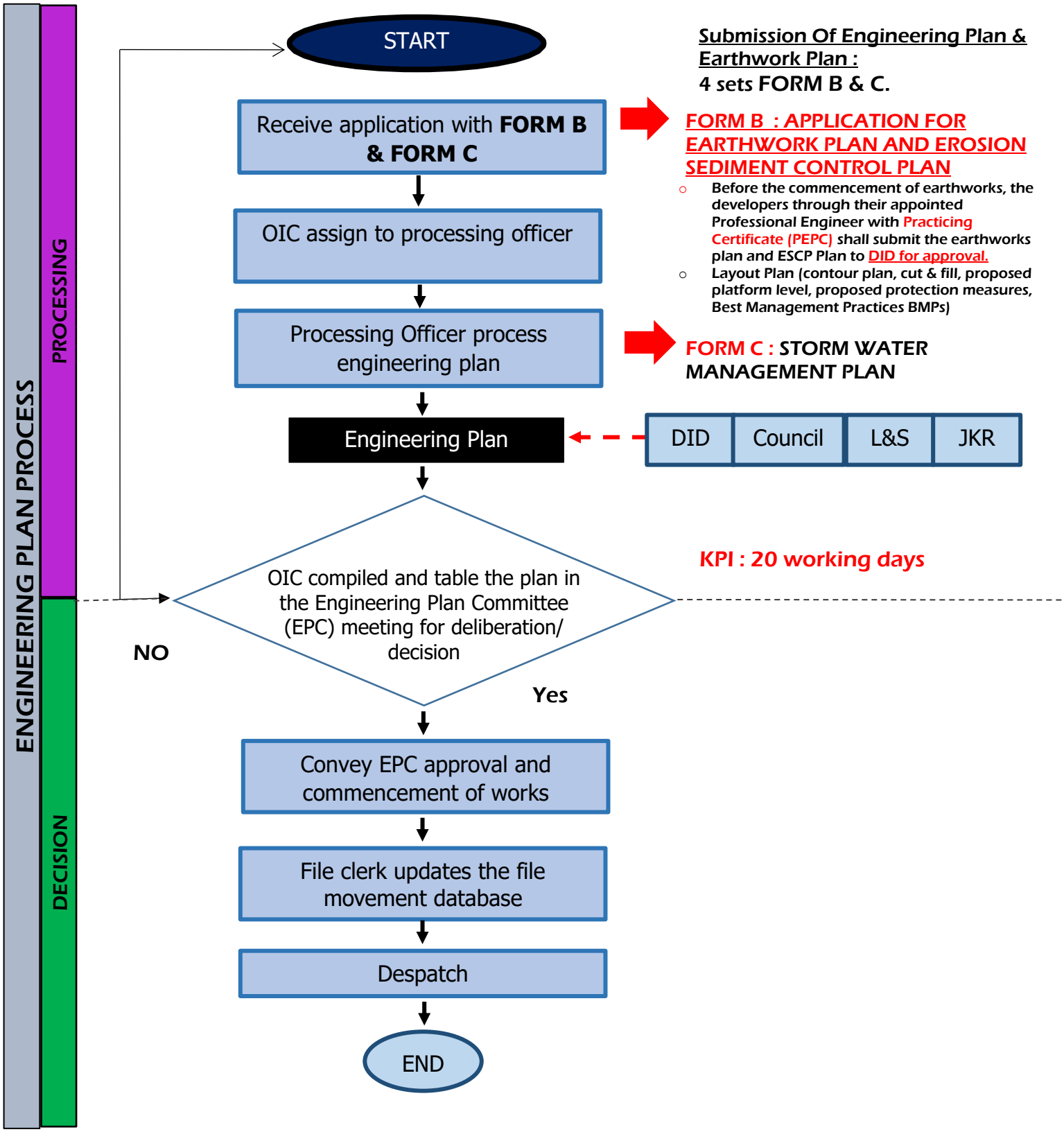
1. Applicant to submit the 3 sets proposed layout plan related to SUStoM requirement.
2. Pre-consultation : Consultant to liaise with DID to confirm through submission checklist (FORM A).
3. Join Site Inspection with applicant/DID/L&S/Local Authorities will be coordinated by DID (if required)

FORM A – SUStoM PLANNING SUBMISSION :

a) Locality Plan
b) Layout Plan (river / drainage alignment, flow direction, type of proposed SUStoM facilities)
c) Topographical Survey Plan
d) Existing Site Condition Photographs
e) Conceptual; design for the Proposed SUStoM facilities
f) Design calculation

APPENDIX B

FLOW CHART EARTHWORK PLAN AND EROSION SEDIMENT CONTROL PLAN, STORMWATER MANAGEMENT PLAN SUBMISSION



DEPARTMENT OF IRIGATION AND DRAINAGE SARAWAK

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