CODE OF PRACTICE FOR SAFE SUPPLY AND USE OF RECYCLED WATER

Water Supplies Department
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TABLE OF CONTENTS

List of Tables

List of Figures

List of Annexes

List of Abbreviations

CFU	Colony Forming Unit
DEVB	Development Bureau
FRC	Free Residual chlorine
GWTP	Grey Water Treatment Plant
NTU	Nephelometric Turbidity Units
RWSP	Recycled Water Safety Plan
TMF	Temporary Mains Water for Flushing
TON	Threshold Odour Number
TRC	Total residual chlorine
TSE	Treated sewage effluent
WHO	World Health Organization
WSD	Water Supplies Department
WSP	Water Safety Plan

Glossary

Authorized Person	An Authorized Person registered under the Buildings Ordinance
Disinfection	A process capable of removing or inactivating pathogens
Fitting	Any apparatus, cistern, cock, equipment, machinery, material, tank, tap and valve; and any appliance or device other than a meter, which is installed or used in a fire service or inside service
Grey water	Used water collected from baths, lavatory basins, wash basins, sinks or similar fitments
Hazard	[a]A biological, chemical, physical or radiological agent in, or condition of water, with the potential to cause an adverse health effect. Another word for hazard includes "contaminant"
Inside Service	The pipes and fittings in premises, and any pipes and fittings between the premises and a connection to the main (other than the pipes and fittings forming part of a fire service) which are used or are intended to be used for the purposes of a supply
Hazardous event	[a]A process whereby a hazard/contaminant is introduced into a water supply

Point of application	Represents the point at which recycled water is reused for a particular activity
Reclaimed water	A water resource generated by further processing treated effluent from sewage treatment works
Recycled Water	Reclaimed water, treated grey water and harvested rainwater
Water Authority	The Director of Water Supplies
Waterworks	Any property occupied, used or maintained by the Water Authority for the purpose of water supply, including all water gathering grounds

[a] - represents the definition adopted by the World Health Organization (2017).

1. Introduction

1.1 Background

1.1.1 The Water Supplies Department (WSD) has been implementing the Total Water Management (TWM) Strategy by taking forward a host of water demand and supply management measures. The adoption of recycled water for non-potable uses is one of the major initiatives to contain fresh water demand growth.

1.1.2 WSD is planning or implementing a host of projects for the Government's centralised supply of recycled water for non-potable uses such as toilet flushing, landscape irrigation, street cleansing etc. A multiple barrier approach ranging from establishment of water quality standard, use of distinguishable pipe identification, addition of biodegradable food grade dye into the recycled water for clear identification and formulation of code of practice etc. is adopted to ensure the recycled water is safe for its intended applications.

1.2 Objectives

1.2.1 Given the non-potable uses of the recycled water, this Code of Practice aims to provide general advisory guidelines, but not exhaustive, for the production and use of recycled water supplied by WSD in order to safeguard the safety and health of the operation and maintenance staff in the water recycling facilities, users of the recycled water and the general public. The use of recycled water in district cooling systems or cooling towers falls outside the scope of this Code of Practice.

1.2.2 This Code of Practice should be read in conjunction with recommendations provided by suppliers / manufacturers of the system equipment as well as relevant ordinances and regulations in Hong Kong.

1.2.3 Users who choose to adopt this Code of Practice are responsible for making their own assessment, judgement and adjustment to suit the specific needs and situation of their projects or uses. WSD does not accept any liability and responsibility for any loss or damage whatsoever arising out of or in connection with the use of this Code of Practice or reliance placed on it.

1.3 Water Quality

1.3.1 The recycled water comprises reclaimed water (from the processing of treated sewage effluent (TSE) from sewage treatment works), treated grey water (from the treatment of used water collected from baths, wash basins, kitchen sinks or similar fitments) and harvested rainwater.

1.3.2 Recycled water systems shall be designed in a way that ensures the effluent is fit for purpose and presents no undue risk to health. Water quality of the recycled water shall meet the standards stipulated in **Table 1.1.**

Table 1.1 Water Quality Standards for Recycled Water

Parameter	Unit	Recommended water quality standards
E. coli	cfu/100 mL	Non detectable
Total residual chlorine	mg/L	≥ 1 exiting treatment system; ≥ 0.2 at user end
Dissolved oxygen in recycled water	mg/L	≥ 2
Total suspended solids (TSS)	mg/L	≤ 5
Colour	Hazen unit	≤ 20
Turbidity	NTU	≤ 5
pH		6 - 9
Threshold Odour Number (TON)		≤ 100
5-day Biochemical oxygen demand (BOD_5)	mg/L	≤ 10
Ammoniacal nitrogen (NH_3-N)	mg/L as N	≤ 1
Synthetic detergents	mg/L	≤ 5

Notes:
1. Apart from total residual chlorine which has been specified, the water quality standards for all parameters shall be applied at the point-of-use of the system.
2. Where recycled water is treated for immediate usage, the level of total residual chlorine exiting treatment system may be lower than the one specified in this table.
3. Immediate usage means the collected grey water/ rainwater is drawn into the treatment process immediate before a particular round of usage and the treated water will be depleted after that round of usage is completed.

1.3.3 For recycled water sourced from sewage with chemical (e.g. pollutants from industrial activities and pharmaceutical residues) or microbiological (e.g. Cryptosporidium and Giardia) risk, a comprehensive risk assessment shall be conducted to assess whether additional parameters should be included.

1.3.4 **Table 1.2** summarises the sources of recycled water, as well as their potential uses.

Table 1.2 Recycled Water Sources and End Uses

Grey Water Sources	Rainwater Sources	Reclaimed Water Sources	Potential End Use After Treatment
• Wash basins • Baths • Showers • Dishwashers • Laundry machines • Kitchen sinks[1]	• Roofs • Permeable paving • Non-permeable paving • Surface runoff from grass and landscaped areas • Air conditioning condensate water	• TSE from sewage treatment works, i.e. effluent polishing plant (EPP)	• Toilet flushing • Drip irrigation • Sprayed irrigation • Water features • Car washing • External cleaning • Street cleansing • Industrial processes (other than food processes)

Note:
1. For the kitchens with food grinder installed, it is not encouraged that food waste grinders connected directly to grey water collection system, as it might induce clogs in local pipes, the downstream grey water treatment plant must capture and treat it.

1.3.5 For the new centralised water recycling plant in Hong Kong, a plant-based water safety plan (WSP) should be developed to ensure that the production, operation and maintenance processes will be carried out in a safe manner and the recycled water can be safely used by consumers.

1.3.6 Recycled water shall be prohibited from the following uses:

(a) Consumed by humans or animals

(b) Used for cleaning of human or animal body such as eye washing, mouth rinsing and wound cleaning

(c) Used to top-up swimming pools or spas

(d) Used for food preparation or washing dishes or kitchen appliances

(e) Used for irrigating in a way that will contact edible parts of herbs, fruit, or vegetables

(f) Piped to hot water services

(g) Air-conditioning system

Part I: Water Recycling Facilities of Government

2. Design and Construction Requirements

2.1 Source Water Collection

Grey Water Collection

2.1.1 Grey water shall be collected in a drainage pipework separated from the sewer pipes and allowed to flow from collection appliances to the grey water treatment system via gravity or siphonic action. Surplus grey water shall be collected and discharged directly to the sewer.

2.1.2 The grey water collection pipework shall be dedicated to the following sources:

(a) Bathroom wash basins

(b) Showers and baths

(c) Clothes washing machines / laundry water

(d) Kitchen sinks

(e) Dishwashers

2.1.3 The collection pipework shall be designed to completely separate blackwater (water from toilet flushing) from the grey water system to prevent contamination.

2.1.4 To reduce the generation of foam, the grey water collection pipework should be designed to minimise turbulence and the use of bends. It should be free draining to avoid stagnation and blockage. Suitable non-intrusive ultrasonic type of flow measurement devices could also be used to avoid blockage.

2.1.5 The collection pipework shall be properly identified and labelled in accordance with Section 7.

2.1.6 A bypass shall be installed around the grey water system allowing the collected grey water to flow directly to the sewer during periods of maintenance or system isolation. Gate valve, for example, as of bypass device / fitting could be considered to install before entering buffer storage tank. The bypass shall not tie into the storm drain system.

2.1.7 Due to water quality concerns from bacterial growth, collection systems should be designed and constructed such that grey water reaches the treatment process as soon as possible. Intermediate storage should be avoided except the grey water / rainwater collection tanks specified in Section 2.2 below.

2.1.8 Housing and / or commercial developers may be required to construct the dedicated grey water collection pipe network which is mandated and enforced by the relevant land documents of the housing and / or commercial developments areas.

Rainwater Collection

2.1.9 Rainwater harvesting system collection consists of:

(a) Roof catchment

(b) Gutters

(c) Downpipes

(d) At-grade catchment, e.g. at-grade pavement or planter drain, etc.

(e) Air conditioning condensate water

2.1.10 A grill or coarse mesh should be placed at the mouth of the drainpipe to prevent large debris (e.g. leaves) from entering the collection system. Where gutters are present, a gutter mesh system can be installed across the gutter section, preferably with a gradient to reduce the need of periodic cleaning. The openings of the grill or gutter mesh should have 4 mm to 6 mm openings.

2.1.11 First-flush diverter, which diverts the first few minutes of rainwater away from the collection tank, should be installed. The first few minutes of rainfall contains particulates, debris, and contaminants such as bird and animal faeces, pesticides, pollution, roofing material, and dissolved gasses.

2.1.12 A bypass shall be installed around the rainwater system allowing the first flush of rainwater from each rainfall event, the collected rainwater during periods of maintenance or system isolation and the surplus rainwater to flow directly to the storm drain system. The bypass shall not tie into the sewer.

2.1.13 The collection pipework shall be properly identified and labelled in accordance with Section 7.

2.1.14 Due to water quality concerns from bacterial growth, collection systems should be designed and constructed such that rainwater reaches the treatment process as soon as possible. Intermediate storage should be avoided except the grey water / rainwater collection tanks specified in Section 2.2 below.

Treated Sewage Effluent Collection

2.1.15 The source for producing reclaimed water shall be part of direct discharge of the TSE from a sewage treatment system, e.g. effluent polishing plant (EPP).

2.1.16 TSE shall be dedicatedly collected in a separate tank and pumped from effluent transfer tank or similar of a sewage treatment system to a water reclamation plant (WRP) via a separate conveyance pipework upon demand.

2.1.17 If TSE entering WRP with quality via on-line monitoring exceeding the "specified WRP influent requirement", the inflow of TSE to the WRP shall be suspended and the TSE shall be discharged through its outlet automatically.

2.1.18 If necessary, the designer of a WRP should make appropriate adjustments to the design with formulation of mitigation measures so as to safeguard the self-cleansing capacity of the pipework, especially during the early stage of occupation / connection where the flow rate of sewer is low.

2.1.19 Due to potential water quality concerns from bacterial growth, collection systems should be designed and constructed such that TSE reaches the treatment process in the WRP as soon as possible. Intermediate storage should be avoided as much as possible.

2.2 Collection Tank

General

2.2.1 Most collection tanks for grey water and rainwater systems are constructed of concrete. Collection tanks should be suitably sealed and protected against the corrosive effects of the stored water. Tanks should be lightproof to minimise algae growth.

2.2.2 Collection tanks should be fitted with a close-fitting, removable cover to allow for periodic inspection and for internal cleaning and maintenance of components, such as sensors and submersible pumps. Providing a lock to the access cover is recommended to avoid accidental entry into the tank.

2.2.3 Collection tanks and also tanks for part of the treatment process shall be waterproof. If buried, they shall be designed to resist likely ground and traffic loadings, floatation due to hydraulic uplift forces, and groundwater ingress when empty or partially full. Ingress may occur due to the permeability of the tank material (e.g. natural permeability of concrete as well as potential cracks in the concrete) or due to deformation of the tank resulting from water, soil, overburden, and traffic loading.

2.2.4 The collection tank should be sited so that the stored water does not attain high temperatures that could encourage microbial growth. Above-ground tanks should be opaque to minimise the potential of warming and algae growth.

2.2.5 For buried tanks that are located in areas subject to flooding, access covers should be raised or sealed.

2.2.6 The collection tank shall be fitted with a screened air vent to avoid building up of any noxious gases.

2.2.7 Filter backwash is considered as foul water and should also be discharged to the foul drain or sewer system.

2.2.8 If the collection tank is buried, or partially buried, sewage backflow into the tank can occur in the event that the foul drain is blocked, or the area becomes flooded. Therefore, sewage backflow prevention should be included in the installation.

2.2.9 The sewage backflow prevention device should be fitted with a visible indicator which may only be reset by manual intervention. The sewage backflow prevention device can be in the form of a valve and a float-operated backflow detection switch in the vertical connecting pipe to the foul drain or sewer.

2.2.10 In the event of sewage backflow, the control system should prevent the recycled water from being supplied until the system has been inspected, and any

necessary remedial measures have been carried out and the recycled water quality has been checked.

Grey Water Collection Tank

2.2.11 Air ejector(s) should be provided in the grey water storage tank to prevent septicity.

2.2.12 Backflow prevention shall be provided to prevent highly contaminated water from re-entering the system in the event of blockage in the foul sewer.

2.2.13 As the generation of grey water is intermittent, a buffered collection storage tank is required to provide a relatively uniform flow through the rest of the treatment process. However, it is advisable to minimise storage of untreated grey water to reduce the adverse effects of stagnation and bacteria proliferation.

2.2.14 The grey water storage tank should be designed to store untreated flow for a period of at least two hours, but no more than twenty-four hours. Grey water collection tanks shall overflow to the sewer system. In addition, an opening with control valve / device is required at the bottom of the collection tank to allow solids that have settled out of the grey water to be collected into a sludge storage tank.

Rainwater Collection Tank

2.2.15 Backflow prevention shall be provided to prevent highly contaminated water from re-entering the system in the event of blockage in the storm drainage system.

2.2.16 A calming inlet is recommended for rainwater collection tanks. A calming inlet prevents the disturbance and re-suspension of fine sediments that may gather on the tank floor and introduces oxygen to the lower layers of the tank which helps prevent anaerobic conditions.

2.2.17 The rainwater collection tank may be stored for 10 to 20 days of supply. An important consideration is space availability.

2.2.18 Assuming that space availability is not an issue, the following three scenarios should be considered:

(a) Insufficient rainwater collected to meet the demands of the potential applications. Tank sizing will be governed by the rainfall and catchment area. The tank size should be based on an evaluation of the rainwater likely to be collected from statistical rainfall patterns, catchment area, and filtration coefficients minus the average use, and also the amount of grey water that may be available.

(b) Excessive rainwater collected to meet the demands of the potential applications during wet weather months. Tank sizing should be governed by the rate of use, according to the level of demand and the required number of days of assured supply.

(c) A rough balance between the rainwater collected and the demands of the potential applications during wet weather months. The tank should be sized sufficiently large such that it does not frequently overflow but not so large that it causes stagnation or is unnecessarily expensive.

2.2.19 Rainwater collection tanks shall overflow to a stormwater drain and not to a foul sewer.

TSE Collection Tank

2.2.20 A TSE collection tank is required to pump the TSE, or transfer the TSE by gravity from EPP to WRP for further treatment. Under certain circumstances, the separate TSE collection tank may not be required if WRP is built nearby the EPP since TSE could be transferred by lifting pumps or effluent transfer pumps in the effluent transfer chamber or similar at the EPP, which serves as "TSE collection tank".

2.3 Recycled Water Treatment

General

2.3.1 The sources for recycled water production require several stages of treatment and a dedicated distribution system to produce and supply water that poses no undue risk to health.

2.3.2 For hygiene purpose, chlorine dosing facility shall be provided for final disinfection to ensure that the supplied recycled water is disinfected, and adequate residual chlorine level of recycled water is maintained above the specified standard of recycled water supply throughout the storage and conveyance period.

2.3.3 As a means to reduce the risk of cross connection between potable water and recycled water supplies, it is highly desirable that biodegradable food grade dye, i.e. Acid Blue 9, should be added in the recycled water before supplying to consumers for flushing purpose.

Grey Water Treatment

2.3.4 Collected grey water in a treatment system shall consist of the following components:

(a) Pre-treatment

(b) Biological treatment

(c) Filtration

(d) Disinfection

(e) Biodegradable food grade dye addition (if for flushing)

2.3.5 Pre-treatment shall include a fine / mesh screen to remove hair, soap, and other particulate matter in the grey water. The screen shall have an opening of 2 mm.

2.3.6 Where grey water is collected from kitchen sinks and dishwashers, pre-treatment shall also include an oil and grease trap. An automatic oil and grease trap, where the oil is skimmed out automatically using a timer or sensor mechanism, shall be used.

2.3.7 The fine / mesh screen shall preferably be of the self-cleaning type to reduce the reliance on the user cleaning the screen to maintain system performance.

2.3.8 Biological treatment shall be included to remove organic matters and other pollutants in the grey water. Various types of biological treatment may be used to treat grey water, including biological aerated filter (BAF), sequencing batch reactors (SBR) and membrane bioreactor (MBR).

2.3.9 Filtration shall be included and shall be able to meet the required effluent turbidity of equal or less than 5 NTU. Many types of filters are commercially available, membrane filtration, such as microfiltration (MF) and ultrafiltration (UF) are most adopted filters with capability of achieving high effluent quality standards on a small footprint.

2.3.10 Disinfection is required as the final treatment step. The recycled water, such as treated grey water, quality criteria stipulate a total residual chlorine (TRC) equal to or greater than 0.2 mg/L at user end.

2.3.11 Disinfection may utilise chlorine disinfection which may be achieved by using a sodium hypochlorite system. A separate disinfection contact chamber of a size to allow a minimum of 30-minute contact time at peak flow for disinfection is required.

2.3.12 The preferred method for disinfection is chlorination using automated flow-paced chlorine dosing with on-line monitoring the TRC to ensure chlorine doses are sufficient and that the required chlorine residual is maintained throughout the supply system.

2.3.13 Ultraviolet (UV) disinfection may be used. However, as it does not produce any disinfectant residual in the treated effluent, the treated water shall be used immediately, i.e. the collected water shall be drawn into the treatment process immediately before a particular round of usage and such treated water shall be depleted after that round of usage is completed.

2.3.14 Where the treated water by UV disinfection is to be stored for future use, it shall be supplemented with chlorine addition to provide the necessary residual chlorine. Simple metering and control devices dosing chlorine can effectively supplement the adequate amount of residual chlorine to meet the water quality standards.

2.3.15 Flow measuring device(s) shall be provided to measure the total quantity of all grey water treated.

2.3.16 The designer shall select the most appropriate process to meet the required water quality requirements.

2.3.17 The treatment system shall be capable of connecting to the sewer such that:

(a) An overflow to the environment will not occur should there be a failure of the treatment system.

(b) The operator may direct grey water to the sewer during periods of rain or other circumstances adverse to the discharge of treated grey water into the reuse distribution system.

2.3.18 The treatment system shall be designed to perform continuously and without any interventions between specified inspection intervals performed by the maintenance staff.

2.3.19 The treatment system shall be constructed in accordance with the design specifications as well as allowing ease of access for maintenance and with regard to the health and safety of users, operators, and people maintaining the facility.

2.3.20 The treatment system shall be clearly marked with the brand name, model, and month and year of manufacture which should be clearly visible after installation.

2.3.21 All metal components shall be of grade 316 stainless steel or other non-corroding material unless adequately protected against corrosion to satisfy the service life of the component.

2.3.22 All plastics and perishable components in the treatment system subject to exposure to UV radiation, or an adverse chemical or biological environment shall be able to retain their integrity under normal operating conditions to satisfy the service life of the component.

2.3.23 All components shall be securely fixed to withstand all loads encountered during transportation, installation, and normal operation.

2.3.24 Unless specifically designed to operate in a submerged condition, all mechanical and electrical equipment when located within the treatment system vessel(s) shall be located above the maximum water level of the treatment system.

Rainwater Treatment

2.3.25 Harvested rainwater in a treatment system shall consist of the following components:

(a) Pre-treatment

(b) Filtration

(c) Disinfection

(d) Biodegradable food grade dye addition (if for flushing)

2.3.26 Pre-treatment shall include a first-flush removal device and oil trap, if applicable.

2.3.27 The two most common types of first-flush device are of constant volume and mechanical actuated valve.

2.3.28 A constant volume first-flush device uses a containment chamber that fills up during the first few minutes of a rainstorm. The containment chamber is a container / sampler or a standpipe with a constant volume. During the first few minutes of rainfall, the rainwater is diverted to the standpipe or container. Once the standpipe or container fills up, the rainwater is transferred into the cistern. At the bottom of the standpipe is a valve that is slightly opened. The valve drains the water from the standpipe so it will be empty for the next rain.

2.3.29 A mechanical actuated valve first-flush device measures the amount of rainwater to divert by a mechanical method. Once the measured amount of rainwater to divert is detected, a valve is triggered to transfer the remaining rainwater to the rainwater storage tank.

2.3.30 An automatic oil trap, where the oil is skimmed out automatically using a timer or sensor mechanism, shall be used for rainwater collected from driveways, car parks, etc, if applicable.

2.3.31 Coarse filtration followed by sand filtration (or cartridge filtration) and granular activated carbon (GAC) filtration or the like shall be used as follows:

(a) The coarse filter shall be rated at 250 micron or smaller to remove large particulate matter.

(b) The sand filter or cartridge filter shall be rated at 50 micron or smaller.

(c) GAC filtration or the like shall be used to remove smaller particulate matter and hydrocarbons.

2.3.32 An option for coarse filtration is available where the filter is installed inside the rainwater collection pipe prior to entering the storage tank.

2.3.33 Disinfection is required as the final treatment step. The recycled water, such as treated rainwater, quality criteria stipulate a total residual chlorine equal to or greater than 0.2 mg/L at user end.

2.3.34 Disinfection may utilise chlorine disinfection which may be achieved by using a sodium hypochlorite system. A separate disinfection contact chamber of a size to allow a minimum of 30-minute contact time at peak flow for disinfection is required.

2.3.35 The preferred method for disinfection is chlorination using automated flow-paced chlorine dosing with on-line monitoring the TRC to ensure chlorine doses are sufficient and that the required chlorine residual is maintained throughout the supply system.

2.3.36 UV disinfection may be used. However, as it does not produce any disinfectant residual in the treated effluent, the treated water shall be used immediately, i.e. the collected water shall be drawn into the treatment process immediate before a particular round of usage and such treated water shall be depleted after that round of usage is completed.

2.3.37 Where the treated water by UV disinfection is to be stored for future use, it shall be supplemented with chlorine addition to provide the necessary residual chlorine. Simple metering and control devices dosing industrial chlorine can effectively supplement the adequate amount of residual chlorine to meet the water quality standards.

2.3.38 Flow measuring device(s) shall be provided to measure the total quantity of all rainwater treated.

2.3.39 The designer shall select the most appropriate process to meet the required water quality requirements.

2.3.40 The treatment system shall be designed to perform continuously and without any interventions between specified inspection intervals performed by the maintenance staff.

2.3.41 The treatment system shall be constructed in accordance with the design specifications as well as allowing ease of access for maintenance and with regard to the health and safety of users, operators, and persons maintaining the facility.

2.3.42 The treatment system shall be clearly marked with the brand name, model, and month and year of manufacture which should be clearly visible after installation.

2.3.43 All metal components shall be of grade 316 stainless steel or other non-corroding material unless adequately protected against corrosion to satisfy the service life of the component.

2.3.44 All plastics and perishable components in the treatment system subject to exposure to UV radiation, or an adverse chemical or biological environment shall be able to retain their integrity under normal operating conditions to satisfy the service life of the component.

2.3.45 All components shall be securely fixed to withstand all loads encountered during transportation, installation, and normal operation.

2.3.46 Unless specifically designed to operate in a submerged condition, all mechanical and electrical equipment when located within the treatment system vessel(s) shall be located above the maximum water level of the treatment system.

Combined Treatment for Grey Water and Rainwater

2.3.47 For installations with both grey water and rainwater, the two streams may be combined such that they produce a single supply of treated water. The rainwater stream may be sent to the grey water treatment system for combined treatment via conveyance from the rainwater storage tank to the grey water collection tank.

2.3.48 During the dry season from October to March, the rainwater system may be shut down. During these months, any rainfall collected from the rainwater collection system may be bypassed directly to the head of the grey water treatment system. The collected rainwater should be metered.

2.3.49 Particular attention should be paid on the dilution effect induced from the rainwater for design of the combined treatment process.

TSE Treatment

2.3.50 TSE conveyed from sewage treatment works should be further processed in a separate treatment system for reclaimed water production, which shall consist of the following components:

(a) Pre-treatment, e.g. ultrafiltration, if any

(b) Disinfection: with/without advanced oxidation process (AOP) or other post - treatment process, if applicable

(c) Biodegradable food-grade dye addition (if for flushing)

2.3.51 Disinfection is required as the final treatment step. The recycled water quality criteria stipulate a total residual chlorine equal to or greater than 0.2 mg/L at user end.

2.3.52 Disinfection may utilise chlorine disinfection which may be achieved by using a sodium hypochlorite system. A separate disinfection contact chamber of a size to allow a minimum of 30-minute contact time at peak flow for disinfection is required.

2.3.53 The preferred method for disinfection is chlorination using automated flow-paced chlorine dosing with on-line monitoring the TRC to ensure chlorine doses are sufficient and that the required chlorine residual is maintained throughout the supply system.

2.3.54 UV disinfection may be used. However, as it does not produce any disinfectant residual in the treated effluent, the treated water shall be used immediately, i.e. the collected water shall be drawn into the treatment process immediately before a particular round of usage and such treated water shall be depleted after that round of usage is completed.

2.3.55 Where the treated water by UV disinfection is to be stored for future use, it shall be supplemented with chlorine addition to provide the necessary residual chlorine. Simple metering and control devices dosing chlorine can effectively supplement the adequate amount of residual chlorine to meet the water quality standards.

2.3.56 Flow measuring device(s) shall be provided to measure the total quantity of all TSE treated.

2.3.57 The designer shall select the most appropriate process to meet the required water quality requirements.

2.3.58 The treatment system shall be capable of connecting to the drainage system such that:

(a) An overflow to the environment will not occur should there be a failure of the treatment system.

(b) The operator may direct reclaimed water to the drainage system (after de-chlorination and decolorization, if any) during periods of the treatment system failure, water quality non-compliance, or other circumstances adverse to the conveyance of reclaimed water into the reuse distribution system.

2.3.59 The treatment system shall be designed to perform continuously and without any interventions between specified inspection intervals performed by the maintenance staff.

2.3.60 The treatment system shall be constructed in accordance with the design specifications as well as allowing ease of access for maintenance and with regard to the health and safety of users, operators, and people maintaining the facility.

2.3.61 The treatment system shall be clearly marked with the brand name, model, and month and year of manufacture which should be clearly visible after installation.

2.3.62 All metal components shall be of grade 316 stainless steel or other non-corroding material unless adequately protected against corrosion to satisfy the service life of the component.

2.3.63 All plastics and perishable components in the treatment system subject to exposure to UV radiation, or an adverse chemical or biological environment shall be able to retain their integrity under normal operating conditions to satisfy the service life of the component.

2.3.64 All components shall be securely fixed to withstand all loads encountered during transportation, installation, and normal operation.

2.3.65 Unless specifically designed to operate in a submerged condition, all mechanical and electrical equipment when located within the treatment system vessel(s) shall be located above the maximum water level of the treatment system.

2.4 Storage in Supply System

2.4.1 Separate tanks should be provided within the boundary of the water recycling plants for storage of undyed (without colour labelled) recycled water. Government contractor will re-fill their water wagons at water recycling plant for landscape irrigation, street cleansing, water features etc. Recycled water will be discharged to the sewerage / storm drain system whichever is appropriate once non-compliance occurs or during maintenance.

2.4.2 The recycled water to be supplied to the public for flushing will be stored in service reservoirs at high elevation.

2.4.3 The storage tank / service reservoir should be sited so that the stored water does not attain high temperatures that could encourage microbial growth. Above-

ground tanks should be opaque to minimise the potential of warming and algae growth.

2.4.4 Below ground tanks should be sufficiently rigid to resist likely ground and traffic loadings and floatation.

2.4.5 A back-up water supply, such as potable water, is required to supplement the recycled water where necessary. Backflow prevention device, such as non-return valve, shall be provided to avoid cross contamination.

2.4.6 The impact of a sudden demand from the back-up water supply should be considered. It is essential that the potable water supply infrastructure is capable of meeting this increase in water demand.

2.4.7 To avoid microbiological growth and bacteria proliferation in the recycled water storage tank / service reservoir, the storage time should be limited. This is especially important in Hong Kong's high temperature climates. As there is generally a steady supply of grey water or TSE, storage equal to a single day's use (24 hours) or less is recommended.

2.5 Pumps

2.5.1 The pumps should be corrosion resistant and properly selected to pump to the required head to fill the storage tank / service reservoir or supply adequate flow if pumped directly to the point of use. Submersible pumps and external self-priming pumps are typical.

2.5.2 Pumps should be protected from dry running. A low-level switch in the collection tank should be used. To prevent overheating or burn out of the pump, the level should be set such that the pump does not continually switch on and off due to small and infrequent inflow of source water.

2.5.3 Pumps should be sized so that each pump is capable of overcoming static lift plus friction losses in the pipework and valves.

2.5.4 Pumps should be selected and arranged such as energy use and noise are minimised, cavitation and undue vibration are avoided, and air is not introduced into the recycled water system.

2.5.5 Pumps for untreated grey water should be able to accommodate any solid matter likely to be contained in the grey water.

2.5.6 For recycled water pumping systems that are installed outside the storage tank, the pump should have its own self-priming mechanism or a control system that ensures a constant fully primed condition. The suction line to the pump should be laid with a steady gradient upwards towards the pump. The pump should be placed in a well-ventilated location and protected from extremes of temperature, with sound-free and vibration-free mountings.

2.5.7 A non-return valve should be provided in the suction line to the pump to prevent the water column from draining down. The pump discharge should be supplied with an isolation valve.

2.5.8 For submersible pumping systems, the immersion depth should be in accordance with the pump manufacturer's requirements. The pump should be removable for maintenance. A non-return valve should be provided, with an isolation valve to enable the non-return valve to be serviced.

2.5.9 The pump control unit should operate the pump(s) to match demand (pump cut-in and cut-out could be actuated by water level sensor or by other means, if applicable); protect the pumps from running dry; protect the motor from over-heating and electric overload; and permit manual override. The surge vessel(s) for protection of pumping mains should be provided where appropriate.

2.6 Mechanical Equipment

2.6.1 All mechanical equipment shall be suitable for continuous and intermittent operation.

2.6.2 Bearings shall be of a type able to provide long life, minimal maintenance, and corrosion protection from the aggressive environment.

2.7 Electrical Equipment

2.7.1 All electrical equipment shall be suitable for continuous and intermittent operation.

2.7.2 Electric motors shall comply with the relevant electrical standards and be fitted with thermal overload devices. The motor shall be located free from explosive gas mixture that may be developed. If the explosive gas environment is unavoidable, explosion-proof electric motor shall be applied and complied with relevant international standards. The motor should be suitable for variable speed pumping if variable speed control is adopted.

2.7.3 The treatment system shall be provided with a control panel that indicates the following as a minimum:

a) indication that system is operating correctly
b) alarms indicating failure of components including identification of component (e.g. pump, level control, chemicals, UV)
c) levels in all tanks
d) power meter shall be installed to monitor the power consumption and show power supply status
e) flows with accumulated total amount
f) operating hours
g) chemical usage
h) automatic control of the alternative water supply as backup to meet variations in supply and demand

i) water quality parameters that can be detected by on-line monitoring instrument, e.g. pH, total residual chlorine, temperature, turbidity, dissolved oxygen and possibly ammonia

j) supply delivery pressure where a pumped system is used

k) on-line monitoring results for surveillance on the quality of treated effluent

2.7.4 The treatment system shall be fail-safe such that untreated water cannot be supplied to points of use in the event of system failure, including loss of power and loss of disinfection. A fail-safe condition should occur if any essential part of the system ceases to operate.

2.8 Noise

2.8.1 The maximum permissible noise level with all operating equipment shall comply with relevant noise criteria.

2.9 Materials and Fittings

2.9.1 Collection and distribution pipework and fittings should be constructed from corrosion resistant components such as high-density polyethylene (HDPE), poly-vinyl chloride (PVC), or acrylonitrile butadiene styrene (ABS) plastic. Black steel or ductile iron pipe may be considered for larger diameter pipe. Copper and galvanised steel pipes are not recommended, although cast iron or ductile iron may be considered for buried piping if ground conditions do not suit the use of plastics.

2.9.2 The materials selected for the recycled water systems shall be suitable for the location and anticipated temperature ranges. All components of the recycled water system shall be capable of withstanding pH levels as low as 5 for the lifetime of the components.

2.10 Power Supply

2.10.1 The power supply shall be readily accessible but also guarded to ensure against inadvertent isolation or disconnection of electricity. Any back-up power supply might be provided, if deemed necessary.

2.11 Back-up Water Supply

2.11.1 An alternative water supply, such as potable water, is required as a back-up water supply to supplement the recycled water. The back-up water supply may be introduced into the following:

(a) The recycled water storage tank / service reservoir

(b) An intermediate storage tank prior to pumping to the recycled water distribution system

2.11.2 The back-up water supply shall be fitted with a control mechanism which ensures that the amount of water supplied is minimised. It shall be fitted with a warning mechanism that alerts the user to the failure of the inlet control valve to

close correctly. The warning device shall activate before the water level overflows.

2.11.3 The back-up water supply shall be sized to meet the full demand requirements.

2.11.4 Flow measuring devices(s) shall be provided to measure the total quantity of all back-up water supplied.

2.12 Backflow Prevention

2.12.1 To prevent recycled water from entering the potable mains water supply, the back-up water supply shall be fitted with a backflow prevention device, such as backflow preventer / double non-return valves should be installed in inlet pipe for preventing back-contamination.

2.12.2 The potable mains water should be supplied via. a make-up tank (intermediate storage tank, such as break pressure tank) before entering the storage tank of recycled water. Flow rates, head loss, and installation requirements shall be taken into account when selecting the backflow prevention device.

2.12.3 The backflow prevention device shall be located upstream or at the point of delivery where the two supplies come into contact with each other.

2.13 Overflow, Bypass and Drainage

2.13.1 An overflow shall be fitted to all tanks to allow excess water to be discharged. The overflow shall incorporate backflow prevention. An overflow fitted to aboveground tanks shall be screened to prevent the ingress of insects and rodents.

2.13.2 The capacity of the overflow outlet pipe shall be capable of draining the maximum inflow.

2.13.3 Where appropriate, the overflow and bypass shall be fitted with an anti-surcharge valve.

2.13.4 The overflow and any bypass of the untreated grey water shall be connected to the foul sewer.

2.13.5 The overflow and any bypass of the rainwater / TSE shall be connected to the storm drain system.

2.13.6 The overflow and any bypass of the recycled water shall be connected to the sewerage / storm drain system whichever is appropriate if non-compliance.

2.13.7 Any discharge to sewerage / storm drain system from the recycled water system shall minimise the volume of foam introduced to the sewerage / storm drain system and shall be properly dechlorinated and decolorized, if necessary.

2.13.8 The discharge of any surplus grey water, rainwater, TSE or recycled water as well as backwash water shall be made at a location that would not overload the

downstream carrying capacity of their respective receiving sewerage or storm drain system.

2.14 Controls

2.14.1 A control unit shall be incorporated in the recycled water systems to ensure that users are aware of whether the systems are operating effectively.

2.14.2 The control unit shall:

(a) Make the user aware when any consumable items need replenishment or replacement

(b) In the event of any system failure:

(i) Alert the user by a visible or audible warning

(ii) Ensure that the bypass directs untreated grey water to the foul sewer, and untreated rainwater to the storm drain, TSE to the storm drain or the discharge channel to receiving water body

(iii) Ensure that treatment of grey water, rainwater and TSE continue or the recycled water are not stored for a period that would allow water quality to deteriorate

(c) In the event of a treatment failure, ensure that the recycled water applications are fed from the back-up water supply

(d) Control pumps and minimise operational wear and energy use

(e) Activate the back-up water supply automatically when required by the control unit

2.14.3 To prevent waste, storage tanks with valve-controlled water inputs shall have a warning system so that any failure is readily noticeable.

2.15 Sludge Holding Tank

2.15.1 A sludge holding tank is necessary to provide temporary storage of sludge produced by the biological treatment component of the water recycling system.

2.15.2 Wet sludge should be hauled off to the local municipal sewage treatment works on a periodic basis, if applicable, or on-site de-watering of the wet sludge should be considered.

2.15.3 The sizing of the sludge holding tank depends on the biological process adopted in the water recycling system (such as MBR, aerobic granular sludge, biological aerated filter, etc.) and the influent characteristics.

2.15.4 An aerator / ejector or the like should be provided for the sludge holding tank to prevent septicity.

2.15.5 Vehicular access should be maintained for desludging tankers.

2.15.6 A sludge holding tank is not required for WRP, where TSE is further processed such as disinfection to produce reclaimed water and no biological sludge is expected.

2.16 Location and Access of Treatment Systems

2.16.1 Recycled water treatment systems are likely to be located at ground level or below.

2.16.2 Proper access for maintenance will ensure safe and efficient operation of the system. The treatment system will need periodic access to maintain pumps, change filters, and cleaning. Easy access around collection and treatment tanks should be provided, including sealed but not airtight man-sized access ports for all but the smallest tanks (e.g. 1 m^3 or smaller).

2.16.3 Access to the treatment room(s) should be restricted and secured from public access for safety reasons.

2.16.4 Regarding the location of the grey water collection tank, the prevention of sewer backflow should be taken into consideration, including the minimum vertical separation between the overflow and sewer pipe. The tank should not be located directly above drainage pipes or other buried services. The tank should be vented to the atmosphere, either via the grey water drain and stack, or with a stub-vent from the tank.

2.17 Distribution

2.17.1 Distribution systems should be designed and constructed such that the overall storage time of recycled water does not result in unacceptable deterioration in water quality through the network to the point of application. Dead zones in the distribution piping should be avoided to prevent bacteria proliferation. For lengthy distribution systems, consideration may be given to recirculation of a small flow of the treated effluent to avoid stagnation.

2.17.2 Care should be taken not to cross connect recycled water and mains water pipework during installation or subsequent work on the system. Pipe marking is essential to help avoid accidental cross-connection. Where necessary, designer may consider using pipe size and material different from potable water system. Such measures may require a dual reticulation system with designated pipe diameters, colour (purple / lavender) and labelling for the pipework conveying each type of water.

2.17.3 All pipework and fittings shall be marked and / or labelled in accordance with Section 7.

2.17.4 To avoid accidental cross contamination, the recycled water system should operate at a lower pressure than the potable water mains supply, if possible. Consideration should be given to minimising the energy used to distribute the recycled water.

2.17.5 Surges and water hammer should be absorbed and prevented from causing undue high pressures by the incorporation of pressure controls or expansion vessels, such as a set of surge vessels.

2.17.6 Pipework should be sized to provide adequate flow and pressure.

2.17.7 Pipework and fittings should be arranged as follows:

(a) To be sufficiently strong to resist bursting from the subjected pressure in operation

(b) To prevent cross-connections with potable mains water supply

(c) To prevent the trapping of air during filling, and the formation of air locks during operation

3. Installation

3.1 General

3.1.1 During system installation, consideration should be given to the following:

(a) Access to the recycled water treatment equipment

(b) Access to underground and above-ground tanks

(c) Location of access covers

(d) Vehicular access to the treatment systems

3.2 Tank Installation

3.2.1 All tanks should be fitted with lids / covers that protect the water from contamination and prevent inadvertent human entry, and avoid ingress of insect and leak of odour.

3.2.2 Above-ground tanks should not be supported by pipework but should be securely mounted and supported on a stable base.

3.2.3 Underground or partially buried tanks should be so installed that they are not deformed or damaged.

3.2.4 Measures should be taken to ensure the structural stability of underground tanks. Examples of measures include concrete surrounds, backfilling, and/or controlled filling with water.

3.2.5 The area around the access covers of any underground tanks should be impervious and free draining away from the covers to avoid contamination during maintenance and inspections.

3.2.6 When installed and correctly supported, tanks should not deform as the water level in the tank changes.

4. Testing and Commissioning

4.1 Commissioning Procedures

4.1.1 For all schemes, the contractor shall provide detailed guidance on commissioning procedures. Commissioning will typically be carried out by the contractor or its representative, who has received appropriate training and has the necessary sampling and testing equipment to verify correct operation of the system.

4.1.2 Commissioning procedures should be system specific. The procedures generally include the following steps:

(a) Visual check of the pipework systems. Verify that actual equipment and pipe layout matches the schematic and that all pipes are properly identified and labelled.

(b) Verify overall system integrity and hydraulic operation using clean water for strength and leak testing.

(c) Verify operation of control strategy, fail-safe features and indicators using clean water.

(d) Initial operation of the collection treatment / system with recycled water being discharged to sewer / storm drain until tests confirm acceptable quality of recycled water.

(e) Full operation with checks on filters, disinfectant and colourant dosing, and operation of level controls.

4.1.3 All pipework shall be tested following construction to ensure that the materials are free of defects and have been installed correctly. The following tests shall be performed prior to handover of the system to the user:

(a) The recycled water distribution system shall be flushed and tested to ensure that pipework and tanks are watertight and that there are no cross-connections with any potable mains water supply. In the event that a cross connection is discovered, immediate rectification actions shall be taken.

(b) The biodegradable food grade dye storage and automatic dosing system shall be checked and tested annually, or more frequently if necessary, to ensure proper operation.

(c) The pipework and fittings of the recycled water distribution system shall be tested in accordance with all relevant WSD requirements and at a minimum of 1.5 times the normal operating pressure.

(d) The recycled water system shall be tested to ensure that wiring is electrically safe and that there is no interference to or from other electrical or electronic equipment, or wiring in the vicinity.

4.1.4 Upon handover of the recycled water system, the operator / owner shall be provided with sufficient information by the contractor to enable them to operate the system satisfactorily, and shall be advised of any procedures or precautions which need to be followed. The information shall cover aspects that will ensure

the reliable operation of the recycled water systems, and any routines that could reduce maintenance requirements.

5. Operation and Maintenance

5.1 System Management

5.1.1 It is the responsibilities of the system owners and the appointed operator to ensure that the water recycling system is used sustainably and operated appropriately according to system specifications / design. They should be familiar with the type of system in place and its performance. A good and regular maintenance and monitoring programme is essential to ensure proper functioning of the water recycling system.

5.1.2 The organisations responsible for operation, maintenance and monitoring need to ensure that they are aware of any changes to regulations and legislation covering recycled water, water quality, electrical installations, etc., such that they can upgrade the schemes as and when appropriate accordingly.

5.2 Operation and Maintenance

5.2.1 Water recycling systems shall be managed to operate reliably and consistently in order to ensure that treated water with well-controlled quality is eventually supplied for use. Some measures to achieve a quality-controlled system include:

- Implementation of "at source" pollution controls , such as discharge of water of unsatisfactory quality to the sewer after pretreatment, or pollution rejection if necessary;
- Effective, reliable and consistent treatment processes;
- Continued operation of disinfection systems;
- Maintaining the physical integrity of the recycled water supply network and avoiding deterioration in recycled water quality through regrowth of pathogens;
- Deploying qualified and trained operators;
- Continual improvement of performance, maintenance, inspection and reporting programs; and
- Mitigation and contingency plans for system failures.

5.2.2 Before maintenance, the recycled water systems shall be drained, and flushed with clean water if possible, to reduce the risk of contamination to maintenance personnel, people in the vicinity and the physical surroundings.

5.2.3 Electricity and all water supplies shall be isolated before opening any sealed lids or covers of tanks.

5.2.4 Human entry into tanks shall be avoided wherever possible. Where entry is essential, it shall only be undertaken by trained personnel with personal protection equipment suitable and provision of adequate on-site supervision according to relevant statutory requirements for confined spaces.

5.2.5 Inspection and maintenance of the parts and components, such as filters, membranes, biological and disinfection systems, pumps and pump controls, system control units, backwash, etc., shall be carried out in accordance with the manufacturer's or system supplier's recommendations. Flow measuring devices shall be calibrated on a periodic basis.

5.2.6 Maintenance repair works should be immediately carried out to resume the operation of recycled water supply system as soon as possible. Spare parts and pipe materials with adequate stock level should be maintained to enable completion of repair works in the shortest possible time.

5.2.7 Where a membrane-based treatment is used, the site management shall implement a regular cleaning / maintenance programme, and shall periodically check the integrity of the membranes as recommended by the membrane manufacturer / supplier.

5.2.8 All labelling and marking of the recycled water pipework and fittings should be checked to ensure that they are in good condition and remain suitable to make all users aware that the water in the supply system is recycled water and is not potable.

5.2.9 For all schemes (grey water, rainwater, combined systems and reclaimed water), an O&M manual should be obtained from the contractor and be validated and kept by owner of the recycling system. All elements of the scheme should be covered in a unified manner. Separate manuals covering all components should be avoided unless there is a comprehensive summary manual covering all components in a coherent manner.

5.2.10 The O&M manual should include a simple fault-finding chart explaining how the system should be put back into operation from a fail-safe condition. It should clearly differentiate between those conditions which can be rectified by the user and those which may require external assistance.

5.2.11 The maintenance schedule shown in **Table 5.1** should be used as a reference for the basic requirement. A log of inspections and maintenance should be kept.

Table 5.1 Maintenance Schedule for Recycled Water Systems

System Component	Frequency	Action
Gutters/downpipes (for rainwater system)	Every six months	Check to ensure there are no leaks or blockages due to buildup of debris; clean gutters if necessary
Manual cleaning filters	Monthly	Check condition of filter and clean if necessary
Self-cleaning or coarse filters	Every three months	Check condition of filter and clean if necessary
Cartridge, GAC filters	Every three months (depending on suspended solids content in the source water)	Replacement
Membranes, biological support media, and strainers	Annually	Check condition and clean or replace if necessary

System Component	Frequency	Action
Storage tanks/cisterns	Annually	Check to ensure there are no leaks, no build up of debris, and that all tanks and cisterns are stable and the covers are correctly fitted
	Every six months	Drain down, clean and disinfect with sodium hypochlorite
Backwash	Annually	Check functionality
Pumps and pump controls	Annually	Check to ensure there are no leaks and corrosion; carry out a test run
Back-up water supply	Annually	Check that the supply is functioning correctly
Control unit	Annually	Check that the unit is operating properly, including alarm functions where applicable
Water level gauge	Annually	Check to ensure that any gauge indication responds correctly to the water level in the storage tanks/cisterns
Wiring	Annually	Visually check that the wiring is electrically safe
Pipework, valves and fittings	Annually	Check to ensure there are no leaks, pipes are watertight, no misconnection
Markings	Annually	Check that warning notices and pipework and valve identification are correct, visible and in place
Support and fixings	Annually	Adjust and tighten, where applicable
UV disinfection	Every six months	Clean and replace lamps, if necessary
Chemical disinfection	Monthly	Check that any dispensing unit is operating properly; replace chemical supply if needed
Biodegradable food grade dye storage and dosing system	Annually	Check to ensure that food dye colourant storage and automatic dosing unit are operating properly
On-line water quality monitors, water metering	As recommended by manufacturer	Regular calibration

5.3 Warranty and Guaranteed Service Life

5.3.1 All metal fittings, fasteners and components of the treatment system, other than pumps and motors, shall be of non-corroding material and should have a service life of at least 15 years, if applicable.

5.3.2 All mechanical and electrical parts installed within the treatment system should have a minimum service life of 15 years, if applicable.

5.4 Manuals

5.4.1 The following manuals and documents shall be provided:

(a) A comprehensive operations and maintenance manual, for use by the operator, which incorporates a detailed routine evaluation and maintenance schedule based on appropriate and defined service intervals. The maintenance schedule shall specify the work to be carried out by the operator as part of the continuous maintenance, and any required work to be conducted by the owner of the system.

(b) A service report form which is suitable for use by operator.

(c) A user instruction manual which includes the following:

(i) Overview of the treatment system and intended use

(ii) Warranty and service life

(iii) Servicing requirements

(iv) Frequency of calibration of on-line water quality monitors

(v) Trouble shooting and signs of failures

(vi) A list of toxic substances / loads to be avoided

(vii) Desludging requirements (if any)

(viii) Safety information

(ix) Spreading of hydraulic loads (if any)

(x) Use of treated effluent – fit for purpose

(xi) Influent sources to be connected to the treatment system

(xii) Alarm information and use restrictions

(xiii) Manufacturers name and contact details

(xiv) Procedures to be taken when cross connection occurs

5.4.2 The instruction manual should include a simple fault-finding chart explaining how the treatment system should be put back into operation from a fail-safe condition. Differentiation should be clearly made between those conditions which can be rectified by the user and those which may require external assistance by service technicians.

5.5 Submittals

5.5.1 The following information shall be provided by the manufacturers:

(a) Statement of warranty and service life containing the following:

(i) Equipment components under the warranty

(ii) Warranty terms, including service life period under the warranty

(iii) Warranty limitations

(iv) Warranty claims and procedures

(b) Installation manual and O&M manuals with summaries / briefs in Chinese

(c) User instruction manual with summaries / briefs in Chinese

(d) Service report form

(e) Certified engineering drawings, dimensioned and accompanied by a schedule of all components with name, model, size, description, function, material of manufacture and location in the treatment system. All components that are to be shown include the following, if applicable:

(i) Electric motor(s)

(ii) Gearbox

(iii) Compressor

(iv) Pump(s)

(v) Valves

(vi) Diffusers

(vii) Flow meter

(viii) Media

(ix) Media fixings

(x) Chlorinator

(xi) Pipework

(xii) Sludge collection and pumping equipment

(xiii) Baffles

(xiv) Partitions

(xv) Brackets

(xvi) Fastenings

(xvii) Electrodes

(xviii) Float switches

(xix) Control panel

(xx) Arrangement of the alarms

(f) Key plan showing location of treatment system within the development

(g) Plan and section showing location of the treatment system within the development and surrounding facilities

(h) Process and instrumentation diagrams

(i) Hydraulic profile with supporting calculations

(j) Detailed process design calculations

(k) Detailed drawings with plan and elevation showing treatment plant room layout, including pipework and equipment

(l) Route of access to the treatment plant room

(m) Ventilation and lighting details

5.5.2 Any dangerous goods (DG) storage required submission to Fire Services Department (FSD), shall be provided by the authorised person on behalf of the system owner.

6. Requirements on Sampling, Monitoring, Flow Measurement and Record Keeping

6.1 General

6.1.1 System owner and operator of water recycling system have a responsibility to implement a water quality monitoring plan and record performance following system commissioning. Collected data is to demonstrate that the recycled water quality is suitable for the intended use and will quickly highlight any problems, if any, with the water treatment system and allow corrective / remedial action to be taken.

6.1.2 Due to different characteristics of adopted treatment process in a water recycling system, the specific sensors and sampling arrangement is subject to the project proponent on a case-by-case basis.

6.2 Sampling and Monitoring

6.2.1 Regular monitoring of recycled water quality is required to ensure that the public health and safety of end users are protected. The recycled water quality criteria stated in **Table 1.1** serves as setting performance criteria and can be used as an operational check of the performance of the treatment system. Establishing performance criteria for treatment, rather than measurement of microbiological parameter (i.e. *E. coli*) for safety, permits treatment processes to be controlled more effectively by continuous monitoring the parameters with quick response (e.g. turbidity and total residual chlorine).

6.2.2 The treatment system requires particular attention to avoid recycled water stagnation during commissioning and early phases of operation, during which might encounter low flow with low intake.

6.2.3 The water sampling and laboratory testing shall be preferably conducted by an organisation accredited for providing laboratory testing services for monitoring parameters under the Hong Kong Laboratory Accreditation Scheme or its partners under the Mutual Recognition Agreement signed with the Hong Kong Accreditation Service.

6.2.4 A routine monitoring programme including on-line sensors / analysers and grab samples collection covering all parameters in **Table 1.1** shall be devised to ensure compliance of the quality of the recycled water from water recycling plant to the user end. As stated in **Table 1.1**, note 1, apart from total residual chlorine which has been specified (≥ 1 mg/L exiting treatment system; ≥ 0.2 mg/L at user end), the water quality standards for all parameters shall be applied at the point-of-use of the system.

6.2.5 Samples for the routine monitoring shall be collected from locations that best represent the whole system status, i.e., the points of use furthest from the treatment system. Additional samples shall also be taken from effluent storage tanks or equivalent and / or recycled water service reservoir, if routine sampling from points of use or other observations indicate a problem.

6.2.6 Should testing results of water parameters exceed the water quality standards in **Table 1.1**, re-sampling and testing shall be performed immediately to confirm the results. System operation shall also be investigated.

6.2.7 Should testing results of water parameters continue to exceed (such as at least two consecutive testing results) the water quality standards, the following remedial measures shall be followed:

(a) Contact contractor for recommendations and employ a treatment specialist to resolve the problem.

(b) Suspend the use of recycled water. Back-up water supply shall be used instead.

(c) Recycled water distribution system shall be flushed and disinfected in accordance with WSD requirements, water sampling and testing could be conducted on site with quick test kit for instant notice, prior to introducing potable water supply to supplement the recycled water supply.

(d) The treatment system shall remain operational while conducting system operation investigation. The treated effluent shall be diverted to discharge.

(e) Once the problem is isolated and resolved, take samples from the system for testing to confirm its compliance with the water quality standard before resuming usage of recycled water.

(f) Should the problem persist, the recycled water system should be shut down until the problem is solved.

6.3 Control, Mitigation and Contingency Measures

6.3.1 Control measures should be applied from collection of source water to delivery of recycled water for its reuse application.

6.3.2 In case of non-compliance with recycled water quality standards set out in **Table 1.1**, mitigation and contingency measures should be considered as suggested in **Table 6.1**. Updates will be made throughout the design, testing and commissioning, and operational phases of the scheme.

Table 6.1 Mitigation and Contingency Measures in Case of Recycled Water Quality Deterioration

Event	Mitigation	Contingency [1]
Presence of *E. coli* (≥1 cfu/100mL)	• Immediately check on-line TRC and *E. coli* data, and collect further grab sample and re-test TRC and *E. coli* • Process diagnosis at the treatment facilities such as hypochlorite dosing, review of CT values & operational log at chlorine contact tank (CCT)	• Isolate treatment facilities from Recycled Water SR if the result is ≥1 cfu/100mL • Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists

Event	Mitigation	Contingency [1]
TRC non-compliance (<1.0 mg/L exiting WRP, or below pre-set level, whichever is higher)	• Increase hypochlorite dosing at the inlet of chlorine contact tank [2] • Trigger hypochlorite trim dose at the outlet of chlorine contact tank • Review *E. coli* results at recycled water • Process diagnosis at the treatment facilities such as hypochlorite dosing, review of CT values & operational log at chlorine contact tank • Examine recent sampling results and identify any source(s) if influent *E. coli* and NH_3-N is high	• Initiate the supplementary chemical dosing system at Recycled Water SR • Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
TRC non-compliance (<0.2 mg/L at selected user end (e.g. public toilets) , or below pre-set level, whichever is higher)	• Review if there is any prolonged flushing water idling or supply suspension along the distribution • Review metering record along the upstream to estimate the equivalent water age and corresponding predicted TRC levels • Increase hypochlorite dosing at chlorine contact tank of the treatment facilities • Optimise service reservoir retention time due to flushing water demand (before achieving ultimate flushing demand)	• Initiate the supplementary chemical dosing system at Recycled Water SR • Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
BOD_5 non-compliance (>10 mg/L)	• Immediately collect further grab sample and re-test	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists (estimation based on surrogate COD value)
TSS non-compliance (>5 mg/L) Turbidity non-compliance (>5 NTU)	• Immediately collect further grab sample and re-test • Examine on any solids / sediments introduced to recycled water via chemical dosing or others	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
DO non-compliance (<2 mg/L)	• Initiate DO supplementary equipment installed at the outlet of chlorine contact tank (the buffer tank) of the treatment facilities • Immediately check on-line DO data and collect further grab sample and re-test	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
TON non-compliance (>100)	• Immediately collect further grab sample and re-test	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
Colour non-compliance (>20 HU);	• Immediately collect further grab sample and re-test • Visually inspect at the treatment facilities to identify any source(s) of colour from influent	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
No visible blue colour	• Visually inspect at the treatment facilities to identify any abnormality of dye dosing system • Increase dye dosing at the treatment facilities	• Initiate the supplementary dye dosing system at Recycled Water SR.
NH_3-N non-compliance (>1 mg/L)	• Immediately check on-line TRC, NH_3-N and *E. coli* data, and collect further grab sample and re-test TRC, NH_3-N and *E. coli* • Examine recent sampling results and identify any source(s) if influent NH_3-N is high	• Increase hypochlorite dosing to achieve breakpoint chlorination for NH_3-N removal • Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists

Event	Mitigation	Contingency [1]
pH non-compliance (>9 or <6)	• Process diagnosis at the treatment facilities such as hypochlorite dosing and operational log at chlorine contact tank • Examine recent monitoring and sampling results and identify any source(s) if influent pH fluctuates	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists
Synthetic detergents non-compliance (>5 mg/L)	• Immediately visually check the appearance of water and collect further grab sample and re-test	• Water Supply in the Recycled Water SR switch to TMF / water mains using fresh water if the exceedance persists

Notes:

[1] "Water Supply in the Recycled Water SR Switch to TMF / water mains using fresh water" will only be considered as last resort under various circumstances after mitigations proved to be ineffective.

[2] Sodium hypochlorite or equivalent will be dosed before source water entering the CCT via the mixing facility for achieving well mixing.

[3] The product of contact time (t in minutes) and the chlorine residual concentration (C in mg/L) at the end of that contact time, is known as the Ct value.

6.3.3 If levels of the bacteriological parameters i.e. *E. coli* exceeding the guideline value in **Table 1.1** persist, the use of the recycling water system shall be isolated until the problem is resolved. Review of system-wide disinfection to tackle exceedance in *E. coli* should be considered if necessary. If the level of the TRC parameter does not meet the recycled water quality requirements as mentioned in **Table 1.1**, the use of the recycling water system shall be isolated also until the problem is resolved.

6.3.4 For the other parameters that do not meet the requirements as mentioned in **Table 1.1**, tests shall be undertaken to investigate the cause. Following completion of the Mitigation and Contingency Measures stated in **Table 6-1,** take samples from the system for testing to confirm its compliance with the water quality standard before resuming usage of recycled water. If the levels still do not meet the requirements, the use of the recycling water system shall be suspended until the problem is resolved.

6.4 Flow Measurement

6.4.1 The total volume of all grey water, rainwater collected shall be fully measured.

6.4.2 The total volume of TSE collected from sewage treatment works shall be fully measured.

6.4.3 The total volume of the recycled water produced and delivered to end users shall be fully measured.

6.4.4 Flow measuring devices(s), such as water meter, shall be provided to measure the total quantity of all potable mains water supply used as backup water supply.

6.4.5 Flow measuring devices(s), such as water meter, shall be provided to measure the total quantity of all grey water, rainwater and TSE collected but not processed to produce recycled water (i.e. overflowed or diverted to bypass and drainage systems).

6.5 Record Keeping

6.5.1 The system operator shall maintain the proper records for a proper period of at least one year using a standard record form (Sample found in **Annex 2**).

6.5.2 All abnormalities on recycled water quality shall be properly documented and kept. Records shall be readily available for WSD to check upon request.

6.5.3 Records to be maintained might include the following:

(a) Water sampling and testing analyses

(b) Records of volume of grey water collected (daily)

(c) Records of volume of rainwater collected (daily, whenever rainwater is collected)

(d) Records of volume of TSE collected (daily)

(e) Records of volume of recycled water produced (daily)

(f) Records of volume of potable mains water supply supplied as back-up water with reason for its use (daily)

(g) Records of volume of grey water, rainwater and TSE collected but not treated, e.g., overflowed, bypassed or drained (daily)

(h) Records of volume of recycled water delivered to end users (daily)

(i) Operating hours (preferably daily records of on / off cycles combined with flows)

(j) Records from visual system inspection of recycled water system conducted annually

(k) Logs of inspections and maintenance work carried out by maintenance staff

(l) Records of chemical consumption (daily)

6.5.4 Contact information of the water recycling system including contractor and relevant government departments shall be updated and recorded regularly.

7. Marking and Labelling

7.1 Identification of Pipelines and Services

7.1.1 Pipework for rainwater collection, grey water collection, and TSE collection and recycled water shall be clearly distinguishable from the potable, salt water and wastewater pipework on a development. This practice prevents inadvertent cross-connection between water of different qualities, particularly drinking water.

7.1.2 The methods for identification are adapted from commonly accepted international standards or relevant Government departments' guidelines.

7.1.3 The pipe colour of recycled water pipes to be adopted may refer to the colour code of underground facilities[1] and be agreed with relevant authorities and maintenance agents as appropriate.

7.2 Labelling of Source Water Collection Pipework

7.2.1 Pipework for rainwater collection could be labelled with "RAINWATER" in order to prevent cross connection between the rainwater and mains water supplies. **Figure 7-1** illustrates an example of the label for reference.

Figure 7-1 Example of Labelling for Rainwater Collection Pipes

7.2.2 Grey water collection pipework could be labelled with "GREY WATER". Markings shall be made at time of piping manufacture, or labelling shall be attached during installation. An example is shown on **Figure 7-2** for reference.

Figure 7-2 Example of Labelling for Grey Water Collection Pipes

7.2.3 Pipework for collection could be labelled along their length with marker tape as appropriate in order to prevent cross connection between the source water and potable water supplies. Colour codes of "grey" colour and "black" background could refer to 10 A 03 from BS 1710 and 00 E 53 from BS 1710, respectively.

7.3 Labelling of Recycled Water Distribution Pipework

7.3.1 Grey water, rainwater and TSE after treatment is defined as recycled water.

[1] https://www.hyd.gov.hk/en/technical_references/technical_document/xppm/related_documents/doc/Colour_Code_of_Underground_Facilities-1.pdf

7.3.2 Distribution pipework could be labelled along their length with marker tape, and coloured, e.g. green colour (12 D 45 from BS 1710) stripes on background of black with green labels. An example is shown in **Figure 7-3** for reference**.**

7.3.3 To prevent discolouration of tapes after pipes are buried underground, it is proposed that labels "RECYCLED WATER" could be imprinted on the marker tapes. These markings could be applied during manufacturing or installation of the pipes, whichever is appropriate.

Figure 7-3 Example of Labelling for Recycled Water Pipes

7.3.4 The requirement and details of identification tape for source water collection pipework and recycled water pipework ahead also refer to relevant WSD Standard Drawings and be agreed with relevant authorities and maintenance agents as appropriate.

8. Safety Precautions

8.1 Safety Precautions for Operation and Maintenance Staff

8.1.1 Training in safe work procedure, including the use and maintenance of protective equipment shall be provided to the personnel carrying out the recycled water system commissioning.

8.1.2 Consideration should be given to basic hygiene practice to ensure that equipment used for application of recycled water is stored properly, to avoid occurrence of microbial growth and increase the risk from opportunistic pathogens, they are predominantly bacteria and include *Legionella pneumophila* and Pseudomonas species, especially, *P. aeruginosa*. These bacteria are able to grow in engineered water systems, particularly in biofilms, that develop in the absence of an effective disinfectant residual.

8.1.3 Recycled water treatment may involve application of chemicals classified as dangerous goods by FSD, which is a major concern. All personnel involved shall be fully conversant with the safe handling of the products.

8.1.4 Chemicals used for disinfection may be hazardous in undiluted form through contact, ingestion or inhalation. Containers should be properly labelled and kept in a secure place away from residents. Chemical suppliers must provide guidance on handling precautions and response procedures in case of accidental contact or ingestion. Chemicals shall be stored at an appropriate location to facilitate chemical handling. Chemicals shall be stored in accordance to FSD's requirements for bulk storage. Storage quantities shall not exceed the exempted quantity under the Dangerous Goods Ordinance (Cap. 295) and its subsidiary regulations.

8.1.5 Sodium hypochlorite solution is a corrosive substance classified as Class 8 dangerous goods item. The solution should be stored in tanks fabricated from fibreglass or rubber lined steel. Under the existing Dangerous Goods Regulations, storage of sodium hypochlorite in quantities exceeding 250 litres requires a license.

8.1.6 Material safety data sheet (MSDS) and relevant recognised data sheet for chemicals used in recycled water treatment processes shall be provided by the contractor and included in the operation and maintenance manual.

8.1.7 MSDS and relevant warning / safety label shall be provided on the surface of chemical buckets. The MSDS and labels shall be properly protected against water and chemical damage.

8.1.8 Eye wash bottles or washing basin with freshwater tap shall be provided adjacent to the recycled water treatment chemicals tanks or any appropriate location for emergency use. The water contained in the eye wash bottle shall be replaced periodically.

8.1.9 Mechanical or natural ventilation shall be provided to the room entirely or partially used for chemical storage.

8.1.10 Electrical work must only be undertaken by a competent electrician. Unless specifically designed to operate under submerged conditions, all electrical devices and connections should be made above the maximum flood level of the system under fault conditions. An electrical safety certificate (the Form WR1 or WR2 under Cap 406) should be issued upon completion of electrical installation or maintenance work.

8.1.11 Electrical fittings and luminaries serving the chemical storage area shall be weather-proof and corrosion resistant type.

8.1.12 Warning signs shall also be erected to restrict the unauthorised access to recycled water treatment systems.

8.1.13 Any part of the water recycling system may be contaminated with pathogenic bacteria. Plumbers, maintenance personnel and any others who come into contact with the water recycling system should wash their hands thereafter.

8.1.14 Grey water / rainwater / TSE collection pipework and tanks should be handled as if contaminated with faecal material. Gloves and overalls should be worn during routine cleaning and maintenance activities, and when cutting into the system.

8.1.15 Sufficient personal protective equipment shall be provided to protect workers during plant activities, such as sampling, from exposure to potential hazards such as aerosols.

8.1.16 Due to the non-potable nature of recycled water, safety precautions associated with the use of recycled water can be managed by minimising direct contact with human and avoiding potable consumption. If splashed in the eyes, wash immediately with clean water.

8.1.17 All workers or persons likely to be using recycled water should be briefed to understand that recycled water is being used, that recycled water is not to be used for drinking, handwashing or other similar uses, and that they shall wash their hands and face with fresh water before eating or finishing work.

8.2 Colour-Labelling of Recycled Water

8.2.1 Purple / lavender colour coded pipework (section 2.17.2) and label identifications on pipe surface (section 7.3) should be adopted to clearly distinguish different types of supply to avoid contamination due to cross-connection of pipes or misuse.

8.2.2 As an additional preventive measure for toilet flushing, colour-labelling of recycled water (i.e. addition of biodegradable food-grade dye i.e. Acid Blue 9 to recycled water at outlet of the water recycling system) is required to make recycled water discernible to fresh water and give an immediate visual warning to customers in case of the fresh water supply system being contaminated by recycled water.

9. Recommended Education and Training Content for Staff

9.1.1 Education and training for staff within water recycling system shall incorporate, but not limited to, the following:

(a) Overview of the treatment technology used within the water recycling system for recycled water production

(b) Prohibited uses as discussed in Section 1.3.6

(c) Induction training for new employees

(d) Training on emergency situation

9.1.2 Posters and pamphlets may be used to reinforce the education and training.

10. Compliance with Water Pollution Control Ordinance (Cap. 358), Waterworks Ordinance (Cap. 102) and associated Environmental Ordinance and Regulations

10.1 General

10.1.1 The design, operation, and maintenance of grey water and rainwater harvesting systems will not be a designated project under the Environmental Impact Assessment Ordinance (Cap. 499) (EIAO) considering grey water is collected from an independent collection system, which is separated from existing sewer system. Environmental Permit (EP) is not required for the building owner or the authorized person of a grey water and rainwater or a solely rainwater reuse system.

10.1.2 The design, operation, and maintenance of reclaimed water produced from TSE systems will be a designated project under Item F.4, Part I of the Schedule 2 of the EIAO, which requires an EP for the building owner or the authorized person of a reclaimed water system for its construction and operation.

10.1.3 The design, operation and maintenance of the recycled water systems shall comply with environmental ordinances and regulations, including but not limited to the Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations (Cap. 123I), Water Pollution Control Ordinance and Regulations (Cap. 358) (WPCO), Noise Control Ordinance (Cap. 400), Air Pollution Control Ordinance (Cap. 311), Waste Disposal Ordinance (Cap. 354), Country Parks Ordinance (Cap. 208), Waterworks Ordinance (Cap. 102)[2], Public Health and Municipal Services Ordinance (Cap. 132), and if applicable Environmental Impact Assessment Ordinance (Cap. 499), and associated Regulations. Such compliance shall include but not limited to the attainment of relevant discharge licenses, if applicable.

10.1.4 Any discharges from the recycled water treatment systems, disposals of used recycled water for various uses to sewers, storm drains or other environmental waters are subject to licensing control under the WPCO. The discharges are required to comply with the licence standard to be specified according to the WPCO Technical Memorandum – "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters".

[2] https://www.elegislation.gov.hk/hk/cap102

Part II: On-site applications of recycled water – Flushing, Landscape Irrigation and Street Cleansing

11. General

11.1.1 Technical requirements and practical guidelines to be adopted in the design and construction of inside service in local buildings have been stipulated in "Technical Requirements for Plumbing Works in Buildings" (December 2021, referred as "TR" thereafter in this Code of Practice).

11.1.2 Existing guidelines for saltwater for flushing regulated in "TR" are also applicable to recycled water system when it is used for flushing purpose. General advisory guidelines, but not exhaustive, for recycled water application are listed in the sections below for reference.

12. Marking and Labelling

12.1 Identification at Points of Use

12.1.1 To minimise the risk of misuse of recycled water, in addition to displaying sufficient signage at the point of use, the installation of accessible taps at the point of use of recycled water should be avoided as far as possible. If the installation of taps is unavoidable, the tap should be properly locked as far as possible.

12.1.2 All outlets supplying recycled water shall be clearly labelled with the words "Non-potable water" or a prohibition sign (**Figure 12-1**) so that users and maintenance personnel are aware of the non-potable water supply.

12.1.3 For landscape areas, general signs should be provided to indicate that the water used for irrigation is recycled water.

12.1.4 Where the majority of points of use are for non-potable water, the point of use for potable water may be identified with the words "Potable water" or by the potable water sign shown on **Figure 12-2**.

Figure 12-1 Example of Prohibition Sign

Figure 12-2 Example of Potable Water Sign

12.1.5 It is recommended that tags identifying each end user application and its water supply be secured using flexible fasteners or the like to avoid being detached.

The lettering shall be no less than 5 mm in height. Examples for recycled water are shown on **Figure 12-3**.

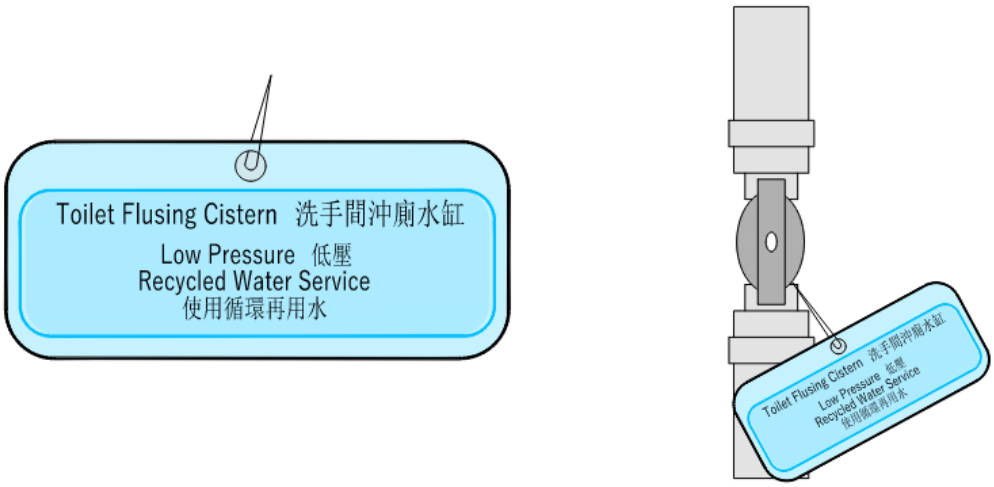

Figure 12-3 Example of Identification Tags and Positioning for Recycled Water

13. Safety Precautions

13.1 Safety Precautions for End Users

13.1.1 Due to the non-potable nature of recycled water, safety precautions associated with the use of recycled water can be managed by minimising direct contact with human and avoiding potable consumption.

13.1.2 End users shall wash hands after being in contact with recycled water. If splashed in the eyes, wash immediately with clean water. Avoid any unnecessary contact with recycled water.

13.1.3 End users shall not consume food or drink while working with recycled water. Wash hands and face with fresh water before eating and finishing work.

13.1.4 End users shall cover any wounds, after washing with soap and fresh water, with a waterproof dressing to prevent contact with recycled water.

13.2 Safety Precautions for Spray Irrigation and Street Cleansing Using High Pressure Sprayer with Recycled Water

13.2.1 Recycled water is treated and disinfected according to the required water quality standards. It is safe for non-potable uses including toilet flushing, landscape irrigation and street cleansing etc.

13.2.2 Due to the non-potable nature of recycled water, suitable precautionary measures shall be applied to prevent the public from making direct contact with recycled water from spray irrigation or street cleansing using high pressure sprayer as far as practicable. For example, portable barriers, cones and warning notices or the like may be placed around the affected areas to avoid approaching of the public. Operation should be avoided to clean busy roads and main traffic thoroughfares during peak hours.

13.2.3 Only freshly prepared recycled water shall be used for irrigation and street cleansing. Each batch of freshly prepared recycled water shall be consumed within 24 hours.

13.2.4 Spray irrigation or street cleansing using high pressure sprayer shall be located away from areas where food or drink is processed for consumption.

13.2.5 Signage of "Recycled Water – Do Not Drink", or prohibition sign as shown in **Figure 12-1** shall be provided in appropriate locations.

Annex 1 – Sample Standard Form for Recording Visual Inspection Results by Licensed Plumber

Standard Form for Recording Visual Inspection Results by Licensed Plumber

Date of Inspection: _____ **Ref. No.** _____

Name of Inspector: _____

Plumber License No.: _____

Location of Inspection: _____
_____

Purpose/ Usage Areas of Recycled Water: _____

Time of Inspection: _____ **Room Temperature:** _____

Physical Observations (water):

Odor:	none	sewage	sulfide	oil	gas	sour	other:_____
Colour:	none	yellow	brown	green	gray	milky	other:_____
Turbidity:	none	cloudy	opaque				

Floatables: none particulates oil sewage other:_____

Deposits: none sediments oily describe: _____

Physical Observations (facilities):
Meters: in place and intact other:

Recycled water lines: in place and intact other:

Pumps and equipment: in place and intact other:

Equipment room/door signs: in place and intact other:

Exposed piping in the equipment room: in place and intact other:

Valve (lock seals): in place and intact other:

Colour labelled for recycled water: in place and intact other:

Cross-connection test: required, not required

Photos:

Annex 2 – Sample Record Form for Recycled Water Systems

Record Form for Recycled Water Systems

Date: _____ **Ref. No. _____**

Name of Operator: _____

Location of the Plant: _____

_____

Purpose/ Usage Areas of Recycled Water: _____

Volume of Grey Water Collected: _____m^3

Volume of Rainwater Collected: _____ m^3

Volume of Treated Sewage Effluent: _____ m^3

Volume of Potable Mains Water Supply supplied as back-up water: _____ m^3

Reason for using Potable Mains Water as back-up water:

_____

Volume of Recycled Water delivered to end users: _____ m^3

Operation Hours: From _____ to _____

Amount of Chemicals Consumption:
Chemical 1: _____ Amount: _____
Chemical 2: _____ Amount: _____
Chemical 3: _____ Amount: _____

Remarks:

_____

_____

Prepared by: _____ **Checked by: _____**