BAHAGIAN JALAN
MAJLIS BANDARAYA IPOH

SENARAI SEMAKAN PERMOHONAN KELULUSAN BAGI KERJA JALAN DAN PERPARITAN

Tajuk Projek :

No. Fail MBI : No. Hak Milik :

Alamat Hartanah :

Nama Pemaju :

Nama / Alamat Juruperunding :

No. Telefon :

Makluman:
Ceklis ini bertujuan untuk membantu Jurutera Perunding bagi mematuhi kehendak-kehendak Majlis didalam mempercepatkan proses semakan. Ceklis ini hanya menyatakan kehendak-kehendak minima sahaja untuk dipatuhi. Adalah menjadi harapan bahawa perkara-perkara yang tersenarai dapat dilaksanakan terlebih dahulu melainkan perkara-perkara yang dikecualikan diatas persetujuan Majlis.

Pengakuan Jurutera :
Saya akui disini bahawa kenyataan dokumen ini mencapai/melebihi Piawaian yang dikehendaki oleh Majlis Bandaraya Ipoh dan telah disediakan dibawah pengawasan saya. Saya juga mengesahkan bahawa daripada pengalaman dan pengetahuan saya, maksud yang ingin dicapai akan terhasil seperti yang dikehendaki.

Tandatangan Jurutera :
Tarikh :

Nama Syarikat : [Meteri/Seal]
Jawatan :

Form: DA/SWMA-CHKLST

STORMWATER MANAGEMENT PLAN SUBMISSION FOR DRAINAGE AND STORMWATER MANAGEMENT REVIEW CHECKLIST

Project Title: _____ Engineering Firm:_____

Property Address:_____ Address:_____

_____ _____

Land Title No:_____ Phone No:_____

Contact Person:_____

DID USE ONLY

Submittal Date: _____ Review Date & Initials:_____

Submission Acceptable/Approval/ Rejected Date:_____ Approved/Rejected by:_____

Legend:

{ / } Complete
{ x } Incomplete/Incorrect
{ - } Not Applicable

This checklist has been developed to provide specific instructions to engineers. The purpose of this checklist is to expedite and facilitate the review process. This checklist gives the minimum requirements needed for review. All items are expected to be addressed in the first submittal, unless indicated otherwise. All items shall be checked as included or marked NA. Failure to do so will result in rejection of the submittal without review. Consultant shall review the entire check list, prior to first submittal, and check the box in the left-hand column ("Consultant's Initial Submission") to indicate compliance. Consultant must sign the first page.

TO THE CONSULTANT

Your submission for Drainage and Stormwater Management approval has been reviewed. The review was made per the following checklist. Please return the checklist and Plans comment sheets with your resubmittal. If you do not address a checklist item, including comments on the plan sheets, explain your reasoning.

I, the undersigned, acknowledge by signature that these documents meet or exceed the design standards of the Department of Irrigation and Drainage Malaysia and that they were prepared under my supervision. I, the undersigned, further acknowledge that to the best of my knowledge and belief, the products resulting from these documents will function as intended.

_____ _____ _____.....

Engineer's Signature Professional Seal Date

_____ _____

Title Company Name

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remark
	1	**GENERAL**	
{ }	1.1	Name of proposed project development and address.	
{ }	1.2	Name of developer with address, and telephone number on first sheet.	
{ }	1.3	Name, address and telephone number of engineering firm or individual who prepared the plans.	
{ }	1.4	Seal, signature and license number of a Malaysian Professional Engineer on all sheets.	
{ }	1.5	Name and signature of License Surveyor on plans prepared by the surveyor	
{ }	1.6	Approval letter for land conversion should be attached	
	2	**SITE PLANS MINIMUM REQUIREMENTS**	
{ }	2.1	Location plan with appropriate scale. A map showing the general location of the project and the state boundary where the project is located.	
{ }	2.2	Key plan with 1:50,000 scale showing the general vicinity of the project within 10 km radius and the river/main drain catchment.	
{ }	2.3	Site plan with 1:3,000 or 1:6,000 scale showing the lot to be developed and the surrounding lots showing existing developments if any, standard syit no, name of Mukim, district, rivers and streams, roads and infrastructure for rivers and drains.	
{ }	2.4	Topography Survey plan 1:500 or 1:1000 scale. The survey should be based on Ordinance Survey Datum and the datum (Bench Mark or Temporary Bench Mark) must be clearly shown. The contour line shall be at 0.5 m interval and site spot levels not more than 10m distance. (with extensions into adjoining properties to cover additional distance of 30 m for development < 10 hectares; 50m for development 10 - 50 hectares; 100 m for development > 50 hectares).	
{ }	2.5	Proposed layout plan 1:500 or 1:1000 scale showing the proposed main drain reserves, existing outlet drain/river reserve (if applicable) .	
{ }	2.6	A similar plan as per item 2.5 but superimposed with existing topography survey.	
{ }	2.7	Plans of the river/main drains if the land is crossed by the river/main drain. The plan comprises Cross-section Survey at every 20m intervals (at scale of 1:100 vertical, 1:100 horizontal) and Longitudinal Survey (at scale of 1:100 vertical, 1:1,000 horizontal) The survey should extend up to at least 150m at upstream and downstream of the lot boundary.	
{ }	2.8	Hydrographic survey of existing pond/lakes/sea if applicable (1:500 or 1:1000 scale) with spots level at 10m interval	
{ }	2.9	All plans submission shall be in hardcopy and digital format in RSO or CASSINI coordinate.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	3	**DRAINAGE AND STORMWATER MANAGEMENT REPORT MINIMUM REQUIREMENTS**	
{ }		A loose leaf binder containing the drainage and stormwater management report. The report shall include the minimum coverage of the following information:	
	3.1	**Project Location and Site Descriptions**	
	A	***Report Requirements;***	
{ }	3.1.1	Description of the location of the proposed development. Include a description of the site and a reference to adjacent properties and landmarks.	
{ }	3.1.2	Description of the site such as	
{ }		– general topography (slopes and slope lengths within the site)	
{ }		– vegetation	
{ }		– extent and nature of existing development	
{ }		– drainage patterns	
{ }		– critical areas within and in the vicinity of the proposed development site that have potential for serious stormwater problems	
{ }	3.1.3	Identification of features such as streams, lakes, residential and commercial areas, reserves, parks and roads that might be affected by the proposed development from the perspective of water management.	
	B	***Mapping Requirements***	
{ }	3.1.4	Provide location plan showing:	
{ }		- legal land description; and	
{ }		- adjacent properties (streams, lakes, residential and commercial areas, reserves, parks and roadways).	
{ }	3.1.5	Show the kinds of development on adjacent properties.	
{ }	3.1.6	Provide a plan showing the river and basin boundary where the project is located.	
{ }	3.1.7	Provide land survey plan showing	
{ }		– existing topography showing contours of the site	
{ }		– existing drainage pattern and flowpaths (together with flow direction) through out the site	
{ }		-any other main features such as drains, culverts, bridges, building, roads, lakes, ponds, or any others services with their invert level and soffit levels in detail.	
{ }	3.1.8	Show critical features/areas within or near the development such as:	
{ }		- Public Water Supply / Raw Water Intake	
{ }		- Reservoir	
{ }		- Swimming Beach	
{ }		- Recreational/Tourism area	
{ }		- Flood prone area	
{ }		- Fishing area/aquaculture	
{ }		- Mangrove Forest	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	3.2	**Proposed Project Development**	
	A	***Report Requirements;***	
{ }	3.2.1	The total project area that will be developed in Ha.	
{ }	3.2.2	Provide a general description of the proposed development, which should include the breakdown details of project components, the development area in Ha of each component and percentage to total development area.	
{ }	3.2.3	The proposed project implementation periods and stages/phases of project development with timing and duration.	
	B	***Mapping Requirements***	
{ }	3.2.4	Show the boundary of each project component, the area in Ha and their project development stages/phases.	
{ }	3.2.5	Show the limits of clearing and grading for each phase of the development. Each boundary line should be identified as to the timing and duration of disturbances.	
{ }	3.2.6	Proposed layout plan with 1:500 or 1:1000 scale which clearly shows the proposed main drain reserve, outlet drain reserve and river reserve (if applicable).	
{ }	3.2.7	Proposed layout plan of 1:500 or 1:1000 scale superimposed with topography survey details.	
{ }	3.2.8	For sites involving existing Mangrove Forest along the river within the project area, the adequate set-back or area reserved for the Mangrove Land Forest shall be provided according to the following criteria:	
{ }		- distance 100m for recreation development	
{ }		- distance 500m for housing development	
{ }		- distance 1000m for industrial development	
{ }	3.2.9	For the area which there are existing sea shore within the project area, the adequate set-back or area reserved shall be provided according to the following criteria:	
{ }		- Distance 60m from the sand beach, measured from Mean High Water Spring (MHWS) during high tide at the sea towards the land.	
{ }		- Distance 400m from the muddy sea shore with mangrove forest measured from seaward edge of mangrove forest towards the land.	
{ }		- There won't be any development allowed within the mangrove forest area or the reserved area for it as published in the Akta Perhutanan Negara 1984.	

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	3.3	**Site Identifications**	
	A	***Report Requirements;***	
{ }	3.3.1	Identification of all existing drainage (pre-development) patterns and flowpaths (together with flow direction) throughout the site with their catchment boundary and catchment area in Ha.	
{ }	3.3.2	Preliminary investigation and basic information about existing stormwater issues within project area and at downstream of discharge points (receiving water) which shall include;	
{ }		– stormwater issues (flooding, sediment, pollution etc.)	
{ }		– previous flood record	
{ }		– existing 100 year flood plains	
{ }		– maximum water level	
{ }		– Tailwater elevation at discharge points (max flood level at river or/and tide Levels at river/sea).	
{ }		– Flow regulating structures such as bridge, culvert, flood/tidal gate, etc.	
{ }		– Soil Types at the site	
	3.4	**Hydrological Data Analysis**	
{ }	3.4.1	Derivation of Design Storm for the Project Area.	
{ }		– Calculation of Critical Time of Concentration for the project site.	
{ }		– Design Rainfall Intensity-Duration-Frequency Curve for the site.	
{ }		– Design Temporal Pattern.	
{ }	3.4.2	Design Frequency used for the drainage and stormwater management control facilities;	
{ }		– Minor drainage (1 or 2 or 5 or 10 year ARI (see Table 4.1 in MSMA) for catchment area less than 20ha).	
{ }		– Between minor and major drainage (50 year ARI for catchment area between 20 ha to 40ha)	
{ }		– Major drainage (100 year ARI for catchment area more than 40 ha) systems.	
{ }		– Stormwater Quantity Detention Pond (100 year ARI)	
{ }		– Stormwater Quality Control Structures (3 month ARI – 40mm rainfall depth)	
{ }	3.4.3	Runoff Estimation Methodology used in the analysis;	
{ }		– Rational Formula.	
{ }		– Rational Hydrographs Method.	
{ }		– Hydrographs Method (methodology and/or computer software used).	
{ }	3.4.4	Evaluation of the pre-development drainage conditions, which shall include the following;	
{ }		– Delineation of the drainage area including off-site areas, and drainage area(s) draining to node(s).	
{ }		– Estimation of runoff data characteristics (runoff coefficient, length, slope, 'n' values etc.)	
{ }		– Calculation of time of concentration (Tc) and determination of critical Tc.	
{ }		– Calculation of pre-development peak discharges for all drainage areas using selected design storm.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }		– Calculation of carrying capacity of existing drainage/culvert/bridge/stream/river and others.	
{ }		Identification of existing drainage/stream/river reserve.	
	3.5	**Development of Stormwater Management Master Plan.**	
{ }		Provide the drainage and stormwater management masterplan which clearly shows the alignment of proposed main drains, drainage flow direction, their outlets and others drainage and stormwater facilities such as swales, waterways, culvert, detention/retention ponds, sediment forebay, wetlands, GPTs, wet/dry ponds, etc. with their proposed reserves.	
	3.5.1	**Drainage and Conveyance System**	
		General	
{ }	3.5.1.1	Proposed drainage system alignment/layout plans, with delineation of the proposed drainage areas and drainage area(s) draining to node(s), and drainage flow direction to the outlet.	
{ }	3.5.1.2	Selection of design storm Average Recurrence Interval (ARI) of the drainage system shall based on minor and major system;	
{ }		– 1 or 2 or 5 or 10 year (see Table 4.1 in MSMA) for minor drainage (drainage area less than 20 ha).	
{ }		– 50 year for drainage between minor and major drainage system (drainage area between 20 ha to 40 ha).	
{ }		– 100 year for major drainage system (drainage area more than 40 ha).	
{ }	3.5.1.3	Determination of runoff data characteristics (appropriate runoff coefficient for proposed landuse, drain/pipe length, slope, and "n" coefficient etc.).	
{ }	3.5.1.4	Calculation of time of concentration (Tc) and determination of critical Tc for all drainage systems.	
{ }	3.5.1.5	Calculation of post-development peak discharges for all drainage areas using selected design storm.	
{ }	3.5.1.6	Determination of drainage types (earth/concrete/composite or open/closed) based on space availability, site suitability, environmental conditions (aesthetic, conservation etc.) and maintenance advantages and disadvantages.	
{ }	3.5.1.7	Tabulation of alls calculations in standard design sheets in which shall contains at least drainage area code ID, drainage link number, drainage length, drainage area, coefficient of runoff, design storm, design post-development discharges, proposed drain sizes and properties, proposed drainage capacity etc.	
{ }	3.5.1.8	Calculation shall also include verification of capacity of the existing drainage system. Proposal to upgrade the existing drainage system shall be submitted if necessary.	
		Open Channel Stormwater Drainage System	
{ }	3.5.1.9	All open channel drainage shall be grass lined/natural channel as far as possible to meet the water sensitive urban design requirement.	
{ }	3.5.1.10	Open channel shall be designed for all major drainage system (for the catchment area > 40 ha).	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.1.11	Drainage slope shall selected to obtain flows within the range of permissible velocities allowable for each drain. Determination of permissible velocities for self cleansing to avoid siltation and vegetation problems;	
{ }		– for earth drain (Vmin>0.6 m/s, Vmax<2m/s)	
{ }		– for lined drain (Vmin>0.8 m/s, Vmax<4m/s)	
{ }	3.5.1.12	Hydraulic design criteria for open channel design shall based on;	
{ }		– open channel characteristics determined by at least by Manning formula with appropriate Manning roughness factors and permissible velocities for open channel design.	
{ }		– Normal depth determined	
{ }		– Water surface profiles are computed for all channels using standard backwater methods and shown on final drawings for design ARI and 100 year ARI.	
{ }		– Used of appropriate computer software available in the market on hydrologic and hydraulic calculations is acceptable (elaborate the methodology used by the software).	
{ }	3.5.1.13	Adequate freeboard of at least 300mm shall be provided from the design water level.	
{ }	3.5.1.14	Adequate drainage reserve shall be provided to allow access for maintenance (see Figure 26.1 and Table 28.1 in MSMA)	
{ }	3.5.1.15	For earth drains, the slope should be properly turf with grass.	
{ }	3.5.1.16	Maximum side slope for the open drainage	
{ }		– concrete/brickwork/blockwork lining (vertical)	
{ }		– stone pitching (1V:1.5H)	
{ }		– grassed/vegetated (1V:2H)	
{ }	3.5.1.17	Minimum bottom width of open drain is 500mm.	
{ }	3.5.1.18	Open drains in locations open to pedestrian access shall be covered if the depth of the drain exceeds 0.6m.	
{ }	3.5.1.19	Sediment trap/drain manhole (min size of 450mm x 450mm) shall be provided along open drain with max interval spacing at every 100m and min depth from drain invert is 600mm.	
{ }	3.5.1.20	Drop structures should be provided to reduce the drainage longitudinal gradient such that the design flow velocities do not exceed the permissible limits.	
{ }	3.5.1.21	Low-flow provision channel must be provided for grass open channel to cater for dry-weather flows.	
{ }	3.5.1.22	Adequate erosion and scour protection shall be provided at high velocity areas such as at sharp bends for earth drains, at drop structures, outlets, sudden changes in cross-section, inlet and outlet of culvert wingwalls, bridge piers etc.	
{ }	3.5.1.23	Adequate weep holes shall be provided for all lined open drains to relieve hydrostatic pressure.	
{ }	3.5.1.24	The reinforced concrete drain should be provided for the lined open drains that exceed 0.9m in depth.	
{ }	3.5.1.25	The stone used for stone-pitching drain shall be hard, durable with sizes between 150mm to 250mm. The top of the stone-pitching shall be capped with cement mortar at least 450mm.	
{ }	3.5.1.26	Lined drains shall be provided with adequate granular bedding (min 100mm to 150mm) under the drain bottom.	
{ }	3.5.1.27	Provide adequate safety measures such as 1.2m high handrail fence or covered with solid/grated cover at populated areas/area locations open to pedestrian access.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
		Closed Stormwater Drainage System	
{ }	3.5.1.28	Closed stormwater drainage system shall be designed for minor drainage system only (for the catchment area < 20 ha).	
{ }	3.5.1.29	Design shall be carried out for the 1 or 2, or 5 or 10 year ARI. Provisions must be made for safe conveyance to cater for 100 year storm to the discharge point via relief swales.	
{ }	3.5.1.30	Design calculations shall be based on Rational Method for the hydrologic estimation.	
{ }	3.5.1.31	All stormwater pipe systems shall be designed using "Hydraulic Grade Line (HGL) method using appropriate pipe friction (eg Darcy-Weisbach, Manning, Colebrook-White) and drainage structure head loss coefficients.	
{ }	3.5.1.32	The HGL analysis shall be carried out to verify that the water level in the catch basins for design storm will not be above the pipe soffit.	
{ }	3.5.1.33	Layout of proposed drainage system must include locations of inlets, manholes, mains, laterals, ditches, culverts, etc.	
{ }	3.5.1.34	Plans shall be provided to show the profile of existing natural ground and final grade along center line of storm drains.	
{ }	3.5.1.35	Drainage slopes shall be selected to obtain flows within the range of permissible velocities allowable for closed conduit drains (min slope at 1 in 500).	
{ }	3.5.1.36	Permissible velocities shall cater for self cleansing to avoid siltation and vegetation problems for closed conduit drain (Vmin>1 m/s, Vmax<6m/s).	
{ }	3.5.1.37	Reinforced concrete scour stop collar shall be provided for pipelines laid on steep slope (>7%),.	
{ }	3.5.1.38	Pipe diameter for closed conduit drainage shall not be less than 450mm.	
{ }	3.5.1.39	Adequate drainage reserve shall be provided to allow access for maintenance (see Table 25.3 MSMA).	
{ }	3.5.1.40	Provide adequate clearance (at least 300mm) from other services between the outer faces of each service (see Table 25.4 MSMA).	
{ }	3.5.1.41	Pipe class shall be selected to provide adequate strength to meet construction, overburden and traffic loads.	
{ }	3.5.1.42	Minimum cover over pipelines should normally be 0.6m as measured from top of pipe to finished surface level.	
{ }	3.5.1.43	Maximum depth of stormwater pipelines to invert level shall generally be 6m.	
{ }	3.5.1.44	Adequate pipe bedding should placed and compacted under the pipes barrel with minimum of 75mm granular material/coarse river sand.	
{ }	3.5.1.45	Stormwater pipelines shall be constructed from materials proven to be structurally sound and durable and have satisfactory jointing systems.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.1.46	Adequate manhole shall be provided for maintenance purposes which comply with design requirement as follows;	
{ }		– provide manhole at changes in direction, grade, pipe size, junction, or at regular intervals for operation and maintenance access.	
{ }		– round manhole shall be used for pipe diameter from 300mm to 675mm.	
{ }		– chambered manhole shall be provided for pipe diameter more than 750mm.	
{ }		– standard step irons shall be provided for maintenance access.	
{ }		– maximum depth of manhole shall not exceed 6m.	
{ }		– maximum manhole spacing should not exceed 40m.	
		Culvert	
{ }	3.5.1.47	Show all culverts with structure I.D.'s label, sizes, types, slope and summary details in tabulation form, in the drawings.	
{ }	3.5.1.48	Methodology/software used shall be presented.	
{ }	3.5.1.49	Minimum pipe culvert sizes shall be 600mm.	
{ }	3.5.1.50	The culvert should be designed with a minimum freeboard of 300mm above the design water level to allow the debris flow.	
{ }	3.5.1.51	The culvert gradient shall be designed for self-cleansing and to avoid siltation with design velocity of not less than 1 m/s.	
{ }	3.5.1.52	Adequate erosion and scour protections shall be provided at inlet and outlet of the culvert.	
	3.5.2	**Wet/Dry Pond (Stormwater Quantity and Quality Control)**	
		General	
{ }	3.5.2.1	Potential hazard for ponds should be identified to determine the risk of the pond failure to downstream populated area.	
{ }	3.5.2.2	Adequate soil investigation shall be conducted to provide parameters as inputs for the design of the pond	
{ }	3.5.2.3	The maximum pond depth should not exceed 3.0m under 1 in 100 year ARI design flow for which the primary outlets have been designed.	
{ }	3.5.2.4	Minimum recommended embankment top widths shall not be less than 4m.	
{ }	3.5.2.5	For ease of maintenance, the side slope of a grassed earthen embankment and basin storage area should not be steeper than 4(H):1(V). However, to increase public safety and facilitate ease of mowing, side slopes of 6(H):1(V) (or flatter) are recommended.	
{ }	3.5.2.6	For reservoir area, the slope can be steeper (max 3(H):1(V)) after reaching a water depth of 1m.	
{ }	3.5.2.7	The floor of the basin shall be designed with a minimum grade of 1% to provide positive drainage and minimise the likelihood of ponding.	
{ }	3.5.2.8	Adequate drainage of the basin floor between storms is essential if the facility is to be used for recreation.	
{ }	3.5.2.9	For dry pond, subsoil drains may be required to prevent soggy ground conditions.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.2.10	The elevation of the top of the settled embankment shall not be less than 300mm (freeboard) above the water surface in the detention basin when the emergency spillway is operating at maximum design flow.	
{ }	3.5.2.11	All fill material in earthen embankments shall be suitable materials and should be free from brush, roots and other organic material subject to decomposition. The fill material should be compacted to at least 95% of the Modified Proctor method.	
{ }	3.5.2.12	The pond basins should be provided with signs that clearly indicate their purpose and their potential danger during storms. Signs should be located such that they are clearly visible at public access points and at entrances and exits to outlet structures.	
{ }	3.5.2.13	A proper pipe rail fence should be provided on steep or vertical drops such as headwalls and wingwalls at the inlet and outlet to a primary outlet structure to discourage public access for public safety.	
{ }	3.5.2.14	Wherever possible, designs should incorporate naturally shaped basins with landscaped banks, footpaths, and selective planting of vegetation to help enrich the area and provide a focal point for surrounding development.	
{ }	3.5.2.15	Maintenance access should be provided around the pond and to areas (such as sediment forebay, inlet and outlets structures etc). requiring regular maintenance and inspections	
		Stormwater Quantity Control Requirements	
{ }	3.5.2.16	Analysis shall be done to cater for downstream drain/stream/channel capacity limitations.	
{ }	3.5.2.17	The post-development outflows (2, 50 and 100 year ARI) from the pond shall be designed to reduce the design flow discharges below the pre-development flows (2 year ARI) from the catchment.	
{ }	3.5.2.18	Primary outlets for detention basins shall be designed to reduce post-development peak flows from the pond below the pre-development peak flows for design storm ARI of 2 year.	
{ }	3.5.2.19	Two-staged outlet configuration (not including the emergency spillway), one outlet configuration to control the minor system design flow (1 in 2 year ARI) and an additional outlet configuration shall be adopted to control the major system design flow (1 in 2 year) in conjunction with the minor system outlet.	
{ }	3.5.2.20	Secondary outlets (spillway) for detention basins shall be designed to safely pass a minimum design storm of 100 year ARI through the basin.	
{ }	3.5.2.21	The design water level of 1 in 100 years ARI in the pond should not exceed the secondary outlet/ spillway crest level.	
{ }	3.5.2.22	Methods used to determine the Pre and Post-Development flows analysis into the proposed pond shall be elaborated.	
{ }	3.5.2.23	Methods used for Stage-Storage and Stage-Discharge calculations (account for Tailwater) shall be elaborated.	
{ }	3.5.2.24	Methods used for Reservoir Routing through the pond related structures shall be elaborated.	

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{ }	3.5.2.25	Determination of the critical storm duration for the maximum basin storage shall be determined by routing post-development inflow hydrograph of different design storm duration (at least 3 times longer than Tc) through the basin.	
{ }	3.5.2.26	If computer software is used for hydrologic, hydraulic and routing calculations, the methodology of the software shall be presented and the results presented.	
{ }	3.5.2.27	Summary of the analysis shall include :	
{ }		– Results presented in tabulation form	
{ }		– Model diagrams for pre and post-development analysis (should be comparable to the drainage plans. Use consistent symbols, areas, structures and cross section labels)	
{ }		– For each analysis point, include: drainage area, runoff coefficient, Tc and Q pre & post for the 2, 50 & 100 years storms	
{ }		– Include Q in, Q out and the design water levels for each design storm.	
{ }	3.5.2.28	Show the Hydrographs (2, 50 & 100 year ARI) for pre-development flows, post-development flows without control (by-passing) and post-development flows with control.	
{ }	3.5.2.29	Show the pre-development flows Hydrographs (2, 50 & 100 year ARI) superimposed with the post-development flows hydrograph (without and without control)	
{ }	3.5.2.30	Show Stage-Storage and Stage-Discharge calculations, both composite and each individual structure within the outlet configuration.	
{ }	3.5.2.31	Include a grading plan of the pond, and a detail of the outlet structure and emergency spillway with all dimensions and elevations.	
{ }	3.5.2.32	Include calculations to justify tailwater and/or headwater conditions used in stage discharge calculation.	
{ }	3.5.2.33	Include hydraulic or hydrologic routing calculations through the reservoir where applicable.	
{ }	3.5.2.34	Adequate number of anti-Seepage Collars shall be provided at the pipe outlet below the pond embankment.	
{ }	3.5.2.35	A cutoff trench shall be provided under the dam embankment to prevent seepage.	
{ }	3.5.2.36	For the Dry Pond design, provision should be made to bypass the low flow (minimum of one half of 1 month ARI flow) through or around the detention basin.	
{ }	3.5.2.37	Include calculation of exit flow velocities from the pond outlets under the range of design storms.	
{ }	3.5.2.38	Adequate energy dissipaters and erosion/scour protection measures shall be provided at outlets.	
{ }	3.5.2.39	Adequate bank erosion/scour protection measures shall be provided at critical areas within the reservoir area such as at inlet to the reservoir, inlet to the outlet structures etc.	
{ }	3.5.2.40	Include sketch showing elevation of pond invert, permanent pool level, and proposed ground level, invert and soffit of pipe outlet (primary and secondary outlet), freeboard and design water levels for 2, 50 and 100 years flows ARI in the pond.	
{ }	3.5.2.41	Include drawings showing the detail design covering among others the primary and secondary outlets arrangement.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
		Stormwater Quality Control Requirements	
{ }	3.5.2.42	Permanent pool storage shall be sized to accommodate at least 3 month ARI of runoff or equivalent to 40mm rainfall depth (wet pond only) from the catchment without any overflow.	
{ }	3.5.2.43	Ponds shall be able to capture and detain (for 24 hr) runoff volume generated by design storm of at least 3 month ARI (or equivalent 40 mm rainfall depth to capture and detain at least 90% of 24 hours storm events runoff volume)	
{ }	3.5.2.44	Include calculations to verify that the permanent pool (wet pond) and extended detention storage (dry pond) can accommodate at least 3 month ARI of runoff.	
{ }	3.5.2.45	The maximum depth of permanent pool shall be 2m while 50% of surface area (wet pond only) shall not be deeper than 1m.	
{ }	3.5.2.46	Seasonally high ground water table is at or below the permanent pool elevation of a wet pond or at least 1m below the bottom of a dry pond.	
{ }	3.5.2.47	Inlet zone shall be provided with sediment traps and debris boom or Gross Pollution Trap (SBTR type are preferable) to remove larger particles/debris including sediment.	
{ }	3.5.2.48	Sediment forebays shall be sized adequately (wet pond only) by estimating sediment loading from the catchment and the calculations shall be shown to justify the sizing of forebays and sediment disposal area.	
{ }	3.5.2.49	The sediment disposal area shall be allocated within the pond area.	
{ }	3.5.2.50	Ponds should be long relative to their width in order to provide optimum flow circulation, with length to width ratio in the range of 3 to 5.	
{ }	3.5.2.51	For wetland, the macrophyte zones shall be at least between 25-50% of the total pond area.	
{ }	3.5.2.52	Water depth in the wetland shall range between 0.1m to 1m with an average of 0.5m. Changes in water level shall be limited to about 0.6m. Wetland which are associated with ponds used for flood control shall be designed to accomodate submergence to depths between 1m to 2m with the max velocity not exceeding 0.1 m/s.	
{ }	3.5.2.53	Include final details.	
	3.5.3	**Onsite Detention (OSD) (Stormwater Quantity Control)**	
{ }	3.5.3.1	On-site Stormwater Detention (OSD) shall be required for small scale development, which is defined as a site/project development where the developed area is smaller than 1,000 m^2 or 0.1 ha.	
{ }	3.5.3.2	The OSD policy is capable to prevent increases of peak stormwater flows to downstream area for storms up to the 10 year ARI event.	
{ }	3.5.3.3	The correct Permissible Site Discharge (PSD) and Site Storage Requirement (SSR) values have been used.	
{ }	3.5.3.4	The OSD Design Summary Calculations are attached.	
{ }	3.5.3.5	A completed "On-Site-Detention" Concept Plan is provided.	
{ }	3.5.3.6	Site layout on the stormwater and OSD drawing corresponds with, and compliments Architectural and Landscape Drawings.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.3.7	Outlet opening for OSD shall have a minimum internal diameter or width of at least 30 mm and shall be protected by an approved mesh screen to reduce the likelihood of the DCP outlet being blocked by debris.	
{ }	3.5.3.8	An overflow system (such as pipe/weir) must be provided to allow the storage compartment to surcharge if the capacity of the system is exceeded due to a blockage of the outlet pipe or a storm larger than the storage design ARI (10 yr ARI).	
{ }	3.5.3.9	Above-ground storage OSD (if any) shall comply with recommended maximum storage depths as follows;	
{ }		- Pedestrian areas (50mm).	
{ }		- Parking areas and driveways (150mm).	
{ }		- Landscaped areas (600mm).	
{ }		- Private courtyards (600mm).	
{ }		- Flat roofs (300mm).	
{ }		- Paved outdoor recreation areas (100mm).	
{ }	3.5.3.10	For OSD above-ground storage, the warning signs and or fencing should be installed where the depth exceeds 600 mm or adjacent to pedestrian traffic areas.	
{ }	3.5.3.11	The design has taken into consideration the following factors:	
{ }		- The Gross Pollutant Trap is installed before the inlet point of OSD.	
{ }		- The bottom slope of OSD must be at min of 2%.	
{ }		- Bed surface slope towards the outlet is 1.5%,	
{ }		- The side slopes should be 1V to 5H.	
{ }		- Ventilation must be provided for underground storage.	
{ }		- Access openings must be provided for maintenance.	
{ }		- Inlet chamber and outlet chamber must be provided.	
{ }		- Appropriate screen must be provided at inlet chamber and outlet.	
{ }	3.5.3.12	All walls, kerbs or crests proposed for the OSD are indicated along with their respective levels. (eg top of wall level).	
{ }	3.5.3.13	Retaining walls forming above ground storage basin/s are of watertight construction (ie: Masonry/Brick) and a typical section detail is provided.	
{ }	3.5.3.14	Finished surface levels are indicated within all courtyards/driveways/ detention storage areas.	
{ }	3.5.3.15	A minimum grade of 1% has been provided on the base of the above ground detention basin located in landscaped/turfed areas and to direct flows to a grated collection pit.	
{ }	3.5.3.16	Sub-soil drainage is indicated within above ground detention basins located in landscaped areas. (Note:- Subsoil drainage shall connect to the collection pits of the detention basin).	
{ }	3.5.3.17	Finished ground floor levels of buildings and garages should be 300mm and 100mm respectively or more above the top of water level of the OSD	
{ }	3.5.3.18	For underground storage, heavy access cover must be avoided to allow easy inspection of the critical parts of the storage from the surface. Concrete cover is not advisable. Opening must be wide enough to allow easy entry to the storage, minimum 600 x 600 (storages up to 600mm deep) and minimum 900 x 900 (storage greater than 600mm deep).	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.3.19	Step irons or access ladders shall be installed where the depth of a below-ground storage or DCP is 1200 mm or greater.	
{ }	3.5.3.20	Satisfactory access is provided within the front setback area and/or rear courtyard into the detention storage area/s with maximum 1 in 4 batters or steps.	
{ }	3.5.3.21	Include final details.	
	3.5.4	**Gross Pollutant Traps (GPTs) (Stormwater Quality Control)**	
{ }	3.5.4.1	Gross Pollutant Traps (GPTs) shall be located at the downstream end of drains or engineered waterways which discharge to rivers, to reduce sediment load, litter, nutrients, oil and chemicals.	
{ }	3.5.4.2	GPTs shall be located as the pretreatment for flow into a pond or wetland or urban lakes to confine the area of deposition of coarse sediments.	
{ }	3.5.4.3	GPTs shall be located before the flow enters an infiltration device or filtration device to remove coarse sediment.	
{ }	3.5.4.4	The GPT must be designed so as to prevent any additional flow surcharge in the stormwater system in the event of partial or complete blockage.	
{ }	3.5.4.5	GPTs shall be designed to retain all litter and debris in the water quality design storm of 3 month ARI.	
{ }	3.5.4.6	Adequate provision for road access to the site by maintenance vehicles and equipment must be made. Suitable walkways, ladders and plinths shall be provided within the structure for access.	
{ }	3.5.4.7	The 'SBTR' trap if provided shall conform to the following:	
{ }		– The ratio length: width of the sediment trap should be between 2 and 3.	
{ }		– Velocity though the sediment trap should not exceed 1.0 m/second, to minimise re-suspension.	
{ }		– Bar spacing shall be capable of retaining a small plastic bottle or an aluminium drink can, with a maximum clear spacing of 50 mm between bars;	
{ }		– Trash racks shall be sized to operate effectively whilst passing the design flow without overtopping and with 50% blockage;	
{ }		– Trash racks shall be structurally stable when overtopped by flood events up to the major design storm when fully blocked;	
{ }		– Trash racks and their supporting structures shall be designed to withstand log impact together with drag loads or debris loads (100% blocked); and	
{ }		– The design must allow water to flow past or over the trash rack when the trash rack is blocked.	
{ }	3.5.4.8	Calculation of the average annual sediment loading estimate from the catchment is shown for the sizing of the trap	
{ }	3.5.4.9	Include all calculations necessary to demonstrate that the practice performs to the standard stated in MSMA.	
{ }	3.5.4.10	Include final details.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	3.5.5	**Filtration (Stormwater Quality Control)**	
{ }	3.5.5.1	The types of stormwater quality filtration BMPs proposed for the site are;	
{ }		– Biofiltration swales	
{ }		– Vegetated filter strips	
{ }		– Media filtration	
{ }	3.5.5.2	Biofiltration swales and vegetated filter strips (if applicable) are to be designed to treat the 3 month design storm of runoff from drainage area.	
{ }	3.5.5.3	Drainage area and the peak discharge calculations for the water quality storm (3 month ARI) and 10 yr storms ARI for conveyance design shall be included.	
		Biofiltration Swales	
{ }	3.5.5.4	The velocity of water shall not exceed 0.5 m/s along a swale of 60 m in length during the water quality design storm (3 month ARI).	
{ }	3.5.5.5	The capacity design for biofiltration swale on the vegetation height equal to the design flow depth and the 3 month ARI design storm.	
{ }	3.5.5.6	Swales shall be designed to accommodate flood passage of 10 years ARI, plus 300 mm freeboard. Runoff from large events will bypass the swale.	
{ }	3.5.5.7	Swales with trapezoidal cross-section shall be recommended for ease of construction. Side slope shall not be steeper than 3H:1V while side slope 4:1 is recommended for safety reason.	
{ }	3.5.5.8	Swales are recommended to have a minimum length of 60 m. If a shorter length must be used, increase swale cross-sectional area by an amount proportional to the reduction in length below 60 m, to obtain the same water residence time (minimum residence time is 2 minutes).	
{ }	3.5.5.9	Swales must have longitudinal slope of at least 2% but no greater than 4% (underdrains required for slopes below 2% and rock check dams for slopes above 4%).	
{ }	3.5.5.10	Below the design water depth, install an erosion control blanket, at least 100 mm of topsoil and the selected biofiltration seed mix.	
{ }	3.5.5.11	Include biofiltration design calculations for the water quality storm (3 month ARI), and capacity check calculations for the 10 yr storm.	
{ }	3.5.5.12	Include all calculations necessary to demonstrate that the practice performs to the standard stated in MSMA.	
{ }	3.5.5.13	Include final cross-sectional details for all swales and plan layout.	
		Vegetated Filter Strip Design	
{ }	3.5.5.14	Vegetated Filter Strips are more suitable for small, less intensely developed sites.	
{ }	3.5.5.15	The minimum residence time for water quality treatment in the strip is about 5 minutes for peak flows of 3 month ARI.	
{ }	3.5.5.16	The necessary length (parallel to flow) to produce a water residence time should be at least 5 minutes. The maximum drainage flowpath is 50 m and the flow depth of less than 25 mm for water quality purposes.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.5.17	Vegetated filter strips should not be used for slopes in excess of 10%. 100 mm of good quality topsoil is required on all the filter strip areas, to help develop a good ground cover.	
{ }	3.5.5.18	Include all calculations necessary to demonstrate that the practice performs to the standard stated in MSMA.	
{ }	3.5.5.19	Include final cross-sectional details and plan layout.	
	3.5.6	**Infiltration (Stormwater Quality Control)**	
{ }	3.5.6.1	The stormwater quality infiltration BMPs proposed for the site are;	
{ }		– Infiltration Trench	
{ }		– Infiltration Basin	
{ }		– Porous Pavement	
{ }	3.5.6.2	The design for stormwater runoff quality treatment to capture 3 month ARI design storm of runoff from the drainage area.	
{ }	3.5.6.3	Contributing drainage areas are shown and calculation is provided to present peak discharge computation for the water quality storm of 3 month ARI and 10 yr storms ARI for conveyance design.	
{ }	3.5.6.4	Soil bore log is shown to demonstrate infiltration characteristins of each of the proposed infiltration facility. Each soils log should extend a minimum of 3m below the bottom of the facility.	
{ }	3.5.6.5	Pre-treatment BMPs, such as grassed swales leading to the infiltration facility are recommended to remove coarse particulate contaminants and to reduce excessive pollutants entering the facilities.	
{ }	3.5.6.6	Stormwater runoff must infiltrate through at least 400 mm of soil which has a minimum infiltration rate (f_c) of 13 mm/hr.	
{ }	3.5.6.7	Soils with 30% or greater clay content or 40% greater silt/clay content shall not be used.	
{ }	3.5.6.8	The infiltration facilities shall be designed to drain completely within 48 hrs.	
{ }	3.5.6.9	Seasonally high groundwater elevation shall be at least 1.5m below the bottom of the facility.	
{ }	3.5.6.10	Infiltration facilities should be situated at least 7m downslope and 50m from building foundations.	
{ }	3.5.6.11	All basins should be located at minimum distance of 20m from any slope greater than 15%.	
{ }	3.5.6.12	Infiltration facilities shall not be installed on or at the top of slopes having natural angle of inclination exceeding 15% or in fill material	
{ }	3.5.6.13	Infiltration BMPs shall be limited in their ability to accept flows from larger drainage areas. The following drainage area limitations will be applied:	
{ }		– Dispersion trenches, maximum of 500 m^2	
{ }		– Infiltration sumps, maximum of 500 m^2	
{ }		– Infiltration trenches, maximum of 4 hectares	
{ }		– Infiltration basins, maximum of 15 hectares	
{ }		– Pavement, maximum of 4 hectares.	
{ }	3.5.6.14	Inflow to infiltration facility, other than roof downspout systems, must first pass through a pre-treatment BMP in order to minimise the suspended solid load and prevent siltation of the infiltration facility.	
{ }	3.5.6.15	Final construction of infiltration facilities shall not be done until after other site construction has finished and the site has been properly stabilised with permanent erosion control practices.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	3.5.6.16	The aggregate material (for trench) shall consist of a clean aggregate with a maximum diameter of 70mm and a min. diameter of 30mm.	
{ }	3.5.6.17	An overflow structure must be provided in the event that the facilities capacity is exceeded.	
{ }	3.5.6.18	Infiltration facilities shall be provided surface inlet and observation well.	
{ }	3.5.6.19	The bottom slope of bottom infiltration beds shall not exceed 5%.	
{ }	3.5.6.20	Include all calculations necessary to demonstrate that the practice performs to the standard stated in MSMA.	
{ }	3.5.6.21	Include final details.	
	4	**MINIMUM REQUIREMENTS FOR FINAL DRAINAGE AND STORMWATER MANAGEMENT PLAN**	
	4.1	**General**	
{ }	4.1.1	Location plan shall include a North Point indicator and the names of a minimum of two roads leading to the site.	
{ }	4.1.2	A copy of the approved layout plan together with copy of the planning permission shall be submitted.	
{ }	4.1.3	Proposed finished site levels on topographic plan with contours at intervals of 2 meters for gradients greater than 1:2 and there under, at intervals of 3 meters.	
{ }	4.1.4	A key plan showing the contour together with proposed layout and all existing natural watercourse and proposed main drains shall be submitted.	
{ }	4.1.5	The topographic plans shall include existing drainage patterns and flowpaths (together with flow direction) throughout the site with their catchment boundary and catchment area in Ha.	
{ }	4.1.6	If the site is located nearby to existing river and/or affected by flood, show the existing 100 year flood plain, maximum water level, flow regulating structures such as bridges, culverts, gates, etc. and the stormwater pollution issues all in the topographic plan.	
{ }	4.1.7	Drawings of the proposal shall be submitted to show project location and layout plan, relevant longitudinal and cross-section and details.	
{ }	4.1.8	A suitable index or key plan showing the reference sheet no for each portion of the development area shall be provided if the various portions of layout are shown on separate drawings.	
{ }	4.1.9	Structural details, if any, shall be indicated on separate drawings as these are submitted for record purposes only.	
{ }	4.1.10	Drawings shall not be bound together. All drawings submitted shall be neatly folded to A4 size, the title block on the front face and in a manner where the drawings can be opened from left to right.	
{ }	4.1.11	Title block shall be provided at the bottom right hand comer of all drawings and properly completed. Title of drawings must indicate the exact nature of works for which approval is sought. There should be a margin of at least 50mm all round the drawing.	
{ }	4.1.12	All drawings submitted must bear the signature of the submitting Engineer/Architect/Surveyor with his full name, address and relevant professional qualifications.	
{ }	4.1.13	All documents submitted for approval shall be certified by the submitting Engineer as following; "I hereby certify that these works have been designed by me in	

		accordance with sound enginering practice and that I take full responsibility for the design and proper performance of the same."	
{ }	4.1.14	All drawings must be countersigned by the owner. The full name and address of the owner must be indicated.	
{ }	4.1.15	Adequate empty space shall be allowed on all drawings for the Approval stamp.	
{ }	4.1.16	Provide the drainage and stormwater management masterplan which clearly shows the location and sizes of proposed main drains and their outlets and other drainage and stormwater facilities such as swales, waterways, detention/retention pond, sediment forebay, wetlands, GPTs, wet/dry ponds, culvert, manhole, sediment trap, etc. and their respective reserves where applicable.	
	4.1.17	Drawings must be suitably coloured as follows:	
{ }		Proposed drains	Red double continuous lines
{ }		Invert levels of proposed drains	Red continuous lines
{ }		Proposed culverts	Red double broken lines
{ }		Type and size of proposed culverts	Red letters and figures
{ }		Proposed carriageway	Grey
{ }		Footpath	Pink
{ }		Green buffer zone	Green
{ }		Kerbs	Orange
{ }		Guard rails and crash barriers	Brown
{ }		Existing drains	Blue double continuous lines
{ }		Existing culverts	Blue double broken lines
{ }		Proposed levels, invert, levels, drains sizes, etc.	Mark in Red
{ }		Existing levels, invert levels, type of drains and sizes etc.	Mark in Blue
{ }	4.1.18	Direction of flow in drains and culverts	Indicate by arrows.
	4.1.19	Plan shall comprise of the following scales of;	
{ }		– Location plan (1:1000)	
{ }		– Site and layout plan (1:1000)	
{ }		– Longitudinal section; Horizontal (1:1000), Vertical (1:100)	
{ }		– Cross- section and other details (1:100).	
{ }	4.1.20	The plans shall show the calculated pre-development peak discharges, post-development peak discharges, proposed drainage carrying capacity, regulated flows after controls at proposed control structures and at proposed drainage outlet points, and the existing carrying capacity of existing receiving water at outside project area.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	4.2	**Drainage and Conveyance System Plans**	
{ }	4.2.1	The catchment area draining into each watercourse or drain shall be clearly indicated in the drawing.	
{ }	4.2.2	Show the drainage divides and flow directions for each drainage area for post-development and show the changes resulting from grading. Include a contour plan of the finished grades at an appropriate scale (1:2000).	
{ }	4.2.3	Detail plans longitudinal and cross-section of the proposed drainage system shall be included.	
{ }	4.2.4	Longitudinal sections taken along centre lines of drainage shall be submitted to indicate:	
{ }		– Reference marks as in site plan to indicate line along which the section is taken.	
{ }		– Existing ground profile to be indicated in broken lines. .	
{ }		– All proposed and existing drains including invert levels and gradients.	
{ }		– Water level profile for storms of designed ARI	
{ }	4.2.5	Location and dimensions of proposed and existing culverts shall be shown in the layout plan.	
{ }	4.2.6	Separate detailed plans shall be submitted to show:	
{ }		– Typical proposed drain section inclusive of dimensions.	
{ }		– Typical sections of proposed roadside drains inclusive of manner of haunching, type of drainside wall, dimensions and finishes.	
{ }		– Details of precast concrete drain covers and/or m.s. gratings, if any.	
{ }		– Cross-sections and longitudinal sections of proposed culverts including dimensions, manner of haunching and gradients.	
{ }		– Typical sumps proposed.	
{ }		– Dimensions and details of scupper drains proposed.	
{ }		– Typical sections and dimensions of kerbs proposed.	
{ }		– Typical details of guard rails and crash barriers where relevant,	
{ }		– Typical entrance culvert and driveway detail.	
{ }		– Typical detail of pre-cast concrete slab for proposed footpath.	
{ }		– Details of proposed cascading drains where relevant.	
{ }	4.2.7	The points of entry and the invert levels of all incoming drains at the points of connection into the main drain shall be indicated in the longitudinal section of the main drain.	
{ }	4.2.8	The top water level of the incoming drains shall not be lower than those of the receiving drains at the points of discharge.	
{ }	4.2.9	Details of all existing outlets to which the proposed drains are to be connected shall be shown and where the capacities of these drains are not adequate to cope with the increased runoff, detail proposals for improving such outlets shall be included.	
{ }	4.2.10	All main drains shall have a free board of not less than 300mm above the TWL of the respective drain.	
{ }	4.2.11	All drains shall be connected in the general direction of flow with proper transition curves provided. Where more than two drains meets at a junction, the flow path of each shall be such as to provide a smooth transition.	
{ }	4.2.12	The soffit level of culverts shall not be lower than the TWL of the open drain downstream and upstream of it.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	4.2.13	All proposed stone pitching shall be provided with concrete capping of not less 450mm wide.	
{ }	4.2.14	All open drains with depths exceeding 1.2m shall be provided with steps recessed into the side of the drain at 50m intervals for maintenance purposes.	
{ }	4.2.15	All sumps or manholes shall be provided with concrete benching. All such manhole covers shall be of H.D. cast iron.	
{ }	4.2.16	Steps of step irons shall be provided to the top of benching and toe holes provided in the benching.	
{ }	4.2.17	Drain cross sections shall also show the minimum drain reserve.	
{ }	4.2.18	Drainage reserve shown parallel to the road should not encroach onto the road reserve otherwise culverts shall be provided instead of open channels.	
{ }	4.2.19	Guard rails/fence is to be provided to main drains that are sited close to carriageway and housing lots.	
{ }	4.2.20	Detail plans showing proposals for connections of the main drains into the river shall be provided.	
	4.3	**Wet/Dry Pond Plans**	
{ }	4.3.1	The catchment area draining into proposed pond shall be clearly indicated.	
{ }	4.3.2	Detail of layouts plan, longitudinal and cross-section of the proposed pond system shall be shown.	
{ }	4.3.3	Detail of layout plan shall includes;	
{ }		– Existing and proposed contours (0.5m intervals).	
{ }		– Location of soil test borings, with seasonally high ground water elevation specified.	
{ }		– Inflow and outflow channel/pipes with invert elevations, outlet channel and erosion/scour protection	
{ }		– Emergency spillway and its outlet channel	
{ }		– Sediment forebay area (wet pond only)	
{ }		– Sloped bench, 3m wide, 0.3m above the permanent pool (wet pond only)	
{ }		– Level bench 3m wide, 0.3m below the permanent pool (wet pond only) along the pond rim.	
{ }	4.3.4	Cross section of the dam through the principal spillway shall be shown together with elevations for all elements in the cross section comprising:	
{ }		– Existing ground.	
{ }		– Proposed ground (slopes no steeper than 3:1 inside, 3:1 outside, top width at least 4m).	
{ }		– Cutoff trench (bottom width and depth at least 1.5m; side slopes not steeper than 1:1)	
{ }		– Impervious core top width, material, side slope and height (at least = 50 yr flood level).	
{ }		– Outlet structure (size and elevation of all openings, trash rack, anti-vortex device, structural detail of the outfall and its foundation. Include all details with dimensions, elevations, and material specs)	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }		– Pipe (specify inside diameter, material, length, slope and water tight couplings)	
{ }		– Phreatic line (start at the permanent pool elevation for wet pond or the 5 yr flood level for dry ponds and follow a 4:1 slope, label the saturated length)	
{ }		– Anti-Seep Collars (provide details and specify material, size, spacing and location on pipe	
{ }		– Bedding for concrete pipe (include detail)	
{ }		– Emergency spillway (crest at least 1m below top of dam and 0.3m above top of the riser	
{ }		– Outlet protection. Provide plan and cross-sectional detail	
{ }		– Top of the dam (must be at least 0.3m above the 100 year D.H.W.) constructed and design (constructed = design + 5% for settlement)	
{ }		– Water surface elevation for permanent pool and all design storms	
{ }		– Inlet and outlet inverts of all channel/pipes	
{ }		– Means to drain the permanent pool	
{ }		– Reverse slope and level benches (at least 3m wide)	
{ }	4.3.5	Profile of the emergency spillway shall be shown to include:	
{ }		– Existing ground	
{ }		– Inlet Control Level and outlet sections	
{ }		– Length and slope of the outlet channel	
{ }		– Details for structural spillway shall be shown if emergency spillway is located at earth fill area	
{ }	4.3.6	Cross section of the dam through the centerline shall be shown to include:	
{ }		– Existing and proposed ground	
{ }		– Type of soil to be used in dam, core and cut off trench	
{ }		– Top of the dam, constructed and settled	
{ }		– Location of emergency spillway	
{ }		– Top of the impervious core and bottom of the cut off trench.	
{ }	4.3.7	Methods of achieving adequate compaction for construction of dams shall be shown to include:	
{ }		– Lift thickness	
{ }		– Degree of compaction	
{ }		– Method for compaction.	
{ }	4.3.8	Sediment disposal area shall be shown to include:	
{ }		– Area per proposed design	
{ }		– Depth (maximum 0.3m)	
{ }		– Slope (maximum 5%).	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	4.4	**Onsite Detention (OSD) Plans**	
{ }	4.4.1	Detailed OSD Drawing at a scale of 1:100 shall be provided (where development site size, excluding section details, requires more than two A1 drawing sheets at 1:100 scale, the drawing may be reduced in scale to 1:200).	
{ }	4.4.2	Site layout on the stormwater and OSD drawing shall correspond with, and compliment, Architectural and Landscape Drawings.	
{ }	4.4.3	All stormwater pipes shall be clearly shown, ie thicker linetype, from downpipes and pits to the outlet connection point into drainage system/kerb & gutter.	
{ }	4.4.4	The site stormwater connection point into drainage system/kerb & gutter shall be indicated on the drawing along with its invert level.	
{ }	4.4.5	All pipe sizes and grades are to be indicated adjacent to all pipes proposed on the site.	
{ }	4.4.6	All pit sizes, surface and invert levels are to be indicated adjacent to all pits proposed on the site. (Note :- minimum pit size 450mm x 450mm).	
{ }	4.4.7	All walls, kerbs or crests proposed on the site are to be indicated along with their respective levels. (eg top of wall level).	
{ }	4.4.8	Finished surface levels are to be indicated within all courtyards/driveways/ detention storage areas.	
{ }	4.4.9	A 1.2m high pool type fence/suitable barrier or railing shall be provided where a vertical drop into an above ground basin exceeds 500mm.	
{ }	4.4.10	All services within the site and footpath area are to be accurately indicated on the stormwater and OSD drawing.	
{ }	4.4.11	Detailed cross-section of the discharge control unit/below ground tank shall be shown.	
{ }	4.4.12	Typical section detail of a surface inlet pit shall be provided.	
{ }	4.4.13	A minimum grade of 1% shall be provided on the base of the above ground detention basin located in landscaped/turfed areas to a grated collection pit.	
{ }	4.4.14	Sub-soil drainage is to be indicated within above ground detention basins located in landscaped areas. (Note :- Subsoil drainage shall connect to the collection pits of the detention basin)	
{ }	4.4.15	Areas of the site that by-pass the detention system/s are to be clearly delineated on the Hydraulic Drawing.	
{ }	4.4.16	Satisfactory access is to be provided within the front setback area and/or rear courtyard into the detention storage area/s with maximum 1 in 4 batters or steps.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
	4.5	**Gross Pollutant Traps (GPTs) Plans**	
{ }	4.5.1	Adequate provision for road access to the site by maintenance vehicles and equipment must be made. Suitable walkways, ladders and plinths shall be provided within the structure for access.	
{ }	4.5.2	The 'SBTR' trap relies on reducing the flow velocity sufficiently to allow settling by gravity. These principles apply to both Type SBTR-1 (major) and SBTR-2 (minor) traps;	
{ }		– The ratio length: width of the sediment trap should be between 2 and 3.	
{ }		– Bar spacing shall be capable of retaining a small plastic bottle or an aluminium drink can, with a maximum clear spacing of 50 mm between bars;	
{ }		– The design must allow water to flow past or over the trash rack when the trash rack is blocked.	
{ }	4.5.3	Include final details.	
	4.6	**Filtration Plans**	
{ }	4.6.1	Biofiltration Swales	
{ }		– Existing and proposed contours at 0.2m intervals	
{ }		– Inlet protection detail	
{ }		– Locations and details for underdrains if slope is less than 2%, locations and details of rock check dams if slope is greater than 4%	
{ }		– Vegetative specification per the Horner Publication	
{ }	4.6.2	Sand Filters	
{ }		– All necessary details and cross-sections	
{ }	4.6.3	Other Filtration practices	
{ }		– All details necessary to clearly demonstrate what is proposed.	
	4.7	**Infiltration Plans**	
{ }	4.7.1	Length, width and depth.	
{ }	4.7.2	Specify type and location of geotextile.	
{ }	4.7.3	Detail of surface inlet and observation well.	
{ }	4.7.4	Cross-sectional detail.	
{ }	4.7.5	Suspended solids filter shall accompany the practice, vegetative filters must be at least 5m in length.	
{ }	4.7.6	Areas draining to the practice are stabilized and vegetative filters are established prior to runoff entering the system	
{ }	4.7.7	Practices deeper than 1m shall be located at least 5m from basement walls.	
{ }	4.7.8	Infiltration practice designed to handle parking lot runoff shall be located at least 50m from any public or private drinking water supply wells.	
{ }	4.7.9	Details of the overflow system, including provisions to impede erosion along its length and at the outfall.	

Consultant's Initial Submission	Items	SUBMISSION REQUIREMENTS	DID Remarks
{ }	4.7.10	Location of soil boring, descriptive bore log, specify infiltration rate (at least 30 mm/hr), specify seasonally high groundwater elevation (at least 1m below practice).	
{ }	4.7.11	Slope of bottom of the practice shall not exceed 5%.	
{ }	4.7.12	Infiltration practices shall not be installed on or atop a slope whose natural angle of inclination exceeds 20% or in fill material.	

ADDITIONAL REQUIREMENTS

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COMMENTS

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