



# Non-Residential Facility Flushing Plan Checklist and Standard Operating Procedures

JBPHH, O‘ahu, Hawai‘i  
FINAL

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## FACILITY FLUSHING CHECKLIST

ADDRESS: _____	ZONE _____	
FACILITY POC: _____	DATE _____	
Facility has been closed since: _____	Facility is currently utilizing JBPHH water: _____	Y / N (circle one) _____

This checklist is to be used by Navy and/or Army personnel, including any Government Contractors, for flushing building facility plumbing systems, to include any buildings which may have been contaminated with petroleum chemicals. This includes any building not included in “the single-family home flushing plan” such as commercial, offices, barracks, apartments, schools, day care facilities, etc. All building facilities shall only be flushed AFTER the water distribution system has been flushed and the Interagency Drinking Water System Team (IDWST) has authorized the specific Flushing Zone to advance to Building Flushing. A copy of this this signed checklist will be provided to the IDWST for the administrative record of this project. Due to the varying sizes of facilities and non-single family buildings, and plumbing complexities the minimum time to completely flush each facility/building will vary.

**ATTENTION**

- DO NOT OVERFLOW DRAINS. DO NOT LEAVE RUNNING FAUCETS UNATTENDED.
- DOCUMENT ANYTHING UNUSUAL ENCOUNTERED BEFORE OR DURING FLUSH.
- IF STRONG FUEL SMELL IS PRESENT WHEN FLUSHING, UTILIZE BLOWERS/CEILING FANS/BATHROOM FANS TO VENTILATE THE SPACE. IF THE FUEL SMELL CANNOT BE CLEARED, CONTACT NAVFAC ENGINEERING WORKING GROUP (EWG).
- PROVIDE NOTICE TO WATER AND WASTEWATER UTILITIES BEFORE FLUSHING LARGE FACILITIES, CONTACT NAVFAC ENGINEERING WORKING GROUP (EWG).
- TO ENSURE ADEQUATE DISTRIBUTION PRESSURE IS MAINTAINED OR TO RESPOND TO LOSS OF PRESSURE EVENT REFER TO APPENDIX C. (FOR FLUSHING EMERGENCIES CALL NAVFAC EMERGENCY SERVICE DESK.)

**NAVFAC EMERGENCY DESK: 808-449-3100    NAVFAC EWG: 808-475-0366**

### STANDAND OPERATING PROCEDURE STEPS\*

- STEP 1: FOLLOW STANDARD SITE SAFETY AND COVID-19 PROTOCOL
  - STEP 2: PREPARE FACILITY FOR FLUSHING
  - STEP 3: PERFORM SERVICE LINE FLUSH AND COLD WATER PLUMBING FLUSH
  - STEP 4: WATER HEATERS AND EXPANSION TANKS
  - STEP 5: PERFORM HOT WATER SYSTEM FLUSH
  - STEP 6: FLUSH ALL SPIGOTS
  - STEP 7: ADDRESS MAJOR APPLIANCES AND WATER CONSUMING EQUIPMENT
  - STEP 8: CLEAN UP
  - STEP 9: RECORD WATER USE OR FLUSHING TIME, OBSERVATIONS AND NOTES
- FUEL ODOR PRESENT DURING OR AFTER FLUSHING?                       YES  NO
- OBSERVATION/NOTES PAGE USED?     YES  NO

\*See Appendix A for detailed checklist of Standard Operating Procedures for Steps 1 – 9.



**OBSERVATIONS AND NOTES**

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*Attach additional pages as needed.*

**CONFIRMATION OF FLUSHING EVENT**

Flushing Lead Name \_\_\_\_\_

Organization \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

(Start Time) (End Time)



## **APPENDIX A: FLUSHING STANDARD OPERATING PROCEDURES**

*Some facilities are more complex to flush than single-family residential buildings. Use personnel who typically work on Heating, Ventilation, Air Conditioning (HVAC) units or on other non-residential water-consuming equipment.*

### **RECOMMENDED MINIMUM FLUSHING TEAM SUPPLIES**

- |   |                                    |
|---|------------------------------------|
| -Water Filter(s) – Provided by Original Installer | -Pliers for Spigot Covers          |
| -Nitrile or Latex gloves                          | -2 x 50-ft (or longer) Garden Hose |
| -Mops and Mop Bucket                              | -2 x 5-GAL Buckets                 |
| -2x Drain Snakes (3 ft. length/each)              | -Wrenches for Aerators             |
| -Towels   | -Trash Bags                        |
| -Booties (for use when footwear is dirty)         | -Wet/Dry Shop VAC, if available    |

### **ATTENTION**

- DO NOT OVERFLOW DRAINS. DO NOT LEAVE RUNNING FAUCETS UNATTENDED.
- HOT WATER SYSTEM SHALL NOT BE FLUSHED UNTIL THE HEATER HAS COOLED.
- DOCUMENT ANYTHING UNUSUAL ENCOUNTERED BEFORE OR DURING FLUSH.
- IF STRONG FUEL SMELL IS PRESENT WHEN FLUSHING, UTILIZE BLOWERS/CEILING FANS/BATHROOM FANS TO VENTILATE THE SPACE. IF THE FUEL SMELL CANNOT BE CLEARED, CONTACT NAVFAC ENGINEERING WORKING GROUP (EWG).
- PROVIDE NOTICE TO WATER AND WASTEWATER UTILITIES BEFORE FLUSHING LARGE FACILITIES, CONTACT NAVFAC ENGINEERING WORKING GROUP (EWG).
- TO ENSURE ADEQUATE DISTRIBUTION PRESSURE IS MAINTAINED OR TO RESPOND TO LOSS OF PRESSURE EVENT REFER TO APPENDIX C. (FOR FLUSHING EMERGENCIES CALL NAVFAC EMERGENCY SERVICE DESK.)

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### **STEP 1: FOLLOW STANDARD SITE SAFETY AND COVID-19 PROTOCOL**

All flushing teams will adhere to the current Center for Disease Control (CDC), State of Hawaii, Department of Navy and Department of Army COVID-19 safety protocols. Flushing teams should conduct tailgate safety briefs before conducting flushing at each facility as all facilities may require different safety considerations.

- Standard site safety procedures reviewed with flushing team in advance.
- COVID-19 (If yes to any question below, do not enter the facility)
  - 1. Have you experienced any of the symptoms in the list below in the last 48 hours? Fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea. **If NO, proceed to question 2.**
  - 2. Are you isolating or quarantining because you tested positive for COVID-19 or are worried that you may be sick with COVID-19? **IF NO, proceed to question 3.**
  - 3. Have you been in close physical contact in the last 14 days with: anyone who is known to have -confirmed COVID-19 or anyone who has symptoms consistent with COVID-19? **IF NO, proceed to start non-residential building flushing.**



## STEP 2: PREPARE FACILITY FOR FLUSHING

### FOR LARGE FACILITIES\*

\*A large facility is any facility with multi-buildings or multi-stories typically located in a closed loop system (after a water meter or backflow prevention assembly) that will require large volumes of water to flush over and above normal water user demands. Examples of this would be schools or childcare centers with multi-buildings, high-rise apartments, or a shopping mall. There are only a limited number of these facilities connected to the JBPHH water systems. Additional guidance is available to aid onsite flushing teams in Appendix E, Additional Considerations and Guidance for Flushing Teams.\*

- Review the facilities/building(s) water systems, to include site plans and construction drawings, if needed.
- Review each building water system. A flow diagram that describes each water system and shows interconnection(s) between multi-buildings in a closed loop system after a meter can be used to efficiently flush large facilities.
- Determine maximum whole facility flushing rate (with break-down by building) to make sure no impact on potable or wastewater systems, as well as ensuring adequate distribution water pressure is maintained throughout the water system (no less than 30 psi in accordance with DOD, Unified Facility Guide (UFC) 3-230-02, Operation and Maintenance: Water Supply Systems).
- Before flushing, contact **NAVFAC EWG @ 808-474-0366** to notify water and wastewater operations, flushing operation is beginning on large facilities/buildings.

### ALL FACILITIES/BUILDINGS

- Facility has been in continuous operation during normal business operations:  YES  NO
- Facility or building has a water meter:  YES  NO
- Facility or building has installed backflow prevention assembly (BFPA):  YES  NO
- Localized residual pressure data accessible to flushing team:  YES  NO

### GENERAL GUIDANCE, NOT FACILITY OR BUILDING SPECIFIC

- Turn-off breaker to hot water heater, and water-using heating and cooling system, if possible. Do NOT turn-off breakers to exhaust fans in bathrooms and kitchens. These should remain on.
- Open windows and/or doors where possible to allow for adequate ventilation; and/or turn on all room ceiling fans, HVAC systems, and EXHAUST FANS (typically, found in kitchens, breakrooms, bathrooms and utility rooms), if present.
- Do initial outside walk-around facility; locate water service meter, if one. Recommend recording meter reading for any large facility to be flushed for documentation. Alternatively, record total flushing time, as well as if building has been in operation and/or closed down.
- Do initial walk-through building(s) with facility/business manager to ensure no operations will be disrupted unannounced.
- Determine water plumbing system closest to service line and furthest point in a facility complex up to last fixture inside most remote business. Utilizing an existing site plan that details water service lines is best for this task.



- During initial walk-through identify plumbing fixtures, water appliances, water or beverage dispensers, and ice machines; highlight on checklist accordingly. Look for water filters under sinks, as well as associated with water or beverage dispensers, and ice machines.
- If hot water heater could not be isolated with breaker, turn off water heater manually.
- Locate and bypass any Point-of-Entry (POE) water filters. Remove filters and set to side, if possible. Document type of water filters and confirm if facility has replacement filters\*.
- Locate any water fountain/cooler, drink dispensers, and ice machine to check for, bypass and/or remove Point-of-Use (POU) water filters, if possible. Document type of filters and confirm if facility has replacements\*.
- Remove aerators, and set near fixture within sight.

\*When feasible, contact the facility manager prior to flushing event to notify them of need to have inventory of replacement water filters ahead of flushing event if possible. If not feasible, instruct water users IAW Appendix B of need to replace all water filters after flushing event.\*

### STEP 3: PERFORM SERVICE LINE FLUSH AND COLD WATER PLUMBING FLUSH

#### **ATTENTION**

- DO NOT OVERFLOW DRAINS. DO NOT LEAVE RUNNING FAUCETS UNATTENDED.
- DOCUMENT ANYTHING UNUSUAL ENCOUNTERED BEFORE OR DURING FLUSH.
- IF STRONG FUEL SMELL IS PRESENT WHEN FLUSHING, UTILIZE BLOWERS/CEILING FANS/BATHROOM FANS TO VENTILATE THE SPACE. IF THE FUEL SMELL CANNOT BE CLEARED, CONTACT NAVFAC ENGINEERING WORKING GROUP (EWG).
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**NAVFAC EMERGENCY DESK: 808-449-3100 NAVFAC EWG: 808-475-0366**

- Locate where the water line enters the facility.
- Locate the building/fixture closest to the point of entry in the facility. Flush the facility systematically, starting at the building lateral/meter where connected to the water mains and flush outward to the furthest outlets in the facility/building to include water using appliances and equipment to include HVAC equipment.
- Remove the fixture aerator CAREFULLY, if possible.
- Open each fixture to include sink fixtures, shower and bathtub fixtures, and utility fixtures for a minimum of 15 minutes. In the interest of conserving water, bathtubs and utility sink fixtures with higher flow capacity can be flushed less than one-half this time using a simple mass balance equation. For large buildings do by zone at service entry point to furthest reaches of the building. Do all fixtures in sets of segregated bathrooms near each other, and all kitchen fixtures should be able to done simultaneous when the kitchen zone is flushed. If multiple large kitchens, do one kitchen at a time. For multiple floors, begin with the lowest floor and work way up to highest floor.
- Flush all toilets 3 times, and if any bidets for 3 minutes.



#### STEP 4: WATER HEATERS AND EXPANSION TANKS\*

\*Large facility/buildings hot water systems can be considerably more complex than residential homes. Utilize facility managers, engineers or maintenance personnel to flush these systems. Also, refer to building construction, and/or engineering or manufacturer documents.\*

- Confirm water in water heater tank is cool (and breaker to water heater is off).
- Have a qualified individual, turn off water supply valve entering the water heater to include isolating or lock-out procedures for any pumps associated with hot water system, particularly for localized pressure systems or solar hot water systems.
- Attach a hose to the tank spigot.
- Run the hose to the exterior clean-out, if possible or nearest floor drain, if not possible. Water hose CANNOT DRAIN onto landscape.
- Slowly open the tank valve to start draining. WATCH FOR LEAKS AND FLOODING.
- After approximately 10-15 minutes or per equipment specific guidance, and close cold water supply valve (this helps to stir-up and flush out sediment and cool the water).
- Open hot water supply valve.
- Once tank is drained open closest hot water fixture(s) to the hot water heater.
- Then close water tank drain valve when empty and remove hose.
- Refill the hot water tank.
  - Slowly open water supply valve entering the water heater for refilling the tank.
  - Watch tanks to ensure no leaks.
- Once tank is full (and pumped system):
  - Open valves that isolate the pumping system.
  - Reactivate/re-energize the pumping system per site-specific facility/building SOP.
- Wipe up any spilled water.

#### STEP 5: PERFORM HOT WATER SYSTEM FLUSH

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**NAVFAC EMERGENCY DESK: 808-449-3100 NAVFAC EWG: 808-475-0366**

- Open each fixture for 15 minutes. DO NOT open too many fixtures at the same time. For large buildings do by zone at service entry point to furthest reaches of the building. Do all fixtures in sets of segregated bathrooms near each other, and all kitchen fixtures should be able to done simultaneous when the kitchen zone is flushed. No maximum number of





fixtures if done by zone. For multiple floors, begin with the lowest flow and work way up to highest floor.

### **STEP 6: FLUSH ALL SPIGOTS**

- Flush all spigots for 15 minutes (typically located outside) to the cleanout, if possible. Avoid disturbing soils and flooding surrounding areas. Also avoid play areas by diverting water, as much as possible away from these areas.

### **STEP 7: ADDRESS MAJOR APPLIANCES AND WATER CONSUMING EQUIPMENT**

- Refrigerators.
  - Connected to water line (automatic icemaker, water in door).
    - Empty ice from freezer.
    - Flush refrigerator for at least 5 minutes and replace filter with a new one when flushing is complete.
    - If filter is not available, either submit or work order or leave a notice with Facility POC.
  - No automatic icemaker. Empty the ice from the freezer and place the ice tray in the sink to be washed by kitchen staff before reuse.
- Dishwashers – Turn on rinse cycle one time.
- Large Ice Machines. Follow similar instructions as refrigerators and/or instruct company to reset service following SOP following a contamination event to include replacing any filters.
- Commercial Water Dispensers. Follow similar instructions as refrigerators and/or instruct company to reset service following SOP following a contamination event to include replacing any filters.
- Beverage Dispensers (Water Connection/Dispenser). Follow similar instructions as refrigerators to include replacing any filters.
- HVAC Systems. Follow facility manager, engineer and/or maintenance personnel direction, as well as consult construction documents and follow Manufacturer’s SOP to include replacing any filters.

### **STEP 8: CLEAN UP**

- Reinstall aerators.
- Clean up any water that may have leaked or spilled throughout the facility.
- Confirm removal hose(s) used for draining hot water heater(s), expansion tank(s), and HVAC or other equipment, if any, as well as collect supplies and tools.
- Turn-on any breakers turned off in Step 2.
- Close all windows and doors that were opened, and turn off all ceiling and exhaust fans that were opened in Step 2.
- Do final walkthrough to ensure all water is secured, trash is removed.



**STEP 9: RECORD WATER USE OR FLUSHING TIME, OBSERVATIONS AND NOTES**

ADDRESS: \_\_\_\_\_ ZONE \_\_\_\_\_

**ATTENTION**

- DOCUMENT ANYTHING UNUSUAL ENCOUNTERED BEFORE OR DURING FLUSH TO INCLUDE THE PRESENCE OF ANY STAINING (SUSPECTED TO BE PETROLEUM-RELATED) OF SINKS, BATHTUBS, TOILETS, ETC. IN THE OBSERVATION/NOTES SECTION ON THE CHECKLIST.

<b>Meter Reading</b>	Stopped	Started	Total Water Use (gallons or cubic feet; circle one)
<b>Total Flushing Time</b>	Stopped (0000)	Started (0000)	Total Minutes

***Record observations and notes on the CHECKLIST. Attach additional pages, as needed.***



## **APPENDIX B: COORDINATING INSTRUCTIONS**

The Department of Navy (DON) will notify users as each flushing zone is flushed and water is in compliance with the Federal Safe Drinking Water Act and State of Hawaii Drinking Water Standards and safe to drink. The DON is available to advise all non-residential facilities connected to JBPHH's water system. Flushing team support will be provided to high public health risk entities, such as schools, daycares, and medical facilities utilizing a combined team of Military and the facility's personnel.

Coordinating instructions for flushing and sampling by type of use and/or ownership of non-residential facilities follows.

### **Daycares, Schools and other Designated Facilities for Children**

Daycares, schools and designed facilities for children will be initially contacted by JBPHH Public Works Department (PWD) and/or Army Directorate of Public Works (DPW). The facility managers or administration will be responsible for coordinating onsite flushing event and ensuring knowledgeable maintenance personnel are available to support flushing operation. Five (5) samples will be collected from all schools and two (2) samples from all other childcare or identified child use facilities to ensure drinking water at these facilities are in compliance with the Federal Safe Drinking Water Act and State of Hawaii Drinking Water Standards, and safe to drink. Samples will be taken in accordance with step 4 requirements of the approved Drinking Water Sampling Plan.

### **Medical Facilities and Health Clinics**

The managers of these facilities will be directed to ensure the buildings are adequately flushed and any treatment system filters are changed out in accordance with manufacturer's recommendations. The two (2) non-DOD dental facilities off-base will be contacted by NAVFAC to discuss dental chair unit configuration and treatment. Department of Navy Bureau of Medicine and Surgery (BUMED) Navy Environmental Preventive Medicine Unit – 6 (NEPMU-6) and/or BUMED Medical Environmental Health personnel will be responsible for communicating this SOP to BUMED Health and Dental Clinics connected to the JBPHH water system. No Army medical facilities connected to JBPHH Water System have been identified. As these are all smaller medical facilities, only one (1) sample each will be collected from each facility to ensure drinking water at these facilities are in compliance with the Federal Safe Drinking Water Act and State of Hawaii Drinking Water Standards, and safe to drink. Samples will be taken in accordance with step 4 requirements of the approved Drinking Water Sampling Plan.

### **Non-Department of Defense (DOD) Non-Residential Facilities**

For non-DOD facilities on-base and off-base that have been shut-down for a variety of reasons, the DON (NAVFAC) will be available to advise on this SOP, facility/business managers will be requested to ensure sinks, water appliances and ice machines are empty prior to arrival of non-residential flush team. If facilities/buildings have not been operation, than facility/business managers should turn off water heaters should be turned off the night before flushing. For Non-DOD on-base and off-base facilities/buildings that remained in operation, the DON is available to provide guidance on additional steps that can be taken.



## DOD Non-Residential Facilities (to include Apartments and Barracks)

This SOP will be distributed by the JBPHH PWD to Facility Management Specialist (FMS) and same for Army DPW to designated Facility Managers who will be responsible for ensuring their facilities/buildings have been adequately flushed in accordance with this SOP. These are facilities that have continued to have been occupied. The Facility/Building Manager is responsible for submitting work tickets to ensure all filters on drinking water fountains and ice machines are changed out. Representative sampling will be done on ten percent (10%) of DOD non-residential facilities to ensure drinking water at these facilities are in compliance with the Federal Safe Drinking Water Act and State of Hawaii Drinking Water Standards, and safe to drink. Samples will be taken in accordance with step 4 requirements of the approved Drinking Water Sampling Plan.

## FLUSHING TEAM INSTRUCTIONS

All flushing related emergencies (e.g., low pressure, water line break, etc.) will be reported through the NAVFAC Emergency Service Desk by calling **808-449-3100** or NAVFAC HI Command Duty Officer (CDO) at **808-347-8289**.

Large facility flushing coordination and any flushing related issues (e.g., low pressure) will be reported through the NAVFAC Engineering Work Group (EWG) by calling **808-474-0366**.



## APPENDIX C: OPERATIONAL RISK MANAGEMENT PLAN (WATER PRESSURE)

Operational Risk Management (ORM): (1) Identify the Hazards (2) Assess the Hazards (3) Develop Controls (4) Implement Controls & (5) Supervise and Evaluate

Task or Subtask	Hazard	Initial Risk Level	Control	Implementation	Residual Risk Level
<b>Flushing Program - Transmission System Pressures</b>	Gravity storage tank water level below tank lower than normal operation level (pump on/off)	Low	Continue tracking and maintaining storage volume similar to distribution flushing event by zone; additionally, JBPHH adequately sized transmission mains and well-looped distribution system reduces risk by design	Already tracked by water system operators; flushing operation will be shut down if tank volumes not maintained	Low
	Transient pressure across JPHH-H Transmission Lines	Low	Continue utilizing NAVFAC Supervisory Control and Data Acquisition (SCADA) system for JBPHH to track the 42 meters located off transmission mains that have pressure sensors installed and log data every 30 seconds	NAVFAC GIS prepare a map that shows these 42 meter locations against flushing zones; and NAVFAC SCADA track transmission main pressure data during in-home and non-residential flushing events; and report low pressure events to NAVFAC EWG	Low
<b>Flushing Program – Distribution System Pressures</b>	Minimize localized distribution system residual pressure loss due to flushing event	Medium	Flushing strategy is to maintain distribution residual pressure of 30 psi, but no less than 20 psi transient; install one pressure recorder per flushing zone near flushing events	Army DPW and Navy PWD will install one pressure data logger per zone or pressure zone being flushed to capture transient pressure events, and at a minimum one analog gauge to capture static and per large facility/building flushing events	Low
		Medium	Report flushing start and stop events of large non-residential facilities to the NAVFAC EWG in addition to daily tracking		Low
	Back-siphoning in the distribution system	Medium	The Army and the Navy installs Backflow Prevention Assemblies (BFPAs) in accordance with (IAW) DOD and industry cross-connection standards and complies with State of Hawaii cross-connection regulations; and at a minimum, BFPAs are inspected and tested annually	Army DPW and Navy PWD to confirm customers are metered in flushing zone and for high risk customers BFPA are installed IAW DOD and industry cross-connection standards, and State of Hawaii cross-connection regulations (see references)	Low
<b>Flushing Program - within Facilities/ Buildings</b>	Minimize residual pressure loss due to flushing event	Low	Ensure flushing volume (gpm) is less than rated meter capacity and/or service line capacity utilizing factor of safety proposed IAW Flushing Checklist and SOP	Flushing team lead will check for meters, and any site plans/construction documents available for service line sizes; and ensure safe flushing rates	Low

Continued next page.

**JBPHH – Interagency Drinking Water System Team**



Task or Subtask	Hazard	Initial Risk Level	Control	Implementation	Residual Risk Level
<b>Flushing Program - within Facilities/ Buildings</b>	Back-siphoning within facility	Low	Same as back-siphoning in the distribution system; BFPAs installed, and inspected and tested annually	Flushing Teams confirm if facility/building is metered and/or has one or more BFPAs (fire, irrigation, etc. and/or for entire facility (e.g., Mall)	Low
	Back-siphoning within the building	Low	Maintain adequate flow at fixtures; building fixtures installed IAW plumbing code (e.g., vacuum breakers, etc.); and air gaps to be maintained	Flushing Teams ensure continuous flow on all open fixtures (no sputtering fixtures); ensure air gaps are maintained during flushing events (air gaps = 2.5 x diameter of hoses from potable water to non-potable)	Low
<b>Low Pressure Event</b>	Potential back-siphoning	Medium	USAG-HI and JBPHH low pressure and main break response IAW established utility standard operating procedures (SOPs); and flushing teams will also call NAVFAC Emergency Service Desk.	Army DPW and Navy PWD, or Flushing Teams to report localized low pressure events to NAVFAC EWG (and IAW established utility operation SOPs) and flushing is paused until IDWST approves restart of flushing operations	Low
	Potential water line Infiltration	Medium		Army DPW or Navy PWD Environmental and/or alternatively Army Public Health (TAMC) or Navy Public Health (BUMED) to test chlorine residual and take bacteriological samples IAW SOPs; to include ensuring personnel performing field testing and bacteriological sampling are trained and experienced	Low
	Potential for Unsatisfactory Water Quality	Medium		Comply with the Federal Safe Drinking Water Act and State of Hawaii Drinking Water Regulations if pressure loss results in unsatisfactory water quality results	Issue BOIL WATER or DO NOT CONSUME WATER as required by regulation and IAW established Army DPW or Navy PWD SOPs

**REFERENCES**

State of Hawaii, Department of Health, Hawaii Administrative Rules, Chapter 11-20, Rules Relating to Public Water Systems, <https://health.hawaii.gov/opppd/files/2018/02/11-20.pdf>.  
 State of Hawaii, Department of Health, Hawaii Administrative Rules 11-21, Cross Connection and Backflow, <https://health.hawaii.gov/opppd/files/2015/06/11-21.pdf>.  
 DOD, Unified Facilities Criteria (UFC) 3-230-01, Water Storage and Distribution, 01 OCT 2018, [https://www.wbdg.org/FFC/DOD/UFC/ufc\\_3\\_230\\_01\\_2018\\_c1.pdf](https://www.wbdg.org/FFC/DOD/UFC/ufc_3_230_01_2018_c1.pdf).  
 DOD, UFC 3-230-02, Operation and Maintenance: Water Supply Systems, 01 APR 2021, [https://www.wbdg.org/FFC/DOD/UFC/ufc\\_3\\_230\\_02\\_2019\\_c1.pdf](https://www.wbdg.org/FFC/DOD/UFC/ufc_3_230_02_2019_c1.pdf).



## **APPENDIX D: ADDITIONAL CONSIDERATIONS AND GUIDANCE FOR FLUSHING TEAMS**

### **1. GENERAL GUIDANCE**

- Request a copy of a site plan and construction drawings. This will be particularly helpful for large non-residential facilities. For daycares and schools, previously prepared lead/copper sampling plans (or the Navy’s Lead in Priority Area sampling) will show/list fixtures. COVID-19 flushing plans drafted for facilities that were shut-down for an extended time, maybe of similar use.
- Building/facility managers/engineers/maintenance staff are a valuable resource, as they will have some knowledge of the plumbing systems - they should be present on flush day.
- Each building may need specialized instructions. At the start - walk through building to count number of fixtures/list them – add to notes.
- Having building maintenance, or at least a building user present is helpful in finding hidden faucets and exterior hydrants. A written inventory adds to defensibility.
- For large buildings, consider breaking them into “smaller zones”, where different team members are responsible. Zones should follow a logical flushing order beginning with a water tap closest to service meter to furthest location in plumbing system which may be in the main building or it could be another onsite building (e.g., if an office complex or shopping mall, etc.).

### **2. PLUMBING CONSIDERATIONS**

- Service Lines. Service lines transport water from the water main into the building.
  - These can be long and non-intuitive, especially as parcels change hands or become developed. Service lines may travel around the building before entering.
  - The diameter for of these service lines may also be large – consider that it likely carries fire suppression water.
  - Campuses with multiple buildings may have a single service line connection (water meter) that branches into other buildings. Try to determine the connection between these buildings before flushing. For example, although an athletic shower house may be closer to a road, it may be connected to the main school building first and then travel across the campus to that separate out building. Consider flushing the service line at the main building before moving out to other buildings.
- Complex connection of plumbing. While homes are typically *trunk & branch* (1-2 continuous lines like a tree) or *Manifold* (individual lines from the basement to each tap – not common on-base), non-residential buildings likely have loops and dead-ends, much like a buried water distribution system.
  - Some buildings, like retail stores, are simple with very few water connections concentrated in 1-2 areas (i.e., bathrooms, breakrooms).
  - Other buildings, like schools have many water connections (e.g., a science lab with 10 benches, each with a sink, showers, art sinks, spigots, water fountains within kindergarten classrooms). Medical facilities might have multiple water connections (e.g., one per dental chairs).



- Point of Entry (POE) or Point of Use (POU) Treatment Devices. Many devices may treat water and/or split flow into multiple systems (e.g., drinking water fountains with more treatment, medical grade water, laboratory grade water). Each one of these devices requires specialized attention. Some examples follow:
  - Drinking water fountains/water bubblers may have their own water treatment systems within the unit or before the unit that should be removed or bypassed to avoid contaminating the system during flushing.
  - Filters and softeners should be removed or otherwise bypassed during flushing procedures. Consider filter media replacement, which could absorb and then leach out contamination after flushing is completed.
- Water Taps. Be sure to look for \*all\* taps - consider that non-residential buildings change uses - there may be sinks in storage rooms or other hard to notice places.
  - There may be additional kinds of taps like janitors' sinks
  - Automatic faucets - (e.g., non-residential bathrooms) may require constant attention for continuous flushing, but controls can also typically be bypassed. If automatic faucets have single temperature - consider doing them *last* and for *twice as long* (as they will be drawing on both cold and hot water at unknown pre-set rates).
- Cold Water. Cold and hot water are carried by different pipes. BOTH sets of pipes in the building need to be flushed.
  - Cold water taps may additionally be split (e.g., water fountains on their own line of softened water). This will increase flushing time, since lines must be longer. It is a good idea, where possible, to look at the pipes and their labels. For example, if a drinking water fountain is between two bathrooms – you will not just flush for the time between the bathroom and the water fountain, but between the water fountain and the next water fountain.
  - Pressure tanks in high rises may additionally have holding tanks to increase pressure on upper floors. These should be drained.
  - Toilets and urinals should be flushed 3 times.
  - Drinking water fountains and other fixtures with sensors will need to be held open manually to flush.
- Hot Water. Hot water systems have much more complexity than cold water systems.
  - Water heater volume. Heaters need to be specifically drained. By simply running hot water, there is mixing within the heater and [non-ideal flows].
    - Some buildings may have multiple tanks in series.
    - Solar water heaters may require turning extra valves to drain.
    - Draining hot water tanks is ideal, but may require more preparation – longer hoses, more buckets, etc. Alternatively, for safety considerations flush hot water directly from water taps nearest the water heater to associated drains. Need to ensure the hot water tanks are turned off before draining.
  - Expansion tank volume. Unlike residential systems, the expansion tank may be much larger and have its own purge valve.
  - Draining. Draining may be simple (like in residences), but may be more complex. Consider having a plumber on hand to handle more complex plumbing and pressure issues.
    - Larger expansion tanks may have drain valves. After allowing the water heater to cool, open these valves.





- Water Boilers used in HVAC systems may also have expansion tanks that need to be drained. Refer to references.
- Major Appliances.
  - Non-residential buildings may have more devices than residential homes, or multiples of devices.
  - Consider dishwashers, refrigerators, ice machines, washing machines/laundry, water features (e.g., fountains, waterfalls), specialized tubs (e.g., athletic tubs in locker rooms), specialized cleaning equipment that is plumbed in (e.g., baby bottle sanitizers) and more. The cleaning procedures for specialized equipment may need to be tailored.
  - Non-residential buildings will also have small personal devices that hold potable water (e.g., coffee makers, rice makers) – so it is important to provide same or similar information provided to single-family residences (i.e., Residential Resource Guide) and/or Appendix B, Additional Information for Water Users.
  - Devices that are in homes might also be more complex, and larger in non-residential buildings – For example, large fish tanks, larger decorative fountains, etc. Building users may need specific help in navigating how they should deal with these devices.
- All Water Filters. All water filters if installed should be removed and replaced now rather than replacing in accordance with manufacturer recommendations or established schedule filter replacement. Consider contacting the building/facility managers before flushing event date to ensure they have an inventory of replacement filters on-hand.

### 3. SPECIAL CONSIDERATIONS

- Alternative Water Systems. Alternative water systems, including but not limited to medical grade water, laboratory grade water and dental lines, require specific attention. Building managers familiar with these systems should be specifically consulted.
- Dental chair units can be either connected directly to the potable water system or each individual chair may have a holding reservoir that utilize water. For dental chair units connected directly to potable water system flush dental lines. For dental chair units using reservoirs that used potable water instead of distilled water, triple rinse and follow standard operating procedures for cleaning units. For POE or POU treatment units see below.
- POE or POU treatment units will require specific attention. These may include filters, membranes, and tanks. Follow manufacturer's standard operating procedures for cleaning units or contact manufacturer for specific instructions.
- Eyewash stations should also be flushed IAW standard operating procedures.
- Flushing of all lines should be performed similarly to cold water systems.
- Special attention should be paid to small diameter piping.

### 4. USE OF WATER QUALITY INDICATORS

- For large facility/buildings that have not be in operation for more a week or longer teams could rely on water quality indicators of adequate flushing:
- Water quality indicators, like chlorine and temperature, can be used as a confirmation that fresh water from the distribution network is being pulled in. This may be especially important in large facilities with shared potable and fire water lines and/or large facilities or buildings with vulnerable populations (e.g., schools with children).



- Both chlorine meters and thermal guns (or regular thermometers) are easy to use. Temperature feedback is immediate, while chlorine using a field test kit may take a couple minutes (to add powder reagent, mix, and measure). Record any measurements in the observations and notes section of the Checklist as part of Step 9 in Appendix A.

**5. MAXIMUM FLUSHING RATE DETERMINATION METHODS**

**Combined Fixture Flow Rates Not to Exceed Based on Meter Size**

Size of Meter (inches)	Type of Meter	AWWA Normal Flow*	AWWA Continuous Flow	Recommended Maximum Flushing Rate
3/4x5/8x3/4 or 5/8x5/8x3/4	Positive Displacement Meter	1-20	10	10
3/4x3/4x1		2-30	15	15
1		3-50	25	25
1x1x1.25		3-50	25	25
1.5		5-100	50	50
2		8-160	80	50**
2	Compound Meters	2-160	-	50**
3		4-320	-	50**
4		6-500	-	50**
6		16-1600	-	50**

\*Velocities not to exceed 8 feet/second.

\*\*Maximum flow rate shall be limited to distribution system and wastewater system capacity.

**Combined Fixture Flow Rates Not to Exceed Based on Service Line:**

Size of Service Line (inches)	Maximum Allowable Flow Rate* (gpm)	Recommended Maximum Flushing Rate** (gpm)
1	21	10
1.25	32	15
1.5	46	20
2	80	40
2.5	120	50**
3	175	50**
4	280	50**

Assuming Copper Tube Type M-ASTM B88

\*Velocities not to exceed 8 fps.

\*\*Maximum flow rate shall be limited to distribution system and wastewater system capacity.

If meter size and service line size is NOT known, recommend not exceeding 10 gpm during flushing event, unless site plans, construction documents or plumbing in premise indicates higher flow volume can be handled (e.g., sometimes multiple stall public restrooms can be used as a guide for what a building can handle – the total capacity of all sinks and toilets in use). The onsite team needs to make this determination in advance of flushing operation.



**Reducing Flushing Rate for High-Flow Rate Fixtures**

Individual flushing rates for non-low flow fixtures can be calculated using the following **mass balance equation** example:

Duration of high-flow fixture (in minutes) = Actual or estimated flow rate of low-flow fixture (in gpm) x recommended flow rate / high-flow fixture rate

**For example:**

*Flush bathtub fixture (in minutes) = Low-flow fixture (max. 2.2 gpm) x 15 minutes / Bathtub (est. 5 gpm) = <7 minutes*

NOTE: Bathtubs average 4-7 gpm (but can be higher) and utility sink faucets about 18 gpm at 60 psi compared to bathroom and kitchen sinks that would have a maximum flow of 2.2 gpm at 60 psi. Also, sometimes plumbing fixtures are stamped with flow rate (underside). Otherwise a bucket/timer method for high-flow fixtures can be used if looking to reduce flushing time across an entire facility.

**6. ONSITE DATA TRACKING TABLE EXAMPLES**

**FIXTURE COUNT**

Fixture	Total		Filters Replaced? (Y / N)
Bathroom Sinks		w/ filters:	
Bathtubs			
Breakroom or Kitchen Sinks		w/ filters:	
Showerheads		w/ filters:	
Toilets		w/ Bidets:	Separate Bidets:
Urinals			
Water Fountains		w/ filters:	
Utility Sinks			
Hose Bibs		Inside:	Outside:

**APPLIANCE INFORMATION**

Water Using Appliances	Total			Filters Replaced? (Y / N)
Refrigerators		w/ water/ice maker:	w/ filters:	
Dishwaters			w/ filters:	
Ice Machines			w/ filters:	
Beverage Machine			w/ filters:	
Dental Chairs (connected to water)		w/ POE or POU:	w/ filters:	

*\*All other small appliances, such as coffee pots, rice makers, etc. leave instructions for customer to clean.*



**HOT WATER AND EXPANSION TANKS:**

Type (Hot Water or Expansion)	Tank Size (gallons)	Location	Electric, Gas or Solar	Drained (Y/N)

**TALLY OF ALL WATER FILTERS**

Unit	Type (Model Number)	Date Last Replaced*	Replaced (Y / N)	Work Order Submitted to Replace (Y / N)
POE Treatment				
Fountains (POU)				
Sinks (POU)				
Ice Machines (POU)				
Other (list):				

\*If marked on filter.

The easiest tool to track fixture flushing and filter locations for any size facility or building would be to use a facility site plan and/or as-built construction documents, if available.

**7. REFERENCES FOR FLUSHING LARGE FACILITIES AND BUILDINGS\***

- Purdue University, Flushing Plans - Center for Plumbing Safety - Purdue University, <https://engineering.purdue.edu/PlumbingSafety/resources/flushing-plans>.
- Purdue University, Engineering, Actual 2 Floor School Building with Central Water Heating, Hot Water Recirculation Loops, Auditorium, Cafeteria, Gym, Classrooms, and Other Rooms, 06 APR 2020, <https://engineering.purdue.edu/PlumbingSafety/resources/Example-Flush-Procedure-Actual-School-2020-04-03.pdf>.
- AWWA Water Science, Wiley Online Library, Considerations for Large Building Water Quality after Extended Stagnation, 16 JUN 2020, <https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1186>.
- ACME, How to Drain the Boiler Expansion Tank: <http://www.acmehowto.com/hvac/drain-expansion-tank.php>.
- CDC, Reopening Buildings after Prolonged Shutdown or Reduced Operation. <https://www.cdc.gov/nceh/ehs/water/legionella/building-water-system.html>.
- DOD, UFC 3-230-02, Operation and Maintenance: Water Supply Systems, 10 DEC 2019, Change 1, 1 APR 2021, <https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-230-02>.
- [Why and How to Flush Building Water Systems? - YouTube \(11:58 second video\)](#).

\*All references last accessed on 24 December 2021.