University Hospitals of Derby and Burton
NHS Foundation Trust

WATER SAFETY PLAN

BOOK 3

CAPITAL MANAGEMENT

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Name: Andrew Selby

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HYDROP E.C.S.

PREPARED BY: Mike Koumi and Philippa Robinson

Wrens Court, 55 Lower Queen Street, Sutton Coldfield, West Midlands, B72 1RT
Tel: 0121 354 2030 Fax: 0121 354 8030
info@hydrop.com www.hydrop.com

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1. INTRODUCTION AND PURPOSE

This WSP Book has been developed to support the Trust Capital Planning Officers with:

a. Ensuring correct and 'fit-for-purpose' and compliant design.

b. Preparing for 'pre-commencement' works.

c. Ensuring for proper installation, 'wetting' and commissioning.

d. Delivering suitable and safe hand-over processes.

1.1. Stage 1:

Instruction, advice and guidance on Procuring Capital Building Projects is provided by current Trust documentation, which must be used in-tandem with this WSP Book.

There are slight differences in the procurement steps, depending on the size of the capital investment. This document sets out the stages of the procurement process for the different sizes of Works, and identifies the people and parties that need to be involved. It provides a checklist, or links to those issued nationally, as well as templates for the key documentation, for the Trust's Project Manager.

1.2 Stage 2:

Once the project has been procured in accordance with the Trust standard, correct execution and delivery of the project is determined by this document – WSP Book 3. The topics detailed in this document include:

- Design Verification
- Pre-commencement works
- Installation Verification
- Pre-Commissioning and System Filling (Wetting)
- Flushing
- Commissioning
- System Disinfection
- Temperature
- Microbiological Analysis
- Hand-Over
- Asset list
- Occupation

2. WATER SYSTEM AND PLANT DESIGN AND INSTALLATION

2.1 Supplies from a water undertaker:

The following factors must be taken into consideration in the initial stages of the design:

i. The water undertaker's requirements.

ii. The estimated daily consumption and the maximum and average flows required, together with the estimated time of peak flow.

iii. The location of the available supply.

iv. The quality, quantity and pressure required.

v. The cold water storage capacity required.

vi. The likelihood of ground subsidence due to mining activities or any other reason.

vii. The likelihood of there being any contaminated land on site.

viii. The proposed method of storage and probable number and purpose of direct connections to pressure mains.

ix. The minimum and maximum pressures available at the service connection.

x. Details of the physical, chemical and microbiological characteristics of the water supply and scope of any possible variations in such characteristics.

xi. The possibility of an alternative service connection from some other part of the water undertaker's network, including pressure details.

2.2 Primary Water Supplies:

Water supplied for such domestic purposes as consist in or include, cooking, drinking, food preparation or washing should be regarded as wholesome as it applies to the supply of water for those domestic purposes, if the following requirements are satisfied:

i. That the water does not contain any micro-organism or parasite; or any substance at a concentration or value which would constitute a potential danger to human health – See 'The Water Supply (Water Quality) Regulations 2016 and The Water Supply (Water Quality) (Amendment) Regulations 2011' and the Trust's 'Biological Contamination Measured Parameters'.

ii. That the water does not contain any substance at a concentration or value which, in conjunction with any other substance it contains would constitute a potential danger to human health.

iii. Water supplies to certain specialist units such as maternity, neo-natal paediatric, general paediatric and renal dialysis units (see the Renal Association, 2002) should be monitored to ensure that water quality is within acceptable limits as defined by BS ISO 13959; 2009: *Water for haemodialysis and related therapies*, BS ISO 13958; 2009: *Concentrates for haemodialysis and related therapies*, and BS ISO 11663; 2009: *Quality of dialysis fluid for haemodialysis and related therapies*. In addition the requirements for water treatment equipment are provided in BS ISO 26722; 2009: *Water treatment equipment for haemodialysis and related therapies,* BS ISO 23500; 2011: *Guidance for the preparation and quality management of fluids for haemodialysis*.

iv. The Trust, or others on its behalf, when providing and managing temporary water supplies, should comply with their duties under the Health and Safety at Work etc. Act and BS 8551:2015 - Provision and management of temporary water supplies (not including provisions for statutory emergencies) and in accordance with the Trust's Business Continuity Plan. This provides clear practical guidance on how to install temporary supplies, whether by connection to the mains or tanker-fed, and how the distribution system should be disinfected and tested to ensure that the water is wholesome.

v. No connection to any part of the hospital's Primary domestic water supply should be made without the written authorisation of the Responsible Person (Estates) using 'Process and Permit to allow connection to hospital's/site Primary Water Supply, found in Book 5 'Associated Processes, Specifications, Certificates and Permits'.

2.3 Water Treatment Requirements:

The Trust requires that any allowance made for supplementary control measures, or deviation from standard control measures, vis-à-vis temperature, in any new builds or major refurbishments, to support water temperature management and control measures, are approved by the WSG following submission of the application process detailed below, where shown to be necessary. Before any such control measures are utilised, the WSG must consider their safety, suitability, accreditation status and usage permission before being proposed for ratification.

i. All water supplied to the Trust sites must comply with current legislation on water quality.

ii. The need for water treatment, and the treatment processes used should depend on the purposes for which the water is to be used and the quantity required for each purpose.

iii. Where continuous water treatment is installed, the commissioning records should include details of settings of the equipment, dosing rates and requirements for testing.

iv. Levels of disinfectant must be agreed with the Estates Project Manager prior to commissioning the plant and equipment and must be in accordance with relevant guidelines.

v. To prevent the accumulation of biofilm during construction and testing, the system should be left dry and uncharged until the latest possible moment within the contract requirements. Consideration should be given to the possibility of using and inert gas or nitrogen as an alternative to using water during this process.

vi. Dosing with an appropriate type and level of biocide as soon as water hits a pipe or storage vessel (when system is first subjected to pressure testing), along with regular flushing, can control the accumulation of biofilm more effectively.

Any additional/supplementary control measures to be employed must be supported by all necessary 'Approval-for-use' certification from the relevant local authorities (where applicable) and be suitable and safe for use in health care environments. In addition, installation of such additional/supplementary control measures must be supported by a detailed and robust installation and management rationale, which must be approved by the WSG before commissioning.

1. Reasons why supplementary bacterial control is necessary.
2. Evidence, data and information used to construct the rationale.
3. 'Failed' parameters and the reasons why these are considered to be failing.
4. Details of the proposed supplementary control measure (type of chemical, expected levels, etc.)

5. Duration of use of supplementary control measure.
6. Interim control measures during the installation of the supplementary control method and anticipated elevated risks during installation, short-term, medium-term and long-term.
7. Exit strategy and parameters used to construct this strategy.

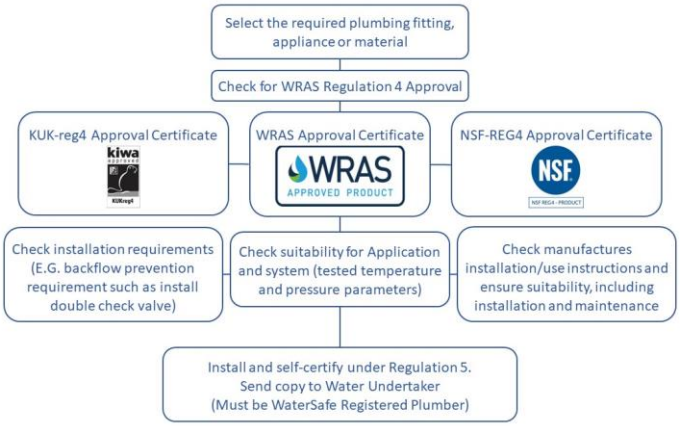
Once the rationale for implantation of the supplementary control method has been approved by the WSG, the following processes must be considered prior to installation:

i. Base-line bacterial contamination levels.
ii. Installation process and mechanical facilitation works required.
iii. Procurement of measuring equipment.
iv. Training of appointed personnel who will be involved in the monitoring of the system.
v. Agreed dosing levels.
vi. Agreed overdosing prevention control measures.

2.4 General Design and Installation Considerations:

Domestic water systems and associated equipment which utilise water and can affect the water supply, the atmosphere and the user, should be properly designed, installed, commissioned, monitored regularly and be subjected to the following regimen prior to handover, practical completion and acceptance by the trust:

i. All designs must be in accordance with all relevant and current Guidelines, British Standards, 'Best-practices' and all current and relevant publications related to NHS estates pertaining to water quality management and control.
ii. The systems should be carefully designed to, where practicable, eliminate or minimise aerosol production and avoid excessive water retention. They must also be designed to be readily accessible, drained, cleaned, and where necessary, suitably disinfected.
iii. No materials used in construction should include those that are known to harbour or provide nutrient for bacteria. Plastic pipe-work should be avoided and copper should be used wherever possible. Any materials that come into contact with the domestic water system should comply with the requirements of the Water Supply (Water Fittings) Regulations 1999. In addition to fittings approved by WRAS, fittings approved by 'other' bodies such as KIWA, and NSF under 'Regulation 4' approval may be used. The selection of materials and fittings should follow the below process. Further information on the selection of materials can be found in BS 8558:2015, BS6920:2014 and HTM 04-01.



iv. All TMVs and TMTs installed must be compliant with HTM 04-01:Supplement 2017 - Health Technical Memorandum04-01: Supplement Performance specification D 08: thermostatic mixing valves (healthcare premises) and the TMV3 Approved Scheme and installed in accordance with all relevant and current Guidelines, British Standards, 'best-practices', Health Technical Memoranda and all current and relevant publications related to NHS estates pertaining to water quality management and control. The list of currently approved TMVs and TMTs is to be found on www.nsfpams.com.

v. The systems must be maintained in a clean and sound condition and must be easily and safely accessible.

vi. All systems must be flushed to simulate the necessary usage frequency (at least daily before practical completion and in accordance with 'Usage Evaluation and Flushing Process' found in Book 5 thereafter), in order to avoid stagnant water which will increase the potential of bacterial growth and proliferation.

vii. No flexible hoses should be fitted to any new buildings or refurbishments commissioned by or on behalf of Trust

viii. It is essential that the needs of individual patient washing and bathing requirements are carefully considered. In new premises, correct citing and installation of showers and wash-hand basins, particularly in accommodation where patients are unlikely to make use of them, requires assessment. For existing premises, and subject to a risk assessment, permanent removal of disused or infrequently used outlets and their associated pipework should be considered.

ix. Tap design has evolved. In older installations, thermostatic control of water temperature was achieved by a separate thermostatic mixing valve (TMV) (commonly called a "t-shaped" TMV), typically located behind the sanitary assembly panel to which a wash-hand basin or other assembly was fitted, which then supplied water to the hot connection of a manual mixing tap or separate tap. Many new installations now include thermostatically controlled thermostatic mixing taps (TMTs) which are usually manually controlled (on and off) and can be adjusted to further reduce outlet temperature to fully cold. All new installations should consider the use of TMTs instead of TMVs, where practicable.

x. The choice and type of water outlets for the augmented care setting is therefore important. This choice should be based on a risk assessment of infection-control and scalding issues.

xi. In intensive care and other critical care areas, where patients are unlikely to be able to use the wash-hand basins, the installation of non-TMV mixing taps may be the preferred control option following a risk assessment.

xii. All plant and distribution pipe-work (where accessible) should be clearly labelled and adequately insulated.

xiii. The use of restricting flow-straighteners shall be avoided. Anti-microbial, non-restricting, flow straighteners shall be fitted to all outlets instead, where practicable.

2.5 Cold Water Storage:

i. Cold water storage tanks should be constructed from non-deleterious materials which must be approved by the relevant body.

ii. Cold water storage tanks should be designed and installed in accordance with the current Water Supply (Water Fittings) Regulations 1999, installed in appropriate and suitable locations to allow easy and safe access to facilitate inspection and maintenance.

iii. Sectional Cold Water Storage tanks should be designed with external assembly flanges and self-draining profiles, since this arrangement facilitates easy cleaning of internal surfaces.

iv. Hollow roof supports are not permitted.

v. Externally located Cold water storage tanks should be suitably protected from environmental conditions, particularly the local high ambient temperatures for all new buildings and, where practicable, for existing installations.

vi. Tank rooms should be adequately ventilated in order to keep the tank room temperature low to ensure the minimisation of ambient heat gain by the stored water.

vii. Cold water storage tanks must be suitably and adequately insulated and protected from the ingress of heat, light, insects and birds.

viii. Cold water storage tanks should be sized and arranged so as to minimise retention time of stored water (12hrs minimum - 24hrs maximum), and therefore to increase the rate of stored water exchange. Variable height ball-valves/control should be used.

ix. Cold water storage tanks should be fitted with a suitable and correctly installed 'quick-fill' connection for emergency and temporary water supplies. It is important to ensure that isolation valves on such connections are located such that dead-legs are avoided.

x. Cold water storage tanks should be subjected to a 'need' test which requires the designer to question the presence of each unit and consider its removal if the services it supplies can be, equally well, supplied by domestic Mains.

xi. Each unit should be subjected to a 'drop-test' designed to ascertain the capacity and demand requirements of each system, in order to ensure that excessive volumes of water are not unnecessarily stored. Eliminating storage within a system would also allow the negation of the necessary PPM Programme tasks and their replacement with much less onerous, more infrequent and less costly tasks to be carried out.

xii. All associated pipework and valves should be adequately insulated and clearly labelled to identify their purpose.

xiii. Flow control valves should be selected on the basis of a local design assessment and the appropriate type of valve selected in order to help avoid stagnation of water.

xiv. Where Cold water storage tanks are linked 'in parallel', each feed to each tank should be fitted, where practicable, with a water meter in order to allow for confirmation of equal and uniform usage from all tanks in the configuration and that all isolation valve configuration must be designed to ensure minimisation of dead-legs when individual units in the set are isolated.

xv. The location of isolation valves on the inlets and outlets of linked tanks must be such that the isolation of any of the linked units does not result in unnecessarily long dead-legs.

xvi. The location of isolation valves on the drains of each tank should be such that it does not result in unnecessarily long dead-legs.

xvii. Various arrangements of pumping systems are indicated in BS 8558:2015. Where booster pumps are to be installed, a break cistern will be required between the mains supply pipe and the pumps. This is required in order to comply with the Water Supply (Water Fittings) Regulations 1999 with regard to prevention of backflow. Control of the pump(s) should be fully automatic in operation and controlled by pressure sensors. Where two or more pumps are installed, the design flow should be achieved with one pump stationary (or out of service). Automatic control should be provided to cyclically and sequentially control all pumps to ensure that each is regularly brought into service.

xviii. Stored water should be maintained at a temperature of <20°C (**and** no more than 2°C from the supply) - *Currently there is no upper limit standard for drinking water temperature in*

European or domestic legislation. In normal circumstances temperatures should be delivered by the undertaker below 20°C but there is growing evidence that supply temperatures may rise above 25°C in summer months. Coupled with improvements in building thermal performance and climate change, rising cold water supply temperature is likely to become more problematical. The design aim should be to ensure that cold water temperature draw-off is as close to the supply temperature as possible. Government guidance to the Water Supply (Water Fittings) Regulations recommends that as far as is reasonably practical cold water temperatures should not exceed 20°C. As far as possible, the objective should be to design the cold water systems to ensure that the inlet, outlet and surface water temperatures of cisterns and cold water feed/header tanks for the hot water calorifiers are not greater than 2°C above that measured of the incoming water supply at the property boundary. Also, at cold water draw-off points, a temperature of no greater than 2°C above the temperature measured in cistern and cold water header tanks should be reached within two minutes..

xix. Where indicated and when it is deemed necessary and practicable, Cold Water Storage Tanks should be upgraded, refurbished, modified or replaced so that they may comply with current Water Supply (Water Fittings) Regulations 1999. Following these works, each tank must be cleaned and disinfected in accordance with BS 8558:2015 and L8 prior to it being allowed back into service.

xx. The temperature of the Cold Water Storage Tanks should be continuously monitored by a suitably calibrated BMS system.

2.6 Hot Water generation and storage:

i. Hot water generation and storage units should be installed in appropriate and suitable locations to allow easy and safe access to facilitate inspection and maintenance.

ii. Where more than one hot water generation unit is used, they should be connected in parallel, taking care to ensure that the flow can be balanced so that the water temperature from all the units exceeds 60˚C at all times and that all isolation valve configuration must be designed to ensure that elements of the system can be isolated for maintenance, or repair purposes, without creating dead-legs when individual units in the set are isolated.

iii. The location of isolation valves on the inlets and outlets of linked units should be such that the isolation of any of the linked units does not result in unnecessarily long dead-legs

iv. The combined storage capacity and heater output must be sufficient to ensure that the outflow temperature, from Calorifier or Plate Heat Exchanger Buffer Vessels, should not be less than 60˚C during normal use. This applies to both circulating and non-circulating hot water systems.

v. Plate heat exchangers should, where practicable, be installed without buffers vessels. Where buffer vessels are used, they should not receive the CWS feed directly. All buffer vessels fitted, must be subjected to a regular temperature monitoring programme and contents maintained at ≥60.0°C.

vi. The positioning of the control and high limit thermostats, cold feed and return water connections must ensure that these temperatures are achieved.

vii. Measures should be taken to prevent warm water entering the cold-feed. A check valve should be provided in the cold feed, where practicable, as close to the unit as practicable, to prevent such circulation. However, the installation of such a check valve should not be carried out in systems that use the cold feed for expansion. In these cases, the installation of a U-bend or S-bend in the cold-feed, sufficient distance from the connection to the unit, so that water which is warm is not displaced (on heating up) beyond the bend and the vertical pipe rise should be carried out.

viii. The practice of terminating the air vent over the Water Storage Tank should be

discouraged. The vent should be arranged to discharge over a separate tun-dish arrangement, with a visible Type A air gap, sited at a level that takes account of the hydrostatic head of the system. The Calorifier or Plate Heat Exchanges Buffer Vessel should be provided with a suitable safety valve of appropriate size and vacuum release arrangement.

ix. Where water quality indicates the need, cathodic protection from galvanic action by means of sacrificial anodes should be provided.

x. Calorifiers and buffer vessels (where necessary) should be fitted with a de-stratification pump, designed to avoid temperature stratification of the stored water. Some semi-storage/high-efficiency calorifiers are supplied with an integral pump that circulates water in the calorifier. De-stratification pumps should not be fitted to this type of units.

xi. A single circulating pump should normally be installed in the return. If, for reasons of reliability, two pumps are installed in parallel they should be arranged to have individual non-return and service valves and be controlled such that each one is brought into operation twice a day.

xii. When units are isolated from the system (for whatever reason), the associated distribution system should be subjected to DAILY flushing. However, this is only necessary when the unit isolated is the sole supply of HWS to that distribution system. Where more than one unit supplies the distribution services, the isolated unit should be drained down (where applicable) and allowed to remain drained whilst off line

xiii. A suitably sized drain should be connected to the base of each Calorifier and Buffer Vessel (where practicable).

xiv. Calorifiers, Buffer Vessels and all other hot water generation units, other than instant water heaters of <15 litres (listed below) should be designed and set to operate and be maintained at the following temperature profiles at all times:

a. Stored and Flow at ≥60.0°C

b. HWS Return at ≥50°C at the calorifiers and ≥55°C throughout the system including Principal, Subordinate and Tertiary HWS return loops.

Circulating HWS principal loops: In circulating systems the far sentinels are the return legs at a point towards the end of the re-circulating loop. Where the system consists of several re-circulating loops, the end of each should be identified as far sentinel points for monthly monitoring. In either case, the layout of the distribution system should be considered rather than the location of the outlets, as they might not correspond.

Subordinate and tertiary HWS loops: Many larger circulating HWS have additional loops consisting of a smaller bore pipe branching from the flow leg of a principal loop to supply a group of outlets and connecting back to the return leg. In systems such as this, the smaller bore loops are the subordinate loops and the larger loops are the principal loops. Subordinate loops should be monitored ideally at a suitable return leg or from a representative outlet, in order to test all subordinate loops quarterly. However, large and complex, often have localised loops that feed only one or two outlets and these can be identified as tertiary loops.

d. Distribution and at point of facility supply at ≥55°C direct-supplied outlets or to thermostatically controlled valves and/or taps (measured at sentinel outlets).

e. Drain at ≥55°C.

f. In order to ensure that the temperatures required for achieving thermal disinfection (≥60ºC for the “Flow” and ≥55ºC) for Distribution)) are maintained, it is important to ensure that:

1. All units should be operated continuously ensuring that the heat source is available constantly.
2. Where a building is to remain un-occupied, the Calorifier or Plate Heat Exchanges Buffer Vessel should, where practicable, be emptied, and pasteurised before being allowed back 'on-line'. This process requires that Notification of closure of facility, is suitably completed.

xv. Hot water generation and storage units should be subjected to Flow and Return temperature monitoring remotely via a BMS system. The BMS sensors should be located such that they can be easily accessible for maintenance and calibration when necessary. The sensors should be calibrated once suitably installed.

xvi. Pasteurisation of Calorifiers and Buffer vessels should be carried out as part of new system disinfections and in the event of major modifications or after a period out of service, before the calorifier is returned to service.

xvii. Cistern-type water heaters should be avoided but where installed they should be maintained such that the cold tank part of the heater is kept clean and at the correct temperature, and the hot tank part maintained at a temperature of >60.0°C allowing for distribution temperatures of >55°C. A screened vent and an insect/rodent overflow screen should be fitted to the tank part of the units.

xviii. Where circulation and shunt pumps to be replaced as part of the refurbishment of a system then they should be replaced with units which are rated exactly the same as the replaced unit in order to avoid major changes in the profile of fluid dynamic of the system so as to avoid changes to the biofilm in the system which can increase the potential of contamination in the system.

xix. Low volume water heaters of <100 - >15 litres and combination boilers in patient areas should be allowed to operate so that the furthest outlet from each unit is ≥55°C – measured at the point of supply to direct-supplied outlets or to thermostatically controlled valves and/or taps.

xx. Instant water heaters of <15 litres, including combination boilers, usually store small water volumes, and because of this they do not usually need to be operated within the temperature profile and limits prescribed for larger systems (≥60°C for the 'flow' and (≥55°C for the 'return' and ≥55°C for 'outlet') which are necessary for thermal disinfection. These units, except those associated with TMVs/TMTs and where the hot supply is >5metres, can, therefore, be operated at "scalding safe" temperatures of ≤41.0°C (+1°C) although they should be switched-on at all times to ensure and encourage adequate use. Infrequent use of these units (less than twice weekly) would increase the potential of bacterial growth and proliferation (as would be the case in all infrequently used areas throughout the system – both hot and cold), although particularly in this case because of the low temperatures where operated.

2.7 Expansion and Pressurisation Vessels:

i. All new and replacement expansion/pressurisation vessels fitted should be of the flow-through type.

ii. Expansion vessels should be located on the cold feed rather than on the hot water side of the system. The length of pipework between the expansion vessel and cold feed should be as short as practicable.

iii. Where expansion and pressurisation vessels are of the single-entry type they must be fitted with appropriate 'anti-Legionella' flow-through valves or drain valves to facilitate flushing of the unit. The vessel should be fitted vertically, with the pipework between the expansion vessel and cold feed constantly rising and should be as short as practicable. The flushing frequency should be determined by assigning "target" units which should be subjected to specified monitoring frequencies but, as a minimum, this

must be at least weekly and carried out by the contractor, or their approved representative, until hand-over.

2.8 Hot and Cold Water Distribution Systems:

i. The design and installation of the hot and cold water distribution system should comply with the Water Supply (Water Fittings) Regulations 1999 and BS 8558:2015.

ii. The design of the pipework should ensure that there is no possibility of a cross-connection between installations conveying potable water and an installation containing non-potable water or water supplied from a private source (untreated). There should be no possibility of backflow towards the source of supply from any tank, cistern or appliance, whether by back siphonage or otherwise.

iii. The selection of water outlets is important. This choice should be based on a risk assessment of infection-control and scalding issues, should be capable to receiving POU filters without contravening Water Regulations compliance and it is important to ensure that they are easy to use and practical for the existing space. In intensive care and other critical care areas, where patients are unlikely to be able to use the wash-hand basins, the installation of non-TMV mixing taps may be the preferred control option following a risk assessment.

iv. All cold distribution pipework, mains and tank down feeds should be located, as far as is practicable, to minimise heat gains from their environment. Pipework should not, as far as is practicable, be routed through hot ducts or run adjacent to heat sources, such as radiators.

v. All pipework should be insulated, except, following written agreement by the Trust, for any exposed final connections to facilities, and should be arranged to eliminate or minimise dead-legs.

vi. Mains and Tanked (including boosted) Cold Water Services (CWS) Distribution at <20°C.

vii. Stored hot water at ≥60°C.

viii. Hot Water Services (HWS) Flow at ≥60°C.

ix. HWS Distribution at all outlets at ≥55°C.

x. HWS Return at ≥50°C at the calorifiers and ≥55°C throughout the system including Principal, Subordinate and Tertiary HWS return loops.

xi. Stagnation should be avoided. Hot and cold water services should be sized to provide sufficient flow at draw-off points. The aim should be to promote turnover of water by means of; the design of the distribution circuitry, adequate usage and avoidance of "disused" areas.

xii. All supplies to drinking water systems should be of wholesome quality. Additionally, it should be established that the usage is sufficient to avoid deterioration in water quality, for example, that the inlet water temperature does not exceed 20°C and that the outlet does not remain unused.

xiii The Trust shall not allow the installation or use of Water Coolers/Chilled Water Dispensers in patient areas. In exceptional circumstances, where the use of a Water Coolers/Chilled Water Dispensers is required, their approval for installation and use shall only be approved following formal completion of and authorisation by Management Process 'Process and Permit for the installation of new water dispenser water cooler', found in Book 5 'Associated Processes, Specifications, Certificates and Permits. Note: The installation and use of Water Bottle Dispensers is not permitted. Where found to be installed, these shall be removed.

xiv. Water Coolers/chilled water dispensers should be positioned so that the warm air exhaust does not impinge directly on taps or pipework supplying cold water.

xv. The domestic hot water system should not be used for heating purposes. This includes all radiators, towel rails, heated bedpan racks etc, whatever the pipework configuration.

xvi. Central 'common blending' systems should not be used, since the length of distribution pipework containing water in the temperature range that supports bacterial growth and proliferation would far exceed the maximum permissible lengths mentioned below.

xvii. Scalding control in all Trust's premises shall be based on a suitable and sufficient risk assessment. In all patient areas (excluding sluices and kitchen sinks) scalding control should be achieved by the installation of Type 3 D 08 specification Thermostatic Mixing Valves (TMVs) and/or Thermostatic Mixing Taps (TMTs) which should be compliant with: HTM 04-01; including HTM 04-01: Supplement 2017 edition and maintained in accordance with BS7942:2011 - Thermostatic mixing valves for use in care establishments - Requirements and test methods.

The temperature from all such outlets should be measured on a regular basis and set at:

1. 41°C (+1°C) max for showers
2. 41°C (+1°C) max for basins
3. 44°C (+1°C) Max for baths
4. 38°C (+1°C) Max for bidets

xviii. Depending on the results of the scalding risk assessment and to be agreed by the WSG, scalding control in non patient areas and public areas should be achieved by general "Warning! Hot Water" notices to indicate and warn users of the potential of scalding.

xix. The pipe-work length from the TMV/TMT to the outlet should be restricted to a maximum of two metres. Where possible, it is preferable that TMTs are used, in order to maintain lengths of pipe-work carrying blended water to minimum.

xx. Where not installed integrally, all TMVs and TMTs should include or be fitted with strainers, isolation valves and non-return valves.

xxi. TMVs and TMTs shall not be fitted or installed with flexible rubber hoses.

xxii. All TMVs and TMTs should be easily and safely accessible.

xxiii. All TMVs and TMTs should be commissioned, inspected and subjected to a fail-safe test (carried out as described in the manufacturer's instructions).

xxiv Hot and cold water circuits (flow and return) temperature should be monitored remotely via a suitably and sufficiently calibrated BMS system. As a minimum, such monitoring shall be at ward/department main branches, but should be extended to include principal and subordinate loops where practicable. The BMS sensors should be located such that they can be easily accessible for maintenance and calibration. The sensors should be calibrated once installed and the calibration repeated at least annually or more frequently in accordance with manufacturer's and installers instructions.

2.9 Showers and TMV:

i. In all patient areas, all showers should be fed via Type 3 D 08 specification shower TMVs which should be maintained and operated at 41°C (+1°C) max.

ii. Shower heads with fixed nozzles should be used at all times. Shower heads which are provided with a means for adjusting the flow, for example fine spray, pulsating flow etc, selected by utilising different sets of nozzles, should not be installed as this will

exacerbate possible stagnation problems. Where present, these should be replaced with shower heads with fixed nozzles.

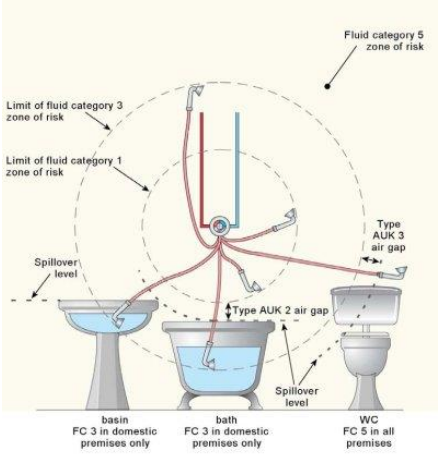
iii. Central 'common blending' shower-block systems should not be used and all pipe-work length from the shower TMV to the shower-head should be restricted to a maximum of two metres.

iv. All shower TMVs should include or be fitted with strainers, isolation valves and non-return valves.

v. All shower TMVs should be easily and safely accessible.

vi. These units should not be fitted or installed with flexible rubber hoses.

vii. Constraining the outlet of a flexible shower hose, so preventing it from being placed below the spill-over level of the shower tray or bath, or reaching the WC, by means of a retaining ring is an acceptable means of backflow prevention.



Robust factory applied retaining rings of the design which do not allow the shower hose to be removed are a recognised method of maintaining an AUK3 air gap acceptable in all types of premises. For further information please refer to www.waterregs.couk/guidance information note 'Prevention of the risk of backflow in the design of domestic bathrooms'.

ix. All shower TMVs should be commissioned, inspected and subjected to a fail-safe test periodically (carried out as described in the manufacturer's instructions).

2.10 Baths and TMV/TMT:

i. To avoid scalding, all baths in patient areas should be fed via Type 3 D 08 specification TMVs/TMTs which should be maintained and operated at 44°C (+1°C) max and in accordance to the Trust's 'Safe Bathing Policy'.

ii. All bath TMVs/TMTs should include or be fitted with strainers, isolation valves and non-return valves.

iii. All bath TMVs/TMTs should be easily and safely accessible.

iv. All bath TMVs/TMTs should be commissioned, inspected and subjected to a fail-safe test periodically (carried out as described in the manufacturer's instructions).

v. These units should not be fitted or installed with flexible rubber hoses.

2.11 Non-Touch Electronic Activated Taps:

i. The installation of Non-Touch Electronic Activated Taps shall only be installed following a successful application to the WSG.

ii. Where installed automatic sensor taps should be set to dispense water for at least 30 seconds per use and where taps can be programmed to flush automatically they should be set to flush for a minimum of one minute every twelve hours from last use.

iii. Where such taps are located in augmented care areas (which should be identified and designated by Trust IPC), these should be set to flush for a minimum of three minutes every six hours from last use

iv. These units should not be fitted or installed with flexible rubber hoses.

2.12 Aerators and Flow straighteners:

i. Owing to their high surface-area-to-volume ratio and location at the tap outlet, certain designs of flow straighteners may present a greater surface area for colonisation and support the growth of organisms. Therefore, when selecting new taps, where possible flow straighteners should be avoided/not included, or should be of the anti-microbial type.

ii. During refurbishments, it is important to consider retrofit devices which can be fitted to existing taps and designed to eliminate this risk.

2.13 Greywater and water harvesting systems:

i. Bearing in mind the link to energy conservation and the environment the use of greywater and rain-harvesting systems should be reviewed in the first instance.

ii. Where possible, greywater systems shall be avoided, where practicable, or installed and maintained in compliance with BS 8525-1:2010 - Greywater systems – Part 1: Code of practice and BS 8525-2:2011 - Greywater systems –Part 2: Domestic greywater treatment equipment – Requirements and test methods.

iii. Where possible, rainwater harvesting systems shall be avoided, where practicable, or installed and maintained in compliance with BS 8515:2009 + A1:2013 - Rainwater harvesting systems - Code of Practice.

2.14 Irrigation Systems:

i. Irrigation systems should not use untreated water or untreated grey water and water should not be dispersed using sprays.

3. DESIGN INSTALLATION AND COMMISSIONING OF REFURBISHED AND NEW-BUILD FACILITIES

3.1 Process Management:

The design, installation and commissioning of all new-builds and refurbished areas should be carried out in accordance with the Trust's current Policies detailed in Section 1 of this document.

3.2 Legislation, standards and guidance:

As well as complying with the recommendations outlined in this document and in accordance with the Polices described above, the design, installation, commissioning and hand-over of the hot and cold water services, new, extended or refurbished, in any NHS premises should also comply with:

i. The Health and Safety At Work Act 1974
ii. The Management of Health and Safety at Work Regulations 1999
iii. Control of substances Hazardous to Health Regulations 1994 (COSHH)
iv. HSE Approved Code of Practice (ACoP) L8 and HSG 274 Parts 1, 2 , 3
v. The Construction (Design and Management) Regulations 2015 (CDM)
vi. the Building Regulations 2010 (and associated amendments)
vii. The Water Regs UK Website https://www.waterregsuk.co.uk , and any other requirements of the local water undertaker
viii. The Water Supply (Water fittings) Regulations 1999
ix. The Water Supply (Water Quality) Regulations 2016
x. CIBSE Guide G Public Health and Plumbing Engineering
xi. BS 1710 – 2014 - Specification for identification of pipeline services
xii. BS 8558:2015 provides complimentary guidance to BS EN 806 . It is a guide to the design, installation, testing, operation and maintenance of services supplying water for domestic use within buildings and their curtilages
xiii. BS EN 806-5:2012 Specification for installations inside buildings conveying water for human consumption - Operation and maintenance
xiv. BS EN 806-1:2000 Specifications for installations inside buildings conveying water for human consumption -General
xv. BS EN 806-2:2005 Specifications for installations inside buildings conveying water for human consumption – Design
xvi. BS EN 806-3:2006 Specifications for installations inside buildings conveying water for human consumption - Pipe sizing. Simplified method
xvii. BS EN 806-4:2010 Specifications for installations inside buildings conveying water for human consumption – Installation
xviii. Health Technical Memorandum 04-01: Safe water in healthcare premises - Part A: Design, installation and commissioning 2016
xix. Health Technical Memorandum 04-01: Supplement - Performance specification D 08: thermostatic mixing valves (healthcare premises) 2017
xx. Health Technical Memorandum 04-01: Safe water in healthcare premises Part B: Operational management 2016

xxi. Health Technical Memorandum 04-01: Safe water in healthcare premises - Part C: *Pseudomonas aeruginosa* – advice for augmented care units 2016

xxii. Heating and ventilation systems Health Technical Memorandum 03-01: Specialised ventilation for healthcare premises

xxiii. Decontamination in primary care dental practices HTM01-05

xxiv. Department of Health 'Performance requirements for building elements used in healthcare facilities Version:0.6:England'

xxv. HBN 00-10 Part C Sanitary assemblies 2013

xxvi. Public Health England (PHE) – Examining food, water and environmental samples from healthcare environments – Microbiological Guidelines:2020

xxvii. BS7592:2022 – Sampling for Legionella bacteria in water systems – Code of practice

xxviii. BS ISO 5667-24:2016 Water Quality - Sampling - Part 24:Guidance on the auditing of water quality sampling

xxix. World Health Organisation (WHO) – Water Safety in buildings:2011

xxx. BS 8580-1:2019 – Water Quality – Risk assessments for Legionella Control – Code of Practice

xxxi. BS 8580-2:2022 Risk assessments for *Pseudomonas aeruginosa* and other waterborne pathogens – Code of practice

xxxii. DH (2008 - 02) Gateway Ref: 9594 Estates and facilities alert re potential ligature risk of rubber/ PVC weatherproof seals

xxxiii. DH (2006 – 07) Estates and Facilities alert re use of doors - and potentially windows as ligature points. Issued:18th October 2006 Gateway Ref: 7208

xxxiv. DH (2006 - 05) Shower heads

xxxv. NHSE (2004 - 10) Bed cubicle rails, shower curtains

3.3 Design Verification:

i. The Project Manager, should formally commission the Trust's Authorising Engineer (Water), indicating the management tasks required for the Authorising Engineer (Water) to complete for each scheme, to verify that each design is compliant with all the relevant requirements of the Trust's WSP.

ii. When applicable, the Authorising Engineer (Water) shall complete and issue to the Project Manager the 'Certificate of Design Compliance with the requirements of the Trust's WSP', found in Book 5.

iii. ***Please Note: It is the responsibility of the Design Engineering Consultants, responsible for the design under review, that Regulations, Guidelines, Codes of Practice and 'Best Practices' or considered and complied with***.

3.4 Pre-commencement works:

i. The full scope of the works to be conducted shall be reviewed prior to commencement utilising to ensure that all the relevant steps can be taken dependent on the size of the project identified.

ii. Ensure all contractors working on Trust water systems are inducted in the required Trust water installation standards prior to commencing work on the project.

iii. Only installers with the appropriate qualifications, regulatory knowledge and competence should be used to install and maintain water installations. At minimum contractors should be able to demonstrate that staff have received the minimum required training as outlined within the most recent version of HTM0401 and L8. It is, however, preferable, that only contractors who are accredited members of an Approved

Contractors' Scheme authorised through the Water Supply (Water Fittings) Regulations 1999. Alternative plumbers may only be used where formal approval has been granted by the WSG.

iv. In addition to plumbing installers, four schemes (APLUS, TAPS, WaterMark and WIAPS) operate sector memberships for specialist areas of work covering external water services (below ground pipework etc), catering equipment and point-of-use (chilled water) equipment.

v. The WaterSafe register holds details from all seven Approved Contractors' Schemes for businesses who have registered and qualified plumbing installers.

vi. Prior to the commencement of any refurbishment works, the Trust should ensure the formal notification of closure of the systems to be worked on by following 'Notification of Closure of Facility', found in Book 5. The same pro-forma should be used to transfer responsibility to the mechanical contractor carrying out the works who should accept 'take-over' of the facility and begin and maintain the necessary processes and procedure required to maintain water quality, to the facility under works and any adjoining 'live' facilities, whilst the facility remains under their jurisdiction.

vii. Furthermore, 'Scheme Risk Impact Assessment Considerations', found in Book 5, must be completed and issued to the WSG in order to ensure that any potential risks, manifested as a result of the works pertaining to this scheme are suitably identified and suitably addressed.

viii. The mechanical contractor shall:

1. Prior to isolating the existing services to make disconnections of existing equipment and plant, or to make new connections, the mechanical contractor should, where practicable, provide 14 days notice in writing to the Client of any isolations that are required throughout the works.

2. With assistance from the Trust Project Manager, consider the impact of these works on adjoining/neighbouring system which will remain 'live' during these works and implement all necessary remedial and on-going actions designed to control any risk caused by the planned works. These actions should be communicated to and agreed by the WSG prior to commencement of works.

3. Carry out capacity requirements/availability, flow rate and temperature checks on the existing systems, serving areas to be affected by the proposed works, to validate the performance of the existing systems and their suitability to connect additional facilities onto. This must include adjacent areas, including all plant rooms and associated plant and equipment that could potentially be impacted upon by the proposed design.

4. The mechanical contractor should be made aware by the Trust of the microbiological condition of the water, at the time of commencement of the project, to allow the contractor to implement the necessary processes to protect its personnel from possible risks posed by the prevailing microbiological contamination status of the systems to be worked on. The contractor should NOT begin to remove existing pipework until consideration of relevant microbiological results and following the implementation of appropriate risk mitigation actions, where applicable.

5. Ensure that the existing plant i.e. pumps, calorifiers etc, is capable of coping with all proposed changes to the system.

6. Ensure that each project which incorporates 'live' facilities, is completed as quickly as possible and keep the number and frequency of connections to systems supplying 'live' facilities as low and infrequent as practicable.

3.5 Process Microbiological Sample Collection and Process Sequence Planning:

Notice should be taken of this section in order to ensure that all the processes, required to timely deliver a fit-for-purpose and safe building (detailed below), are suitably and sufficiently planned in order to allow the correct sequential delivery of each stage of the scheme's development:

i. **Microbiological Sample Collection - Batch 1 (S1):** This batch of samples should be collected where existing domestic hot and/or cold supplies (donor supplies) are to be utilised to supply the scheme's new pipework. These samples are required in order to provide a microbiological *baseline* of the current water quality of donor systems:

- In accordance with 'Microbiological Sample Collection Protocol', found in Book 5, hot and cold pre and post flush '*Pre work' Legionella sp*. and *Pseudomonas aeruginosa and other pathogens* (when instructed by IPC) samples should be collected *'up-stream'* and *'down-stream'* of the donor system from the scheme's demise - to be collected as close to the commencement of the scheme as practicable. Sample locations and sample results parameters shall be determined and agreed between contractor and the Project Manager on a 'scheme-by-scheme' basis prior to the commencement of each scheme. All sampling rationales shall be ratified by the relevant WSG representatives, including the Trust consultant microbiologist and/or Authorising Engineer (Water) and shall depend on the extent of the system being sampled and the sample batch shall be of a suitable size (as large as possible) to be considered 'representative'. A minimum of 14 days prior to the commencement of the scheme should be allowed for the sample results to be received and considered.

i. **Microbiological Sample Collection - Sample Batch 2 (S2):** This batch of samples should be collected for all new-builds and major refurbishment works, in order to provide clarification on the microbiological contamination status of the new or refurbished pipework installation and the efficacy of the cleaning and disinfection process. This batch of samples should be collected prior to the new pipework being connected and opened up to donor supplies:

iv. In accordance with 'Microbiological Sample Collection Protocol, pre and post flush *Legionella sp*. and *Pseudomonas aeruginosa and other pathogens* (when instructed by IPC) samples shall be collected, at between 48 and 72 hours, post all disinfection works (carried out in accordance with Section 3.10 System Disinfection. The number of samples to be collected, which shall be agreed by the Responsible Person (Estates), shall depend on the extent of the system being sampled and the sample batch shall be of a suitable size (at least half of all outlets where the number of outlets is <100; 25% of all outlets where total number of outlets is >100 - <500; 12% of all outlets where total number of outlets is >500) to be considered 'representative'.

Note: Once this batch of samples has been collected and acceptable results received, the donor domestic cold and hot water flow and return isolation valves can be opened to allow for system thermal balancing to take place. If suitable and sufficient thermal balancing is not achieved within 24 hours of system operation, the hot water flow and returns from the donor supplies should be isolated and only reconnected when the necessary remedial actions have been completed. Where pipework alterations have been carried out as a result of such remedial works, the whole of the scheme's pipework should be re-disinfected and Sample Batch 2 (S2), and subsequent processes repeated.

iii. **Microbiological Sample Collection - Sample Batch 3 (S3):** – Post connection and balancing samples:

In accordance with 'Microbiological Sample Collection Protocol', pre and post flush *Legionella sp*., and *Pseudomonas aeruginosa and other pathogens* (when instructed by TCM/IPCL) samples should be collected between 48 and 72 hours, post successful, suitable and sufficient thermal balancing. The type, number and location of samples collected for each system must be the same as Sample Batch 2 (S2).

iv. ***Samples, on whose results such decisions are made, should not be more than 2 weeks old.***

v. All works detailed above should be witnessed by the Trust's appointed representative.

3.6 Installation Verification:

i. The system should be regularly checked during installation to ensure that it is being carried in accordance with the requirements detailed above and as specified in the relevant scheme design specifications and contractual agreements.

ii. In the absence of a scheme Clerk-of Works, the Trust Project manager, with assistance from the Authorising Engineer (Water), shall verify and ratify each installation (or stage thereof) and confirm that it is found to be compliant with all requirements of the verified and approved design and documented in an email report to the WSG and relevant project group. In the absence of a scheme Clerk-of Works, the Trust Project Manager shall be responsible for issuing a suitably completed Certificate of Installation Compliance with the requirements of the approved design and the Trust's WSP, found in Book 5, when each completed installation has been found to be compliant with all requirements stipulated above at the handover of the completed project.

iii. ***Please Note: It is the responsibility of the Mechanical Contractor, responsible for the installation under review, that Regulations, Guidelines, Codes of Practice and 'Best Practices' or considered and complied with.***

iv. The contractor should provide a dedicated clean storage container(s) to store all domestic water pipework and fittings in an orderly manner. All other components for the mechanical installation should be stored in a separate container. The container should also be used for 'dip-disinfection' and storing the disinfected components before installation. The container SHOULD NOT be used for storing tools, personal equipment, bracketry etc (Domestic water pipework, fittings and brassware only).

v. The shelving for these areas should be easily cleanable by spraying with disinfectant and wiping down with a clean disposable cloth, i.e. melamine or similar.

vi. The contractor should ensure that disinfectant and clean disposable cloths are stored within the container at all times.

vii. The mechanical contractor should be responsible for ensuring all components are clean from point of delivery to installation.

viii. Component parts that come in their own individual packaging should remain in this until the time to either install or disinfected these prior to fitting. Should components be delivered in dirty packaging, there will be a requirement to clean the packaging prior to storage in order to prevent the contamination of individual components.

ix. All pipework should be stored with stop ends in place at all times.

x. Contamination from third parties also working on site during construction, typically, electricians, plasterers, joiners etc. should be prevented. These trades could unknowingly contaminate the installation. Adequate protection from dust, debris and damage must be afforded to all hardware and fittings installed including IPS panels, heat-emission devices, outlets, WCs/Urinals, etc.

xi. For pipework storage, a hand pushfit (plastic or copper) stop end is sufficient and should be fitted to all pipework in storage and within the installation at all times. A sheet of plastic held in place with sticky tape is **NOT** acceptable. The main contractor should be responsible to ensure this does not occur.

xii. On site, at no point should a pipework end be left open to contamination when not being worked on, should this be found the installation should be written off and replaced at the contractors cost and without compromising the program.

xiii. For low level installation works, the contractor should provide a clean tray to lay the components in prior to installation. Typically, connecting up a kitchen sink, WC etc.

xiv. During installation on site, all pipework should be supported off the ground with a pipe support.

xv. Any pipework, components etc. seen laying on the floor should be scrapped at the contractor's cost.

xvi. Where the preferred installation option is not utilised, special care should be taken before final assembly and closing up to ensure that all pipes are properly cleaned out and free from flux grit, scale and jointing materials.

xvii. During the installation of new pipework no foreign bodies are to be allowed to remain in or enter the pipes. Where pipework is to remain open during the installation it is important that the contractor ensures that open ends are kept sealed. No open ends should be left after working hours.

xviii. All horizontal pipework should be arranged such that the cold water pipework is below hot water pipework in order to minimise any potential heat transfer. All pipework in boxing should be thermally insulated. All pipe-work within voids and IPS panels should be insulated in accordance with BS 5970, BS 5422, BS476 and current Building Regulations Part L. This is to ensure that there is no heat-gain or loss occurring. It must be ensured that all pipework installed is distanced to allow the installation of the correct insulation.

xix. The use of physical drain cocks should be minimised and kept as short as practicable. Consideration should be given to the ability to open pipework joints as a means of draining such as to wash hand basins etc. and to arrange pipework such that tap spouts are at the lowest point.

xx. Strategically located isolation valves and injection points must be installed on each main run or loop in order to allow for zonal isolation and/or disinfection of each system should such be required.

xxi. To achieve the required circulating temperatures, it will be necessary to provide some form of regulation to balance the flow to individual pipe branches serving groups of draw-off points, for example each washroom/toilet and en-suite facility.

xxii. The means of balancing the hot water circulation can be achieved by either manual or thermostatic regulating valves installed in the return loops to all outlets. There should be means of isolation, both upstream and downstream. Adequate access for servicing is also essential. Lock-shield valves should not be used for balancing.

xxiii. Where isolation valves are installed at high level, these should be installed as close to the 'Tee' as possible. Although this does not usually affect the day to day running of the services it must be noted that should there ever be a requirement to isolate the services from these isolation valves, this would inadvertently create dead-legs. It is therefore recommended that where isolation valves and/or stopcocks are installed i.e. at each branch off, that these are located as close to mains run/Tee as possible. It must be highlighted however, that the position of the valves must not compromise any future maintenance requirements.

xxiv. Branch connections, taken from the hot water circulation to the point of discharge, should ideally be <300mm but certainly no more than 500mm. In exceptional circumstances, lengths of up-to 1m may be allowed subject to agreement, following formal written application provided by the Project Manager, by the WSG. It must also be ensured that the isolation valves on the hot flow and return are positioned so that circulation is not affected should the outlet need to be isolated.

xxv. Within the system, it is essential to include facilities for measuring, regulating, isolating, venting, draining and controlling the flow of water. Regulating valves with built-in pressure tappings or orifice plates with manometer tappings will be required for the measurement of pressure drop, which enables the volume rates of flow to be

determined. Care should be taken to ensure that regulating valves or orifice plates are sited well away from bends or fittings.

xxvi. Air-release valves should be provided at summits and drainage valves at low points between summits unless adequate provision is made for the discharge of air and water by the presence of service connections. Large-orifice air valves will discharge displaced air when mains are being charged with water. When air is liable to collect at summits under ordinary conditions of flow, small orifice air valves, which discharge air under pressure, may be required. “Double-acting” air valves having both large and small orifices should be provided where necessary. Air-valve chambers should be adequately drained to avoid the possibility of contamination.

xxvii. Automatic air-release valves should be installed where accessible for maintenance. Installation in ceiling voids is not recommended.

xxviii. Drain points should not discharge directly into a drain or sewer or into a manhole or chamber connected thereto without an appropriate air gap between the water system and the drain. This can be achieved with a Type AA air gap or an air-break-to-drain device in accordance with BS EN 1717 clause 9. Where a wash-out discharges into a natural watercourse, the discharge should at all times be well above the highest possible water level in the watercourse. Consent for this discharge may be required from the Environment Agency. In some cases it may be necessary for the wash-out to discharge into a watertight sump, which has to be emptied while in use by portable pumping equipment.

xxix. In order to minimise quantities of water that may collect in stub pipes at drain points, the length of such stub pipes should be kept to an absolute minimum. This relates in particular to drains from hot water calorifiers, storage cisterns and distribution pipework.

xxx. In addition to backflow protection at all points of use, the whole installation protection should be provided as required by the Water Supply (Water Fittings) Regulations 1999.

xxxi. Healthcare buildings and medical premises have been identified as involving Fluid Category 5 backflow risks which are defined as points of use or delivery of water where backflow is likely to involve fluids contaminated with human waste or pathogens. Within healthcare facilities, water usage covers a wide range of applications, from domestic use by patients and staff to specialised use in operating departments and pathology laboratories, and with equipment such as bedpan washers and haemodialysis machines. Even within high-risk specialist areas such as pathology laboratories, further separation of water supplies may be required to protect water used for domestic uses from those high-risk applications. In addition, many apparently “commercial” usages may be classed as high-risk because they are for healthcare purposes (such as centralised laundries).

xxxii. Where any doubt exists with regard to the level of protection required against water supply contamination, reference should be made to the Water Supply (Water Fittings) Regulations 1999 and guidance contained on The Water Regs UK Website https://www.waterregsuk.co.uk, or to the water undertaker.

xxxiii. It must be ensured that all fittings and fixtures are fitted in a timely manner and no retrospective equipment is to be installed as this will cause dead-legs on the system until the installation is complete.

xxxiv. All terminal fittings should be disinfected and be suitably and sufficiently recorded.

xxxv. Quality audits will be undertaken to ensure compliance with relevant Trust standards at a frequency to be agreed with Project Manager and dependant on the project.

xxxvi. If non- conformances are found depending on the severity, these will be discussed with the project manager/ relevant trade supervisor and any necessary rectification

works will be agreed and monitored for completion. The Trust reserves the right to have non-compliant trade staff evicted from site.

3.7 Pre-Commissioning and System Filling (Wetting):

For more detailed information on Pre-Commissioning and System Filling (Wetting), Commissioning and System Disinfection Process Management see Flow-Diagram 3 Appendix 1.

i. The purpose of pre-commissioning is to ensure that the system is in a satisfactory and safe condition before final filling and setting to work. Pre-commissioning is the responsibility of the installer. Final inspection must be carried out by the Clerk of Works (where appointed) or the Project Manager and/or AE (W).

ii. The Clerk of Works' (where appointed) or the Project Manager's and/or AE (W)'s final inspection must aim to ensure that the system is complete, correctly installed and ready for the commencement of commissioning. This will avoid abortive time on behalf of the commissioning specialist. On large or complex projects, a commissioning specialist should be engaged during the commissioning process.

iii. Filling (wetting) should also comply with the requirements of the Water Supply (Water Fittings) Regulations 1999 for the prevention of backflow. This usually requires a break tank with a suitable air gap for indirect filling. The existing water supplies, (donor supplies), should not be used to wet new pipework until suitable and sufficient disinfection has been undertaken, in accordance with Section 3.10 System Disinfection and the processes described in Section 3.5 Process Microbiological Sample Collection and Process Sequence Planning have been properly carried out.

iv. In a re-development, the existing water supply infrastructure could be in poor condition, oversized, underused, etc. If the development is large the supply might have been isolated during the build process and could remain stagnant until pressure testing is required. The local water supplier should be consulted and a plan agreed for the provision of water for initial filling, flushing and disinfection. The contractor needs to ensure that all connections made to the existing water systems during the construction process meet the requirements of the Water Fittings Regulations.

v. The use of hospital ring-main or boosted cold supplies for indirect filling new systems should not be used without the written consent of the Clerk of Works (where appointed) or the Project Manager and/or AE (W).

vi. Filling of the system should not be carried out without the written authorisation of the Clerk of Works (where appointed) or the Project Manager and/or AE (W). Authorisation should require the completion of the Certificate of Installation Compliance with the requirements of the approved design and the Trust's WSP, found in Book 5. In order to allow for this authorisation, the contractor should provide a detailed method statement and risk assessment for the process including suitable certification that the water source to be used is microbiologically 'clean' (within the acceptable microbiological contamination parameters detailed elsewhere in this document). No connection should be carried out without this authorisation.

vii. As an alternative to delaying the wet charging of the system, or using inert gas/nitrogen for pressure testing instead of water, the use of continuous dosing of water systems with appropriate biocides, such as chlorine dioxide, should be considered. Such treated systems should be regularly flushed to ensure that the biocide reaches all parts of the systems, and particularly outlets. Dosing with an appropriate level of biocide as soon as water hits a pipe or storage vessel (when system is first subjected to pressure testing), along with regular flushing, can control the accumulation of biofilm more effectively.

viii. To ensure effective venting, fill slowly from the bottom upward thus forcing the air to high points for venting to atmosphere. Careful consideration should be given to the

setting of valves and air vents before and during filling to avoid airlocks and excessive spillage, particularly where the fill water is treated. Care should be taken not to exceed the working pressure of the system when filling from a high pressure source. When the whole system is filled, disconnect the filling source, open the permanent supply connections and adjust the feed tank water levels.

ix. If water turnover is anticipated initially to be low it might be advisable to bypass or reduce the volume of cold water storage cisterns until the building is ready for occupation. This ensures that flushing during low-use periods draws directly on the incoming supply rather than intermediate storage. If bypassing storage is being considered, the water undertaker should be consulted to ensure conformity to The Water Fittings Regulations [4], [5] and [6] and that no adverse impacts occur.

x. If a building is to be completed and occupied in stages, the design of the water system should take this into account. Allowance should be made to fill, pressure-test, commission, disinfect and bring into use sections independently without compromising other sections.

xi. When a hot water system (HWS) has been filled and tested it should not then be allowed to stagnate or maintain temperatures between 20°C and 55°C. An HWS incorporating a circulatory system must be operated circulating at operational temperatures continuously after commissioning. Low volume (<15 L) point-of-use water heaters should achieve a temperature of 55°C to 60°C at the outlet.

Note: All distribution pipework and associated storage vessels should be liberally purged to remove debris associated with the installation process, prior to final connections and end-of-line fittings installation.

3.8 System Flushing:

i. Once filled, systems should not be drained unless full disinfection is to be carried out prior to building occupancy and use. However, allowing water in newly installed plumbing to stagnate can result in water borne bacteria (biofilm) growing and proliferating in the storage vessels and peripheral parts of the domestic water system. To reduce the risk of this, it is vital that flushing should take place on a **daily basis** to introduce fresh water throughout the system. All flushing tasks must be suitably recorded, dated and signed by the contractor and provided to the Project Manager with the project documentation.

ii. Flushing is to be undertaken with hot flow and hot return alternately isolated to prevent circulation. Sufficient time must be allowed by the contractor to achieve stages below.

1. All domestic services pipework receive hot full bore flush, before strainers, to remove flux.
2. Full bore flushing of pipework before strainers.
3. Flushing of hot and cold services through strainers to outlets.
4. When the contractor is satisfied that all strainers are clear, Estates Representative will witness flushing of all outlets with hot flow and return alternately isolated and inspect all strainers for cleanliness.
5. Chlorination will be allowed to go ahead following satisfactory witnessing of strainers by Estates Representative.

iii. Dosing with an appropriate level of biocide as soon as water hits a pipe or storage vessel, along with regular flushing, can control the accumulation of biofilm more effectively. Once started, this procedure has to be sustained and logged, as lapses can result in a critical increase in water borne bacteria at the outlet. Treated systems must be flushed on a **daily basis** to ensure that the biocide reaches all parts of the systems,

and particularly outlets. All completed flushing-logs must be submitted to the Project Manager on weekly basis in arrears.

iv. Accurate water consumption figures must be kept and provided to the Project Manager upon request, in order to allow for suitable comparison of water use during commissioning and when the system in in use.

v. The following actions must be considered before the introduction of a suitable flushing regime:

1. Confirmation that the incoming mains supply was flushed at least 3 x weekly prior to connection to system. Microbiological and potability testing of the mains should be carried out before connection to the system.
2. Confirmation that, once wetted for pressure testing, all parts of the system have been subject to a daily flushing programme and/or, *where applicable*, that the level of biocide dosed was within recommended levels during this period - this needs to adequately certificated by the project supervisor.
3. Confirmation required that the flushing included locations which may be capped-off whilst awaiting future connection to equipment and/or other facilities and that any machines (such as washing machines etc.) already connected to the system are removed during the disinfection process to allow for disinfectant solution to be drawn and made available to these areas.
4. Confirmation that the system has been subject to at least daily flushing following disinfection.

vi. The following installation works must be complete before any flushing, chlorination and sampling can take place:

1. Installation of all sanitary appliances complete, including drainage connections;
2. All domestic services pipework lagged with ID labelling
3. Power supplies to all Rada Sense outlets connected and live.
4. Substantial sections/systems fitted with dosing and draining points
5. Washing Machine Tees fitted before outlet appliances to allow full bore hot and cold flushing to drain before strainers

3.9 Commissioning:

i. Correct commissioning is vitally important for the satisfactory operation of the hot and cold water systems. The designer should prepare a commissioning brief for use by the contractor's commissioning engineer. This brief should specify fully and clearly the extent of the commissioning and the objectives which must be achieved, and should include:

1. full design data on temperatures, chemical levels, water flow rates and pressures;
2. *HWS balancing;
3. plant and equipment data;
4. number commissioning procedures for thermostatic mixing valves in accordance with specification detailed in HTM 04-01 Part A;
5. drawings and schematics;
6. microbiological activity levels;
7. a list of test certificates to be provided;
8. water quality (Legionella and *Pseudomonas aeruginosa and other pathogens (where augmented care or when requested by the Trust Consultant Microbiologist/Lead Infection Prevention and Control)*) risk Assessment.

**Connection of new HWS return pipework to existing HWS return system, to facilitate balancing of the system, must only be carried out following completion of the*

processes described in Section 3.5 Process Microbiological Sample Collection and Process Sequence Planning.

ii. The designer assisted by a member of the site maintenance team, shall prepare a list of tests and measurements that are to be taken by the contractor and recorded by him/her. These should be witnessed by the Project Manager who shall circulate the results in accordance with the client's instructions. The installation, on completion, should be operated by the contractor as a whole, and subjected to functional or performance tests as specified by the designer.

iii. The commissioning manual should be prepared by the contractor and submitted to the client's commissioning adviser for review before being issued in final form. Typical schedules of checks and performance tests should be included in the commissioning manual together with record sheets. If performance is not acceptable, the matter should be dealt with in accordance with the contract requirements.

iv. The Project Manager, who should countersign any relevant test record documents, should appoint a Trust representative, typically the AE(W), to witness commissioning and testing. "As installed" record drawings, schematic diagrams, operating and maintenance instructions must be supplied at the time of handover. Certified records of pressure testing and disinfection should also be made available. The whole commissioning procedure should be carried out under the guidance of a single authority, although the involvement of specialists or manufacturers may be required for specific items of plant. Valid calibration certificates should be submitted and checked for all measuring equipment to be used by the commissioning engineers prior to commencement of commissioning. The commissioning should be carried out in a logical and methodical manner.

v. The installation, on completion, should be operated by the contractor as a whole, and subjected to specified functional or performance tests. Once the system meets the design intent, the final completion record sheet(s) should be completed. In the event of performance not being acceptable, the matter should be dealt with in accordance with the contract requirements.

vi. It is essential that a full report of all commissioning and testing activities is compiled and handed over to be incorporated within the operation and maintenance manuals. These commissioning and testing records will be required so that subsequent maintenance and periodic checks can be made to ensure that the installation continues to operate as intended.

3.10 System disinfection:

i. Proprietary solutions of disinfectant must be used in accordance with the manufacturers' instructions. The COSHH Regulations require that the risks from using the disinfectant for each task be assessed to ensure that the control procedures adopted are suitable for the particular application. Disinfection must not be undertaken before materials, for example linings in cisterns, have fully cured. Advice must be sought from equipment manufacturers to ensure that proposed disinfection chemicals will not adversely affect performance. No heat source must be applied during the disinfection procedure, including final flushing.

ii. The disinfection should be carried in accordance with: a) 'Water Storage Tank – Cleaning and Disinfection'; b) 'Domestic water services disinfection'; 'Calorifier or Plate Heat Exchanger Buffer Vessel Pasteurisation', found in Book. The appropriate Certificates of Conformity must be completed by the contractor carrying out the disinfection process and provided to the Project manager.

iii. The use of hospital ring-main or boosted cold supplies should not be used to facilitate disinfection without the written consent of the Responsible Person (Estates) or the Project Manager and/or AE (W). Where such supplies are to be used, they must not be connected directly onto the new pipework system. Instead, the disinfectant solution must be introduced into the new pipework, at suitably installed injection points, using

a suitably sized tank and pump system to allow for the introduction and re-circulation of the disinfectant solution for the duration of the disinfection process.

iv. The contractor should provide a detailed method statement and risk assessment for the process including suitable certification that the water source, where an alternative, water source, other than the hospital ring-main or boosted cold supplies is to be used is microbiologically 'clean' (within the acceptable microbiological contamination parameters detailed elsewhere in this document). No connection should be carried out without this authorisation.

v. All taps, shower heads, TMVs/TMTs, associated strainers and aerators should dip-disinfected, in accordance with 'Thermostatic Mixing Valves/Taps Clean, Descale and Disinfection', prior to final connection, prior to final connection.

vi. The disinfection process should ensure that locations which may be capped-off whilst awaiting future connection to equipment and/or other facilities and that any machines (such as washing machines etc.) already connected to the system are removed during the disinfection process to allow for disinfectant solution to be drawn and made available to these areas.

vii. Connection of new HWS return pipework to existing HWS return system, to facilitate balancing of the system, must only be carried out following completion of the processes described in Section 3.5 Process Microbiological Sample Collection and Process Sequence Planning.
Note: All 'confirmation' microbiological samples to be collected between 48 and 72 hours following any disinfection works. In addition, Samples, on whose results such decisions are made, should not be more than 2 weeks old.

viii. For refurbishment works, where the new system is already connected to the donor supplies, prior to the process being carried out, a suitable and sufficient risk assessment should be carried out, using 'Disinfection Impact Assessment', found in Book 5, in order to determine the risk to the patients, staff and visitors from exposure to the disinfecting agent use. The risk assessment should seek input from operational workshops, Facilities, IPC and Nursing and the WSG.

ix. Great care and attention must be taken to ensure that the process is designed, planned and executed correctly and safely and only carried out when all other control measures have failed and when the impending risk of infection is greater that the risks associated with the process.

x. The disinfection process should be carried out using suitably approved and agreed disinfection agents. The choice of disinfectant agent should be dependent on the requirements of each process and should be agreed in writing, following submission of a detailed risk assessment, by the Project manager/Authorising Engineer (Water), prior to use. This process must only be carried out by suitably equipped and trained personnel form approved contractors who are members of the Legionella Control Association or by suitably equipped and trained Trust personnel. Where alternative disinfection agents are intended for use, a written proposal outlining the reasons why an alternative disinfection agent is proposed for use, the proposed disinfection agent, COSHH sheets, risk assessment and methodology should be presented to the Authorising Engineer (Water) for written authorisation. Alternative disinfection agents should not be used without prior written consent from the Project manager/AE(W).

3.11 Domestic Hot Water Balancing:

i. Balancing of the Domestic Hot Water system is to be undertaken immediately after disinfection and microbiological sampling as Section 5.5 ii.

ii. This work is to be carried out by specialist contractor (Balancing/Commissioning Engineer). Balancing to achieve a minimum of 55°C on all returns, including subordinate loops (minimum 50°C at the final connection to the calorifiers).

iii. Monitoring of all return loops should be repeated 1 day, 4 days and 7 days after initial balancing is completed to ensure the system is still operating effectively and all air has been removed. Where loops are found to be <55◦C, the balancing exercise should be repeated.

3.12 Temperature and *where applicable* supplementary chemical control disinfectant Profiles:

i. These tests should be performed prior to contractual handover and bringing the system into use. Separate calibrated thermostatic measuring and recording equipment should be used, that is, independent of any building management system. It will be necessary to have systems fully operational and to simulate typical draw-off of water. Once disinfection has taken place, it is essential to put in place measures to ensure that hot and cold water temperatures are maintained. This will require regular flushing and temperature monitoring, at least weekly, and possibly more frequently during periods of hot weather.

ii. Water temperatures and Supplementary chemical control disinfectant levels to be recorded three times equally spaced over 24 hours, under simulated maximum usage requirements, to demonstrate that the recommended temperatures are being achieved. Temperature and Supplementary chemical control disinfectant measurement equipment and water sampling equipment should be suitably calibrated via UKAS calibration and accredited to ISO 17025 and calibration certificate made available:

1. Measure and record the Incoming MCWS. Temperature not to exceed 20°C.
2. Measure and record the stored water. Temperature not to exceed 20°C.
3. After 2 minutes of running cold water the temperature to be reached should be maximum 20°C.
4. Maximum 2°C higher than that at the point of supply.
5. Measure and record the Set temperature setting of the thermostat (if fitted and calibrated). Temperature to exceed 60°C.
6. Measure and record the "Flow" temperature using a contact thermometer or fitted gauge. Temperature to be taken from Flow pipework as close to the Calorifier or Plate Heat Exchanges Buffer Vessel as possible. Temperature to exceed 60°C.
7. Measure and record the Return temperature using a contact thermometer or fitted gauge. Temperature to be taken from Return pipework as close to the Calorifier or Plate Heat Exchanges Buffer Vessel as possible. Temperature ≥50°C at the calorifiers and ≥55°C throughout the system including Principal, Subordinate and Tertiary HWS return loops.
8. Isolate Cold Feed and open drain point and measure and record temperature. Temperature to exceed 60°C within 1 minute.
9. Where the unit is monitored using BMS, collect the readings of all the fields listed above, for at least a 24hr period and consider the results. Adjust control parameters as necessary.
10. After 1 minute of running hot water the temperature to be reached should be minimum 55°C.

Note: Non-circulating HWS: Monitoring temperature or any other control measure in hot water should be conducted at sentinel points, specifically selected to represent the condition of water in the system. In a non-circulating (single pipe) HWS, the sentinel points would

typically be the taps furthest (far sentinel) and the nearest (near sentinel) to the hot water heater (calorifier). In branched systems, the outlets at the ends of significant spurs should be identified as additional far sentinel points. In either case, the layout of the distribution system should be considered rather than the location of the outlet, as they might not correspond.

Circulating HWS principal loops: In circulating systems the far sentinels are the return legs at a point towards the end of the re-circulating loop. Where the system consists of several re-circulating loops, the end of each should be identified as far sentinel points for monthly monitoring. In either case, the layout of the distribution system should be considered rather than the location of the outlets, as they might not correspond.

Subordinate and tertiary HWS loops: Many larger circulating HWS have additional loops consisting of a smaller bore pipe branching from the flow leg of a principal loop to supply a group of outlets and connecting back to the return leg. In systems such as this, the smaller bore loops are the subordinate loops and the larger loops are the principal loops. Subordinate loops should be monitored ideally at a suitable return leg or from a representative outlet, in order to test all subordinate loops quarterly. However, large and complex, often have localised loops that feed only one or two outlets and these can be identified as tertiary loops.

11. HWS to the TMV/TMT minimum 55°C; CWS to TMV/TMT maximum 20°C (See above).
12. 41°C (+1°C) Max for showers
13. 41°C (+1°C) Max for basins
14. 44°C (+1°C) Max for baths
15. 38°C (+1°C) Max for bidets
16. Chlorine Dioxide Profiles

    a) Point of injection – between 0.25 and 0.5ppm

    Note: 0.8ppm must be consider as the maximum allowed level at point of injection and it is only allowed at this level at this point in order to allow for the minimum levels to be achieved at the point of delivery. Any level fluctuations must only be tolerated within this range and care must be exercised to ensure that the level of ClO_2 at the nearest outlet does not exceed 0.5ppm.

    b) Point of delivery (measured at sentinel outlets) – between 0.25 and 0.5ppm.

    Note; The Trust is aware of documented and anecdotal evidence which suggests that some infants and young children who drink water containing ClO_2 in excess of the Maximum Recommended Daily Level (MRDL) - 0.8mg/l (ppm) could experience nervous system effects. Similar effects may occur in foetuses of pregnant women who drink water containing ClO_2 in excess of the MRDL. Some people may experience anaemia. This evidence also suggests that violations of the MRDL may harm human health based on short-term exposures. Certain groups, including foetuses, infants, and young children, may be especially susceptible to nervous system effects from excessive ClO_2 exposure. There are no obvious symptoms, but ClO_2 can affect development of the nervous system. The Trust should ensure that water, juice, and formula for young children and for pregnant women should not be prepared with tap water which is treated with ClO_2. Instead, where practicable, a separate non-treated supply (preferably a direct mains supply) or a designated outlet fitted with a suitable activated carbon filter designed to remove the presence of ClO_2 at the point of delivery is provided for this purpose. ClO_2 and its breakdown products chlorite and chlorate can be deleterious to renal dialysis patients and should be removed, where possible, from the water supply to these units using localised filtration. Alternatively, where practicable, these areas should be supplied with ClO_2 free water. The Trust is also aware that Chlorine dioxide and its disinfection by-products chlorite and chlorate can create problems for dialysis patients. For this reason, the Trust should ensure that any water systems treated with Chlorine dioxide

which can come into contact with renal dialysis patients are suitably and sufficiently fitted with adequate carbon filtration.

17. Where designated sentinel outlets are fitted with TMV/TMT, the temperature of the hot and cold supply must be measured by surface (contact) temperature measurement. If contact probe is to be used for temperature monitoring through copper pipework, Temperatures must be collected as described in BSRIA Application Guide AG 4/94 – Guide to Legionellosis – Temperature measurements for hot and cold water services. The temperature measurements should be carried out at different times during the day in order to allow indicative temperature monitoring of the system during a typical daily usage profile.

3.13 Microbiological Analysis

i. Microbiological Sampling must be carried out in accordance with:

1. 'Microbiological Sample Collection Protocol'.
2. BS EN ISO 5667-1:2006 BS 6068-6.1:2006 - Water quality Sampling - Part 1: Guidance on the design of sampling programmes and sampling techniques.
3. BS ISO 5667-24:2016 Water quality - Sampling Part 24: Guidance on the auditing of water quality sampling.
4. BS 7592:2022 - Sampling for Legionella bacteria in water systems – Code of practice.
5. BS 8554:2015 Code of practice for the sampling and monitoring of hot and cold water services in buildings.
6. PHE - Hospital Waters - how to ensure high quality microbiological testing:2014
7. PHE - Examining food, water and environmental samples from healthcare environments - Microbiological Guidelines:2013.

ii. Samples should be collected in accordance with Section 3.5 Process Microbiological Sample Collection and Process Sequence Planning.
Note: All 'confirmation' microbiological samples to be collected between 48 and 72 hours following any disinfection works. Samples, on whose results, the decision to hand-over and/or occupy is made, should not be more than 2 weeks old.

iii. Sample locations and sample results parameters should be determined and agreed between contractor and the Project Manager on a 'scheme-by-scheme' basis prior to the commencement of each scheme. All sampling rationales should be ratified by the Trust consultant microbiologist and/or Authorising Engineer (Water).

iv. Samples must be sufficient in number to be fully representative of the distribution system, sub-branches, tanks, cisterns and hot water storage vessels – see Section 3.5 Process Microbiological Sample Collection and Process Sequence Planning.

v. Sample points must be unambiguously described to enable later re-sampling and/or identification by all parties other than the original sampler and microbiological levels must be agreed before sampling.

vi. Samples must only be collected when the system is under 'business-as-usual' status and when all interim control measures have ceased.

vii. Microbiological levels (pass/fail) must be agreed before sampling commences. The Trust considered the levels, detailed in the table below, as appropriate and they shall be used to determine pass/fail of sample results.

viii. On the instruction of the consultant microbiologist and/or IPC, samples for additional pathogens may be collected. The consultant microbiologist reserves the right to reject

'Permit for Hand-over and Occupation of New-build or Refurbished Facilities' where 'pathogens of interest have been identified. Similarly, the consultant microbiologist reserves the right to accept and sign-off the 'Permit to Occupy' in the presence of 'fail' levels of TVC results, including where additional analysis indicates that 'pathogens of interest have not been identified.

ix. It is accepted that no system can be completely sterile and a certain level of bacterial contamination can be considered natural and, therefore, acceptable. For the purpose of signing-off 'Permit for Hand-over and Occupation of New-build or Refurbished Facilities', *and always at the discretion of the consultant microbiologist*, a maximum level of 10% failed sample results shall be considered acceptable but only if the risk of infection at locations which have 'failed' is suitably mitigated in accordance with WSP Book 4. It is expected that all 'failed' locations will be suitably managed and continued to be sampled until sample results 'pass'.

Domestic water microbiological analysis sample results - level of contamination key:

Analysis Sample	Reported Results	Result Interpretation	
Legionella sp.	None Detected	Negative	PASS
	Limit of detection - <1000cfu/l	Significant	FAIL
	≥1000cfu/l	Highly Significant	FAIL
Pseudomonas aeruginosa	None Detected	Negative	PASS
	≥1cfu/100ml - <10cfu/100ml	Significant	FAIL
	≥10cfu/100ml	Highly Significant	FAIL
Coliforms *and E. coli*	None Detected	Negative	PASS
	≥1cfu/100ml	Highly Significant	FAIL
TVCC @ 37 and TVCC @ 22	Not Detected	Negative	PASS
	≥1cfu/ml – <100 cfu/ml	Insignificant	PASS
	≥100cfu/ml – <1000 cfu/ml	Significant	FAIL
	≥1000 cfu/ml	Highly Significant	FAIL

3.14 Hand-Over:

For more detailed information on Hand-Over and Occupation Process Management see Flow-Diagram 4 Appendix 1.

i. Hand-over of all new-builds and refurbishments must not be carried out until all of the requirements detailed in the relevant processes described below are satisfied and the appropriate process and 'Permit for Hand-over and Occupation of New-build or Refurbished Facilities, found in Book 5.

ii. These tests should be performed prior to contractual handover and bringing the system into use. Separate thermostatic measuring and recording equipment should be used, that is, independent of any building management system. It will be necessary to have systems fully operational and to simulate typical draw-off of water. Once disinfection has taken place, it is essential to put in place measures to ensure that hot and cold water temperatures are maintained.

iii. This will require **DAILY** flushing and possibly more frequently during periods of hot weather. Water temperatures and Supplementary chemical control disinfectant levels to be recorded, under simulated maximum usage requirements, to demonstrate that the recommended temperatures are being achieved. Temperature and Supplementary chemical control disinfectant measurement equipment and water sampling equipment should be suitably calibrated via UKAS calibration and accredited to ISO 17025 and calibration certificate made available.

iv. Given the timescales detailed above, an overall period of at least 18 days must be allowed by the Contractor for commissioning and handover of any Public Health Water System, from commencement of flushing to acceptance by Trust (assuming no sample failures).

3.15 Asset List:

i. A full and complete asset list, previously approved by a Responsible Person (Estates), must be provided to the Estates Manager - Operations one month prior to handover in order to ensure planned maintenance can be suitably arranged once successful completion and handover has taken place. Such asset list must be provided in a format capable of being easily uploaded onto the Trust's systems. Its is the responsibility of the contractor to ensure for this.

3.16 Occupation:

i. Occupation of all new-builds and refurbishments must not be carried out until all of the requirements detailed in the relevant processes described below are satisfied and the appropriate process and 'Permit for Hand-over and Occupation of New-build or Refurbished Facilities' is completed and duly signed.