

# **CODE OF PRACTICE ON ENVIRONMENTAL HEALTH**



**ENVIRONMENTAL PUBLIC HEALTH DIVISION  
NATIONAL ENVIRONMENT AGENCY  
SINGAPORE**

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## **INTRODUCTION**

The Code of Practice on Environmental Health (COPEH) provides the guidelines to address environmental health concerns in the design of buildings. The Code spells out the objectives to be met and stipulates only the minimum basic design criteria. In this way, Qualified Persons (QPs: Architects or Professional Engineers) may exercise flexibility and creativity in the design to meet the stated requirements without compromising functional and maintenance needs. So long as design outcomes satisfy the stated objectives, the building plans will be deemed to have complied with the COPEH. Notwithstanding this, the QP shall be fully responsible for safety, effectiveness and all other aspects of the design.

**Director General of Public Health  
National Environment Agency  
Ministry of the Environment and Water Resources  
Singapore**



# 1 REFUSE STORAGE AND COLLECTION SYSTEM

## 1.1 Objective

The refuse storage and collection system shall be mechanised where possible and designed so as not to cause nuisance to occupants and neighbouring premises, and to prevent pollution to the environment. All facilities provided shall be adequately sized to meet the anticipated refuse output.

## 1.2 Refuse Output

- (a) The refuse output for the various categories of premises shall be computed as follows:

| Category of Premises                             | Refuse Output (litres/day)        |
|--|-----------------------------------|
| Office   | 15 per 100 sq m gross floor area  |
| Hotel / dormitory                                | 10 per 100 sq m gross floor area  |
| Shop / trade premises                            | 30 per 100 sq m gross floor area  |
| Supermarket / market /department store           | 100 per 100 sq m gross floor area |
| Restaurant / eating house /food centre / canteen | 200 per 100 sq m gross floor area |
| Residential premises                             | 20 per dwelling premises          |
| Petrol station                                   | 300 per premises                  |

- (b) Where a proposed development has a combination of different types of premises (for example, a shopping complex with offices, residential premises and a food centre), the total refuse output shall be the sum of the outputs of each category of premises.

## 1.3 Refuse Chute

Refuse chutes shall be provided for residential buildings and buildings with residential component taller than four (4) storeys so that occupants need not have to bring their refuse into lifts or walk down the stairs with it. Refuse chutes shall meet the following requirements:

- (a) The cross-sectional area of the chute shall be at least 0.3 sq m.
- (b) The chute shall terminate at the roof of a building. The chute shall be ventilated at the top with at least two openings of not less than 0.1 sq m each. This top section of the refuse chute shall be accessible from the common area to facilitate maintenance.
- (c) If the roof is to be used as a roof terrace/garden, particular attention shall be paid to the siting of the refuse chute, the location of its openings and the maintenance requirements so as not to cause any smell nuisance. Ventilation openings shall be located at least 2.1 m above roof level.

- (d) There shall be a system to wash and flush the whole length of the chute. The control valve for the flushing system is preferably located at the chamber level. The system shall be designed for manual activation of flushing and automatic de-activation.
- (e) Where a centralised refuse chute is provided, the hopper shall be sited as far away as possible from residential dwelling units and not be facing the entrance of the units. The hopper shall be screened when this requirement cannot be achieved.

#### **1.4 Refuse Chute Chamber (for Premises with Refuse Bin Centre/Bin Point)**

A refuse chute chamber shall be built at the bottom of a chute to house a bin. The refuse chute chamber shall be suitably located to facilitate easy and nuisance-free conveyance of refuse. The refuse chute chamber shall meet the following requirements:

- (a) The size of the refuse chute chamber shall be large enough to house a wheeled refuse bin with cover, which can contain at least one (1) day of refuse output from all the premises connected to the chute. If this is not possible for authorised reasons, the bin shall be cleared more frequently as required to prevent excessive piling of refuse within the refuse chamber.
- (b) The walls shall be lined with tiles or other smooth, impervious materials.
- (c) The floor shall be recessed at least 100 mm below the apron area and graded towards a gully connected to a sewer.
- (d) The maximum gap between the termination point of the refuse chute and the top of the bulk bin shall be 200 mm.
- (e) An airtight non-corrosive flap door shall be provided for access to the refuse chute chamber.
- (f) The refuse bin shall be a SS EN-840 standard wheeled bin with a maximum size of 660 litres.

#### **1.5 Refuse Room (for Premises without Refuse Bin Centre/Bin Point)**

A refuse room shall be provided at the bottom of a chute and to house a mechanical refuse handling equipment, e.g. a dust-screw or any other enclosed fixed system. Refuse collected in the refuse handling equipment is conveyed directly into a refuse collection vehicle, which backs up into the refuse room. The refuse room shall meet the following requirements:

- (a) The refuse room shall be large enough to accommodate two (2) days of refuse output from all the premises connected to or served by the chute.
- (b) The access to the refuse room shall be such that a refuse collection vehicle can make a three-point turn within the premises to back up into the entrance of the refuse room. To allow ease of access for the refuse

collection vehicle during collection, the refuse room floor level shall be at the same level as the vehicular access road. The distance for a refuse collection vehicle to reverse into the refuse room shall be minimised. A setback distance of at least 13 m shall be provided to ensure that the refuse room is accessible to refuse collection vehicles. The swept path of a refuse collection vehicle from the service road to refuse room shall meet the minimum required turning radius of 9 m and also be free of obstructions.

- (c) The walls shall be lined with smooth tiles or other smooth impervious materials.
- (d) The floor shall be graded towards a gully/floor trap connected to the sewer.
- (e) A water tap shall be provided in accordance with the latest Public Utilities (Water Supply) Regulations and Singapore Standard CP 48. The standards and requirements for water taps stipulated by PUB can be found at PUB's website at [www.pub.gov.sg](http://www.pub.gov.sg). The water tap shall be securely locked to prevent unauthorised use.
- (f) The refuse room shall be rendered pest-proof against birds, rodents and insects.
- (g) The required roller shutter opening of the refuse room shall be 3.4m (clear width) by 4m (clear height).

## **1.6 Refuse Bin Point and Refuse Bin Centre**

For premises adopting the Refuse Chute Chamber system, a bin centre shall be provided when the amount of refuse output exceeds 1,000 litres/day. The bin centre shall meet the following requirements:

- (a) The bin centre shall be sited so as not to cause nuisance to neighbouring premises, and be accessible to a refuse collection vehicle. An adequate turning area shall be provided where necessary to accommodate the various sizes of refuse trucks available in the market. Refuse collections shall be carried out only from within the premises.
- (b) The combined refuse storage capacity of the bin centre and the refuse chute chambers shall be sufficient for at least two (2) days of refuse output from the proposed development. The bin centre shall be designed for access of SS- EN 840 standard wheeled bins from within the development. Sufficient space shall be provided for washing and manoeuvring of refuse bins within the bin centre.
- (c) The walls shall be lined with smooth tiles or other smooth, impervious materials.
- (d) The floor shall be graded towards a gully/floor-trap connected to the sewer.

- (e) A roof with no gutters shall be provided. The roof shall have an adequate gradient to prevent water stagnation and mosquito breeding.
- (f) The bin centre shall be adequately ventilated and rendered pest-proof against birds, rodents and insects.
- (g) The entrance and ventilation openings of the bin centre shall face away from any residential premises in the vicinity. Aesthetic screening shall be provided where practical, so as not to cause a nuisance to neighbouring premises.
- (h) An access walkway of at least 1m clear width shall be provided within the bin centre.
- (i) Where the daily refuse output of the premises is less than 4,000 litres, the area of the bin centre shall be large enough to store the required number of wheeled refuse bins for two (2) days refuse output in 1.6 (b).
- (j) Where the daily refuse output of the premises is 4,000 litres or more, an enclosed roll-on roll-off (RORO) compactor/container, dust screw compactor or a rotary drum system shall be provided. The type of system to be provided depends on the refuse composition and the amount of refuse output from the premises. The RORO compactor/container provided shall be designed in accordance with DIN 30722. The following additional design requirements of the bin centre shall apply:
  - i. The required roller shutter opening of the bin centre shall be 4m (clear width) by 5m (clear height).
  - ii. A 5m clear height shall also be provided in front of the entrance when a RORO compactor/container or any other refuse storage system that requires haulage is provided.
  - iii. A setback distance of at least 13 m shall be provided to ensure that the bin centre is accessible to refuse collection vehicles. The swept path of a refuse truck from the main or service road to the bin centre shall meet the minimum required turning radius of 9m and also be free of obstructions.
  - iv. The bin centre floor level shall be at the same level as the vehicular access road.
  - v. The distance for refuse collection vehicles to reverse into the bin centre shall be minimised. A guide of the layout of a bin centre is shown Appendix 1A.
  - vi. If bin lifter is used, there shall be sufficient space to enable the bin lifter to operate the bin properly.
  - vii. When there are more than 1 RORO compactor/container in the bin centre, the minimum separation between the adjacent compactor/containers shall be 0.5m.

- viii. The orientation of RORO compactor/container's tail gate shall face the inside of the bin centre.
- ix. Floor markings shall be provided in front of the entrance of the bin centre to guide the refuse collection vehicle when reversing during operation.
- (k) Where the daily refuse output is less than 1,000 litres and a bin point is required, washing points and water taps are not required and the bin point need not be connected to the sewer. The bin point shall have a pleasant architectural appearance and be sited so as not to cause a nuisance to neighbouring premises.

## **1.7 Pneumatic Waste Conveyance System (PWCS)**

All new strata-titled properties with 500 or more residential dwelling units for which development applications are submitted to URA from 1 April 2018 onwards shall be provided with a PWCS. Applicants shall provide a copy of URA's Provisional Permission in their DC application to NEA.

Where a PWCS (i.e. stationary vacuum system or vacuum truck system) is provided, the following requirements shall be complied with:

- (a) For refuse chute which are square, the cross-sectional area of the chute shall be not less 0.3 sq m. For refuse chute which are round, the minimum internal diameter of the chute should not be less than the diameter of 600mm.
- (b) The opening of the chute hopper is to be fully volume-controlled to restrict large or long items from entering the chute (see Appendix 1B). The chute hopper shall be adequately sized to accommodate bagged waste of size 300 to 350 mm measured in any angle. These features will allow the disposal of bagged waste of typical sizes, and prevent oversized waste from choking the hopper and the chute.
- (c) Sensors and monitoring equipment shall be provided to monitor the refuse collected at the refuse chute and activate the discharge cycle to convey the refuse to the bin centre to prevent excessive piling of refuse within the refuse chute.
- (d) Inspection openings shall be provided at intervals of not more than 50m along straight sections, and at locations of the PWCS conveyance pipe network where refuse is likely to accumulate and block the conveyance pipe, including, but not limited to, pipe connections and bends in the conveyance pipes.
- (e) The ventilation, air intake and air outlet units shall be sited so as not to cause any noise or smell nuisance to neighbouring premises or residents of the premises served by the PWCS.

- (f) The system shall be designed so as not to cause any noise nuisance to residents of the premises served or neighbouring premises when it is operated.
- (g) Dust and odours shall be removed from the air that conveys the refuse before the air is discharged into the atmosphere. Measures to remove dust and odours include, but are not limited to the following:
  - i. Dust and deodorising filters shall be provided to filter dust and foul odours from the air conveying the refuse before the air is discharged to the atmosphere.
  - ii. The type and quantity of filters provided shall be appropriate and sufficient to treat all air exhausted from the PWCS system.
  - iii. The filters shall efficiently filter the air without affecting system performance and in an energy efficient manner.
  - iv. All filter media shall have a life span of no less than six (6) months between replacements.
  - v. In addition to the filters, an Odour Treatment System shall be provided to treat the air such that the discharged air from the exhaust air outlet or bin centre does not cause smell nuisance to residents.

The discharge point shall also be located at the highest level possible and pointed away from residential dwelling units and commercial spaces within and surrounding the development.

- (h) A PWCS bin centre shall be provided for stationary systems. The PWCS bin centre shall be designed to meet the same requirements stated in section 1.6. The refuse storage capacity in the bin centre shall be sufficient for storage of at least two (2) days of refuse output of the development. The PWCS refuse container shall be designed in accordance with DIN 30722.
- (i) For vacuum truck systems, the size of the intermediate storage area shall be sufficient for the storage of at least two (2) days of refuse output. The requirements stated in section 1.6 shall still apply so that a proper storage facility within the development is available in the event that the vacuum truck is not available for collection.
- (j) The bin centre shall be accessible to refuse collection vehicles, and be so sited so as not to cause nuisance to neighbouring premises. The design requirements for the bin centre as stated in section 1.6(i) shall still apply.
- (k) A communications system shall be incorporated into the system to automatically and immediately alert the management and appointed service provider of any faults or breakdowns detected in the system so that repair work can be promptly arranged.

- (l) The complete system including the exhaust air treatment system shall be designed for ease of maintenance.
- (m) The electrical and electronic components (including the Programmable Logic Controller) shall use Original Equipment Manufacturer (OEM) parts.

## **2 PUBLIC TOILET**

### **2.1 Objective**

The public toilets shall be designed to withstand heavy usage. Ventilation is therefore important. The design shall also take into consideration ease of maintenance and should facilitate proper toilet use and personal toilet hygiene. There shall be adequate provision of toilet facilities for premises provided with public toilet.

### **2.2 Definition of Public Toilet**

2.2.1 A public toilet is defined as a toilet within premises which the general public has free access, regardless of payment/ non-payment to access the premises. The general public is free to access the public toilet without having to be a resident, student, staff, member or a guest, or a regular client. Toilets in the following places are classified as public toilets:

shopping mall or centre, including the floor in commercial buildings with shops;

supermarket and wet market;

eating establishment and food centre (restaurant, coffeeshop, hawker centre food court)/ bar/ nightclub/ discotheque/ pub;

conference hall/ cinema/ theatre/ convention hall/ exhibition hall;

park;

bus terminal/ interchange;

petrol station;

community centre/ community clubs;

MRT station;

stadium;

public swimming pool.

Although toilets within premises which the general public does not have free access (e.g. condominiums, terraced workshops, places of worship, etc) are not covered under this code of practice, QPs are encouraged to adopt the guidelines stipulated here.

2.2.2 Although construction sites are not freely accessible to the public, sanitary facilities in a construction site shall be provided in accordance with the requirements stipulated in Appendix 2.

## 2.3 General Design Criteria

The general design requirements for public toilet shall be as follows:

- (a) Wall finishes shall be of materials which are impervious and durable such as ceramic tiles and phenolic panels to facilitate cleaning.
- (b) Floors shall be constructed of waterproof non-slip surfaces like ceramic tiles, natural stone, homogeneous tiles or other impervious materials to facilitate cleaning.
- (c) The toilet's main entrance shall preferably have no door, and the cubicles, urinals and mirrors shall be away from the line of sight from the main entrance.
- (d) The minimum lighting level shall be 300 lux to ensure that areas with water closets, wash basins and urinals are sufficiently illuminated.
- (e) All toilet cubicles shall be at least 900 mm wide and 1500 mm deep.
- (f) Cubicle partitions shall be of rigid design and wall or ceiling hung, where practical, without leg support for easy cleaning of the floor.

## 2.4 Sanitary and Water Fittings Required in Public Toilet

Sanitary and water appliances and fittings installed in public toilets shall be of heavy-duty classification and quality and shall be easily-cleaned. Water fittings shall comply with the relevant standards and requirements stipulated by PUB and their installation shall be in accordance with the latest Public Utilities (Water Supply) Regulations and Singapore Standard CP 48 – Code of Practice for Water Services. For water fittings, appliances and products covered under PUB's Mandatory Water Efficiency Labelling Scheme, only fittings, appliances and products registered under the Scheme shall be installed. The standards and requirements for water fittings stipulated by PUB and fittings, appliances and products registered under PUB's Mandatory Water Efficiency Labelling Scheme can be found at PUB's website at [www.pub.gov.sg](http://www.pub.gov.sg)

Where sanitary and water provisions are to be made for person with disabilities, such provisions shall be in accordance with the requirements stipulated in BCA's "**Code on Barrier-Free Accessibility in Buildings**".

A glossary of the terms used in this section is given in Appendix 8.

### 2.4.1 Number of sanitary fittings

The number of public toilets and sanitary fittings to be provided in buildings accessible to the general public is given in Appendix 2. The numbers of facilities provided are minimum requirements and QPs should design the toilets to ensure sufficient facilities are provided based on the highest expected toilet use.

### **2.4.2 Water closets**

- (a) Pedestal type water closets shall preferably be wall hung, without leg support, so as to facilitate cleaning.
- (b) The cubicle, where a squatting WC pan is provided, should be kerbed such that water will not flow out of the boundary of the cubicle. The cubicle floor shall be properly graded towards the gully trap within the cubicle.
- (c) Each water closet shall be fitted with a sensor-operated flush valve and coupled with manual by-pass and manual override.
- (d) For volume of water per flush in urinals and water closets, please refer to the latest Public Utilities (Water Supply) Regulations and Singapore Standard CP 48 – Code of Practice for Water Services.
- (e) A water tap point with spring loaded nozzle shall be provided within one cubicle of the toilet.
- (f) Where water tap points with spring loaded nozzle are provided, they shall be installed with a check-valve and an anti-vacuum valve to prevent backflow.
- (g) For cubicles where water tap points with spring loaded nozzle are provided, the cubicle floor shall be properly graded towards the gully trap within the cubicle. Scupper drains with metal grating shall preferably be installed within the cubicle to facilitate the draining off of water. For such cubicles, there shall be signage on the cubicle door indicating the provision of the water tap point with spring loaded nozzle. Signage is not required for toilets where all cubicles are provided with the water tap point with spring loaded nozzle.

### **2.4.3 Urinals**

- (a) Each urinal shall be fitted with a sensor-operated flush valve with manual override feature.
- (b) Where a waterless urinal is installed, it shall be maintained in accordance with manufacturer's instructions and not cause any odour nuisance. Only waterless urinals registered under PUB's Mandatory Water Efficiency Labelling Scheme shall be installed.
- (c) There shall be a scupper drain underneath the urinals along the wall where urinals are installed, to facilitate the removal of dripping during cleaning of the floor. The width of the scupper drain should not be more than 150 mm.
- (d) Handrails or grab bars shall be provided for at least one urinal.

- (e) Individually wall-hung urinal units shall be at least 300 mm wide and the lip of the collection area shall project from the wall by at least 300 mm.

#### **2.4.4 Wash hand basins and taps**

- (a) Wash-hand basins shall be installed such that there is sufficient gradient to allow dirty and debris to be effectively washed into the drain pipes.
- (b) Wash hand basins shall be under-counter. Other designs are allowed provided that they can minimise the problem of water spilling over from the basin to the counter. For basins that sit on top of the counter or are stand-alone, these shall be deep enough to prevent water splashing out of the basins when in use.
- (c) All wash hand basin taps shall be sensor taps with self-closing delayed action feature, except for one which shall be self-closing delayed-action mechanical or battery-operated sensor type tap, installed per toilet block to ensure that one tap remains functional during power supply outage.

For toilet block provided with only one wash hand basin, only self-closing delayed-action mechanical or battery-operated sensor type tap shall be installed.

To support water conservation, the flow rate for the self-closing delayed-action mechanical or sensor type taps at these basins shall be set at 2 litres/minute.

Please refer to the Public Utilities (Water Supply) Regulations and the Singapore Standard CP 48 – Code of Practice for Water Services for requirements on timings and allowable flowrates for taps.

Public toilet shall be located at common area should be included.]

- (d) Wash hand basins provided in accessible individual washrooms as prescribed in BCA's "Code on Accessibility in the Built Environment" shall have either self-closing delayed-action sensory type taps or long lever handle taps. For accessible toilets where the wash basin designated for persons with disabilities is grouped together with wash basins for general use, the wash basin designated for persons with disabilities shall only have self-closing delayed-action sensor type taps.
- (e) In food retail outlets where toilet facilities are provided, wash hand basins shall preferably be provided outside the toilet. Wash hand basin taps shall comply with the requirements in clause c of Section 2.4.4 of the COPEH.
- (f) Where there is more than one wash hand basin provided, at least one shall be installed at a level to accommodate use by children.

## 2.5 Amenities to Be Provided

(a) **Liquid soap or foam soap dispenser**

One soap dispenser shall be provided for every two count of wash hand basins, subject to a minimum of one. The dispenser shall be positioned at least between every two wash hand basins. The dispenser shall have a transparent window so that the level of soap in the dispenser is clearly visible.

(b) **Hand-dryer blower or paper towel dispenser**

One electronic hand-dryer or paper towel dispenser shall be provided for every two count of wash hand basins, subject to a minimum of one. The electronic hand-dryers shall be positioned immediately next to the wash hand basins where practical. Where paper towel dispensers are provided, they shall be positioned directly above and at least between every two wash hand basins.

(c) **Litterbins**

A minimum of one litterbin shall be provided directly below or in close proximity to the wash hand basins. A sanitary bin for the disposal of sanitary pads shall be provided in each WC cubicle in the female and unisex toilets. Bins shall be operated without hand contact e.g. foot pedal or electronic motion sensor devices.

(d) **Toilet paper holder**

A jumbo paper toilet roll holder or a toilet tissue dispenser of similar capacity shall be installed in each WC cubicle.

(e) **Cleaner's sink with tap-point**

A dedicated sink with tap-point for maintenance personnel to clean public toilets shall be provided within or in close proximity to each toilet block, where practical.

(f) **Diaper changing facility**

Diaper changing stations, benches or tables shall be provided in toilets of shopping malls, MRT stations, bus terminals/interchanges, hawker centres as well as any other buildings where families with infants and/or toddlers are expected to frequent. The diaper changing surfaces shall be non-porous, easily cleaned and water proof.

## 2.6 VENTILATION

- (a) The toilet shall well-ventilated by natural or mechanical means to remove odours and to keep floors dry. Where mechanical means are used, the air exchange rate shall have a minimum of 15 air changes per hour. Service access ducts, if fully enclosed, shall be connected to the

mechanical ventilation system. For natural ventilation, suitable fresh air inlet grilles shall be provided to ensure an air exchange rate of 5 air changes per hour.

- (b) The exhaust system shall dispel the air directly outdoors without causing any nuisance to neighbouring premises.

Note: While this Code stipulates the minimum basic design criteria, QPs are encouraged to refer to the publication <A Guide to Better Public Toilet Design and Maintenance> for further reference on good examples of toilet design.

### **3 FOOD RETAIL OUTLET**

#### **3.1 Objective**

Food retail outlets, such as restaurants, food courts, etc. (also known as “food shops”) shall be designed to ensure that the size and layout can support an efficient workflow which minimises likelihood of food contamination. It shall be designed to ensure adequate access to facilitate cleaning and maintenance. A good layout will help the operator attain a high standard of food hygiene and cleanliness in the premises.

#### **3.2 General Design Criteria**

The general design criteria for a food retail outlet shall be as follows:

##### **3.2.1 Minimum Food Preparation Area**

The minimum food preparation area for a food shop or food stall shall be 10 square metres.

##### **3.2.2 Floor**

- (a) The floor of the kitchen shall be graded towards floor traps.
- (b) Floors shall be constructed of non-slip and impervious materials to facilitate cleaning.
- (c) The edge adjoining the wall and the ground should be coved.

##### **3.2.3 Wall**

The walls of the preparation and servery area shall be lined with glazed tiles or other suitable impervious materials of not less than 1.5m, to facilitate cleaning. Walls or partitions shall preferably be in light colour.

##### **3.2.4 Washing Facilities**

###### Washing Facilities in Food Preparation Area

- (a) At least one sink shall be provided in the food preparation area.

###### Hand-Washing Facilities in Food Preparation Area

- (b) At least one wash hand basin shall be provided for workers in the kitchen. The tap of the wash hand basin shall preferably be non-hand operated. It shall be strictly for hand washing purpose.

- (c) If a double-bowl sink is installed and one of which is dedicated for hand washing purpose, the sink should be installed with two separate water taps.

#### Hand-Washing Facilities in Refreshment Area

- (d) At least one wash hand basin shall be provided in the refreshment area of a foodshop which serves cuisines to be consumed using hands and is without toilet facilities. Taps shall be suitably adjusted to minimise splashing and shall be delayed-action type or auto-sensor operated type.
- (e) Hand soap, and hand dryer or hand drying towel, shall be provided at hand-washing facilities.

### **3.2.5 Centralized Washing Area**

- (a) Food shop with 6 to 15 individual food stalls shall have a centralised wash area with a minimum size of 5 square metres.
- (b) Food shop with more than 15 food stalls shall have a centralised wash area with a minimum size of 7 square metres.
- (c) The centralised wash area shall be located in a well-ventilated room or an enclosure, and the walls shall be lined with glazed tiles or other suitable impervious materials. The provision of a commercial dishwashing machine in the centralised wash area is encouraged.

### **3.2.6 Storage**

- (a) Separate storage facility shall be provided for workers' personal belongings, cleaning tools/material, food ingredients, cutlery, and food packaging materials respectively.
- (b) A storage room shall be provided, where practical, for the storage of large equipment such as additional chairs, tables etc.

### **3.2.7 Equipment Spacing Clearance**

All kitchen appliances and equipment such as oven, etc, and piping shall be kept at least 150 mm above the finished floor level.

### **3.2.8 Sanitary Fittings**

- (a) Floor trap shall be constructed in the food preparation area for the discharge waste water to sewer.
- (b) No manhole, inspection chamber, waste sump, screen chamber, grease trap or overhead sanitary/waste/drain pipes shall be sited within the areas where food is prepared, cooked, stored or served; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.

### **3.2.9 Toilets**

Where there are public toilets within the building where the food shop is located, the provision of a toilet within the food shop is not necessary. Otherwise, the number of toilets and sanitary fittings provided shall be in accordance with the requirements in Section 2 of the COPEH.

### **3.2.10 Pest Control**

Premises should be rendered pest-proof to prevent pest access and to eliminate pest potential breeding sites.

### **3.2.11 Ventilation and Air Exhaust System**

- (a) All fumes from the cooking range shall be extracted immediately and treated with an air cleaning system. The air cleaning system shall capture particulate matters, grease, oil, water vapour and smell causing compounds such that there is:
  - i. No visible black smoke and fumes (white or otherwise) from the exhaust;
  - ii. No emission of grease or oil from the exhaust as evident by the deposition on the grating or in the surrounding area of the exhaust;
  - iii. No intense/ irritating smell of frying, charbroiling, roasting and such other cooking in the vicinity of exhaust.
- (b) The air cleaning system shall not cause noise nuisance.
- (c) The cleaned air shall be exhausted outdoors by a hood and flue or other extractor fan system at or above the roof, facing away and aesthetically screened from the immediate neighbouring premises, such that it will not cause smell or other public health nuisance. Where it is not practical to exhaust the fumes at or above the roof, an alternate location of the discharge point in the outdoors may be selected, facing away and aesthetically screened from the immediate neighbouring premises.
- (d) Consideration shall be given to aesthetic aspect of the exhaust outlets if it is sited near residential premises.
- (e) There shall be regular cleaning and maintenance of the exhausts.
- (f) The food shop shall be well ventilated. Where mechanical ventilation is employed, there shall be at least 20 air changes per hour in the kitchen.
- (g) Sufficient make-up air shall be provided and negative pressure shall be maintained when the kitchen hood is in operation.
- (h) All air ducts (incoming and outgoing) in the kitchen shall be made of non-combustible materials and of smooth texture, and easy to clean. Inspection openings shall also be provided in the air ducting.

- (i) For approval of building plans for premises with food shop(s), a qualified person shall ensure that the exhaust and ventilation system complies with the above requirements and all applicable guidelines stipulated under Section 12.2 and 14.3 of the latest edition of Singapore Standard SS 553 : 2009.

## **4 SUPERMARKET**

### **4.1 Objective**

Supermarket is the final point where a large variety of food is sold to consumers. Supermarkets shall be so designed to ensure that the layout can support an efficient workflow. The size of the food preparation and storage area shall be sufficient to meet needs of the supermarket. The floor shall be properly graded and drained so that the preparation area can be kept dry. If the preparation area is not air-conditioned, it must be well ventilated. A good layout will help the supermarket prevent cross contamination and attain a high standard of food hygiene and cleanliness.

### **4.2 Design Criteria**

The design criteria for a supermarket shall be as follows:

- (a) The walls of preparation and servery area shall be lined with glazed tiles or other suitable impervious materials of not less than 1.5 m, to facilitate cleaning.
- (b) Floor of preparation and servery area shall be paved with non-slip heavy-duty homogenous quarry/ ceramic tiles and graded towards floor traps.
- (c) No manhole, overhead sanitary wastepipe, inspection chamber or grease trap shall be sited inside the preparation area; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.
- (d) All over-hanging sanitary/ waste/ drain pipes within the premises shall be boxed-in/ concealed.
- (e) Adequate number of commercial sinks with drying benches shall be provided in the preparation area.
- (f) Adequate number of NEA approved wheeled refuse bins shall be provided to contain the refuse. The wheeled bins must be placed inside the premise at all times and can only be brought outside the premise during collection.
- (g) Toilets shall be provided in accordance with Section 2 of the COPEH.
- (h) All food stores and cabinets provided shall be rendered pest-proof and rodent-proof.
- (i) A cabinet shall be provided for the storage of cleaning tools, brooms, cleaning materials, etc.
- (j) A room or cabinet shall be provided for the storage of workers' personal belongings.

- (k) Cold stores, if provided, shall be designed to take into account the intended food products, storage time and the optimal temperature requirements. The walls of the stores shall be effectively insulated to prevent condensation on the other side of the walls. The loading and unloading bays shall be so designed to allow the transfer of frozen/ chilled products from the refrigerated trucks to the cold store with minimal exposure to ambient temperature and with the least possible handling.
- (l) All mist generating systems and fans installed shall be in accordance with the requirements stated in Appendix 3.
- (m) The preparation of cooked/ready to eat food and raw food shall be done in distinctly separated areas to prevent cross contamination.
- (n) All food retail outlets located within premises of the supermarket, shall comply with Section 3 of the COPEH.

## **5 FOOD CATERING OUTLET**

### **5.1 Objective**

A food catering outlet shall be designed to ensure that the layout can support an efficient workflow. This is to reduce the risk of cross-contamination during the preparation process. Separate storage areas shall be provided for raw materials, final products, chilled or frozen products, packing materials and cleaning equipment, etc. A good layout will enhance hygiene during food preparation.

### **5.2 Design Criteria**

The following design criteria are applicable to food catering outlets:

- (a) The minimum kitchen area shall be 16 sq meters.
- (b) The floors shall be graded towards floor traps or internal drains.
- (c) The walls of the kitchen shall be lined with glazed tiles or other suitable impervious materials to facilitate cleaning. All internal wall partitions separating the work areas shall be erected up to the height of the ceiling to eliminate cross-contamination of food products.
- (d) No manhole, overhead sanitary wastepipe, inspection chamber or grease trap shall be sited inside the preparation area; or other areas where they are likely to give rise to nuisance, health or hygiene hazards during maintenance.
- (e) Ventilation and air exhaust systems installed, shall comply with Section 3.3 of the COPEH.
- (f) Adequate lighting shall be provided at all working areas.
- (g) Washing facilities shall be provided in the preparation area. Hands-free taps for wash-hand basins/sinks complete with liquid soap dispensers and hand dryers shall be provided.
- (h) Toilets, if provided, shall be located away from the food preparation area. Toilets and sanitary fittings provided shall preferably be in accordance with the requirements in Sections 2.4, 2.5 and 2.6 of the COPEH.
- (i) Cold stores, if provided, shall be designed to take into account the intended food products, storage time and the optimal temperature requirements. The walls of the stores shall be effectively insulated to prevent condensation on the other side of the walls. The loading and unloading bays shall be designed to allow transfer of products between the cold store and the refrigerated vehicle with the least exposure to ambient temperature and with the least possible handling.

- (j) All stores and storage cabinets provided shall be pest-proof and rodent-proof.
- (k) A storage cabinet shall be provided for cleaning tools, brooms, cleaning materials etc.
- (l) A storage room or cabinet shall be provided, where necessary, for the workers' belongings.
- (m) A storage room, where practical, shall be provided for the storage of items such as tables, skirtings, buffet utensils etc.
- (n) All kitchen appliances and equipment such as oven, etc, and piping shall be kept at least 15 cm above the finished floor level.
- (o) The loading bay for the transfer of food from the premises to the vehicle shall be covered and designed to allow transfer of food with the least exposure to the ambient temperature and with the least possible handling.
- (p) The entrance to the loading bay shall be equipped with a door, which shall be kept close except for loading and unloading.

## **6 MARKET**

### **6.1 Objective**

A market shall be designed such that the premises can be kept dry and clean at all times with an effective built-in internal drainage system for each stall. The market shall be well ventilated and adequately lighted with sufficient protection against rain splashing and sun penetration.

### **6.2 Design Criteria**

The design criteria for a market shall be as follows:

- (a) The floors shall be graded towards floor sumps, such that during washing, water does not flow into the surrounding apron area.
- (b) A common service corridor shall be provided for access into the back of each stall.
- (c) Waste sumps shall be sited at service corridors and away from main public area. Inspection Chamber shall be sited outside the market proper.
- (d) Floor sumps shall be provided at service corridor.
- (e) Tap points shall be provided at strategic locations for the washing of the market.
- (f) Market stalls shall preferably be designed with a service counter that stretches across the width of the stall. The service counter shall be designed with entrance, if necessary. A low wall shall be provided to segregate the stalls.
- (g) The minimum stall area shall be 8 sq meters.

The floor level of the stall and common passageway shall be designed such that, during washing, water from the common passageways do not enter the stalls and vice versa.

- (h) Each stall shall be provided with a tap point and a commercial sink, unless stall space does not permit.
- (i) The floor of each stall shall be graded and drained towards either a floor sump or an open scupper drain covered with a grating. The width of the scupper drain shall be at least 150 mm and the depth shall be at least 75 mm at the shallowest end.
- (j) Common passageways for customers shall have a width of at least 2.5 m. Other connecting passageways shall have a width of at least 1.5 m.
- (k) The floor of the common passageway shall be graded and drained away from the stall, towards the floor sumps.

- (l) All scupper drains within the stalls, at the service corridors, and the common passageways shall be provided with floor sumps.
- (m) The floor sumps within the stalls and at the service corridors, as well as floor traps at the common passageways, shall be connected by drain-lines to waste sumps.
- (n) The sanitary piping and details of floor sumps, waste sumps, etc., shall be in accordance with the requirements stated in Appendix 4.
- (o) A loading/ unloading bay shall be provided.
- (p) A common storage (for chillers/freezers) and sorting area shall be considered, if needed.
- (q) A common storage area for general cleansing equipment shall preferably be provided.
- (r) Toilets shall be provided in accordance with Section 2 of the COPEH.

## **7 SWIMMING POOL**

### **7.1 Objective**

This section addresses specifically the design criteria for public swimming pools from the consideration of public health. The pool shall be so designed that the water quality will always remain safe for the public during its operation. Whilst landscaping to enhance the appearance of the pool is encouraged, it shall not be done in such a way or to such an extent that it can contaminate the water in the pool or create a problem for the maintenance of the pool.

A good pool design shall also take into consideration the physical safety of swimmers and safety guidelines mentioned in Appendix 6, the expected user load, water depth, relevant guidelines available within the Singapore Standard 556 (herein referred as "SS 556"), and the regulatory requirements outlined in the Environmental Public Health (Swimming Pools) Regulations, including the requirements for licensing of swimming pools.

### **7.2 Design Criteria**

The design criteria for swimming pool shall be as follows:

- (a) A water-circulation system consisting of pumps, piping, perimeter overflow system, strainer(s), balancing or surge tank, return inlets, filters and other necessary equipment shall be provided for complete circulation of the water through all parts of the pool. The water-circulation pumps and motors shall be of adequate sizes to turn over the entire pool water capacity at least once every 6 hours for the main pool and not more than 2 hours for standalone wading pool.
- (b) A perimeter overflow system shall be provided for at least 50% of the perimeter of the pool. Design of a perimeter overflow system should take into consideration the following:
  - i. It should allow ease of inspection, cleaning, and repair.
  - ii. Be designed and provided with sufficient drains and piping which will not allow backflow of water into the pool, and flooding of the overflow channel during the normal operation of the pool.
  - iii. Water that overflows from the pool shall be recirculated for reuse.
  - iv. A deck level channel design can be adopted for the perimeter overflow system. Drawings of an example of deck level channel can be found in Appendix 5.
- (c) For balancing tanks and surge tanks of swimming pools, the following conditions shall apply:

- i. They shall not contain, or be located directly below any sanitary or sewerage pipes, or such other pipes conveying fluids that may cause contamination to the water in the tanks.
  - ii. There shall be easy and safe access to the tanks to allow for maintenance and inspection of the tanks.
  - iii. Any overflow pipes and air vents installed on the balancing tanks shall be properly screened with non-corrodible, or corrosion-resistant stainless steel mosquito-proof netting of aperture size not exceeding 0.65 mm.
  - iv. For the fresh water supplied to the tanks, the water fittings should not allow any backflow or siphonage (e.g. either by using double check valves or any other means).
- (d) Similar to balancing tanks and surge tanks, the swimming pools shall also not contain, or be located directly below any sanitary or sewerage pipes, or such other pipes conveying fluids that may cause contamination to the water in the pools.
- (e) There shall be at least one standby pump unit and motor to supplement the duty pump provided in the filtration system.
- (f) Flow meters shall be installed on all re-circulation systems and shall be capable of measuring water flows of 1.5 times the designed flow rate.
- (g) The filtration plant shall be the rapid sand, diatomaceous earth or any other acceptable filtration system. Individual filters shall be designed with necessary valves and piping to permit isolation of individual filters for repairs or backwashing while other units are in service.
- (h) Sampling taps shall be provided at the inlet and outlet pipes of the filter.
- (i) Filter backwash water shall be discharged into the sewer via a backwash water holding tank.
- (j) The swimming pool system shall be equipped with chemical feeders, pumps or such other systems or devices, to treat the water in the pool in accordance with the relevant regulatory requirements prescribed in the Environmental Public Health (Swimming Pools) Regulations.
- (k) Pool edges and landscaping shall be of such design and materials so as facilitate easy cleaning.

The design of planting strips(s) close to the pool edge shall incorporate measures to ensure no overflow of water or run-off from the planting strip(s)/ area(s) into the pool water.

- (l) Linkways and bridges across the pool are allowed. Care must be taken in the design to ensure no overflow of water or, runoff from planting strips on the linkways and bridges into the pool water.

- (m) If a submerged facility such as a bar is constructed or placed in the pool to provide food or drinks, a sink connected to a sewer shall be provided.
- (n) For premises with one swimming pool, a minimum of two pre-swim showers shall be provided around the swimming pool. Premises with multiple swimming pools shall have a minimum of two pre-swim showers for the largest pool (based on area of swimming pool), and a minimum of one pre-swim shower around each additional pool.
- (o) Design of indoor swimming pools shall address the issue of adequate ventilation. The minimum ventilation capacity should be in accordance with the relevant guidelines available within SS 556 on ventilation in indoor aquatic facilities.
- (p) The Qualified Person may refer to Appendix 6 for suggested guidelines on safety features in pool design and landscaping.

## **8 DORMITORY**

### **8.1 Design Criteria**

The following guidelines should be used for stand-alone dormitories:

- (a) The occupancy load shall comply with the latest version of SCDF's Fire Code on the section on Workers Dormitories  
(Available at: [http://www.scdf.gov.sg/content/scdf\\_internet/en/building-professionals/publications\\_and\\_circulars.html](http://www.scdf.gov.sg/content/scdf_internet/en/building-professionals/publications_and_circulars.html) )
- (b) The room shall be adequately ventilated and lighted.
- (c) Adequate number of toilets and sanitary fittings shall be provided in accordance with Section 2 of the COPEH.
- (d) Where cooking area is to be provided in the dormitories, such provisions shall be in accordance with the requirements stipulated under Section 3.4 of the latest edition of Singapore Standard SS 547.

## **9 ANTI-MOSQUITO BREEDING**

### **9.1 Objective**

During the design of any building or structures, the QP shall take into consideration and avoid features that may result in water stagnation and become potential breeding habitat for mosquitoes. Any part of a building where water stagnation may occur shall be provided with permanent and safe access for maintenance purpose.

### **9.2 Roof Gutter**

a. With effect from 1 Nov 2005, no roof gutters shall be installed for any new developments.

b. With effect from 1 Sep 2016, existing roof gutters shall be removed or sealed up in all building works involving roof structures which are also A&A or reconstruction works, where such building works are as defined under the Building Control Act.

c. Qualified Persons (QP) are advised to consider alternative designs/solutions to ensure effective conveyance and drainage of rain water.

### **9.3 Air-Conditioning Tray**

Trays or receptacles should not be placed beneath or on top of any air-conditioning unit as they may create conditions favourable for mosquito breeding. If there is a need for installation of such trays to address other issues, premises owners should ensure that they install HDB's patented air-conditioner trays. Regular checks and maintenance of the tray is still necessary to ensure there are no chokages at the drainage point that could result in water ponding. Premises owners are liable to be penalised under the Control of Vectors and Pesticides Act (CVPA) should NEA find the trays creating conditions favourable to the breeding and propagation of mosquitoes.

### **9.4 Floor Trap**

Adequate measures, such as installation of anti-mosquito devices at the floor trap, shall be taken to prevent mosquitoes from breeding in the water seal of the floor trap.

## **10 PREMISES WITH CATTLE**

### **10.1 Design Criteria**

Living quarters or dormitories shall not be sited in stables, cattle-sheds, or any building used or intended to be used for the keeping of buffaloes, cows, oxen, sheep, goats and horses, etc.

## 11 STORAGE AND COLLECTION SYSTEM FOR RECYCABLES AT STRATA-TITLED PROPERTIES WITH RESIDENTIAL UNITS

### 11.1 Objective

A recyclables storage and collection system shall be installed for strata-titled properties with residential units so that residents can conveniently recycle their waste. The design and layout of the system shall not create a nuisance to residents and neighbouring premises or cause pollution to the environment. A recyclables storage and collection system can comprise designated recycling points for placing recycling receptacles and/or a recyclables chute system. The recyclables storage and collection system shall be adequately sized to meet the anticipated recyclables output without compromising the refuse storage and collection system.

### 11.2 Recyclables Output

- (a) “Recyclables” is defined under the First Schedule of Environmental Public Health (General Waste Collection) Regulations as follows:-

| Recyclables      | Examples  |
|------------------|---|
| Paper products   | Newspaper, computer printouts, writing paper, envelopes, car park coupons, brochures/pamphlets, magazines, books, cardboard and paper packaging (such as cereal boxes and drink cartons) and other paper products but excluding tissue paper and paper food wrappers    |
| Metal products   | Cans or containers made of metal such as soft drink cans, beer cans, milk powder tins and food cans.  |
| Plastic products | Bottles or containers made of plastic such as detergent containers, milk containers, mineral water bottles, soft drink bottles, juice bottles, plastic bags, plastic packaging and other plastic products but excluding styrofoam, disposable cutleries and crockeries. |
| Glass products   | Jars, wine bottles and beer bottles but excluding light bulbs, window glass, porcelain, ceramic and fish tanks.   |

- (b) The daily recyclables output shall be computed to be either **an additional 30%** by volume of the daily refuse output estimated under section 1.2 or 240L/d of recyclables, whichever is higher.

### 11.3 Designated Recycling Points for Recycling Receptacles

All premises shall be provided a recycling point at each residential block for depositing recyclables. The recycling system within the premises shall meet the following requirements:-

- (a) Arrangements shall be made for the consolidation and storage of the recyclables from each residential block's recycling point to a main recycling point. The main recycling point shall be accessible to a recyclables collection vehicle. The main recycling point shall allow the placement of bulk bin(s) or container(s) to accommodate the collection and storage of the minimum daily recyclables output specified in section 11.2. The main recycling point shall be separate and independent from, and also not compromise the refuse storage and collection system.
- (b) A setback distance of at least 13m shall be provided to ensure that the main recycling point is accessible to recyclables collection vehicles. The main recycling point floor level shall be at the same level as the vehicular access road. The distance for recyclables collection vehicles to reverse into the main recycling point shall be minimised.
- (c) The capacity of the intermediate recycling receptacles at intermediate recycling points shall not be deducted from the required capacity (as calculated under 11.3(a)) of the recycling receptacles that are placed at the main recycling point.
- (d) The collection of recyclables shall not cause any nuisance to estate occupants and occupants of neighbouring premises.

### 11.4 Recyclables Chute System

All new formal development applications submitted to URA from 1 April 2018 onwards that are taller than four (4) storeys and for which refuse chutes are required shall also be provided with separate chutes for recyclables. Applicants shall provide a copy of URA's Provisional Permission in their DC application to NEA.

The recyclables chute system shall meet the following requirements: -

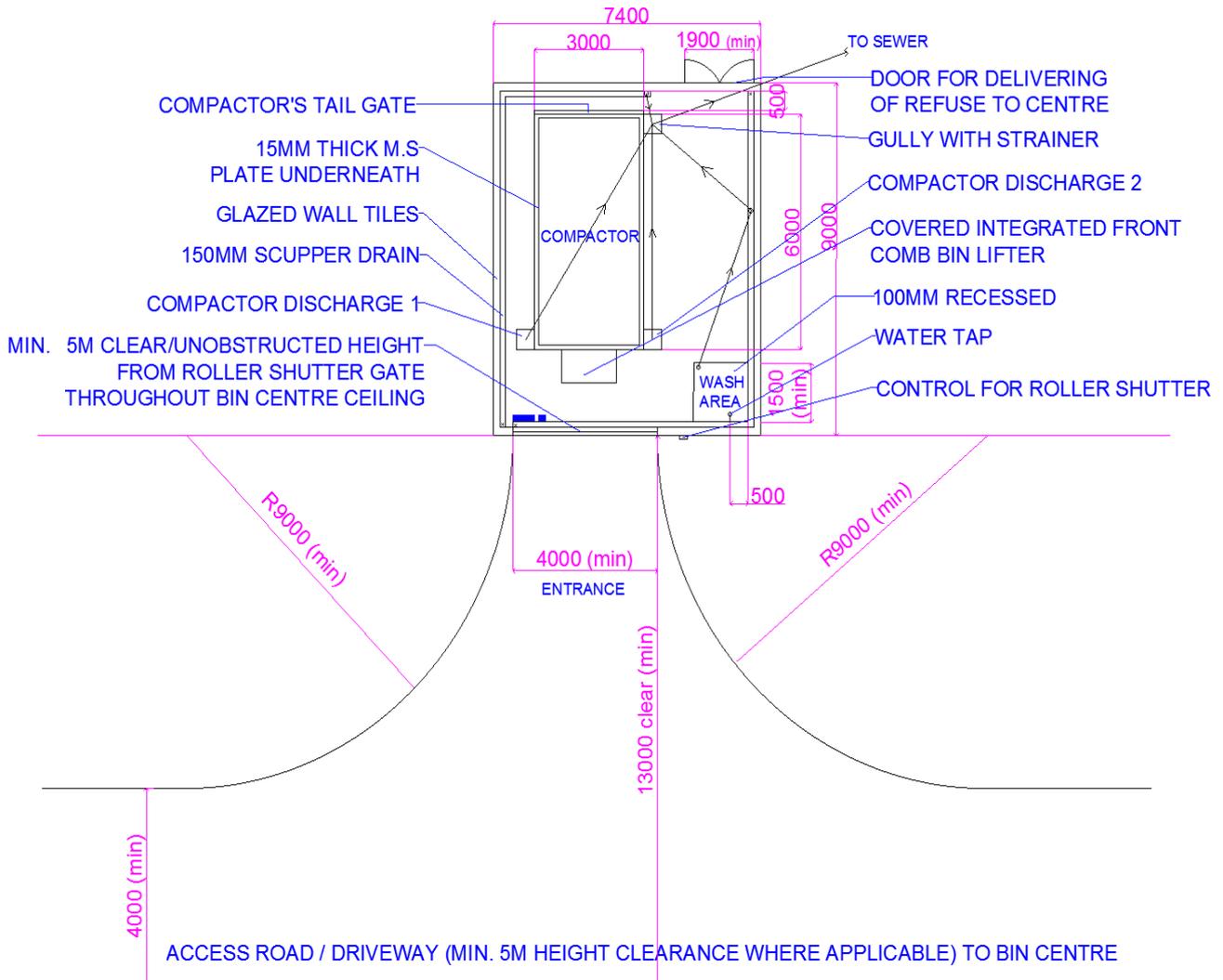
- (a) A recyclables chute shall be provided next to every refuse chute in the premises. The recyclables chute shall comply with the same requirements for refuse chutes stated in section 1.3.
- (b) A recyclables chute chamber shall be provided. It shall be connected to a recyclables chute and house a recycling bin. The recyclables chute and its chamber shall be suitably located to facilitate easy and nuisance-free removal of recyclables and shall be designed to meet the same requirements as those for the refuse chute chamber stated in section 1.4. The capacity shall be sufficient for at least one day of recyclables output

from all the premises connected to the recyclables chute. Recyclables deposited in the recyclables chute chamber shall be consolidated and stored at a main recycling point for collection. The main recycling point shall comply with the same requirements stated in section 11.3(a) and 11.3(b).

- (c) A recyclables collection room shall be built at the bottom of a centralised recyclables chute to house a large container. Recyclables collected in the container are transferred to the recyclables collection vehicle. The recyclables collection room shall comply with the same requirements as those for refuses room stated in section 1.5 and a minimum capacity to accommodate two (2) days of recyclables output.
- (d) A pneumatic recyclables chute conveyance system shall comply with the same requirements that apply to pneumatic waste conveyance systems stated in section 1.7. The capacity of the pneumatic recyclables chute conveyance system shall be sufficient for a minimum of two (2) days of recyclables output.
- (e) The complete recyclables chute system shall be designed to minimise pilferage and/or damage of recyclables.

## APPENDIX 1:

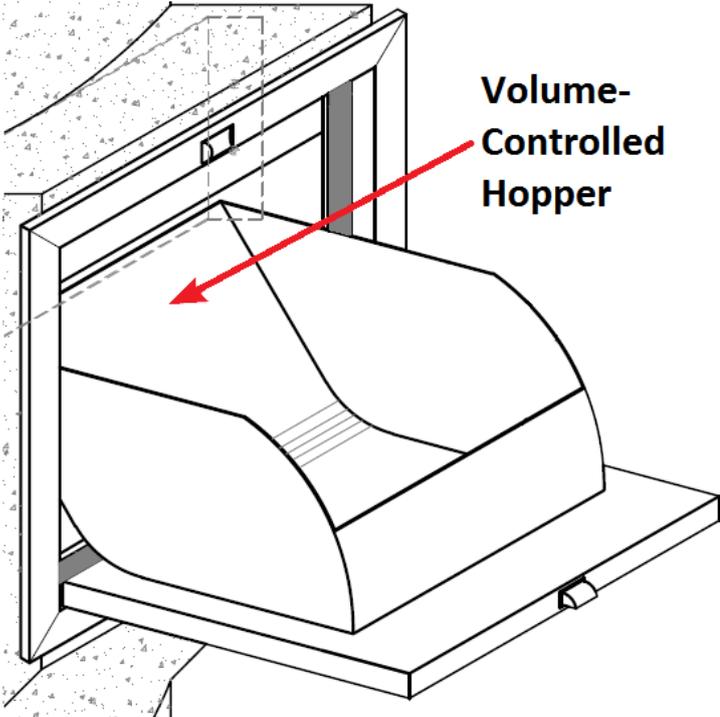
### APPENDIX 1A: TYPICAL LAYOUT OF BIN CENTRE



#### NOTES:

- NO ENCLOSED ROOM WITHIN BIN CENTRE
- ONLY CRITICAL DIMENSIONS ARE INDICATED ON PLAN IN MM UNLESS OTHERWISE STATED
- FOR PWCS, THE BIN CENTRE ROOM SPACE IS FOR THE STORAGE SYSTEM ONLY: ALL OTHER ANCILLARY EQUIPMENT SHALL BE STORED IN A ROOM ADJACENT TO THE BIN CENTRE

**APPENDIX 1B: TYPICAL VOLUME-CONTROLLED REFUSE HOPPER**



## **APPENDIX 2: PROVISION OF SANITARY FACILITIES**

Sanitary facilities shall be provided in accordance with the requirements listed below. The floor area for Category (1) to (3) refers to the **gross floor area**.

| Categories of Places   | Number of Sanitary Facilities |     |      |    |     |
|--|-------------------------------|-----|------|----|-----|
|  | Female                        |     | Male |    |     |
|  | WC                            | WHB | WC   | UR | WHB |
| <b>(1) SHOPPING MALL (EACH FLOOR)</b>  |                               |     |      |    |     |
| Not more than 350 sq m   | 1*                            | 1*  | -    | -  | -   |
| 351 sq m to 700 sq m   | 3                             | 2   | 1    | 1  | 1   |
| 701 sq m to 1,000 sq m   | 5                             | 3   | 1    | 2  | 1   |
| 1,001 sq m to 1,500 sq m   | 7                             | 4   | 1    | 3  | 2   |
| 1,501 sq m to 3,000 sq m   | 8                             | 4   | 2    | 3  | 3   |
| 3,001 sq m to 5,000 sq m   | 12                            | 6   | 3    | 4  | 4   |
| Every additional 2,000 sq m or less in excess of 5,000 sq m  | 3                             | 2   | 1    | 1  | 1   |
| Toilet facilities shall be provided on every floor of shopping malls. The number of sanitary facilities provided shall be based on the gross floor area of each floor. |                               |     |      |    |     |
| <b>(2) SUPERMARKET/ WET MARKET</b>   |                               |     |      |    |     |
| Not more than 350 sq m   | 1*                            | 1*  | -    | -  | -   |
| 351 sq m to 700 sq m   | 2                             | 1   | 1    | 1  | 1   |
| 701 sq m to 1,000 sq m   | 3                             | 2   | 1    | 2  | 1   |
| 1,001 sq m to 1,500 sq m   | 4                             | 3   | 1    | 3  | 2   |
| 1,501 sq m to 3,000 sq m   | 5                             | 3   | 2    | 3  | 3   |
| 3,001 sq m to 5,000 sq m   | 7                             | 4   | 3    | 4  | 4   |
| Every additional 2,000 sq m or less in excess of 5,000 sq m  | 2                             | 1   | 1    | 1  | 1   |
| <b>(3) EATING ESTABLISHMENT/ FOOD CENTRE/ BAR/ NIGHTCLUB</b>   |                               |     |      |    |     |
| Not more than 250 sq m   | 1*                            | 1*  | -    | -  | -   |
| 251 sq m to 500 sq m   | 2                             | 1   | 1    | 1  | 1   |
| 501 sq m to 750 sq m   | 3                             | 2   | 1    | 2  | 2   |
| 751 sq m to 1,000 sq m   | 5                             | 2   | 2    | 3  | 2   |
| 1,001 sq m to 1,500 sq m   | 6                             | 3   | 2    | 4  | 3   |
| 1,501 sq m to 2,000 sq m   | 8                             | 4   | 3    | 5  | 4   |
| 2,001 sq m to 3,000 sq m   | 9                             | 5   | 3    | 6  | 4   |
| 3,001 sq m to 4,500 sq m   | 11                            | 6   | 4    | 7  | 5   |
| Every additional 1,500 sq m or less in excess of 4,500 sq m  | 2                             | 1   | 1    | 1  | 1   |

| Categories of Places   | Number of Sanitary Facilities |     |      |    |     |
|--|-------------------------------|-----|------|----|-----|
|  | Female                        |     | Male |    |     |
|  | WC                            | WHB | WC   | UR | WHB |
| <b>(4) CONFERENCE HALL/ CINEMA/ THEATRE</b> (seating capacity)   |                               |     |      |    |     |
| <b>CONVENTION HALL/ EXHIBITION HALL</b> (capacity)   |                               |     |      |    |     |
| Not more than 150 persons  | 5                             | 3   | 1    | 2  | 1   |
| 151 to 300 persons   | 8                             | 4   | 2    | 3  | 2   |
| 301 to 450 persons   | 10                            | 5   | 3    | 4  | 3   |
| 451 to 600 persons   | 13                            | 7   | 3    | 5  | 4   |
| 601 to 900 persons   | 17                            | 9   | 3    | 7  | 5   |
| Every additional 100 persons or less in excess of 900 persons  | 1                             | 1   | -    | -  | -   |
| Every additional 150 persons or less in excess of 900 persons  | -                             | -   | 1    | 1  | 1   |
| <b>(5) PARK</b>  | 2                             | 2   | 2    | 2  | 2   |
| <b>Note: 2 nos of shower rooms each shall be provided for the female and male public toilet block when the Park is abutting a beach.</b> |                               |     |      |    |     |
| <b>(6) BUS TERMINAL/ INTERCHANGE</b>   |                               |     |      |    |     |
| Not more than 20 bus bays  | 5                             | 3   | 1    | 2  | 1   |
| 21 to 50   | 10                            | 5   | 2    | 4  | 2   |
| 51 to 100  | 15                            | 8   | 3    | 6  | 3   |
| More than 100  | 18                            | 9   | 4    | 7  | 4   |
| <b>(7) PETROL STATIONS</b>   | 1                             | 1   | 1    | 1  | 1   |

| Categories of Places   | Number of Sanitary Facilities |     |      |    |     |
|--|-------------------------------|-----|------|----|-----|
|  | Female                        |     | Male |    |     |
|  | WC                            | WHB | WC   | UR | WHB |
| <b>(8) MRT STATIONS<br/>TOILET (CONCOURSE)</b>   |                               |     |      |    |     |
| (a) Stations without Retail Shops, or<br>with retail space not more than 1,000<br>sq m   | 7                             | 4   | 2    | 2  | 2   |
| (b) Station with Retail Shops,<br>Retail space of  |                               |     |      |    |     |
| 1,001 to 1,500 sq m  | 12                            | 6   | 3    | 4  | 4   |
| Exceeding 1,500 sq m   | 17                            | 9   | 4    | 6  | 5   |
| <b>(9) STADIUM</b>   |                               |     |      |    |     |
| Capacity   |                               |     |      |    |     |
| Not more than 2,000 persons  | 10                            | 6   | 3    | 7  | 6   |
| 2,001 to 5,000 persons   | 15                            | 8   | 5    | 10 | 8   |
| 5,001 to 10,000 persons  | 26                            | 14  | 8    | 18 | 14  |
| 10,001 to 20,000 persons   | 40                            | 20  | 12   | 28 | 20  |
| 20,001 to 50,000 persons   | 60                            | 32  | 18   | 42 | 32  |
| 50,001 to 100,000 persons  | 100                           | 46  | 30   | 70 | 46  |
| <b><i>Sanitary facilities within the stadium<br/>shall be uniformly distributed.</i></b> |                               |     |      |    |     |

| Categories of Places                                      | Number of Sanitary Facilities |     |    |    |      |     |    |    |    |
|---|-------------------------------|-----|----|----|------|-----|----|----|----|
|   | Female                        |     |    |    | Male |     |    |    |    |
|   | WC                            | WHB | BR | BH | WC   | WHB | UR | BR | BH |
| <b>(10) PUBLIC SWIMMING POOL</b>                          |                               |     |    |    |      |     |    |    |    |
| Up to 250 sq m  | 2                             | 1   | 2  | 2  | 1    | 1   | 1  | 2  | 2  |
| 251 sq m to 500 sq m                                      | 4                             | 2   | 3  | 3  | 2    | 2   | 2  | 3  | 3  |
| 501 sq m to 1,000 sq m                                    | 6                             | 3   | 4  | 3  | 3    | 3   | 3  | 4  | 3  |
| 1,001 sq m to 1,500 sq m                                  | 7                             | 4   | 5  | 4  | 3    | 4   | 4  | 5  | 4  |
| Exceeding 1,500 sq m                                      | 9                             | 5   | 8  | 6  | 4    | 5   | 5  | 8  | 6  |
| <b>(11) CONSTRUCTION SITE/<br/>DORMITORY</b>              |                               |     |    |    |      |     |    |    |    |
| (a) Construction site with living quarters/ dormitories   |                               |     |    |    |      |     |    |    |    |
| Every 15 male workers or less                             | -                             | -   | -  | -  | 1    | 1   | 1  | 1  | -  |
| Every 15 female workers or less                           | 2                             | 1   | 1  | -  | -    | -   | -  | -  | -  |
| (b) Construction site without living quarters,            |                               |     |    |    |      |     |    |    |    |
| Every 25 male workers or less, up to 500 male workers     | -                             | -   | -  | -  | 1    | 1   | 1  | 1  | -  |
| Every 25 female workers or less, up to 500 female workers | 2                             | 1   | 1  | -  | -    | -   | -  | -  | -  |

**Notation:**

\*: To be used by both male and female

WC: Water Closet

WHB: Wash Hand Basin

UR: Urinal

BH: Bench with Hanger

BR: Bathroom with bench

## **APPENDIX 3: MIST GENERATING SYSTEM AND FAN**

Legionella bacteria can be found naturally in water sources in the environment. They may colonise poorly designed or maintained water systems such as mist generating systems and misting fan (or devices). When people, especially those with weak immunity, are exposed to the mist or water aerosols containing legionella bacteria, they may acquire legionnaires' disease or Pontiac fever, which are collectively known as legionellosis. To reduce the risk to public health due to inhalation of legionella bacteria, it is important to minimise the conditions favouring bacteria proliferation in such water systems and thereby reduce the human exposure to contaminated mist or water aerosols.

The owner(s) and operator(s) or the mist generating systems or misting fans shall ensure that:

- (a) The system shall be made from corrosion resistant materials that can withstand the pressure of the water aerosolized.
- (b) The design of the system shall be such that the water is drained off during the standby conditions to avoid proliferation of bacteria in stagnant water.
- (c) Misting fans shall be installed at such height or in a manner that the intense stream of mist (as it leaves the nozzle) is not blown directly at a person's face.
- (d) The water used to produce the mist shall be of drinking water quality.
- (e) The system shall be equipped with a UV lamp or such other antimicrobial device after the filter, to disinfect the water and minimise the proliferation of microbiological growth.
- (f) All chokages (at nozzles or spray heads) shall be cleared promptly. The entire system (including interior piping, nozzles, pump, antimicrobial device, etc.) shall be cleaned and disinfected by a competent person, at least once every three months (or more frequently if recommended by the manufacturer) and kept in a good working condition.
- (g) When a system is switched on, care shall be taken to avoid exposure of initial mist stream to any person. For systems that have been shut down for five days or more, cleaning and disinfection of the entire system shall be carried out before switching the system on.
- (h) Records of any remedial or maintenance work, inspection or test carried out shall be kept and made available for inspection.

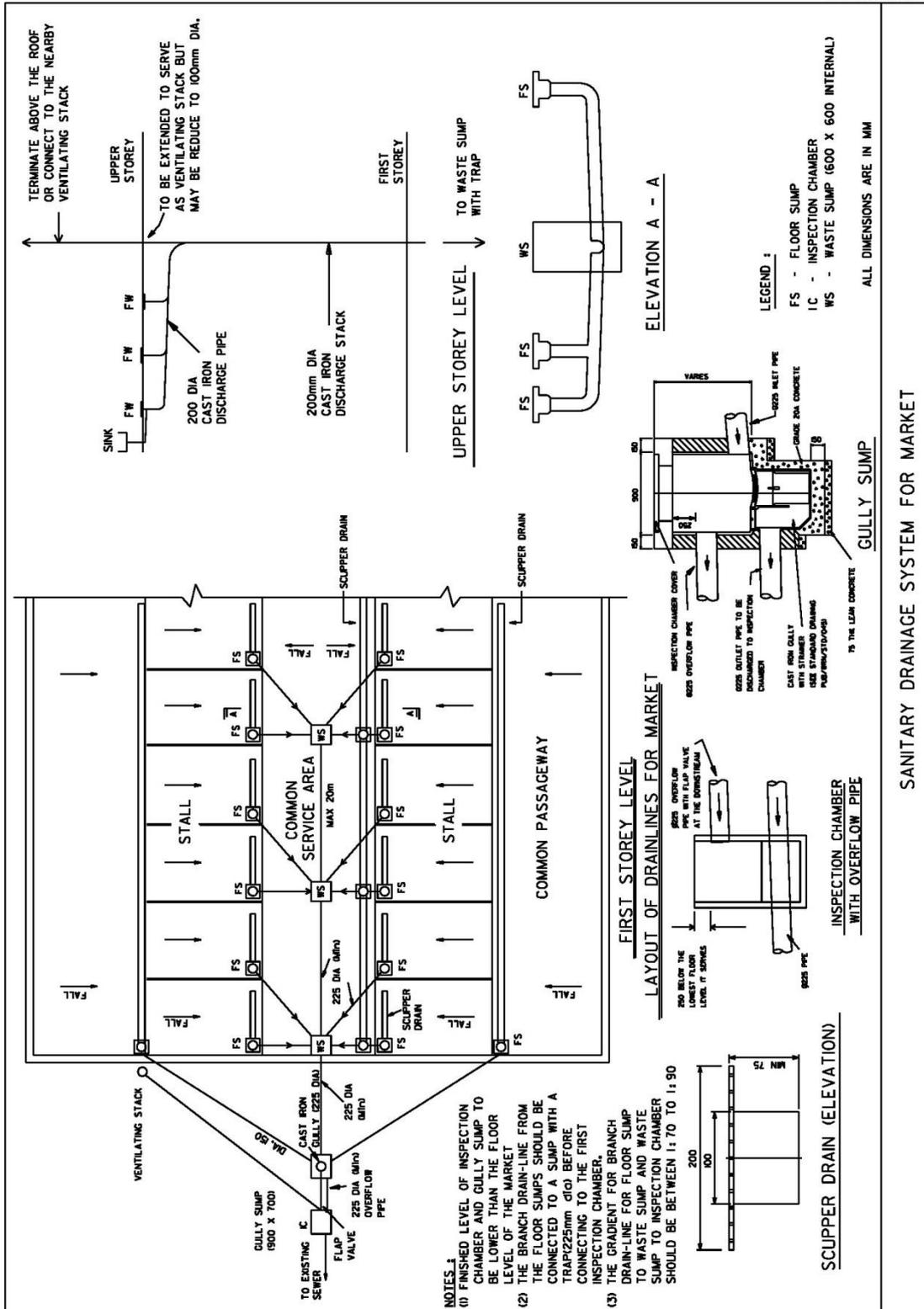
## **APPENDIX 4: PLUMBING DETAILS FOR MARKET**

An example of the layout of the drain lines for the stalls, the common service corridor, and the common passageway is shown in Drawing 1.

- (a) The floor sumps from an upper storey shall be connected to a vertical discharge stack of cast iron or UPVC of at least 250 mm in diameter. The discharge stack shall be connected to a waste sump.
- (b) Provision of floor sump to be in accordance with Drawing No. 3-13 of Code of Practice on Sewerage & Sanitary Works
- (c) Provision of waste sump to be in accordance with Drawing No. 3-10 and Section 3.1.3.11(b) of Code of Practice on Sewerage & Sanitary Works
- (d) The inspection chamber shall measure 900 mm x 700 mm in dimensions [Please made reference to Drawing No. 3-7 Of Code of Practice on Sewerage and Sanitary Works]
- (e) The last inspection chamber before the sewer manhole shall be provided with an overflow pipe of at least 225 mm in diameter. The overflow pipe shall have a flap valve.
- (f) The main drain-lines shall be at least 200 mm in diameter with a minimum gradient of 1:150 but not exceeding 1:40. The main drain-line connected to the last inspection chamber shall have a gully trap.
- (g) The branch drain-lines connecting the floor sumps within the stalls and at the service corridors to the waste sumps shall be at least 225 mm in diameter. The other branch drain-lines shall be at least 150 mm in diameter. All branch drain-lines shall have a minimum gradient of 1:90 but not exceeding 1:30.
- (h) Layout of drainlines to be in accordance with Drawing No. 3-12a of Code of Practice on Sewerage & Sanitary Works.

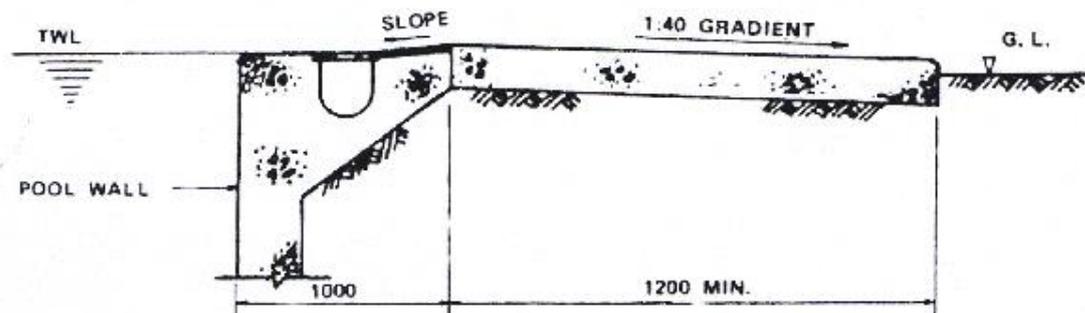
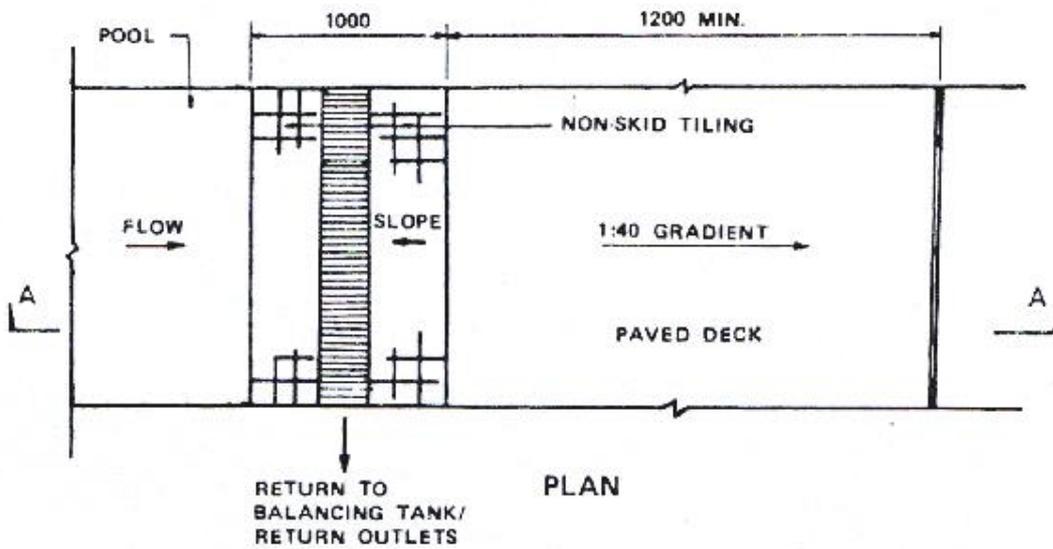
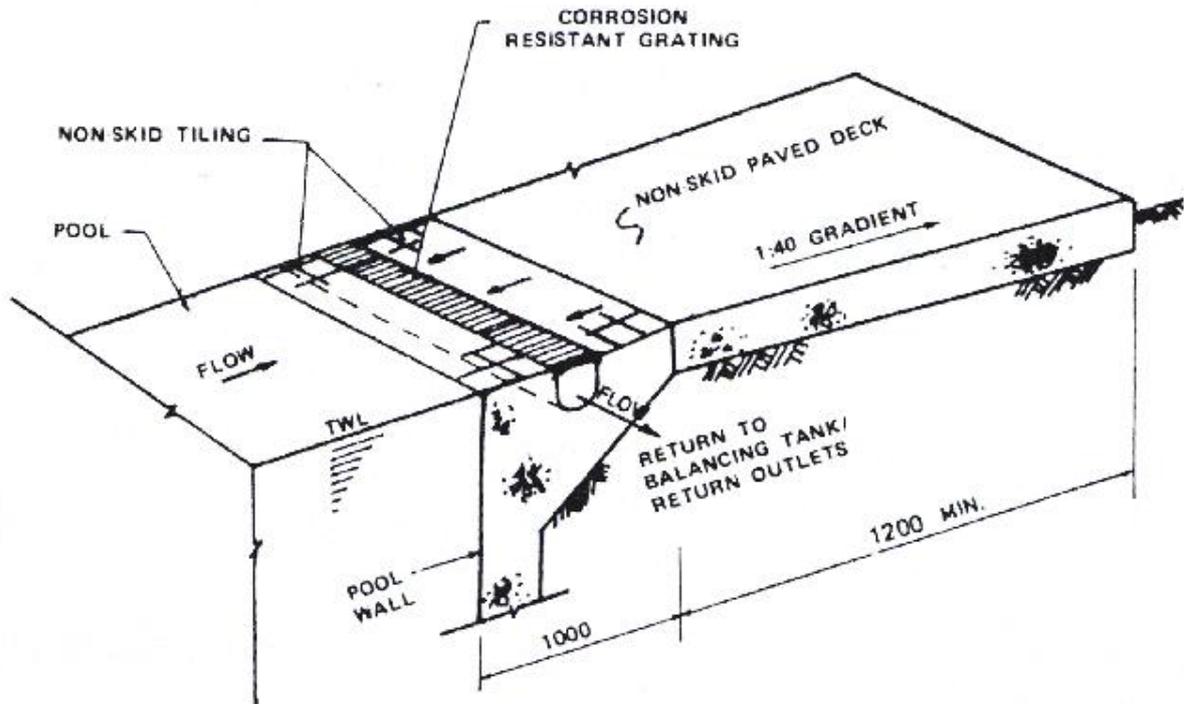
# DRAWING 1 - LAYOUT OF DRAINLINES FOR MARKET

DRAWING NO. 3-120



SANITARY DRAINAGE SYSTEM FOR MARKET

## APPENDIX 5: DETAILS OF DECK LEVEL CHANNEL



NOTE:  
ALL DIMENSIONS  
ARE IN MILLIMETRES

## **APPENDIX 6: SUGGESTED GUIDELINES ON SAFETY FEATURES IN POOL DESIGN AND LANDSCAPING**

The suggested guidelines below are recommendations for QP's consideration when designing pool facilities and surrounding landscaping. They do not form part of the design criteria stipulated for Building Plan submission.

- (a) The pool bottom of the shallow area and steps of the swimming pool shall be of non-slip finish. Grip tiles used along the edges of the pools shall also be non-slippery and non-abrasive to avoid injuries to users.
- (b) Where the pool bottom transits to a steeper slope, the transition shall be marked on the bottom and walls of the pool by a stripe of dark contrasting colour at least 15 cm wide.
- (c) At any part of the swimming pool with water depth less than 1.5 m, the slope of the floor shall be uniform and not steeper than 1:12.
- (d) The pool shall have at least two means of exit located so as to serve both ends of the pool. The distance from any point in the pool to an exit shall not be more than 15 m.
- (e) The depth of water in metres shall be marked plainly in numerals of at least 100 mm in height embedded into the edge of the pool wall and the corresponding pool deck. Depth markings shall be provided at the shallow and deep ends of the pool and the transition point.
- (f) The pool should have no sharp or raised edges or projections that could cause injury, especially below the water level.
- (g) Perimeter overflow system, drains, openings, sumps, or inlets and outlets of the pool water circulation system should have suitable protective covers or grilles. They should be designed to prevent arms and feet getting trapped. All suction outlet covers must be designed to prevent entrapment and undue suction to prevent injuries.
- (h) The depth of water in the wading pool shall not exceed 500 mm.
- (i) At least 5 m of unobstructed headroom above the diving board shall be provided.
- (j) The diving board shall not be placed more than 1 m above the surface of the water for a depth of 2.5 m of water in the swimming pool.
- (k) A horizontal separation of 3 m shall be provided between adjacent diving boards and between any diving board and the sidewall.

## **APPENDIX 7: GLOSSARY OF TERMS**

The definitions of the following terms apply in this document:

### **1. Sensor-operated flush valves**

A valve with an electronic control device that is automatically actuated to supply a predetermined quantity of water (not more than 4.5 and 1.5 litres of water per flush for WC and urinal respectively) to a WC or urinal for the purpose of flushing after each use.

### **2. Manual override**

A built-in feature in the urinal sensor-operated flush valve to allow the user to manually actuate an immediate flushing of the urinal by pressing a button. The sensor and the manual override will not function in the event of a power supply failure.

When the override button is used, the manual override feature overrides the sensor operation and discharges only a preset volume of water (not more than 1.5 litres of water per flush) even if the button continues to be held actuated. No second flush shall be activated when the user leaves the urinal.

### **3. Manual override cum by-pass**

A built-in feature in the WC sensor-operated flush valve to allow the user to manually actuate an immediate flushing of the WC by pressing a button. The sensor and the manual override will not function in the event of a power supply failure. The manual by-pass feature will enable the flush valve to continue to function manually in the event of a power supply failure.

When the override cum by-pass button is used, the manual override and by-pass features override the sensor operation and discharge only a preset volume of water (not more than 4.5 litres of water per flush) even if the button continues to be held actuated. No second flush shall be activated when the user leaves the WC.

### **4. Waterless Urinals**

A urinal made of urine repellent vitreous china or acrylic and requiring no flush valves (i.e. water free). The fixture's drain outlet includes an immiscible liquid sealant that floats on top of the urine layer. This combination seal blocks out sewer gases, and blocks out urine odors. Also includes waterless urinals of mechanical cartridge (membrane or sealant) and microbial types.

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