



Army Water Planning Guide

“The world’s ultimate weapon runs on water, everything else runs on fuel”

Office of the Deputy Chief of Staff, G-4
Headquarters, Department of the Army

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*This document supersedes the Water Planning Guide, dated 25 November 2008.



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20 March 2023

MEMORANDUM FOR RECORD

SUBJECT: Approval of the Army Water Planning Guide

1. References:

- a. AR 700-8, Logistics Planning Factors and Data Management, 15 March 2011.
- b. AR 700-136, Tactical Land-Based Water Resources Management, 5 June 2009 (Pending FY23 Update).
- c. DoD Directive 4705.01E, Management of Land-Based Water Resources in Support of Contingency Operations.

2. The Army Water Planning Guide serves as a comprehensive sustainment planning tool that identifies requirements, assesses capabilities, and identifies resources to support military operations at all levels.

3. The Army Water Planning Guide was approved by the QM Commandant on 21 February 2023 and briefed to HQDA G44S and HQDA G4/3/5/7 on 7 March 2023. By the Approval Authority delegated to me as the Acting DCS, G-4, I hereby approve of the Army Water Planning Guide.

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Acting Deputy Chief of Staff, G-4

Version History

Version	Date	Summary
DRAFT	9 Oct 2022	Worldwide Staffing Complete
Final	20 Mar 2023	Approved by HQDA G4

Points of Contact

Organizations
HQDA ODCS G4
CASCOM, QM Commandant
CASCOM, FFID
CASCOM FDD, QM Branch
CASCOM Planning Data Branch
CASCOM Doctrine Directorate
U.S. Army Research Institute of Environmental Medicine
The Army Heat Center
The Army Public Health Center
U.S. Army DEVCOM and Joint Culinary Center of Excellence
Medical Center of Excellence (MEDCoE)
Joint Mortuary Affairs Center
Maneuver Support Center of Excellence (MSCoE)
CBRN Doctrine Development Branch
Office of the Corps of Engineers, Geospatial
HQDA Office of the Chief of Engineers (OCE)
U.S. Army QM School, Petroleum and Water Department
Aerial Delivery and Field Services Department
US Army Futures Command, S-CDID
Office of the Deputy Assistant Secretary of Defense –Logistics
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Contents

Part 1	General Overview	1-1
1.1	Purpose	1-1
1.2	Introduction	1-1
1.3	Operational Context	1-2
1.4	Water Support Responsibilities	1-3
1.5	Water Planning Process	1-7
1.6	How to Use the Guide for Operational Planning	1-11
1.7	Planning Assumptions	1-17
Part 2	Water Planning Requirements	2-1
2.1	Planning Factors for Drinking	2-1
2.1.1	Planning Factors for Bottled Water	2-4
2.1.2	Transportation Factors for Bottled Water	2-5
2.2	Planning Factors for Personal Hygiene	2-6
2.3	Planning Factors for Central Hygiene (Shower and Laundry)	2-8
2.4	Planning Factors for Field Feeding	2-10
2.5	Planning Factors for Heat Injury Treatment	2-15
2.6	Planning Factors for Medical Treatment	2-17
2.7	Planning Factors for Veterinary Medicine	2-24
2.8	Planning Factors for Dental Company Area Support, Dental Role 1–3	2-27
2.9	Planning Factors for Blood Management	2-29
2.10	Planning Factors for Chemical, Biological, Radiological and Nuclear (CBRN) Decontamination	2-32
2.11	Planning Factors for Equipment Washing and Maintenance Procedures	2-35
2.12	Planning Factors for Engineer Operations	2-38
2.13	Planning Factors for Mortuary Affairs	2-41
2.14	Planning Factors for Detainee Operations	2-43
2.15	Planning Factors for Force Provider	2-44
2.16	Planning Factors for Evaporation, Waste, and Spillage	2-45
Part 3	Water Planning Resources	3-1
	Appendix A Water Planning Tools	3-1
	Appendix B Environmental Conditions	3-5

Appendix C Water Acceptability and Water Inspection.....	3-10
Appendix D Water Production.....	3-16
Appendix E Shower and Laundry Equipment	3-23
Appendix F Water Storage.....	3-26
Appendix G Water Distribution Systems	3-30
Appendix H Force Provider Equipment.....	3-38
Appendix I Water Testing Equipment.....	3-42
Appendix J Emerging Water Equipment	3-44
Appendix K Water Site Reconnaissance and Selection	3-50
Appendix L Wastewater Management	3-51
Appendix M Lessons Learned.....	3-55
Appendix N Bulk Water Request Process.....	3-59
Appendix O Applicable Forms	3-61
Appendix P Abbreviations.....	3-72
References	3-75

Figures

Figure 1-1. Support Operations Framework.....	1-3
Figure 1-2. Water Planning Cycle	1-11
Figure 1-3. Bulk Water Flow example	1-15
Figure 1-4. Packaged Water Flow example	1-15

Tables

Table 1-1. UUL Planning Factors.....	1-8
Table 1-2. SUL Planning Factors (UUL + Functional Mission Requirements)	1-8
Table 2-1. Hot Climate Consumption Planning Factors for Drinking (gal/person/day)	2-3
Table 2-2. Temperate Climate Consumption Planning Factors for Drinking (gal/person/day)	2-3
Table 2-3. Cold Climate Consumption Planning Factors for Drinking (gal/person/day)	2-3
Table 2-4. Drinking Water Planning Factors.....	2-4
Table 2-5. Bottled Water and Transportation Information Extracted from the Food and Water Tool Developed by the CASCOT Planning Data Branch	2-6

Table 2-6. Personal Hygiene Water Planning Factors.....	2-8
Table 2-7. Central Hygiene (Shower and Laundry) Planning Factors.....	2-9
Table 2-8. Unitized Group Rations Water Planning Factors	2-12
Table 2-9. Individual Meals water planning factors.....	2-14
Table 2-10. Meal Enhancement water planning factors	2-15
Table 2-11. Medical Nutrition Supplement water planning factors:.....	2-15
Table 2-12. Containerized Kitchen Sanitation Center Water Planning Factors.....	2-15
Table 2-13. Heat Injury Water Planning Factors	2-17
Table 2-14. Medical Water Planning Factors	2-20
Table 2-15. Medical Units Water Planning Factors (Medical Units Role 1-3).....	2-22
Table 2-16. Veterinary Medicine Role 2-3 Water Planning Factors	2-27
Table 2-17. Dental Role 1-3 Water Planning Factors	2-29
Table 2-18. Blood Detachment Water Planning Factors—Blood Detachment Requirements (WB, pRBC, Plasma)	2-32
Table 2-19. CBRN Water Planning Factors.....	2-34
Table 2-20. Vehicle Wash-Rack Water Planning Factors.....	2-35
Table 2-21. Watercraft Water Planning Factors	2-36
Table 2-22. Aircraft Water Planning Factors	2-37
Table 2-23. Engineer Operations Water Planning Factors (Engineer Construction)	2-40
Table 2-24. Mortuary Affairs (MA) Water Planning Factors	2-43
Table 2-25. Detainee Operations Water Planning Factors	2-44
Table 2-26. Force Provider Water Planning Factors	2-45

Part 1

General Overview

1.1 Purpose

The Army Water Planning Guide (AWPG) serves as a comprehensive sustainment planning tool that identifies requirements, assesses capabilities, and identifies resources to support military operations at all levels. This document is developed to be used during liquid logistics operational planning and it includes a detailed break-down of functional factors so that they may be tailored to fit specific circumstances.

1.2 Introduction

The Army coordinates with other services and the Joint Staff to develop joint policy, procedures, and requirements for water management resources to support land-based forces. Planners must determine the water requirements and types of units required to support specific operational plans and to establish a phased deployment plan to ensure that support is available for deploying forces. While researching and developing this guide, the research team revisited the previous factors (published in 2008) and challenged the proponents of water-consuming processes to validate or revise those factors. The following stakeholders provided detailed responsibilities, procedures, and data to provide commanders and planners a comprehensive water planning tool:

- Army Water Proponency: Headquarters, Department of the Army, the Deputy Chief of Staff, G-4 (HQDA G-4) is designated as the Army Staff proponent for all land based water resource matters. Under the guidance and policies of the HQDA G-4, the U.S. Army Training and Doctrine Command (TRADOC) is responsible for validating DoD and Army water consumption planning factors. Within TRADOC, the U.S. Army Combined Arms Support Command (CASCOM) is the proponent for developing, validating, and maintaining Army water consumption planning factors. To accomplish this, the CASCOM Planning Data Branch acquires battlefield functional mission water usage profile data from related studies and expertise from the field.
- U.S. Army Sustainment Center of Excellence—Field feeding, shower, laundry, and mortuary affairs functional mission operations
- U.S. Army Maneuver Support Center of Excellence—Engineer Operations (horizontal and vertical construction, well drilling, base camp) and CBRN (personnel and equipment decontamination) mission operations
- U.S. Army Geospatial Center—Water Resource Database
- U.S. Army Medical Center of Excellence—Role 1 through Role 3 medical, dental, blood laboratory, and veterinary functional mission operations
- U.S. Army Research Institute of Environmental Medicine—Drinking, environmental, and heat injury factors

- U.S. Army Public Health Center—Preventive medicine, personal hygiene, central hygiene, and Force Provider factors
- The Army Heat Center, Warrior Heat Illness Collaborative—Heat injury planning and water requirements
- HQDA G44M-AVN Aviation Maintenance—Aviation functional mission operations
- CASCOM FDD OD—Vehicle maintenance and vehicle wash rack functional mission operations
- AFC S-CDID—Watercraft functional mission operations.

1.3 Operational Context

The multidomain operations environment presents far greater threats to our Army and Joint Force in terms of danger and magnitude than recent experiences in Iraq and Afghanistan. Near-peer adversaries have indicated their intent to gain and maintain strategic positional advantage in an attempt to deny the U.S. and other nations freedom of action across the land, maritime, air, space, and cyberspace domains. This large-scale type of combat operations will see us return to a battlefield with multi-corps combat operations characterized by more complex medical treatment requirements for our Soldiers and maintenance for our equipment. Fuel, ammunition, food, and water consumption are some of the most significant demand characteristics of the multidomain force. The sustainment community's ability to deliver optimized support to a widely dispersed and highly mobile forces on the battlefield will be tested. Tactical, operational, and strategic planning for multidomain operations must become continuous because the expectation is that the multidomain force will be engaged 100% of the time. The rapid nature of multidomain environment requires mobility and distribution to ensure U.S. forces can perform the mission in the time required.

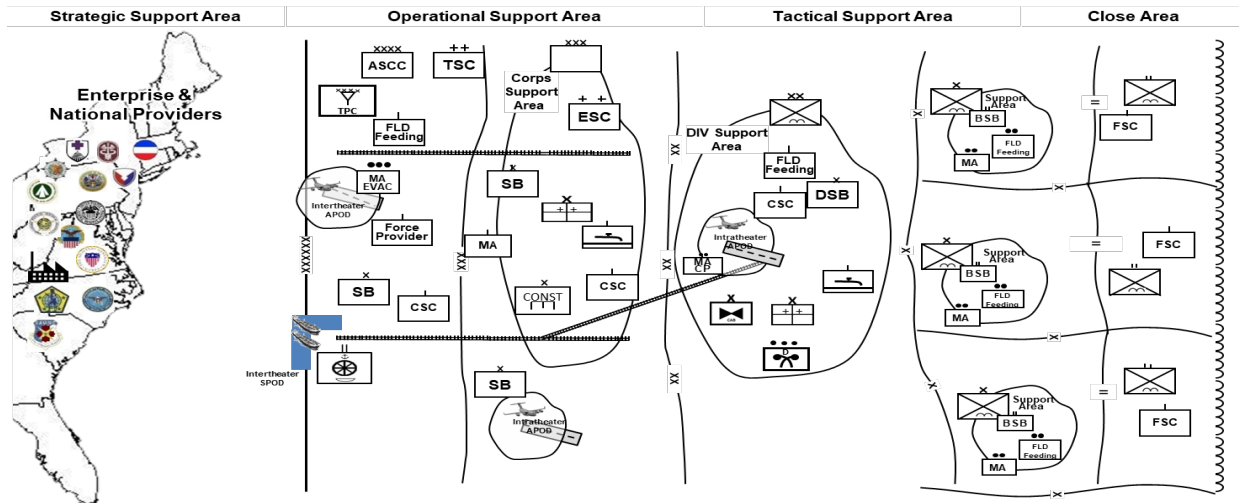
Coupled with the challenges of multidomain operations, changing climate factors are also bound to impact and disrupt Army activities, displace individuals and communities, and increase the frequency of crisis deployments. The Army will face simultaneous readiness challenges as units contend with limited access at flooded bases, increased water scarcity, and land degradation in other areas. Adversaries and other malign actors may seize dwindling resources while seeking new opportunities to threaten U.S. national interests. Taken together, climate hazards will result in less economic and social stability, fewer goods to meet basic needs, and a less secure world.

The U.S. Army and the Joint Force must continue to identify the primary and alternative sources of water which reduce the total demand through point-of-need water production, reuse, and efficiencies. Sourcing water at the point of need improves ability to meet demand, reduces convoy requirements and logistics footprint, and facilitates endurance of expeditionary forces. Whenever possible, the use of host nation water sources, facilities, and equipment should be considered; however, planners must be aware of the international rules and conventions that govern using water resources with regards to local populations, labor force, dislocated civilians, and detainees.

This guide aims to align the process of water planning across a range of military operations while accounting for capacity, adaptability, and resilience for managing water resources. Commanders at all levels must ensure that water conservation and supply

discipline are continuously exercised and enforced. Information presented in this guide will enable planners (at all levels) to identify requirements, assess capabilities, and identify resources (i.e., water purification, storage, and distribution) that can support current and future military operations.

Figure 1-1. Support Operations Framework



1.4 Water Support Responsibilities

Water support operations are a U.S. Army Quartermaster Corps function, as well as a component of the Sustainment warfighting function which provides the operational commander freedom of action, extended operational reach, and operational endurance. The ability of the Army to perform its mission rests on sound planning, timely support and proper use of resources. One of the most critical of resources is water. Commanders and Staff Officers should know the capabilities of their sustainment units as well as additional water support available from the higher echelons.

The Army Service Component Commands (ASCCs) ensure that water support for other services is incorporated into Operational Plans (OPLANS) or pre-planned with Inter-Service Support Agreements (ISSA) when the Army is required to provide such support. In general, The Army Service Component is responsible for providing backup water support to other U.S. Military Services in an area of operation (AO) when requested and/or when water support requirements of the other services exceed their own organic capability. Responsibilities for water planning begin with the amount of water required and depend on the battlefield environment, projected timeline of the operations, and the size of the force. Water support management, equipment and operations vary from one organizational level to another. The following responsibilities have been identified:

- Assistant Secretary of Defense for Logistics and Material Management. Department of Defense Directive (DODD) 4705.01E designates the Secretary of the Army as the DOD executive agent for land-based water resources. Therefore, the Army is the lead service for all matters concerning water management in a joint operations area. As the lead service, the Under Secretary of Defense for Logistics and Materiel Readiness is required to establish DOD

policy on all land-based water resource matters. Under Secretary of Defense tasks the Assistant Secretary of Defense for Logistics and Materiel Readiness to provide overall guidance and direction for land-based water resource matters through the joint water resources management action group (JWRMAG). The JWRMAG is the joint strategic organization for resolving issues related to water. The Secretary of the Army designates the JWRMAG chair; each DOD component has a representative in the JWRMAG. See DODD 4705.01E for more information. The functions of the JWRMAG are to:

- Determine effects of water resources and related decisions on contingency support functions.
 - Develop water support technology research and development and equipment acquisition plans to support operations in all environments.
 - Develop and operate an improved, expanded, and automated water resources intelligence database for rapid retrieval of selected data.
 - Assess the water needs of all DOD and non-DOD organizations that affect the availability of water resources to support contingency operational requirements.
 - Find solutions to problems presented to the group.
 - Recommend policy changes to the Assistant Secretary of Defense for Logistics and Materiel Readiness.
 - Provide liaison support to host nations, allied or multinational forces, and others, to resolve water concerns related to contingency operations.
- An ASCC is the senior Army command in an area of responsibility (AOR) and is responsible for all sustainment support requirements established under Title 10 United States Code. The assistant chief of staff, operations (G-3) and the assistant chief of staff, logistics (G-4) are the primary staff at the ASCC-level and are concerned with water requirements determination. Theater level water situational awareness occurs between the ASCC and the theater level logistics headquarters.
 - Joint Task Force and Corps. The Army corps headquarters is the organization best suited to commanding and controlling land forces or transitioning to a Joint Task Force or joint force land component commander headquarters for major operations. The logistics directorate of a joint staff (J-4), with input from the manpower and personnel directorate of a joint staff (J-1) and operations directorate of a joint staff (J-3), will plan and forecast water requirements to support tactical operations.
 - Division Headquarters, the echelon of command below corps, can perform command and control of multiple brigade combat teams (BCTs) and other functional and multifunctional brigades engaged in multidomain operations. The division assistant chief of staff, operations, and G-4 have responsibilities to plan for operational water requirements and consolidate, monitor, and communicate water reports through support channels during operations. However, the actual function of providing logistical support to facilitate water supply operations on the battlefield rests with sustainment organizations. Water materiel management

functions are performed at the theater sustainment command (TSC), expeditionary sustainment command (ESC), and sustainment brigade headquarters.

- Theater Sustainment Command (TSC) is the senior Army sustainment headquarters within an AOR. The TSC is assigned to and receives mission command from the ASCC to support the geographic combatant commander. The TSC provides water support by directly managing the requirements, storage objectives, and distribution of water in the assigned AOR. The TSC ensures an adequate water support structure is in place to support the AOR. The fuel and water branch within the TSC support operations (SPO) staff section plan and coordinate water support with subordinate ESCs or other subordinate headquarters as necessary. The TSC also reaches back to leverage strategic partners as necessary.
- The Theater Petroleum Center (TPC) provides liaison between the Defense Logistics Agency Energy (DLA-E), host/partner nations, the ASCC, Combatant Command (COCOM), and TSC as needed, and serves as the senior theater Army water advisor to the COCOM with strategic-operational planning support. TPC could be assigned to an ASCC, TSC, or ESC. The TPC, theater G-4 staff, and TSC fuel and water branch coordinates the theater's land-based plan for bulk potable water support and distribution. The TPC is allocated one per theater supporting a COCOM, or in the TSC when its capabilities to plan and execute liquid logistics operations are exceeded. The
- The Quartermaster, Petroleum, Oils, Lubricants, (POL) and Water Group is normally assigned to the TSC or an ESC. The group provides planning, liaison, and supervision of the supply and distribution of petroleum and water for a theater of operations. It is structured to bridge the gap between the strategic and operational levels for liquid logistics. This unit provides centralized management of bulk petroleum and water by receiving, consolidating, and tracking accountability reports for water and providing liaison to ESCs, the TSC, and other echelons above brigade as required.
- The ESC deploys to an AO and provides command and control capabilities when multiple sustainment brigades are employed or when the TSC determines that a forward command is required. Similar to the TSC, the fuel and water branch within the ESC SPO staff section plans and coordinates water support with subordinate sustainment brigades or other subordinate headquarters as necessary.
- Sustainment Brigades provide command and control to assigned units to execute the missions directed by the TSC and ESC. The fuel and water section within the SPO staff section provides water planning, guidance, and support to forces in an AO.
- The Combat Sustainment and Support Battalion (CSSB) is assigned to the Sustainment Brigade. Its fuel and water section within the SPO staff section provides water planning, guidance, and support to forces in an AO.
- A Composite Supply Company (CSC) is assigned to a CSSB to provide general supply, petroleum, and water support to the BCT and supported units. The water section has capability to produce (using TWPS and LWPS), store, and distribute

water using the water storage and distribution system (WSDS) and 2,000 gallon load handling system (LHS) compatible water tank rack systems (HIPPOs). The Company Operations Section is responsible for mission analysis and planning.

- The Quartermaster Water Support Company is assigned to a CSSB to produce, store and distribute potable water to supported units within a designated area. The Company Operations Section is responsible for mission analysis and planning.

Note: The Quartermaster Water Support Company design (production, storage and distribution capability) is currently under review.

- The Division Sustainment Brigade (DSB) is assigned to a division to integrate, synchronize, and sustain operations at Division level and below. The DSB employs sustainment capabilities to create desired effects and support the division commander's objectives. DSB SPO water distribution management responsibilities are the same as at the sustainment brigade, except that it supports units within the division sustainment area.
- Division Sustainment and Support Battalions (DSSBs) are organic to each DSB supporting a division. DSSB capabilities are task organized by the division commander in accordance with requirements. The DSSB synchronizes and executes logistics support to BCTs and multifunctional support brigades attached to the division. The fuel and water section within the SPO staff section provides water planning, guidance, and support to forces in an AO.
- Brigade level water operations are carried out by the brigade S-4, who develops, coordinates, and monitors plans, policies, procedures, and programs for supply, transportation, maintenance, field services, and facilities for the command's subordinate units. The brigade S-4 determines requirements in coordination with the brigade S-1 and S-3.
- Brigade Support Battalions (BSBs) support the brigade's execution of operations by providing logistic support. The BSB SPO is the principal staff officer responsible for synchronizing BSB water distribution operations for all units assigned or attached to the brigade.
- Each BSB Distribution Company contains a fuel and water platoon that provides water storage and distribution support to the BCT. The water section within the fuel and water platoon does not have an organic water treatment capability. The water section is reliant on the composite supply company to provide water treatment capabilities, which may be pushed forward based on the concept of support and METTC-I considerations. If conditions allow, the BSB distribution company may be issued 1,500-GPH tactical water purification system. The TWPS provides a fully contained mobile water purification system capable of purifying, storing, and dispensing water meeting military field water standards for long-term consumption. The distribution company water section currently has the capability to store and distribute water using a forward area water point supply system (FAWPSS) and water HIPPOs (23,000 gallons with 10 HIPPOs and 1 FAWPSS). The Company Operations Section is responsible for mission analysis and planning.

Forward Support Companies (FSCs) do not have the organic capability to purify water, or store and distribute water to maneuver units. The FSC's water storage capability is limited only to internal operational requirements. However, to extend the reach of the BSB into the maneuver area, the BSB may assign HIPPOs and other water support equipment to the FSC to expedite the resupplying of maneuver units allowing the FSC to deliver resupply packages that can include water procured from the BSB. FSC commanders will coordinate with the supported battalion's S-4, the executive officer, and the BSB SPO. The FSC commander ensures that logistics operations are conducted in accordance with the supported commander's concept of operations.

- Host Nation Support Logistics planners should develop contingency plans with host nations for identifying and determining the availability of water resources for use by U.S. forces. Existing host nation communication channels should be used to determine the ability of the host nation to help meet water requirements.

1.5 Water Planning Process

Liquid logistics planners use guidelines and planning factors presented in this guide to determine the quantities of water needed to support an operation. The principals at the tactical, operational, and strategic levels must plan for water consumption requirements, identify water sources, and determine unit organic capabilities. These planning factors take into account population, various environments, and unit specific mission details. Planners should modify or adjust planning factors based on the latest logistics preparation of the battlefield assessments or other unique conditions associated with a given operation or AO. The water support requirement drives the proper force structuring. The time-phased deployment of units in that structure is an iterative process performed by organizational integrators who consider the operational scenario, strategic lift availability (sorties), and pre-positioned supplies and equipment. Organization commanders and staffs must assess adequacy of water capabilities and request additional capabilities as required. Early deployment of water units can be expected in arid regions. Water planning requirements are delineated between Universal Unit Levels and Sustaining Unit Levels.

- a. **Universal Unit Levels (UULs)** are water requirements that apply to all units regardless of mission profile. They include water for drinking, personal hygiene, and individual meal preparation, including the Meal Ready to Eat (MRE) heater and beverage mix. UULs represent minimum water consumption rates that are critical to maintaining force mission effectiveness during the beginning phase of the operation typically characterized by high mobility and a heavily contested environment. Table 1-1 reflects the average roll-up of UUL planning factors used to develop initial water consumption estimates.

UUL Planning Requirements (roll-up):

Table 1-1. UUL Planning Factors

Function		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Resp.	Paragraph
Drinking (gal/person/day)	Workload plus independent factors	2.10	2.10	1.90	1.93	P	Unit	2.1
Personal Hygiene (gal/person/day)	Brushing, shaving, sponge bath etc.	1.73	1.73	1.73	1.73	P	Unit	2.2
Field Feeding (gal/person/day)	3 x MRE	0.45	0.45	0.45	0.45	P	Unit	2.4
Total		4.28	4.28	4.08	4.11	P	Unit	

Note: For operational planning, calculate totals and apply spillage factor of 10% (4% evaporation and 6% waste and spillage) which must be considered for potable water in all environments.

- b. **Sustaining Unit Levels (SULs)** include UULs and account for functional unit mission water requirements that may consist of central hygiene, field feeding, medical operations, mortuary affairs, CBRN, engineer operations, vehicle operations/maintenance, and other factors as related to supporting discrete population sets (detainees and dislocated civilians) and the use of Force Provider equipment. SULs represent the sustaining amount of water that is required to maintain military force mission effectiveness after the initial operations have concluded.

SUL Planning Requirements (roll-up):

Table 1-2. SUL Planning Factors (UUL + Functional Mission Requirements)

Function	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Resp.	Remarks/ Paragraph
Drinking (gal/person/day)							
Drinking Heavy Workload	2.10	2.10	1.90	1.93	P	Unit	2.1
Personal Hygiene (gal/person/day)							
Brushing, shaving, sponge bath etc.	1.73	1.73	1.73	1.73	P	Unit	2.2
Field Feeding							
MRE (per meal)	0.15	0.15	0.15	0.15	P	Unit	2.4
Meal Cold Weather (per meal)	0.29	0.29	0.29	0.29	P	Unit	2.4
First Strike Ration (per meal)	0.24	0.24	0.24	0.24	P	Unit	2.4
Modular Operational Ration Enhancement (per meal)	0.19	0.19	0.09	0.09	P	Unit	2.4
UGR-A Breakfast (gal/person/meal*)	0.28	0.28	0.28	0.28	P	Unit	2.4

Function	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Resp.	Remarks/ Paragraph
UGR-A Dinner Average (gal/person/meal*)	0.36	0.36	0.36	0.36	P	Unit	2.4
UGR H&S Breakfast Average (gal/person/meal*)	0.14	0.14	0.14	0.14	P	Unit	2.4
UGR H&S Dinner Average (gal/person/meal*)	0.07	0.07	0.07	0.07	P	Unit	2.4
UGR-M Breakfast Average (gal/person/meal*)	0.29	0.29	0.29	0.29	P	Unit	2.4
UGR-M Dinner Average (gal/person/meal*)	0.42	0.42	0.42	0.42	P	Unit	2.4
Sanitation Water (CK requires initial charge) gal/person/meal	0.25	0.25	0.25	0.25	P	Unit	2.4
Heating Pan (AK, CK, MKT) gal/person/meal	0.12	0.12	0.12	0.12	P	Unit	2.4
Central Hygiene (Showers, LADS, and CBL require initial charge)							
Showers (gal/person)	6.00	6.00	6.00	6.00	P	EAB	2.3
LADS (gal/person)	1.08	1.08	1.08	1.08	NP	EAB	2.3
CBL (gal/ICU patient)	22.00	22.00	22.00	22.00	NP	EAB	2.3
CBL (gal/ambulatory patient)	10.00	10.00	10.00	10.00	NP	EAB	2.3
CBL (gal/staff)	9.40	9.40	9.40	9.40	NP	EAB	2.3
Medical Treatment							
Role 1 and Role 2 (Ambulatory, gal/patient/day)	3.70	3.70	3.70	3.70	P	Unit	2.6
Role 2 and Role 3 (Holding, gal/patient/day)	13.50	13.50	13.50	13.50	P	EAB	2.6
Role 2 and Role 3 (Surgical, gal/patient/day)	13.00	13.00	13.00	13.00	P	EAB	2.6
Brigade Support Medical Company (BMSC) 20 bed (gal/day)	2,342.80	2,342.80	2,342.80	2,342.80	P	Unit	2.6
Medical Company Area Support (MCAS) 40 bed (gal/day)	2,931.00	2,931.00	2,931.00	2,931.00	P	EAB	2.6
Combat Support Hospital (CSH) (gal/day)	19,440.00	19,440.00	19,440.00	19,440.00	P	EAB	2.6
Hospital Center (gal/day)	16,965.00	16,965.00	16,965.00	16,965.00	P	EAB	2.6
Dental Company Area Support (DCAS), Dental Role 1–3 (gal/day)	904.11	904.11	904.11	904.11	P	EAB	2.6
Veterinary Medicine Role 2–3 (gal/day)	90.20	90.20	85.20	85.20	P	EAB	2.6
Veterinary Food Procurement and Laboratory Team (FPLT) (gal/person/day)	76.75	76.75	76.75	76.75	P	EAB	2.6

Function	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Resp.	Remarks/ Paragraph
Medical Detachment Blood Support (MDBS) (gal/day)	218.00	218.00	218.00	218.00	P	EAB	2.6
CBRN (immediate and operational decontamination)							
Personnel	1.00	1.00	1.00	1.00	P	Unit	2.10
Wheeled Vehicles	150.00	150.00	150.00	150.00	NP	Unit +EAB	2.10
Armored Vehicles	200.00	200.00	200.00	200.00	NP	Unit +EAB	2.10
CBRN (thorough decontamination)							
Personnel	7.95	7.95	7.95	7.95	P	EAB	2.10
Vehicles (wheeled and armored)	450.00	450.00	450.00	450.00	NP	EAB	2.10
Aircraft RW (CH-46E, CH-47, UH-60, AH-64, OH-58, UH-1)	951.44	951.44	951.44	951.44	NP	EAB	2.10
Aircraft FW (C130)	2,400.00	2,400.00	2,400.00	2,400.00	NP	EAB	2.10
Area (100m x 30m)	1,500.00	1,500.00	1,500.00	1,500.00	NP	EAB	2.10
Mortuary Affairs (gal/hr)							
Remains Processing Non-Contaminated	2.50	2.50	2.50	2.50	NP	EAB	2.13
Remains Processing Contaminated	20.00	20.00	20.00	20.00	NP	EAB	2.13
Mortuary Affairs Equipment	16.50	16.50	16.50	16.50	NP	EAB	2.13
Engineer Construction (gal/day)							
Road/Airfield Construction (gal/km)	10,000.00	10,000.00	10,000.00	10,000.00	NP	EAB	2.12
Quarry Operations (gal/hr)	22.50	22.50	22.50	22.50	NP	EAB	2.12
Well Drilling (gal/linear ft.)	44.00	44.00	44.00	44.00	NP	EAB	2.12
Concrete Construction (gal/day)	26.00–400.00	26.00–400.00	26.00–400.00	26.00–400.00	NP	EAB	2.12
Pipeline Testing (gal/cu ft.)	7.00	7.00	7.00	7.00	NP	EAB	2.12
Base Camp (gal/person/day)	30.00–50.00	30.00–50.00	30.00–50.00	30.00–50.00	NP	EAB	2.12
Sewage Treatment (gal/person/day)	2.50	2.50	2.50	2.50	NP	EAB	2.12
Equipment (gal/day)							
Vehicle emergency use	0.36	0.36	0.19	0.19	NP	ALL	2.11
Ground Vehicles (wash-rack)	220.00–330.00	220.00–330.00	220.00–330.00	220.00–330.00	NP	ALL	2.11
Aircraft (daily wash)	25.00	25.00	25.00	25.00	NP	EAB	2.11
Aircraft (monthly wash)	660.00–1,320.00	660.00–1,320.00	660.00–1,320.00	660.00–1,320.00	NP	EAB	2.11
Watercraft	1,100.00–2,200.00	1,100.00–2,200.00	1,100.00–2,200.00	1,100.00–2,200.00	NP	EAB	2.11

Note: For operational planning, calculate totals and apply spillage factor of 10%.
Initial Charging amount represents the quantity of water required to place the piece of equipment into operation.
* Field feeding head count must be rounded to the nearest increment of 50 when calculating water for UGR type rations.

1.6 How to Use the Guide for Operational Planning

Figure 1-2. Water Planning Cycle



(i) Receipt of Mission and Analysis. Water planning is critical for any maneuver operation and it is primarily population- and equipment-based. Bulk and bottled water planning follow the same military decision-making process of identifying capabilities, requirements, and shortfalls. Planning for water support begins with determining the amount and quality of water required. During this stage, the planner evaluates mission guidance from the tactical commander, mission scope, mission duration and stage of operation, operational environment (see Appendix B), enemy CBRN capabilities, and size of the force. In any operational context the water logistics estimate is comprised of initial entry requirements (UULs) or enduring requirements (SULs).

(ii) Determine requirements and develop water consumption estimate. During this step, the planner will focus on the mission, terrain, environmental conditions, size of the force, operational reach, and endurance to identify culmination points. Planners analyze the water consumption factors presented in this guide and determine a water consumption estimate based on the population and mission assigned.

- a. The UUL water estimate rates identified in this section reflect water consumption during the initial phases of operational plan, which are characterized by high mobility and intense combat (typically between D Day and D+7). Consumption under these conditions includes essential functions such as drinking, food preparation (individual meals such as MREs), personal hygiene, and vehicles (if applicable). All units, regardless of mission set, must be able to estimate the minimum amount of water that is required to maintain military force mission effectiveness. Early in the mission planning process, it is acceptable to use the UUL roll-ups depicted in Table 1-1. However, as the requirements begin to solidify, that estimate must be updated using detailed planning data described in Part 2 of this guide.

EXAMPLE: Given an Infantry Battalion of 641 Soldiers conducting operations in a temperate environment, calculate the UULs for the initial seven days of the operation (using Table 1-1):

Drinking Water = 1.90 gal x 641 Soldiers = 1,218 gal

Personal Hygiene = 1.73 gal x 641 Soldiers = 1,109 gal

Individual Meals (MREs) = .15 gal x 3 MREs per day x 641 Soldiers = 288 gal

Total 2,615 gal + 10% spillage factor = 2,877 gal

Total water consumption for this scenario is 2,877 gallons per day.

2,877 gallons per day x 7 days = 20,139 gallons per week

- b. The SUL represents the sustaining amount of water that is required to maintain a military force's mission effectiveness after initial entry operations have concluded (enduring period typically D+7 and beyond). The sustaining water consumption includes the UUL planning factors plus functional mission requirements. Under this condition, all functions dependent on water are satisfied for the duration of the operation without any degradation. Planners establish, evaluate, and modify sustaining planning factors based on the reported consumption and any other requirements associated with a given operation or AO. During this phase of planning, the consumption factors still include all of the factors depicted in the UULs, but the planning does not stop there. As the operations progress, the specific water-

dependent functions are added to the planning factors. These planning estimates may include establishing field feeding operations, field services such as laundry and showers, Mortuary Affairs (MA), and CBRN requirements. Medical planners may begin establishing Role 2–3 medical treatment facilities and Engineer planners may begin road construction or well drilling to support the U.S. Army Quartermaster water production mission. Each one of these requirements is analyzed to ensure adequate support and to avoid wasting water or resources associated with distribution, production, and storage. Early in the mission planning process it is acceptable to use the SUL roll-ups depicted in Table 1-2. However, as the requirements begin to solidify, that estimate must be updated using detailed planning data described in Part 2 of this guide.

Example: Given the IN BN of 641 Soldiers and 65 Trucks calculate the SUL planning factors comprised of UUL's (drinking, personal hygiene, and MRE's) plus the functional mission services related to shower, laundry, and field feeding to a maximum level of detail using information depicted in the appropriate paragraph of this guide. The field feeding ration cycle is U-M-U (A-M-A), with menu items 1 through 7.

Drinking Water = 1.9 gal x 641 Soldiers = 1,218 gallons per day x 7 = 8,526 gallons per week (paragraph 2-1)

Personal Hygiene = 1.73 gal x 641 Soldiers = 1,109 gallons per day x 7 = 7,763 gallons per week (paragraph 2-2)

Vehicles = .19 gal x 65 trucks = 12.4 gallons per day x 7 = 87 gallons per week (paragraph 2-11)

Central Showers (one per week) = 6 gal x 641 Soldiers = 3,846 gallons per weekly shower (paragraph 2-3)

Central Laundry, LADS (one per week) = 460 gallons initial charge + (1.08 gallons x 641 Soldiers) = 1,152 gallons (assuming one laundry load per week, paragraph 2-3)

Detailed unit rations plan will be published in the Concept of Support Annex to the OPOD. For field feeding calculations use detailed planning factors described in paragraph 2-4. For this example, we will calculate water requirements for the U-M-U (A-M-A menu days 1 through 7) meal plan, which means Unitized Group Rations (A) (UGR-As) for breakfast and dinner, with MREs issued for lunch. Additionally, the field feeding requires water for cleaning and sanitation of dishes, utensils, and food preparation area.

UGR-As come in 50 person modules, so in this scenario, 641 personnel divided by 50 determines the number of modules required per meal ($641 / 50 = 12.82$, which is rounded up to 13)

Day 1: UGR-A breakfast plus dinner = $(10 + 12.5) \times 13 = 293$

Day 2: UGR-A breakfast plus dinner = $(7 + 12) \times 13 = 247$

Day 3: UGR-A breakfast plus dinner = $(7.5 + 14) \times 13 = 280$

Day 4: UGR-A breakfast plus dinner = $(7 + 18) \times 13 = 325$

Day 5: UGR-A breakfast plus dinner = $(5 + 12) \times 13 = 221$

Day 6: UGR-A breakfast plus dinner = $(14 + 15) \times 13 = 377$

Day 7: UGR-A breakfast plus dinner = $(8.5 + 14) \times 13 = 293$

Water required for UGR-A preparation of meal days 1–7 is 2,036 gallons.

MRE prep (one per day) = .15 gallons x 641 Soldiers = 96 gallons per day x 7 = 673 gallons per week (paragraph 2-4)

Food Sanitation Center (gal/person/meal) = $(0.25 \text{ gal} \times 641 \text{ Soldiers per day}) \times 2 \text{ meals} = 160 \text{ gallons per day} \times 7 = 1,120 \text{ gallons per week}$ (paragraph 2-4)

Food Heating Pan (gal/person/meal) = $(0.12 \text{ gal} \times 641 \text{ Soldiers per day}) \times 2 \text{ meals} = 154 \text{ gallons per day} \times 7 = 1,078 \text{ gallons per week}$ (paragraph 2-4)

Total field feeding requirement 2,036 gal + 673 gal + 1,120 gal + 1,078 gal = 4,907 gal

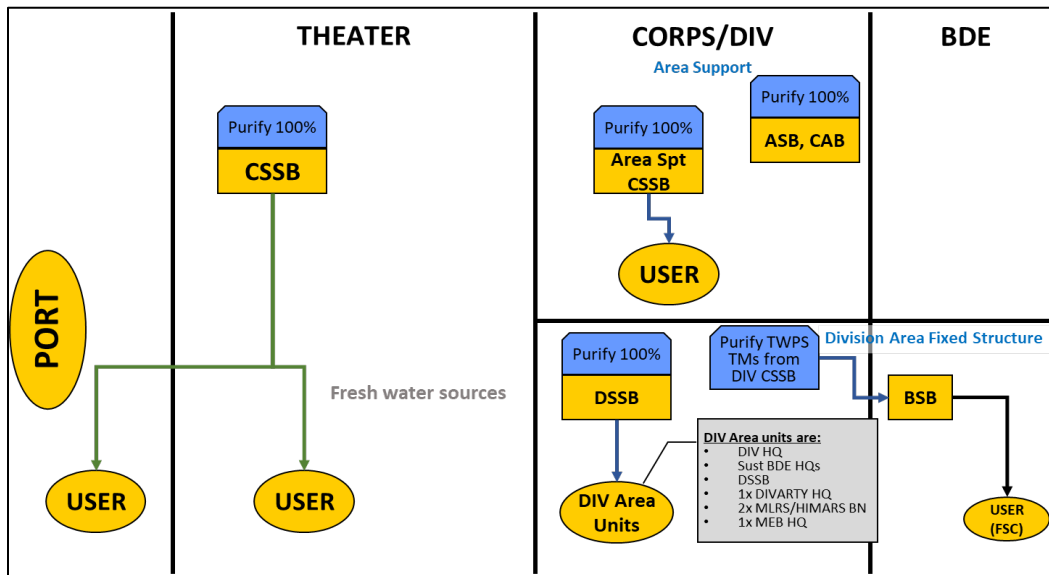
In this scenario, SUL factors which include water for drinking, personal hygiene, vehicles, showers, laundry, and field feeding is estimated at 26,254 gallons per week.

Total water requirement: 26,254 gal + 10% spillage factor = 28,879 gal per week

Additional tools used for water planning include: Operational Logistics (OPLOG) Planner, Quick Logistics Estimation Tool (QLET), The Soldier Water Estimation Tool (SWET), Joint Acquisition CBRN Knowledge System (JACKS), and Automated Decontaminant Calculator. (Listed in Appendix A)

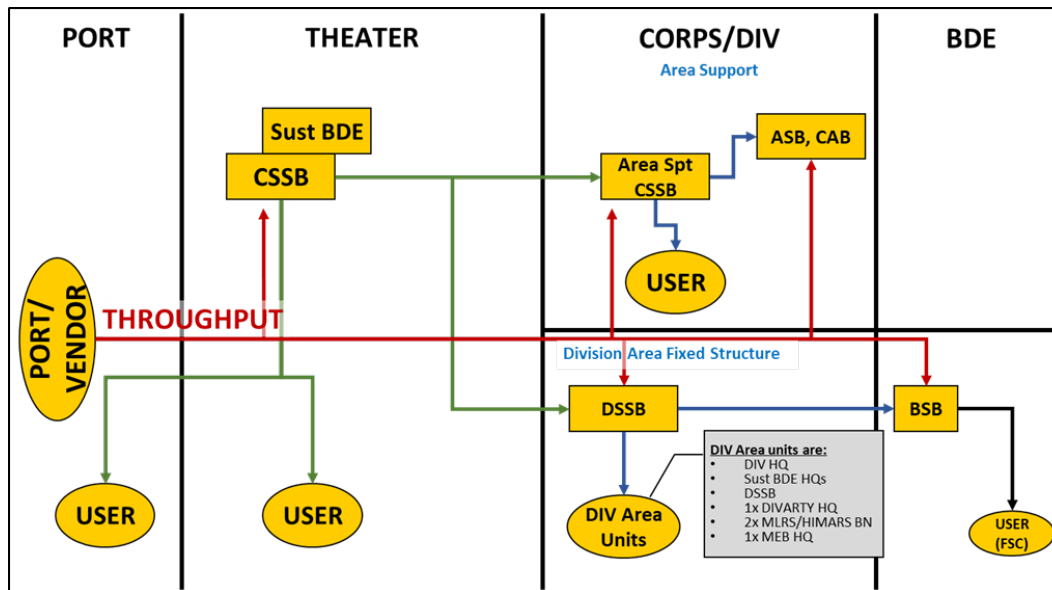
(iii) Determine the capabilities required to fulfill the need. The SPO liquid logistics planning section analyzes water production, water storage, and water distribution capabilities. This includes the latest reported on-hand asset availability, the force structure, and water source required to understand and meet operational demand. Planners use unit data available from the mission specific documents/orders as well as unit specific information available in the Force Management System Website (FMSWeb, Appendix A). A well-developed water estimate influences senior leader decisions regarding water production, storage, and the type of transportation assets required for distribution. A detailed list of water resources is included in Appendixes A–M of this guide and in ATP 4-44 (Water Support Operations).

Bulk water production is executed by water support units, as close as possible to supported units, and produced water is normally stored in water tanks or bladders. Bulk water can be transported using the prime mover and the 2000-gallon load handling system compatible water tank-rack systems (HIPPO), the 3,000-gallon and 5,000-gallon Semitrailer Mounted Fabric Tank (SMFT), the 800-gallon Unit Water Pod System (Camel II) or 400 Gallon Water Trailer (Water Buffalo).

Figure 1-3. Bulk Water Flow example

Packaged water is procured through contracted means, and it is transported the same way as any other palletized cargo utilizing the U.S. Army transportation assets such as flat-racks, line haul, and local haul systems.

Determining the right water requirements allows the distribution planner to synchronize resupply and determine factors such as the amount of water assets required to support the mission. At echelons above brigade level, water consumption requirements are used to establish priorities for distribution. At lower echelons, water consumption requirements are the basis for near-term or daily resupply.

Figure 1-4. Packaged Water Flow example

Example: Using the same scenario to support the above-mentioned Infantry Battalion, the planners must calculate distribution assets for SUL consumption water requirements.

- Bulk Water: Using water estimates and the approved distribution system for 28,879 gallons per week with a 2,000-gallon HIPPO equates to ~15 loads delivered to the point of need. Distribution of bulk water is a main constraint for units that do not have their own transportation assets.
- Packaged Water is primarily used for drinking requirements during the initial phases of the operation. Packaged water comes in different configurations, so these elements must be described in detail to prepare for distribution requirements. Distribution estimates for bottled water are addressed in paragraph 2-1 of this guide (Table 2-5). If bottled water is procured for the drinking requirements in our example, the distribution estimate is developed as follows:

To estimate the distribution assets required to move 8,526 gallons, first consider the size of the water bottle; it affects the volume and the quantity of the items placed on the pallet. For this estimate, use .5 liters, the most common water bottle configuration.

First, convert the drinking estimate from gallons to liters using 3.785 liters to 1 gallon: $8,526 \text{ gal} \times 3.785 = 32,271\text{L}$.

Second, determine the quantity of bottles to be distributed: $32,271 \text{ liters} / .5\text{-liter bottles} = 64,542 \text{ half-liter bottles}$.

Third, determine the number of pallets required to transport 64,542 bottles. Using reference Table 2- in paragraph 2-1, the most common configuration is 24 bottles in a case and 1,728 bottles per pallet: $64,542 / 1,728 = 38 \text{ pallets of bottled water}$

Finally, determine the number of transportation assets. For this example, we will use the PLS flat rack as a mean to distribute bottled water. Using data Table 2- presented in paragraph 2-1, the PLS/LHS flat-rack can transport 8 pallets on a single lift: $38 \text{ pallets divided by } 8 = 4.75 \text{ (rounded up to 5) flat racks}$

The Infantry Battalion in this example requires 5 flat racks to distribute a 1-week supply of bottled drinking requirement.

The remaining bulk water requirement of 20,353 gallons will still require ~11 HIPPOs.

Note: Bottled water requirements taper off as the bulk water production points are established. During COIN, bottled water requirements were calculated at 1 gallon per person and supply points were placed in the areas where Soldiers can easily access water for hydration (dining facilities, work and living areas). Bulk water was used for sustaining factors such as central hygiene, vehicles, field feeding, medical and engineer operations.

(iv) Incorporate the water support plan into the Concept of Support. It is absolutely critical that support plans are synchronized with maneuver plans. During this stage, planners will provide input to COA Development, COA Analysis, and COA Comparison. Planners work closely with the S-4/G-4/J-4 to ensure that the water support requirements are included in the LOGSYNCH matrix and address estimated consumption, procurement contracts (if applicable), locations, and lines of communication (LOCs), daily reporting requirements, contingencies, and force

protection. Upon COA approval, the concept of support is typically updated and provided to S-3/G-3/J-3 to be included in paragraph 4 and Annex F of the operations order (OPORD).

Units traditionally deploy with the basic load of bottled water on hand until water production is established. Bottled water used for operational missions is procured through the contracting vehicles established by the Contracting Support Brigade or theater support type contracts. The U.S. Army Public Health Center maintains the Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement which provides drinking water bottling plants/sources around the world.

Bottled water and ice used for field feeding operations is procured through Class I type contracts established by the Defense Logistics Agency (DLA).

Bulk water produced by the organic U.S. Army equipment is dependent on the location and availability of the raw water source. Raw water can be sourced from surface or ground water, including springs and wells. The U.S. Army Corps of Engineers (USACE) Geospatial Center maintains the Water Resources Database (WRD), which analyzes the water tables and well drilling sites based on the AO (described in Appendix A).

In the multidomain context, the intent is to produce the bulk water as close as possible to the end user to minimize the distribution requirements. The detailed bulk water request process is described in Appendix M.

(v) Implement the Concept of Support. Sustainment rehearsals provide the last opportunity to achieve a shared understanding of the support and casualty evacuation plan. During operations, water requirements are included in the Logistics Status (LOGSTAT) reports that drive specific requirements, provide visibility on critical shortages, and provide the logistics common operational picture. Planners establish the water stockage levels with their supporting activity and conduct LOGSYNC meetings that serve as a mechanism to continuously evaluate and update the planning factors.

(vi) Evaluate and update the estimate. Planners will cross-reference the supporting unit structure and mission against usage data. Use the initial analysis for forecasting requirements and adjust estimate based on the consumption data as the operation progresses. Consistently analyze unit task organization for personnel and equipment numbers and determine requirements based on Threat, Scheme of Maneuver, and Environmental factors.

Note: The Water planning process is dynamic and cyclic at the same time, progressing through “stages” that require disciplined management and consistent updates.

1.7 Planning Assumptions

This guide is a comprehensive and flexible water requirements planning tool divided between planning factors (Part 2 of this guide) and resources (Part 3 listed in Appendixes A–M). Planners should access these planning factors to quickly determine situational requirements based on the latest logistics preparation, the battlefield assessments, or other unique conditions associated with a given AO. During deliberate planning, units may sequentially work through each section of this planning guide to

most accurately determine and balance force water consumption and water purification, storage, and distribution.

The following assumptions were made while developing the water consumption estimates presented in this planning guide. Whenever the logistics intelligence of the theater, historical data, experience, or command planning guidance provides different or more accurate data, logistics planners should modify appropriate consumption data as necessary.

- a. The quality of water for drinking, medical treatment, personal hygiene, and food preparation will not be compromised.
- b. Water production will be accomplished through organic U.S. Army equipment, acquired from the host nation, or purchased through contract support. Water sources must be accessible and exploitable.
- c. Water planning responsibilities are conducted by the unit (brigade level and below) or at echelons above brigade (EAB).
- d. Water data tables delineate between potable (P) and non-potable (NP) requirements.
- e. Role 1–3 medical treatment facilities, dental and veterinary services are addressed in this guide. Role 4 medical treatment facilities uses a municipal water source.
- f. Field feeding water requirements are shown in UUL numbers, which include water required for MREs and drink packets. SULs include water required to prepare the UGR, meal enhancements and individual rations (see paragraph 2-4).
- g. In cold, basic/temperate, and tropical environments, potable water will be provided only for functions that specifically require potable water.
- h. All water used in a hot, arid environment will be potable because of the restricted availability of water sources and to prevent contamination of water purification, storage, and distribution equipment.
- i. A 10% loss factor (4% evaporation and 6% waste and spillage) must be considered for potable water in all environments. The same spillage factors should be applied to ice.
- j. Only potable water is used for personal hygiene (instead of sanitizers and disinfecting wipes).
- k. Engineer assumptions are based on the current equipment capabilities and base camp requirements.
- l. Non-Potable water distribution is available through either organic or contracting means.
- m. U.S. Army units traditionally deploy with a basic load of MREs and bottled water. Bulk water is required for Field Feeding, Central Hygiene, Medical and Engineer Operations, CBRN, and Equipment Operations/Maintenance.

Part 2

Water Planning Requirements

2.1 Planning Factors for Drinking

Description of Function

Potable water is essential for life. It is necessary for the digestion and absorption of food, helps maintain proper muscle tone, supplies oxygen and nutrients to the cells, rids the body of wastes, and serves as a natural air conditioning system. Water used for these functions includes all water-containing fluids consumed by an individual (including soups, hot and cold drinks, and plain water) to satisfy bodily needs for internal water. It replaces fluids lost by urination, perspiration, and respiration. Replacement is required to prevent the debilitating effects of acute dehydration.

Water Quality Requirements

Minimum potability standards for drinking water are based on maximum concentrations of CBRN contaminants. In the U.S. Army, water is disinfected by chlorinating to levels that provide reasonable assurance that no pathogenic organisms are present. Human consumption requires water of the highest quality available because of the potential for immediate and extended adverse effects on Soldiers.

Basis for Estimates

- i. Estimates are based on research done by the U.S. Army Research Institute of Environmental Medicine (USARIEM). USARIEM has also developed a smartphone application, Soldier Water Estimation Tool (SWET), to aide in logistical water planning and estimating fluid replacement from work in varying environmental conditions (Charkoudian, et al. 2016, 1142–1150).
- ii. The Institute of Medicine recommends a total daily water intake of 3.9 and 2.9 quarts per day for men and women respectively (Erdman and Appel 2005, 73–185). However, working in hot and humid environments can increase sweat rates leading to greater fluid losses. Water intake should increase to match sweat losses but should never exceed 12 quarts per day or 1.5 quarts per hour.
- iii. Water is an essential component of the human body, and although the body maintains a reserve, it is small and easily depleted. A person with a water deficit exceeding 2% in body weight loses a significant part of the ability to function successfully. A deficit of 5% or more of body weight renders a Soldier completely ineffective. Therefore, to retain individual effectiveness requires replacing water equivalent to losses.
- iv. Water loss from waste elimination is relatively constant and uncontrollable. Water lost with excrement is roughly balanced by water ingested with solid food except when intestinal upset produces diarrhea. Water lost with urine is relatively constant for healthy individuals (between 750 mL and 1,250 mL/day). Excessive water consumption increases urinary output, but urinary output under water-deprived conditions is not significantly

reduced until the individual is dangerously dehydrated. Replacing water lost to urinary output is estimated to require one quart/person/day on average.

v. The body produces sweat to dissipate heat and when individuals are sweating, the majority of body water loss is caused by perspiration. Sweat loss can range from almost nothing while performing no work in a controlled environment to more than 1.5 quarts/hour while performing strenuous work in environments where wet bulb globe temperatures begin to exceed 85°F. Sweat rates increase with ambient temperature and with the physical intensity of work. A wide range of water requirements results from the wide variation in sweat rates over the range of work intensity as expressed in the three categories of work that are defined as follows:

(1) **Heavy or Very Heavy work.** Forced marching, stevedoring (manual loading/unloading cargo from ships), entrenching, and road marching with heavy loads or while wearing CBRN protective clothing.

- The following example activities are considered hard work: field assaults, walking on hard surface at 3.5 miles per hour with more than 40 pounds of load, or walking on loose sand at 2.5 miles per hour with any kind of load. Refer to table 3-1 from TB MED 507 (Appendix B of this guide) for work/rest cycles and water consumption information.

(2) **Moderate work.** Road marching and working with moderate lifting or pushing.

- The following example activities are considered moderate work: calisthenics, patrolling, individual movement techniques (low or high crawl), defensive position construction, walking on loose sand at 2.5 miles per hour with no load, or walking on hard surface at 3.5 miles per hour with less than 40 pounds of load.

(3) **Light work.** Desk work, vehicle driving, or light bench work. Ambient temperatures cause a base sweat rate, which is included in the estimates for light work.

- The following example activities are considered easy work: weapon maintenance, marksmanship training, drill and ceremony, manual of arms, and walking on hard surface at 2.5 miles per hour with less than 30 pounds of load.

Note: *Work factors apply to an average sized, heat-acclimated Soldier wearing their duty uniform (ATP 4-02.4, paragraph 5-134).*

vi. Water loss caused by respiration is usually low but rises with increasing exercise intensity. Coincidentally, the amount of water produced by cell metabolism is approximately the same as respiratory water loss at any given oxygen uptake in basic and hot climates. As a result, there is no need for oral fluid intake to replace respiratory water losses. In extreme cold however, the humidity of air inhaled is essentially zero and expired air is 98% saturated at body temperature. During heavy work in these environments, this can create a water loss of approximately 1–1.5 quarts per day (Breibbia, Goldman, and Buskirk 1957, 219–222).

vii. Work in CB protective clothing prevents evaporation of perspiration. The body continues to perspire, but the protective clothing retains heat. Radiological, or nuclear conditions may reduce individual water consumption if Soldiers wear less protective clothing. However, these conditions are not considered in this guide.

Tables 2-2 through 2-5 summarize the individual calculations to show planning factors for drinking water:

Table 2-1. Hot Climate Consumption Planning Factors for Drinking (gal/person/day)

Work-independent Components	12-hour rest period	0.25
	Urination	0.25
Work-related Components	Light Work	1.50
	Moderate Work	2.25
	Heavy or Very Heavy Work (Sustainable)	3.00

Note: Operations in Mission-Oriented Protective Posture 3 or 4 are considered to be in the sustainable heavy work category, regardless of the intensity of labor performed. In this posture, individuals will rapidly succumb to heat injuries unless afforded sufficient rest breaks with ability to replace body water.

Table 2-2. Temperate Climate Consumption Planning Factors for Drinking (gal/person/day)

Work-independent Components	12-hour rest period	0.25
	Urination	0.25
Work-related Components	Light Work	0.60
	Moderate Work	1.80
	Heavy or Very Heavy Work (Sustainable)	3.00

Table 2-3. Cold Climate Consumption Planning Factors for Drinking (gal/person/day)

Work-independent Components	12-hour rest period	0.25
	Urination	0.25
	Respiration	0.50
Work-related Components	Light Work	0.25
	Moderate Work	0.75
	Heavy or Very Heavy Work (Sustainable)	1.50

Note: Six hours of sustained heavy work in arctic clothing is expected to exhaust an individual. The maximum heavy work would be done only in extreme cases. Arctic clothing is designed to keep an individual warm with minimal activity. During periods of heavy work, there is a significant heat buildup inside the suit, creating a hot microclimate. Under conditions of extreme cold, opening arctic clothing to reduce heat load can produce frostbite, and removing layers of clothing is too cumbersome to be a reasonable option. Operations in Mission-Oriented Protective Posture 3 or 4 will not produce a significantly greater individual burden above that of arctic clothing with the exception of the degradation caused by the protective mask.

Table 2-4. Drinking Water Planning Factors

Water Usage (Gal/Person/Day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Rest (12-hour rest period)	0.25	0.25	0.25	0.25	P	Line Unit	USARIEM
Urination	0.25	0.25	0.25	0.25	P	Line Unit	USARIEM
Respiration	N/A			0.50	P	Line Unit	USARIEM
Drinking Light Workload	1.25	1.25	0.60	0.25	P	Line Unit	USARIEM
Drinking Moderate Workload	2.25	2.25	1.80	0.75	P	Line Unit	USARIEM
Drinking Heavy Workload	3.00	3.00	3.00	1.50	P	Line Unit	USARIEM
Drinking Estimate (gal/person/day)	2.1	2.1	1.9	1.93	P	Line Unit	USARIEM

Estimate based on 8 hours of heavy workload, 4 hours of moderate workload, 4 hours of light workload, plus rest/urination for hot and temperate environment; 12 hours of heavy workload, 4 hours of light workload, plus rest/urination for cold climate. For operational planning, apply spillage factor of 10%.

***Note:** Data in Table 2-44 represent estimated amounts given the workload assumptions, environment, and independent factors (rest and urination). **The maximum amount of water consumed should never exceed 3 gallons/person/day.** Drinking water estimate is updated based on detailed information provided during different stages of the Military Decision-Making Process.*

2.1.1 Planning Factors for Bottled Water

a. Data depicted in the drinking requirements (Table 2-4) does not delineate between bottled and bulk water but serves as the total drinking water requirements needed to support U.S. Army personnel. Bottled water is water that is sealed in bottles, packages, or other containers by commercial (non-military) interests for human consumption and it is most often issued along with meals. Use of bottled and packaged water for deployment is further described in appendix C of TB MED 577.

b. In accordance with ATP 4-41 (Army Field Feeding and Class I Operations), U.S. Army units typically deploy with a basic load of MREs and bottled water (as specified in the OPLAN or OPORD). Bottled water is procured and issued (for all drinking requirements) during initial stages, until bulk water purification, storage, and distribution can be established. After the bulk water operations are established, the sustaining factor for bottled water is typically 1 gallon per person per day and may vary based on METTC-I factors. Bottled water should be shipped in 20-foot International Organization for Standardization (ISO) shipping containers. The advantage to using bottled water in hot tropic and arid climates is that the water can be placed where it is accessible to all troops, unlike water trailers. The disadvantage is that bottled water distribution takes up a tremendous amount of distribution assets. Once an enduring presence is determined—depending upon distribution distances, force protection measures, and threat levels within the theater—theater class I planners should determine if bottled water delivery should be contracted out to capable prime vendors or bottled water plants should be established at selected base camps. The goal of contracting or establishing bottled water plants is to reduce the number of distribution assets (trucks, security,

personnel, and material handling equipment) required to move the bottled water each day.

Note: *Bottled water will not be purchased with subsistence funds. Units deploying away from home station and mobilization for contingency operations are entitled to purchase bottled water as part of their Unit Basic Load using the designated contingency operation project code. Provisions for standard levels of food service, including remote site feeding, water, and ice support will be specified in either the task order or the performance work statement, as appropriate (see AR 30-22, paragraph 4–14).*

c. Source. Bottled water can come from one or more commercial or military sources, either within or outside the theater. Senior Army logisticians recommend that contracted military bottling and ice-making capability be co-located and established early. Using this type of bottling and ice-making capability not only provides control and security, but also allows to be positioned to minimize impact on the transportation system while allowing maximum use of military water purification, storage, and distribution capability. A list of military-approved sources worldwide is published by Army Public Health Center at: <https://phc.amedd.army.mil/topics/foodwater/ca/Pages/DoDApprovedFoodSources.aspx>

d. Packaging. To determine the optimum bottle size, restrictions on storage duration, distribution conditions, disposition of bottles, container weight and size, and similar factors must be considered. These issues require extensive Mission, Enemy, Terrain, Troops available, Time, Civilian considerations, and Informational considerations. Interviews with Soldiers indicate that the preferred bottle size is 0.5 Liter. This preference is consistent among bottlers, consumers and transporters. A review of sales by retail stores indicates that American retailers, consumers and transporters mirror this preference. It is the most convenient size, it has the lowest damage in transport and storage, and it allows the most efficient storage and packaging. It is significant that Soldiers who were interviewed noted that the 0.5 liter size also reduced much of the waste that occurs with larger-sized bottles.

2.1.2 Transportation Factors for Bottled Water

(1) There are no standards for pallet sizes, pallet loading, bottle shapes, or case sizes for bottled water. Use of military facilities for bottling water could lead to the development of standard bottling, palletizing, and packaging. For general reference, Table 2- below shows several packaging configurations used by commercial bottlers.

(2) Due to its high density, weight rather than volume is normally be the limiting factor for the amount of bottled water that can be carried on a vehicle. Also, pallet stacking should be minimized to limit damage to bottles and reduce the waste of bottled water.

Commercial shippers typically do not stack pallets of bottled water. In military applications, where road surfaces are generally rougher than commercial carriers experience in the U.S., the need to avoid stacking is evident. Table 2- shows that even with the variation in packaging and palletizing, pallet weight is usually around 2,000 pounds and how that compares to the weight capacities of some common military transport equipment.

Note: Purifying, storing, packaging, packing, and transporting bottled water requires many logistics resources. In some cases, bottled water competes with other logistics requirements. As a result, commanders at all levels should apply discipline to ensure that waste is minimized.

In emergency situations, or when personnel are cut off from supply lines, the use of iodine tablets can be used to minimize the risk for severe intestinal distress caused by water borne pathogens.

Table 2-5. Bottled Water and Transportation Information Extracted from the Food and Water Tool Developed by the CASCOT Planning Data Branch

BOTTLED WATER DATA								
16.9 ounces (0.5 liter) bottles								
24.0000	bottles per case							
72.0000	cases per pallet							
1,728.0000	bottles per pallet							
228.2445	Gallons per pallet							
864.0000	Liters per Pallet							
3.785	Liters per Gallon							
288.0000	personnel @ 3 gal per day							
128.0000	ounces = 1 GAL							
0.2642	Gallons per Liter							
8.7795	inches is the height of a .5 liter bottle							
52.6772	height of water on pallet (not including pallet height)							
6.0000	inches height of pallet itself							
58.6772	total height of a pallet of half liter bottles packed as above (measured)							
Bottles/ Case	Cases/ Pallet	Rows/ Pallet	Bottles/ Pallet	Lb/ Case	L/ Pallet	Gal/ Pallet	Lb/ Pallet	ST/ Pallet
24	72	6	1,728	27	864	228	2,020.00	1.01
24	66	7	1,584	27	792	209	1,832	0.92
12	132	7	1,584	13.6	792	209	1,845	0.92
24	84	7	2,016	27	1,008	266	2,358	1.18
32	60	6	1,920	39	960	254	2,425	1.21
TABLE R-1 DATA FOR EXAMPLES OF BOTTLED WATER PACKAGING CONFIGURATIONS (Water Planning Guide Study Report, pg R-2, revised, 102908)								
EXAMPLES OF CARGO CAPACITY								
Model	Number of Pallets		Model	Number of Pallets		Model	Number of Pallets	
M977/985	8		40ft ISO	18		CH47	8	
M989A1	6		463L Pallet	4		C130	24	
PLS/LHS	8		LMTV/MTV	6		C17	72	
PLS Trailer	8		M871	14		C5	144	
20ft ISO	8		M872	18				
Based on 40-in x 48-in warehouse pallets single stacked								

2.2 Planning Factors for Personal Hygiene

Description of Function. Water used for this function includes all water used for shaving, brushing teeth, washing hands, and taking sponge baths. It does not include drinking water or laundry and shower water, which are covered in paragraph 2-3. Personal Hygiene water requirements are directly related to the number of personnel in the area for which planning is being accomplished.

Water Quality Requirements. Potable water should be used for nearly all military water-requiring activities if it is available. From a military health perspective, potable water must be used for all activities where doing otherwise poses a significant risk to Soldiers' well-being. These include drinking, cooking, brushing teeth, shaving, and making ice that contacts food. Potable water should also be used for showering because of exposure to cuts and scratches, incidental ingestion, and breathing of volatile or aerosolized material, all of which may allow contaminant entrance to the body. However, in situations where the potable water supply is insufficient to meet all water requirements, and an appropriate health risk assessment is performed and approved by the commander, disinfected water of less than drinking-water quality may be used for purposes other than drinking. (ATP 4-25.12 Unit Field Sanitation Teams)

Basis for Estimates. Personnel should brush their teeth two times/day, shave once/day, wash hands often, and take a sponge bath each day showers are not available. Table 2-5 shows consumption planning factors for personal hygiene.

a. Showers: Under optimal conditions Soldiers should have access to a shower every day, or at least once every week to maintain good personal hygiene. Frequent showering prevents skin infections and potential parasite infestations. Given mission constraints, if showers are not available, washing daily with a washcloth is advised. Particular attention should be given to sweaty areas or places that become wet such as armpits, feet, genitals, between thighs and buttocks, and under breasts. It is highly recommended that female Soldiers that are menstruating while in the field or deployed have daily access to shower facilities. This does not mean that there must be a fixed facility with hot and cold running water on site. In situations where shower facilities are not available, female Soldiers can establish a private space with adequate drainage and bathe using a washcloth and water. A full canteen (0.25 gal) of water should be adequate for one Soldier and a five-gallon water container for multiple Soldiers. Female Soldiers who are not menstruating should be treated like male Soldiers with regard to accessing fixed shower facilities. Shower runs should be coordinated without gender preference influencing the frequency of the showers (ATP 4-25.12 Unit Field Sanitation Teams, paragraph 2-20 through 2-23)

b. Hand Washing: One of the most effective practices that Soldiers can perform to protect themselves and others from the spread of disease is to thoroughly wash or sanitize their hands frequently. Regularly washing or sanitizing the hands denies disease-causing bacteria and viruses from gaining easy entry into the body. Soldiers who fail to wash their hands frequently increase the risk of spreading germs picked up from other sources, possibly infecting themselves when touching their eyes, nose, or mouth.

When to wash and or sanitize the hands, at a minimum (TC 4-02.3, paragraphs 2-14 and 2-15):

- Before eating or snacking.
- After eating or snacking.
- Before handling or preparing food.
- After using the latrine.

- After handling anything that could potentially transfer germs.
- Frequently during the workday to keep your hands free of germs.
- After coming into contact with any local flora or fauna.
- After physical contact with local nationals.

c. **Teeth Brushing.** Soldiers should brush their teeth at least twice a day, especially before sleeping. Brushing should include the use of fluoride toothpaste to brush all the surfaces of the teeth using a circular motion. Soldiers should not rinse, eat, or drink anything for at least 30 minutes after brushing to allow the fluoride to stay on the teeth longer and protect them better. If toothpaste is not available, Soldiers should still brush their teeth. Brushing should include the tongue and the roof of the mouth. Soldiers can also enhance their oral hygiene by chewing the gum contained in the accessory packet of every field ration. The gum is made with a sweetener that helps control the buildup of oral bacteria and reduces tooth decay when used regularly.

Table 2-6. Personal Hygiene Water Planning Factors

Water Usage (gal/person/day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Brushing Teeth 2 Times/Day	0.15	0.15	0.15	0.15	P	Unit	ATP 4-25.12
Shaving 1 Time/Day	0.23	0.23	0.23	0.23	P	Unit	ATP 4-25.12
Washing Hands 8 Times/Day	1.10	1.10	1.10	1.10	P	Unit	TC 4-02.3
Sponge Bath, 1 Times/Day	0.25	0.25	0.25	0.25	P	Unit	ATP 4-25.12

For operational planning, apply spillage factor of 10%. Water requirements can be reduced using alcohol-based hand sanitizer, alcohol wipes, or commercial cleansing wipes.

2.3 Planning Factors for Central Hygiene (Shower and Laundry)

Description of Function. Soldier central hygiene capabilities are organic to the tactical and operational field services company and the composite supply company assigned to a sustainment brigade to support the division and to the Theater Sustainment Command (TSC). Shower and laundry sections can be pushed forward to support BCTs during mission staging operations that last at least 48 hours or that support established AOs. The Surgeon General recommends a minimum of one shower weekly and up to 15 pounds of laundry/week. This equates to two sets of US Army Operational Camouflage Pattern (OCP) uniforms; one week's worth of underwear, socks, and handkerchiefs; and two towels. Role 3 medical treatment facilities have organic laundry and shower capability for continuous patient care support.

Responsibilities. Commanders and planners at all levels, Preventive Medicine (PM), and Field Sanitation Teams

Water Quality Requirements. Disinfected fresh water (non-potable) is suitable for showers (TB MED 577). Untreated fresh water that is colorless, odorless, has minimal turbidity, and is free from the effects of industrial or municipal discharges may be used for laundry. The local medical authority might require disinfection of water before use. Shower and laundry water may be treated and recycled/reused for the same or other purposes with local medical authority approval.

Basis for Estimates. These estimates were computed by the U.S. Army Public Health Center in coordination with the U.S. Army Sustainment Center of Excellence (QM School).

a. **Showers.** Consumption planning factors for central hygiene are as follows:

(1) Shower Point Operation. Each Shower and Laundry (S&L) Team utilizes the 12-Head Shower Unit for shower operations. The 12-Head Shower Unit (LIN: S62898) will provide warm showers for a maximum of 500 Soldiers per day. The shower element may be set up at a fixed site or a tactical location in a field environment. An approved central drainage system to collect gray water must be coordinated through appropriate command levels. The shower point is staffed with at least three shower personnel. A planning factor of 3K gallons of water per day (per system) is needed for sustained operations.

b. **Laundry.** Field laundry is conducted in conjunction with showers. The planning factors in this paragraph are for work uniforms and do not include hospital linens, which are addressed under Medical Treatment (paragraph 2-6). The current laundry units are:

(1) The Laundry Advanced System (LADS, LIN: L70538) is capable of washing up to 400 lbs. of laundry per hour for up to a maximum of 20 hours per day in any environment. Four hours are needed for LADS maintenance per day. Dirty wash water is recycled through a distillation process to recapture 90% of water used for laundry operations. Each S&L team has one LADS capable of supporting 500 Soldiers per day (TM 10-3510-221-10).

(2) The Containerized Batch Laundry (CBL) System (LIN: C28019) is the laundry system normally assigned to an Army Field Hospital. The CBL is designed to provide laundry services for direct patient-related linen, for ambulatory patients and direct patient care providers. The CBL provides a capability to wash and dry 150–200 lbs. of laundry per hour in an ISO Frame containerized system. The water reuse system (if used) recovers over 50% of the laundry waste water. It is capable of collecting gray water and transferring it to an approved gray water source (TM 10-3510-226-10).

Table 2-7. Central Hygiene (Shower and Laundry) Planning Factors

Function	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Resp.	Source or Reference
Showers—12pt units initial charge*	3,000.00	3,000.00	3,000.00	3,000.00	NP	EAB	QM School, FS

Function	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Resp.	Source or Reference
Showers—12pt units (gal/person/day)	6.00	6.00	6.00	6.00	NP	EAB	QM School, FS
LADS initial charge*	460.00	460.00	460.00	460.00	NP	EAB	QM School, FS
LADS (gal/person/day)	1.08	1.08	1.08	1.08	NP	EAB	QM School, FS
CBL initial charge	680.00	680.00	680.00	680.00	NP	EAB	QM School, FS
CBL, 500 Soldiers (gal/day w/o reuse)	3,000.00	3,000.00	3,000.00	3,000.00	NP	EAB	QM School, FS
CBL, 500 Soldiers (gal/day w/ reuse)	1,500.00	1,500.00	1,500.00	15,00.00	NP	EAB	QM School, FS
CBL, ICU and ICW (gal/bed/day)	22.00	22.00	22.00	22.00	NP	EAB	TC 8-13
CBL, Ambulatory Patients (gal/patient/day)	10.00	10.00	10.00	10.00	NP	EAB	TC 8-13
CBL, Medical Staff (gal/person/day)	9.40	9.40	9.40	9.40	NP	EAB	TC 8-13

*Initial charge amount represents the quantity of water required to place the piece of equipment into operation. For operational planning, calculate totals and apply spillage factor of 10%.

*Disinfected fresh water (non-potable) is suitable for showers (TB MED 577).

2.4 Planning Factors for Field Feeding

Description of Function. Water used in field feeding operations serves two main functions: food preparation and equipment sanitation. The Army family of rations used to support field feeding consists of individual and UGR meals plus the authorized supplements and enhancements. The amount of water required each day is dependent on the command policies concerning the type of operational ration served. The ration cycle is published in the sustainment annex of the OPORD and is normally expressed as a three-letter combination such as M-M-M or U-M-U (MRE=M, UGR=U). Further guidance on which type of UGR Heat and Serve (H&S) or A-Ration (UGR-A) will also be stated.

Water Quality Requirements. Water for use in food preparation must be potable and routinely monitored by PM in an austere environment.

Basis for Estimates.

a. This water consumption data was coordinated with the U.S. Army Sustainment Center of Excellence and the Program Manager Force Sustainment at the U.S. Army Natick Soldier Systems Center. Field feeding equipment heating trays water requirements are depicted in the standard planning factor tables in the gallons of water per ration type.

b. The field feeding ration cycle changes as the theater matures. In the early phases of operations, the ration cycle is three MREs per day. As the theater develops, UGR rations use will increase, and MRE use will decrease.

c. Water used for MRE heating and mixing of hot/cold drinks is included in the UUL factors.

d. The Food Sanitation Center (FSC) is used to clean field feeding equipment. When the ration cycle calls for serving UGR hot meals, the water required for field feeding equipment sanitation operations is often overlooked. One FSC is required per kitchen serving up to 800 troops on a sustaining basis. Initial water required to begin sanitation consists of 60 gallons required to begin washing, rinsing, and sanitizing operations. An additional 0.25 gallons/person/day is added to the requirement for kitchen area and kitchen utensil cleaning and additional handwashing.

NOTE: If the water reuse system (WRS) is used, the initial FSC water requirement is 60 gal per meal with 20 gallons required at "reset".

e. Field feeding function has ability to employ a variety of equipment that provide Culinary Specialists the ability to prepare and serve quality meals to unit members and hospital in-patients during training exercises and operational deployments. In accordance with ATP 4-41, Army Field Feeding and Class I Operations, the systems currently used in the U.S. Army formations are:

- Mobile Kitchen Trailer (MKT) supports approximately 300 personnel using the UGR-A or UGRH&S (TM 10-7360-206-13). MKT is equipped with eight (8) five-gallon water jugs for initial set-up of heating pans.
- Containerized Kitchen (CK) supports approximately 800 Soldiers per meal using any of the group meals in the Army family of rations (TM 10-7360-226-13&P). CK is equipped with six (6) five-gallon water jugs for initial set-up of heating pans.
- The Kitchen, Company Level Field Feeding (KCLFF) operated by two Soldiers with the capability to feed one UGR H&S per day for up to 250 Soldiers. Using the range outfit, griddle assembly, and ice chest provided with the KCLFF-E enables one food service specialist to prepare limited UGR-A and UGR H&S rations for up to 150 Soldiers (TM 10-7360-209-13&P). KCLFF is equipped with six (6) five-gallon water jugs for initial set-up of heating pans.
- The Assault Kitchen (AK) supports limited UGR-A for 150 Soldiers and UGR H&S for 250 Soldiers. It also provides the ability to heat UGR H&S while on the move (TM 10-7360-230-13&P). AK is equipped with six (6) five-gallon water jugs for initial set-up of heating pans.

NOTE: It is the unit's responsibility to coordinate adequate water resources (i.e.. Water Buffalo or Camel) required for field feeding.

f. Ice is a requirement in a deployed or training environment. Six pounds of ice/person/day are required for food preparation in hot climates and two pounds of ice/person/day are required in temperate and cold climates. Ice for food preparation must be made with potable water. U.S. Army Field Feeding function does not have ice production capability and any ice is procured through contracting means. Locally purchased ice will be priced at contract or purchase order price. Subsistence funds will not be used to purchase ice. Ice will not be managed using the DA-approved automated food management systems. Ice will normally be ordered by the SSMO using fund sites provided by the requesting unit. Procedures for ordering and issuing ice are contained in DA Pam 30-22.

g. Class I planners must calculate refrigerated transportation and storage requirements based on the proposed ration cycle. UGR-As, ice, perishable line item A-rations, and

enhancements require refrigeration. The Multi-Temperature Refrigerated Containerized System (MTRCS) provides the capability to transport and store refrigerated and frozen product on the battlefield in a single container. It can carry 3 days of rations for up to 800 Soldiers.

Field Feeding Planning Factors. Data tables include planning factors for UGR rations, Individual Meals, Enhancements, and kitchen equipment/sanitation requirements. Any additional water requirements (such as hand washing and drinking) for field feeding personnel can be calculated using planning factors depicted in the appropriate section of this guide.

Table 2-8. UGR Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
UGR-A (gallons per 50 person module)								
Group	UGR-A Breakfast 1		10.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 2		7.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 3		7.50			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 4		7.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 5		5.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 6		14.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Breakfast 7		8.50			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 1		12.50			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 2		12.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 3		14.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 4		18.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 5		12.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 6		15.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 7		14.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 8		15.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 9		12.50			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 10		16.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 11		12.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 12		12.50			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 13		15.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Dinner 14		14.00			P	Line Unit	PM Force Sustainment
Group	UGR-A Short Order 1		7.60			P	Line Unit	PM Force Sustainment
Group	UGR-A Short Order 2		9.10			P	Line Unit	PM Force Sustainment
Group	UGR-A Short Order 3		7.60			P	Line Unit	PM Force Sustainment
Group	UGR-A Short Order 4		9.00			P	Line Unit	PM Force Sustainment

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
UGR-M (gallons per 50 person module)								
Group	UGR-M Breakfast 1	13.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 2	8.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 3	14.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 4	10.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 5	11.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 6	12.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Breakfast 7	11.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 1	13.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 2	11.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 3	12.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 4	13.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 5	20.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 6	21.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 7	12.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 8	15.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 9	12.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 10	19.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 11	14.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 12	15.00				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 13	20.50				P	Line Unit	PM Force Sustainment
Group	UGR-M Dinner 14	11.50				P	Line Unit	PM Force Sustainment
UGR-H&S (gallons per 50 person module)								
Group	UGR H&S Breakfast 1	6.70				P	Line Unit	PM Force Sustainment
Group	UGR H&S Breakfast 2	6.10				P	Line Unit	PM Force Sustainment
Group	UGR H&S Breakfast 3	6.70				P	Line Unit	PM Force Sustainment
Group	UGR H&S Breakfast 4	5.20				P	Line Unit	PM Force Sustainment
Group	UGR H&S Breakfast 5	6.25				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 1	2.10				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 2	3.60				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 3	2.10				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 4	3.60				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 5	2.10				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 6	3.60				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 7	2.10				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 8	3.60				P	Line Unit	PM Force Sustainment
Group	UGR H&S Dinner 9	2.10				P	Line Unit	PM Force Sustainment

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Group	UGR H&S Dinner 10	3.60				P	Line Unit	PM Force Sustainment

For operational planning round up the total headcount to the nearest 50, calculate totals, and apply spillage factor of 10%.

Table 2-9. Individual Meals Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Meal Ready to Eat (MRE) beverages + Field Rations Heater (FRH) (gallons per meal)								
Individual	MRE Menus 1,3, 9	.15 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menus 2, 7, 15	.07 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menu 4	.23 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menus 5, 8, 10, 13, 16, 18, 21, 22	.10 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menus 6, 11, 19, 20, 24	.21 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menus 12, 14, 17	.16 gal				P	Line Unit	PM Force Sustainment
Individual	MRE Menu 23	.27 gal				P	Line Unit	PM Force Sustainment
Meal Cold Weather (MCW) (gallons per meal)								
Individual	MCW Menus 1, 4, 11	.31 gal				P	Line Unit	PM Force Sustainment
Individual	MCW Menus 2, 7, 9	.26 gal				P	Line Unit	PM Force Sustainment
Individual	MCW Menus 3, 5	.22 gal				P	Line Unit	PM Force Sustainment
Individual	MCW Menus 6, 10	.33 gal				P	Line Unit	PM Force Sustainment
Individual	MCW Menu 8	.44 gal				P	Line Unit	PM Force Sustainment
Individual	MCW Menu 12	.23 gal				P	Line Unit	PM Force Sustainment
First Strike Rations (FSR) (gallons per meal)								
Individual	FSR Menu 1	.31 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 2	.34 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 3, 4, 7	.23 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 5	.16 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 6	.14 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 8	.19 gal				P	Line Unit	PM Force Sustainment
Individual	FSR Menu 9	.30 gal				P	Line Unit	PM Force Sustainment

For operational planning, calculate totals and apply spillage factor of 10%.

Table 2-10. Meal Enhancement Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Modular Operational Rations Enhancement (MORE) (gallons per meal)								
Individual	MORE High Altitude Cold Weather Packs 2, 3		.09 gal (12oz)			P	Line Unit	PM Force Sustainment
Individual	MORE Hot Weather Packs 1, 2, 3		.19 gal (24oz)			P	Line Unit	PM Force Sustainment

For operational planning, calculate totals and apply spillage factor of 10%.

Table 2-11. Medical Nutrition Supplement Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Medical Nutrition Supplement (gallons per meal)								
Individual	Beverages, Soups, and other items		.69 gal/patient/meal (9.9 gallons per pack)			P	Line Unit	PM Force Sustainment

For operational planning, calculate totals and apply spillage factor of 10%.

Table 2-22. Food Heating and Sanitation Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Field Feeding Equipment Sanitation								
Sanitation	Kitchen Area, Utensils, and Handwashing		.25 gal/person/meal			P	Line Unit	PM Force Sustainment
Heating	Food Heating Pan		.12 gal/person/meal			P	Line Unit	PM Force Sustainment

*Initial Charging amount represents the quantity of water required to place the food sanitation center into operation (if equipped). Calculate totals and apply spillage factor of 10%

Note: Field feeding sanitation creates the requirement for disposal of gray water which drives the creation of soakage pit or trench (described in ATP 4-41, Appendix C).

2.5 Planning Factors for Heat Injury Treatment

Description of Function. Extreme heat degrades physical performance and places each Soldier at risk for heat injury. For optimum performance, body temperatures must be maintained within normal limits. It is important that the body loses the heat it gains from

physical work or from the environment. Heat injury depends on physical activity, hydration, heat acclimatization, clothing, load carried, terrain, and climatic conditions. Excess body heat is reduced by numerous physiological mechanisms, but when air temperature is above skin temperature, evaporation of sweat is the only mechanism for heat loss. When water is lost via sweat, water must be consumed to replace lost fluids. If the body fluid lost through sweating is not replaced, dehydration will follow. Dehydration can increase risk for heat injury, which must be treated immediately. A cold water bath should be used to quickly reduce the body temperature of a person exhibiting symptoms of heat stroke.

Water Quality Requirements. Water for treatment of heat injury must be potable. Using non-potable water for this function requires a risk assessment and permission from the command/theater surgeon and the commander. Ice should also be available to aid in cooling for Soldiers experiencing exertional heat stroke (EHS).

Basis for Estimate.

a. In April 2021, the Armed Forces Health Surveillance Branch published a study on heat illness diagnoses across the Joint Force documenting a total number of heat injury cases at 1.61 per 1000 person per year. The subgroup-specific incidence rates of heat stroke were highest among males, those less than 20 years old, Asian/Pacific Islanders, Marine Corps and Army members, recruit trainees, and those in combat-specific occupations (Infantry, Artillery, Combat Engineer, and Armor). The incidence rate of heat stroke among service women was 48.2% lower than the rate among service men.

b. Despite well documented and effective techniques for prevention, heat illnesses continue to be a threat to Soldiers in training and combat. Heat related illnesses consist of the following:

i. Heat exhaustion

- Symptoms: Dizziness, headache, nausea, weakness, clumsy/unsteady walk, muscle cramps
- Treatment: Rest Soldier in shade, loosen uniform/ remove head gear, have Soldier drink 2 quarts of water over 1 hour, and evacuate if no improvement in 30 min or if Soldier's condition worsens.

ii. Heat stroke

- Symptoms: Altered mental status, profuse sweating, convulsions and chills, stumbling, vomiting, confusion, mumbling, combative, passing out (unconscious)
- Treatment: Medical emergency, strip, rapid cool (ice sheets), call for evacuation, continue cooling during transport, and keep at least one other person with them the whole way to observe for mental status change.

iii. Water intoxication (hyponatremia)

- Symptoms: History of large water consumption, altered mental status, confusion, vomiting (liquid, no food), convulsions, clear urine
- Treatment: Medical emergency, call for evacuation, move to shade, and initiate cooling procedures as necessary (ice sheets).

Heat Injury Planning Factors. The resulting standard planning factor for both hot and basic climates is small. Although hot climates (with higher Wet Bulb Globe Temperature) increase risk, exertional heat illness can still occur in basic climates, particularly if heavy work is being conducted. The most effective treatment of cooling down a heat casualty is through the use of cooling sheets and dunk tanks. The water requirement for each method is as follows:

a. Ice sheets: Ten gallons total (ice + water) is filled in a large cooler (60 qt) along with 10 sheets. Two coolers are required per each company-sized element during high risk training, which is enough for four simultaneous casualties.

b. Dunk tanks: Forty gallons of chilled water is required to reduce body temperature to an acceptable level (35–70°F). When a Soldier's body temperature is above 104°F, ice should be used to aggressively reduce body temperature to less than 100°F as quickly as possible.

Table 2-33. Heat Injury Water Planning Factors

Type		Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Heat Injury Water Requirements (gallons per company size element)								
Chilled water	Ice Sheets (water + ice)	10.00		N/A		P	All	USARIEM
Chilled water	Dunk Tank (water + ice)	40.00		N/A		P	All	USARIEM

For operational planning, use minimum 1:1 ratio of ice and water to create chilled water. Calculate totals and apply spillage factor of 10%.

Note: Additional heat injury treatment includes drenching with water, fanning, placing a casualty in shade, removing outer layers of clothing, resting with feet propped (helmet, sandbag, etc.). If a casualty is conscious, allow victim to sip cool water. If unconscious, monitor airway and breathing.

2.6 Planning Factors for Medical Treatment

Description of Function.

Medical treatment and direct patient care are primary aspects of the Army Health System's health service support mission. The medical treatment function encompasses Roles 1 and 2 medical support which requires water for washing ambulance interiors and litters, cleaning patients, washing instruments, and washing hands of direct patient care providers. It does not include staff requirements common to all units (such as drinking, personal hygiene, and central hygiene). Role 2 medical support does not include organic surgical capabilities but may be augmented by a forward resuscitative and surgical detachment to provide resuscitation and emergency surgical care.

Hospitalization provides essential care within the theater evacuation policy to either return a patient to duty or stabilization for further evacuation to a definitive care facility outside the area of operations. The theater hospitalization mission is executed by Army hospital centers and their organic field hospitals providing Role 3 medical support.

Water used to provide Role 3 medical support includes all water used for patient care, food preparation for patients and staff, showers and laundry for patients, surgery scrub-up, instrument sterilization and operating room clean-up, extra staff showers and laundry, and laboratory and x-ray processing. The Role 3 field hospital in the theater of operations is equipped with 248 beds and has a staff of 494 personnel, of which 315 are involved in direct patient care. Role 4 medical treatment facilities receive water from municipal water sources. Those figures are not included in this document. See Table 2-44 for medical water planning factors.

Area Medical Laboratory/Global Medical Field Laboratory identifies and evaluates health hazards in the AO through unique medical laboratory analyses and rapid health hazard assessments of nuclear, biological, chemical, endemic disease, occupational and environmental health threats. This unit is capable of detaching into three individual Threat Assessment Teams to provide theater level laboratory confirmation support to a division or as a complete unit to support a single corps.

Responsibilities. Commanders and Medical Planners at all levels, PM, and Field Sanitation Teams

Water Quality Requirements. Only potable water should be supplied to medical treatment facilities because of the increased susceptibility of patients to infections. Sterile water is used for all lab functions.

Basis for Estimates.

These estimates resulted from coordination with the U.S. Army Medical Center of Excellence. The water requirements in this paragraph are a detailed description of water consumption that supports Medical Treatment operations.

a. Patient care

(1) Food preparation. The medical diet field feeding supplement, used in combination with the UGR, provides medically unique food components required to prepare modified diets for consumption by patients in medical treatment facilities. The supplement was designed to simplify and streamline the ordering process of medically unique food items. The supplement is not a stocked item; it is ordered and purchased as needed. For detailed planning purposes, use the applicable water tables in the field feeding paragraph 2-4 as well as the estimate provided by the TC 8-13.

(2) Bed bath and showers. For planning purposes use 5.00 gal/bed/day for bed bath and shower purposes, in accordance with TC 8-13.

Patients confined to bed receive a daily bed bath. Two standard 7-liter plastic basins are used, one for wash and one for rinse. The basins contain only about 5.5 quarts each for a total of 2.75 gallons/bed.

Showers. Ambulatory patients are provided with three showers/week for infection control and patient morale. For shower planning factors, see paragraph 2-3.

(3) Bedpan wash. Patients' bedpans are washed daily using about 1.5 gallons of water.

(4) Laboratory. Daily lab work is performed for all patients. It uses 0.2 gallons of water/patient.

(5) Sterilizer refill. Sterilizer refill. For planning purposes use 0.2 gal/bed/day for sterilizer, in accordance with TC 8-13.

A sterilizer holds five gallons of potable water and requires refill after two cycles. Estimate 18 cycles or 9 refills in a 24-hour period for a daily consumption of 45 gallons/sterilizer. Each of the 16 sterilizers in the hospital is filled daily.

(6) X-ray. For planning purposes, use 0.2 gal/bed/day for X-ray, in accordance with TC 8-13.

Additional information: Each of the two X-ray developers in the hospital must be filled daily with 5 gallons of water per developer (initial charging amount).

(7) Cleanup. Daily cleanup of each patient's bed and surrounding area uses 1.00 gallon of water/bed.

(8) Laundry. The Army Field Hospital has an organic CBL for hospital linen, surgical clothing, and extra uniforms for direct patient care staff members. For planning purposes use the following hospital laundry estimate which has been discussed in the paragraph 2-3 and TC 8-13:

Bed patients: (ICU and ICW beds occupied) x 22.0 gal./day

Ambulatory patients: (MCW beds occupied) x 10.0 gal/day

Staff: (unit strength) x 9.4 gal/day

b. Surgical

(1) Scrub. For planning purposes, use 8.00 gallons of water/event for surgical scrub estimate, in accordance with TC 8-13.

Additional Information: Each Combat Support Hospital is designed to support 48 surgical cases daily. It takes a 5–10 minute scrub to ensure cleanliness prior to surgery. Some surgical cases might require as many as 5-6 medical personnel to scrub, while others might require only 2-3.

(2) Instrument Rinse and Wash. For planning purposes, use initial amounts of 20 gallons for rinse and 17.5 gallons for ultrasonic cleaner. Add 2.00 gallons of water per case for instrument cleaning estimate, in accordance with TC 8-13.

Additional Information: Following surgery, all instruments are manually rinsed in the surgical sinks for five minutes. Each rinse requires 20 gallons. The instruments are then placed in an ultrasonic cleaner that uses 17.5 gallons of water per cycle.

(3) Operating room cleanup. The operating room is completely washed down and disinfected after each operation. This requires about 3.00 gallons of water/surgical case.

c. Staff

(1) Food preparation. For planning purposes, use field feeding preparation (and equipment sanitization) estimate in table 1-2 or detailed level of planning in paragraph 2-4.

(2) Extra showers. For planning purposes, use central hygiene planning factors for showers (paragraph 2-3).

(3) Extra uniforms. For infection control and patient morale, staff members performing direct patient care change uniforms three times/week. Water for this purpose is included in hospital laundry planning factors (paragraph 2-3).

Table 2-44. Medical Water Planning Factors

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Role 1 (gal/patient/day)								
Role 1	Combat Medic	0.12	0.12	0.12	0.12	P	Unit	
Role 1	Treatment Team (gal/patient/day)	3.70	3.70	3.70	3.70	P	Unit	
Role 1 Total		3.82						
Role 2 (gal/patient/day)								
Role 1	Battle Aid Station (gal/patient/day)	3.70	3.70	3.70	3.70	P	Unit	
Role 1	Treatment Squad (gal/patient/day)	3.70	3.70	3.70	3.70	P	Unit	
Role 3	Forward Resuscitative and Surgical Detachment (FRSD) (gal/patient/day)	13.00	13.00	13.00	13.00	P	EAB	TC 8-13
Role 2	Patient Hold Squad (gal/patient/day)	13.50	13.50	13.50	13.50	P	EAB	TC 8-13
Hospital Surgical And Medical Augmentation (gal/patient/day)								
Role 3	Hospital Augmentation Team (Head and Neck)	13.00 gallons per patient per day				P	EAB	TC 8-13
Role 3	Medical Detachment (minimal care)					P	EAB	TC 8-13
Role 3	Medical Team Forward Surgical					P	EAB	TC 8-13
Role 3	Medical Detachment (FRSD)					P	EAB	TC 8-13
Medical Patient Care (gal/bed/day) itemized								
Role 1-3	Drinking	1.50	1.50	1.50	1.50	P		TC 8-13
Role 1-3	Food Preparation	3.75	3.75	3.75	3.75	P		TC 8-13
Role 1-3	Bed Bath	5.00	5.00	5.00	5.00	P		TC 8-13
Role 1-3	Hygiene	1.70	1.70	1.70	1.70	P		TC 8-13

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Role 1-3	Bedpan wash	1.50	1.50	1.50	1.50	P		TC 8-13
Role 1-3	Laboratory test	0.20	0.20	0.20	0.20	P		TC 8-13
Role 1-3	Sterilizer (45 gal to start)	0.20	0.20	0.20	0.20	P		ATP 4-02.10
Role 1-3	X-ray processor (5 gal per developer to start)	0.20	0.20	0.20	0.20	P		ATP 4-02.10
Role 1-3	Cleanup	1.00	1.00	1.00	1.00	P		TC 8-13
Role 1-3	Handwashing	2.00	2.00	2.00	2.00	P		TC 8-13
Role 1-3	Heat Treatment	0.20	0.20	0.20	0.20	P		TC 8-13
Surgical instrument Cleaning (gal/case/event)								
Role 2-3	Scrub	8.00	8.00	8.00	8.00	P		TC 8-13
Role 2-3	Instrument Soak (initial charge)	20.00	20.00	20.00	20.00	P		TC 8-13
Role 2-4	Ultrasonic Cleaner (initial charge per wash)	17.50	17.50	17.50	17.50	P		TC 8-13
Role 2-3	Instrument Wash (Gal/case/wash)	2.00	2.00	2.00	2.00	P		TC 8-13
Role 2-3	Operating Room (OR) Cleanup	3.00	3.00	3.00	3.00	P		TC 8-13
Surgical Instrument Cleaning Total (gal/case/event)		50.50				P		TC 8-13
Hospital Laundry (gal/patient/day)								
Role 2-3	Bed Patients	22.00	22.00	22.00	22.00	P		TC 8-13
Role 2-3	Ambulatory Patients	10.00	10.00	10.00	10.00	P		TC 8-13
Role 2-3	Staff Smocks	9.40	9.40	9.40	9.40	P		TC 8-13
Hospital Laundry Total		41.40				P		
Staff (gal/person/day)								
Role 2-3	Staff Drinking	1.50	1.50	1.50	1.50	P		TC 8-13
Role 2-3	Hygiene	1.70	1.70	1.70	1.70	P		TC 8-13
Role 2-3	Food Preparation	1.75	1.75	1.75	1.75	P		TC 8-13
Role 2-3	Extra Showers	5.30	5.30	5.30	5.30	P		TC 8-13
Staff Total		10.25				P		
Equipment (gal/wash)								
Role 1-3	Ground Ambulance wash	1.10	1.10	1.10	1.10	P		
Role 1-3	Litter wash	1.10	1.10	1.10	1.10	P		

Table 2-55. Medical Units Water Planning Factors (Common Medical Units Role 1-3)

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Hospital Surgical And Medical Augmentation Patient Support Only								
Role 2	Brigade Support Medical Company (BMSC) 20 bed patients	270.00			P	EAB	TC 8-13	
	Brigade Support Medical Company (BMSC) Staff Support for 82 personnel	840.50			P	EAB	TC 8-13	
	Brigade Support Medical Company (BMSC) Laundry	1,210.80			P	EAB	TC 8-13	
	Brigade Support Medical Company (BMSC) Equipment for 10 Ambulances	22.00			P	EAB	TC 8-13	
Total		2,343.30						
Role 2	Medical Company Area Support (MCAS) 40 bed patients	540.00			P	EAB	TC 8-13	
	Medical Company Area Support (MCAS) Staff Support for 76 personnel	779.00			P	EAB	TC 8-13	
	Medical Company Area Support (MCAS) Laundry	1,594.40			P	EAB	TC 8-13	
	Medical Company Area Support (MCAS) Equipment for 8 Ambulances	17.60			P	EAB	TC 8-13	
Total		2,931.00						
Role 3	Forward Surgical Team Patient Support for 10 beds	130.00			P	EAB	TC 8-13	
	Forward Surgical Team Staff Support for 20 personnel	205.00			P	EAB	TC 8-13	
	Forward Surgical Team Laundry	408.00			P	EAB	TC 8-13	
	Forward Surgical Team Equipment Sanitation	505.00			P	EAB	TC 8-13	
Total		1,248.00						
Combat Support Hospital								
Role 3	Hospital Company (84 Bed) Patient Support	1,134.00			P	EAB	TC 8-13	
	Hospital Company (84 Bed) Staff Support for 218 personnel	2,234.50			P	EAB	TC 8-13	
	Hospital Company (84 Bed) Laundry Patients and Staff	3,897.20			P	EAB	TC 8-13	
	Hospital Company (84 Bed) Surgical instrument cleaning	151.50			P	EAB	TC 8-13	
Total		7,417.20						
Role 3	Hospital Company B (164 Bed) Patient Support	2,214.00			P	EAB	TC 8-13	
	Hospital Company (164 Bed) Staff Support for 277 personnel	2,839.25			P	EAB	TC 8-13	

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
	Hospital Company (164 Bed) Laundry Patients and Staff	6,211.80				P	EAB	TC 8-13
	Hospital Company (164 Bed) Surgical Instrument cleaning	757.50				P	EAB	TC 8-14
Total		12,022.55						
Hospital Center								
HHD	HHD Hospital Center Staff Support for 27 personnel	276.75				P	EAB	TC 8-13
Role 3	Field Hospital (32 Bed) Patient Support	432.00				P	EAB	TC 8-13
	Field Hospital (32 Bed) Staff Support for 166 personnel	1,701.50				P	EAB	TC 8-13
	Field Hospital (32 Bed) Laundry	2,264.40				P	EAB	TC 8-13
Total		4,674.65						
Role 3	Hospital Augmentation Detachment (medical 32 Bed)	432.00				P	EAB	TC 8-13
	Hospital Augmentation Detachment (medical 32 Bed) Staff Support for 46 personnel	471.50				P	EAB	TC 8-13
	Hospital Augmentation Detachment (medical 32 Bed) Laundry	1,136.40				P	EAB	TC 8-13
Total		2,039.90						
Role 3	Hospital Augmentation Detachment (surgical 24 Bed)	324.00				P	EAB	TC 8-13
	Hospital Augmentation Detachment (surgical 24 Bed) Staff Support for 66 personnel	676.50				P	EAB	TC 8-13
	Hospital Augmentation Detachment (surgical 24 Bed) Laundry	1,148.40				P	EAB	TC 8-13
	Hospital Augmentation Detachment (surgical 24 Bed) Surgical Instrument Cleaning	505.00				P	EAB	TC 8-13
Total		2,653.90						
Role 3	Hospital Augmentation Detachment (Intermediate Care Ward 60 Bed)	810.00				P	EAB	TC 8-13
	Hospital Augmentation Detachment (Intermediate Care Ward 60 Bed) Staff Support for 33 personnel	338.25				P	EAB	TC 8-13
	Hospital Augmentation Detachment (Intermediate Care Ward 60 Bed) Laundry	1,630.20				P	EAB	TC 8-13
Total		2,778.45						

Note: Medical operations create the requirement for disposal of gray water covered in Appendix K.

2.7 Planning Factors for Veterinary Medicine

Description of Function. The U.S. Army Veterinary Corps is the sole provider of veterinary services to DoD. Veterinary units can be task-organized to support food protection, food protection (food safety and food defense), quality assurance, and/or the medical care mission for military and contract working dogs, and other government-owned animals. The food protection mission ensures quality, food safety, and food defense of food sources and food storage areas for deployed sources to minimize foodborne illness threats. The animal care mission provides preventive and casualty care as authorized for other animals eligible for U.S. Army provided veterinary care. It is discussed in a similar fashion as are the roles of medical care used to describe the successive and increasing capabilities to provide care to our injured and wounded Service members. Veterinary Role 2 medical care is provided by a forward-deployed Veterinary Service Support Team (VSST) veterinarian and an animal care specialist from the Medical Detachment (Veterinary Service Support). Veterinary Role 3 medical care is provided by the Veterinary Medical and Surgical Team and includes referral for veterinary diagnostic, therapeutic, and surgical procedures, and requires advanced clinical capabilities.

One VSST can support 50 military or DOD contract working dogs. One VMST can provide Veterinary Role 3 care for catchment population of up to 300 working dogs provided five VSSTs are deployed in support. Veterinary teams range in size but average 4-7 personnel per team (Headquarters element has 12 Soldiers).

Responsibilities. Commanders and planners at all levels, PM, and Field Sanitation Teams

Water Quality Requirements. Only potable water should be supplied to veterinary facilities because of the increased susceptibility of military working dogs (MWD's) to infections. This will eliminate the possibility of mistakenly using non-potable water for a function requiring potable water.

Basis For Estimates. These estimates are pulled from a combination of sources, including equipment assigned to U.S. Army veterinary detachments as well as adapted from what is used by human Role 2 and 3 facilities. The water requirements in this appendix are over and above the water listed in other appendices for consumption by each Soldier.

a. Veterinary Role 2 or 3 Medical Care.

(1) Food preparation: MWDs are fed a commercially available balanced diet which is procured by kennels. In the event that is not available or will not be eaten by the MWDs, such as hospitalized MWDs unwilling to eat, a diet also served to humans may be necessary. In addition to water already allocated under the food preparation function, an additional gallon per hospitalized MWD may be required for meals. EXAMPLE:

$$1.0 \text{ gal/day} \times 5 \text{ patients} = 5 \text{ gal/day}$$

(2) MWD Washing. These are not often needed for hospitalized MWDs. If an MWD soils itself, for infection control and patient comfort, a bath may be required. This may range from a focal rinse to a full body bath. In case of a full bath, this may require two 5-gallon water cans, however this is likely to be uncommon. If necessary, likely a single 5-gallon water can will be required. It is estimated that less than 20% of patients will need this per week. EXAMPLE:

$$1 \text{ hospitalized MWD} \times 5 \text{ gal} / 7 \text{ days} = 1 \text{ gal/day (rounded up from 0.7 gal/day)}$$

(3) Showers. Full showers will not be used by MWDs. See above.

(4) Bedpan wash. This will not be required for veterinary patients. Cleaning of kennels is accounted for in "General MWD Area Clean-up."

(5) Laboratory. Assigned laboratory analyzers (Abaxis HM5, VetScan VS2, iSTAT) do not require water to run samples. They require periodic cleaning and maintenance, with reagent provided through the manufacturer.

(6) Sterilizer refill. The assigned sterilizer (Tuttnaur 2540M) holds 3L (0.66 gallons) of potable water. It needs to be flushed and refilled weekly. With heavy use, it may need to be refilled daily. It needs to be flushed weekly with sterile water. The included water distiller (Tuttnaur 9000) can produce 1 gallon of distilled water every 4.5 hours.

EXAMPLE:

$$0.7 \text{ gal/day} \times 7 \text{ day} = 5 \text{ gal/week}$$

$$5 \text{ gal/week} + 0.7 \text{ gal/week for flushing} = 5.7 \text{ gal/week}$$

$$5.7 \text{ gal/week} / 7 \text{ days/week} = 1 \text{ gal/day (rounded up from 0.8 gal/day)}$$

(7) X-ray. Veterinary units are not assigned X-ray equipment requiring water for film development.

(8) Direct care provider hand wash. Medical personnel wash hands before and after treating each MWD. Teams range in number of care providers from 2–4, with most having 2 providers. Assigned sinks are manually pumped from a 5-gallon water container; flow rate is variable. Average 1 gallon per provider per case. EXAMPLE:

$$1.0 \text{ gal/wash} \times 2 \text{ providers/case} \times 5 \text{ MWDs/day} = 10.0 \text{ gal/day}$$

(9) Cleanup. Daily cleanup of each MWD's bed and surrounding area uses one gallon of water/MWD. EXAMPLE:

$$1.0 \text{ gal/wash} \times 5 \text{ MWDs} = 5.0 \text{ gal/day}$$

(10) Laundry. Laundry support would need to be provided by the supporting unit (e.g. BSB, FH, etc.) as veterinary detachments do not have organic laundry capacity. Exact water usage numbers would vary based on the efficiency of machines. Laundry service needs would be similar to a human Role 3 (kennel linen, care staff uniform), only providing for 5 veterinary patients. Outside of normal, projected laundry, plan for additional laundry for medical personnel. For planning purposes use laundry factors presented in paragraph 2-4 and paragraph 2-6, a8.

(11) MWD Decontamination after exposure to CBRN threat.

b. Veterinary Role 2 or 3 Surgical Care

(1) Surgical Scrub. A veterinary team would likely perform no more than one surgery per day on average. It takes at least a 5 minute scrub to ensure cleanliness prior to surgery. Some surgical cases might require 2–3 medical personnel to scrub in, while others may require only one. Assume an average of 2 personnel/surgical case. Assigned sinks are manually pumped from a 5-gallon water container; flow rate is variable. Estimate five minutes of water flow per seven-minute scrub.

$$2.5 \text{ gallons/provider scrubbing} \times 2 \text{ providers/case} \times 1 \text{ case/day} = 5.0 \text{ gal/day}$$

(2) Instrument Cleaning. Following surgery, all instruments are manually rinsed in the surgical sinks for five minutes. Each rinse requires 5–10 gallons. A veterinary team would likely perform no more than one surgery per day on average.

$$10.0 \text{ gal/surgical case}$$

(3) Operating room cleanup. The operating area should be completely washed down and disinfected after each operation. This requires about 1 gallon of water/surgical case.

$$1.0 \text{ gal/surgical case}$$

c. Veterinary Role 2 or 3 Staff.

(1) Most Veterinary teams have 6 personnel. Use Field Feeding factors in paragraph 2-5 for food preparation water requirements.

(2) Use data in Central Hygiene paragraph 2-4 to calculate water for regular showers.

(3) Use data in paragraph 2-3 for laundry requirements.

Veterinary Care Planning Factors. Canines require 2–6 ml/kg/hour of fluid for maintenance, but in recovery situations, that may be increased. While many MWDs will require IV sterile fluids, offering fluid by mouth may be beneficial. Using maintenance calculations of 5–10 ml/kg/hr (based on U.S. Army's Veterinary Medical Standards Board) with most patients being approximately 30 kg. This is likely an overestimate with lower requirements during more temperate or cooler weather. EXAMPLE:

$$5 \text{ mg/kg/hr} \times 30 \text{ kg} \times 24 \text{ hrs} = 3,600 \text{ ml/MWD (1 gal/patient)}$$

$$10 \text{ mg/kg/hr} \times 30 \text{ kg} \times 24 \text{ hrs} = 7,200 \text{ ml/MWD (2 gal/patient)}$$

d. Food Procurement and Laboratory Team (FPLT). The FPLT does not see animal patients, instead focusing on food protection. Therefore, they will have different water-use requirements.

(1) Handwashing. Personnel will wash hands before and after preparing each patient's sample. The FPLT averages 4 personnel. Assigned sinks are manually pumped from a 5-gallon water container; flow rate is variable. Assume an average of 1 gallon per provider per case. EXAMPLE:

$$2 \text{ gal/wash} \times 4 \text{ PAX} \times 5 \text{ samples processed/day} = 40 \text{ gal/day potable water}$$

(2) Sterile water. Used for sample preparation and analysis. 2 gal/day.

(3) Cleanup. Used to ensure areas are clean. This is especially important before and after sample preparation and processing. EXAMPLE:

$$2 \text{ gal/sample/day} \times 20 \text{ samples} = 40 \text{ gal/day potable water}$$

Table 2-66. Veterinary Medicine Role 2/3 Water Planning Factors

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Role 2-3	Surgical Instrument Wash-down (gal/day)	10.00	10.00	10.00	10.00	P	EAB	Same as human Role 3
	Provider Hand Wash (gal/day)	10.00	10.00	10.00	10.00	P	EAB	Similar to human Role 3
	MWD Washing (gal/day)	1.00	1.00	1.00	1.00	P	EAB	1 bath every 5 patients
	General MWD Care gal/dog/day	10.00	10.00	5.00	5.00	P	EAB	Fluid therapy guidelines
	Food Preparation for MWD daily rations (gal/day)	5.00	5.00	5.00	5.00	P	EAB	Similar to human Role 3
	General MWD Care - Area Clean-up (gal/day)	5.00	5.00	5.00	5.00	P	EAB	Similar to human Role 3
	Surgical Instrument Sterilization (gal/day)	1.00	1.00	1.00	1.00	P	EAB	Based on assigned equipment
	Surgical Scrub (gal/day)	5.00	5.00	5.00	5.00	P	EAB	Veterinary protocol, assigned equipment
	Surgical Operating Room Cleanup (gal/day)	1.00	1.00	1.00	1.00	P	EAB	Similar to human Role 3
	Staff Support for 4 personnel	42.20	42.20	42.20	42.20	P	EAB	TC 8-13
Veterinary Role 2-3 Total (gal/day)		90.20		85.20		P		
Food Procurement and Laboratory Team (FPLT)								
FPLT	Provider Hand Wash per case	1.00				P	EAB	
	Sample Preparation and Analysis (gal/sample/day)	2.00				P	EAB	
	Area Clean-up (gal/sample/day)	2.00				P	EAB	
	Staff Support for 7 personnel	71.75				P	EAB	
FPLT Total (gal/day)		76.75				P	EAB	

For operational planning, calculate totals and apply 10% spillage factor.

2.8 Planning Factors for Dental Company Area Support, Dental Role 1–3

Description of Function (Levels of Dental Support). There are three levels of dental support, previously known as levels of dental care, within the AO. These levels are defined primarily by the relationship of the dental assets supporting the patient population within each level. These levels of dental support are exclusive and not

synonymous with the medical roles of care. Reference FM 4-02 for more discussion on the medical roles of care.

Level 1 Dental Support/Role 1 or Forward. The first dental care a Soldier receives is provided by Level 1 dental support (previously known as unit-level dental care). This level of support consists of those services provided by dental personnel organic to the supporting medical companies and Special Forces groups (SFGs). This level of support provides operational dental care to Soldiers during a range of military operations from dental assets in a direct support relationship to an area support task. Major emphasis is placed on those measures necessary for the patient to return to duty or to stabilize them and allow for their evacuation to the next role of medical care.

Level 2 Dental Support/Role 2 or within Role 3 Facility. Level 2 dental support (previously known as hospital-level dental care) consists of those services provided by hospital dental staff to minimize loss of life and disability resulting from oral and maxillofacial injuries and wounds. The hospital dental staff provides operational dental care and preventive dental care to all injured or wounded Soldiers, as well as the hospital staff. The hospital dental staff will not normally provide Level 1 dental support to organizations outside of the hospital, however they will direct patients to the Level 3 dental support activity. Emphasis is placed on those measures necessary for the patient to return to duty or to stabilize them and allow for their evacuation to the next role of medical care. If needed, hospital dental staff can coordinate with the Dental Company Area Support (DCAS) for patient consultation and treatment.

Level 3 Dental Support/Role 3, Area, Forward, CORPS Rear Boundary. Level 3 dental support (previously known as area dental support) is provided for units that do not have organic dental assets or those patients being referred by the Level 2 dental support. This level of support is provided by the DCAS. The DCAS provides operational dental care and has dental assets that can deploy when and where necessary to augment or reinforce the area support squads.

Responsibilities. Dental Company Area Support Commanders and Command planners at all levels

Water Quality Requirements. Dental primary water source is the use of CLS VIII supplies. When unavailable, all dental equipment must have potable water supplied daily to provide dental services and sterilize dental instruments for infection control.

Basis for Estimates. The basis for these estimates were derived from the maximum water storage tank and capabilities of the Aseptico Transport III Portable Dental System, Dental Field Treatment Operating System (DEFTOS), and table top sterilizer. This equipment required to provide dental services to the operational dental care mission and have water requirements necessary to ensure return to duty meets readiness expectation along with 72 hours of prolonged care.

a. Water Distribution.

(1) The Aseptico Transport III container for water storage is the container reservoir. The reservoir holds 0.26 gallons of water and can support 3 to 6 patients. EXAMPLE
Aseptico Transport III:

3 patients = 0.13 gallons

6 patients = 0.26 gallons

(2) DEFTOS holds two (2) water storage container reservoirs. Each reservoir holds 0.53 gallons of water and can support 6 to 12 patients. EXAMPLE:

6 patients = 0.26 gallons

(3) The Table Top Sterilizer water storage reservoir holds 1.32 gallons. This allows sterilization supporting 3 to 6 dental cassettes, or 4 to 8 full dental trays. EXAMPLE:

3 cassettes/4 dental trays = 0.66 gallons

6 cassettes/8 dental trays = 1.32 gallons

Table 2-77. Dental Role 1–3 Water Planning Factors

Type	Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
DCAS	Aseptico Transport III container (support up to 6 patients)	0.26				P	EAB	MED CoE
DCAS	DEFTOS container (support up to 12 patients)	0.53				P	EAB	MED CoE
DCAS	Table Top Sterilizer	1.32				P	EAB	MED CoE
DCAS	Staff Support for 88 personnel	902.00				P	EAB	MED CoE
DCAS Total (gal/day)		904.11				P		

For operational planning, calculate totals and apply 10% spillage factor.

2.9 Planning Factors for Blood Management

Description of Function. The Medical Detachment Blood Support (MDBS) serves as the primary blood depot for the theater of operations tasked to provide blood and blood product support to Brigade Combat Teams (BCTs), echelons above brigade medical units, other services, and international partners as directed. The Role 3 Blood Bank Laboratory may fill this role in a limited capacity.

One MDBS has the capability of storing, manufacturing, distributing, and collecting up to 3900 units of chilled liquid blood product (Whole Blood [WB], packed Red Blood Cells [pRBC], and Thawed Plasma) per day. One Role 3 Blood Bank Laboratory has the capability of storing, manufacturing, distributing, and collecting 480 units of chilled liquid blood product per day.

Responsibilities. MDBS commanders, Role 3 commanders, and planners at all levels

Water Quality Requirements. All blood storage and distribution facilities must have potable water supplied to them daily to prevent contamination of blood units.

Basis for Estimates. The basis for these estimates were derived from the max liquid blood product storage and distribution capabilities of a MDBS and a Role 3 Blood Bank laboratory as they relate to the number of WB and pRBC units necessary to ensure patient survivability meets or exceeds 95% for 72 hours of prolonged care and prolonged field care.

a. Blood Distribution

(1) The primary container of transporting chilled liquid blood products is the Box Blood Products Shipping Compartmented Small (a.k.a. Collins Box). Each Collins Box holds 30 units of pRBCs or Thawed Plasma or 20 units of WB. Each Collins Box can support 3.33 to 5 patients. EXAMPLE:

pRBCs and Thawed Plasma: 30 units / 6 units per container = 5 patients per Collins Box

WB: 20 units / 6 units per patient = 3.33 patients per Collins Box

(2) The Collins Box is capable of maintaining a constant internal temperature of 34°F to 50.0°F (1 to 10°C) within an ambient temperature range of -20°F to 120°F (-29°C to 49°C) for a maximum of 72 hours. If the ambient temperature exceeds the rated temperature range of the Collins Box, please consult with the nearest Joint Blood Program Office for additional guidance. To maintain the prescribed temperature range, each Collins Box must have 14 pounds of wet ice packed with each liquid blood product shipment without regard to the amount of blood product within. The production of 14 pounds of wet ice requires 1.61 gallons of water per shipment. EXAMPLE:

$(14.72\text{oz per 1 lb. ice} \times 14\text{lb. of ice}) / 128\text{ oz per gallon} = 1.61\text{ gallons per shipment}$

(3) The maximum daily throughput of chilled liquid blood for the MDBS is 3900 units and 480 units for the Role 3 Laboratory. The number of shipments an MDBS may process varies between from 130 to 156 Collins Boxes per day and 16 to 24 Collins boxes per day for the Role 3 Laboratory. The percentage of WB, pRBC, and Thawed Plasma Units on hand is determined by the Theater Commander and Area Joint Blood Program Office. To calculate the daily water requirement for ice, use the following formula, where % = prescribed percentage of inventory for specific product (use 40 to represent 40%, 63 for 63%, and so on):

$((\text{Total Inventory} \times \% \times .01) / 20 \text{ for WB or } 30 \text{ for other liquid blood products}) \times 1.61 \text{ gal per shipment} = \text{Total Daily Water Requirement}$

Blood Lab Planning Factors.

Each shipment of chilled liquid blood product will support 3 to 5 patients and requires 1.61 gallons of water per shipment.

a. Medical Detachment Blood Support (MDBS). Assuming the on-hand blood inventory prescribed ratio is 40:20:40 (pRBC:plasma:WB) and the MDBS has a daily throughput of 3900 units of chilled liquid blood products, the water requirement is 251.16 gal/day. EXAMPLE:

$$\begin{aligned} & ((3900 \times 40 \times .01) / 20 \text{ for WB}) \times 1.61 \text{ gal} = 125.58 \text{ gal} \\ & ((3900 \times 60 \times .01) / 30 \text{ for other liquid products}) \times 1.61 \text{ gal} = 125.58 \text{ gal} \\ & 125.58 + 125.58 = 251.16 \text{ gal/day} \end{aligned}$$

b. Role 3 Laboratory. Assuming the on-hand blood inventory prescribed ratio is 40:20:40 (pRBC:plasma:WB) and the Role 3 Laboratory has a daily throughput of 200 units of chilled liquid blood products, the water requirement is 12.88 gal/day. EXAMPLE:

$$\begin{aligned} & ((200 \times 40 \times .01) / 20 \text{ for WB}) \times 1.61 = 6.44 \text{ gal} \\ & ((200 \times 60 \times .01) / 30 \text{ for other liquid products}) \times 1.61 \text{ gal} = 6.44 \text{ gal} \\ & 6.44 + 6.44 = 12.88 \text{ gal/day} \end{aligned}$$

c. Evaporation. To account for evaporation, add 10% to the Total Daily Water Requirement.

d. Water Requirements for Blood Based on Patient Projections. One Collins Box will provide blood to an average range of 3 to 5 patients. To calculate the water requirements per patient, use the following formula:

$$\begin{aligned} \text{WB: } & 1.61 \text{ gal/box} / 3 \text{ patients/box} = 0.5367 \text{ gal/patient} \\ \text{Other Liquid Blood Products; } & 1.61 \text{ gal/box} / 5 \text{ patients/box} = 0.322 \text{ gal/patient} \end{aligned}$$

Note: Only use this value if WB is not a part of the inventory. Add 0.019 gallons to account for evaporation and spillage.

(4) Ice for Blood Detachment mission. The flow of blood begins at the CONUS donor base. Boxes of blood are moved to the Armed Services Whole Blood Processing Laboratory (ASWBPL) and then to forward-based AF Expeditionary Blood Transshipment Centers. Once it is in the theater, the blood is re-iced and moved forward to Army Blood Support Detachments (BSDs). The BSDs re-pack and re-ice the blood for forward movement to the supported hospitals and Forward Surgical Teams (FSTs). Hospitals and FSTs must also re-ice the blood for any cross leveling of blood from their locations. Ice is also necessary for backup in case of loss of power to blood storage units. Hospital blood banks and BSDs have limited ice-making capability. Units also look for alternate sources (e.g., dining facilities and commercially-available ice sources) in case the main supply is disrupted. Pelletized dry ice may also be available via contract.

Table 2-88. Blood Management Water Planning Factors

Type	Water Usage (gal/day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
WB, pRBC, Plasma	Blood Distribution (Medical Detachment Blood Support)	0.57	0.54	0.54	0.54	P	EAB	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
WB, pRBC, Plasma	Role 1 and 2 Medical (Laboratory)	0.57	0.54	0.54	0.54	P	BN	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
WB, pRBC, Plasma	Role 3 Medical (General Patient Care Laboratory)	0.57	0.54	0.54	0.54	P	EAB	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
pRBC, Plasma	Blood Distribution (Medical Detachment Blood Support)	0.34	0.32	0.32	0.32	P	EAB	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
pRBC, Plasma	Role 1 and 2 Medical (Laboratory)	0.34	0.32	0.32	0.32	P	BN	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
pRBC, Plasma	Role 3 Medical (General Patient Care Laboratory)	0.34	0.32	0.32	0.32	P	EAB	CSD Models; ATP 4-02.1 JP 4-02 TM 8-227-12
Blood Det.	Staff Support for 21 personnel	215.25	215.25	215.25	215.25	P	EAB	Army Health System Doctrine Smart Book
Blood Detachment Total (gal/day)		218.00						

For operational planning, calculate totals and apply 10% spillage factor.

2.10 Planning Factors for Chemical, Biological, Radiological and Nuclear (CBRN) Decontamination

Description of Function. Water is used in decontamination to remove CBRN hazards from the skin of personnel, individual and unit equipment, terrain and facilities.

a. Immediate decontamination is performed by the individual using an individual decontamination kit to remove or neutralize chemical contaminants on exposed portions of the skin. Clean water is used to flush contaminants from the eyes. Showers or water for rinsing are unnecessary after immediate decontamination other than for morale or hygienic purposes. Depending on the CBRN hazard water showers may facilitate removal of the agents from the body. In emergency situations, casualties may be rinsed to remove contamination prior to evacuation to medical facilities.

b. Decontaminate biological agents immediately with soap and water. A dilute chlorine solution may also be used on the skin. Certain alcohol may also be used for biological agents. Wash exposed areas of the skin with soap and water to remove radiological dust particles.

c. Water is essential to decontaminate individual and unit equipment. Uniforms and web gear must be laundered or rinsed to remove CBRN contaminants. However, such equipment should be checked since decontamination may not remove all contaminants. Although decontaminants are effective for the immediate skin decontamination and immediate personal wipe down of equipment, small amounts of water may be required for eyes or other sensitive areas.

Responsibilities. Commanders and planners at all levels, CBRN staff planners, Preventive Medicine and Field Sanitation Teams

Water Quality Requirements. Water used to decontaminate personnel contaminated by CBRN agents should meet the same standards as water used for routine showers. Water used to decontaminate weapons, vehicles, and equipment should be free and clear of any contaminants, but may otherwise be of a lesser quality.

Basis for Estimates.

Data to compute water consumption rates was extracted from ATP 3-11.32, Multiservice Tactics, Techniques, And Procedures for Chemical, Biological, Radiological, and Nuclear Passive Defense, including change 2 dated 9 September 2021, and confirmed by the MSCoE.

a. Vehicle Decontamination Processes.

(1) Operational Vehicle Decontamination. This is a quick wash to remove the gross contaminate. Operators must continue to wear Mission-Oriented Protective Posture clothing. It requires about 150 gallons of water for each wheeled vehicle and about 200 gallons of water for each tracked vehicle.

(2) Detailed Equipment Decontamination. This is the complete cleaning and removal of all contaminants from vehicles and equipment. Wheeled vehicles require a primary wash using 250 gallons of water and a rinse using 200 gallons. Tracked vehicles require up to 300 gallons for primary wash and 200 gallons for rinse. The water required will depend on the water flow rates of the decontamination equipment used (M26/M12) and the decontaminant (GPD/STB). Weathering effects in hot, arid environments may mitigate contamination and reduce water requirements.

b. Troop Decontamination. Detailed troop decontamination uses approximately 8 gallons of water per person.

c. Aircraft Decontamination.

(1) Operational Decontamination. The decontamination site must have sufficient fresh water to wet the entire exterior of the aircraft. For planning purposes, the following recommendations are provided: CH46, 250 gallons; CH53, 350 gallons.

(2) Thorough Decontamination. Considerations for selecting a thorough decontamination site and the preparation of that site are similar to those for operational decontamination. The following recommendations are provided: CH46, 500 gallons; CH53, 700 gallons.

Table 2-19. CBRN Water Planning Factors

Type	Water Usage (Gal/Application/Day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Personnel immediate	Individual Skin Decontamination (<1min)	0.25	0.25			P	Individual	ATP 3-11.32 CBRN
Personnel immediate	Immediate Personal Wipe Down (15min)	0.25	0.25			P	Individual	ATP 3-11.32 CBRN
Personnel operational	Mission-Oriented Protective Posture Gear Exchange (w/in 6 hours)	1.00	1.00			P	Unit	ATP 3-11.32 CBRN
Personnel Thorough	Detailed Troop Decontamination	7.95	7.95			P	Unit	ATP 3-11.32 CBRN
Personnel	Patient Decontamination	0.25	0.25			P	Unit	ATP 3-11.32 CBRN
Objects Immediate	Operator Wipe Down (vehicles + sensitive equipment)	1.05	1.05			NP	Unit	ATP 3-11.32 CBRN
Objects Immediate	Spot Decontamination (Aircraft)	1.44	1.44			NP	Unit	ATP 3-11.32 CBRN
Objects Operational	Vehicle Wash Down (Regular Vehicles)	150.00	150.00			NP	Unit	ATP 3-11.32 CBRN
Objects Operational	Vehicle Wash Down (Armored + Larger Vehicles)	200.00	200.00			NP	Unit	ATP 3-11.32 CBRN
Objects Thorough	Detailed Equipment Decontamination (Regular Vehicles)	450.00	450.00			NP	EAB	ATP 3-11.32 CBRN
Objects Thorough	Detailed Equipment Decontamination (Armored Vehicles)	512.50	512.50			NP	EAB	ATP 3-11.32 CBRN
Objects Operational	Detailed Aircraft Decontamination CH-46E, CH-47, UH-60, AH-64, OH-58, UH-1	250.00	250.00			NP	EAB	ATP 3-11.32 CBRN
Objects Operational	Detailed Aircraft Decontamination CH-53	350.00	350.00			NP	EAB	ATP 3-11.32 CBRN
Objects Operational	Detailed Aircraft Decontamination C130	800.00	800.00			NP	EAB	ATP 3-11.32 CBRN
Objects Thorough	Detailed Aircraft Decontamination CH-46E, CH-47, UH-60, AH-64, OH-58, UH-1	500.00	500.00			NP	EAB	ATP 3-11.32 CBRN
Objects Thorough	Detailed Aircraft Decontamination CH-53	700.00	700.00			NP	EAB	ATP 3-11.32 CBRN
Objects Thorough	Detailed Aircraft Decontamination C130	1600.00	1600.00			NP	EAB	ATP 3-11.32 CBRN
Area	Terrain Decontamination (100m x 30m area)	1500.00	1500.00			NP	EAB	ATP 3-11.32 CBRN

For operational planning, calculate totals and apply spillage factor of 10%. Water requirements for Immediate Decontamination depend on the type of exposure and the availability of CBRN kits and decontamination wipes. Personnel decontamination water factors are equivalent to personal hygiene factors (TC 4-02.3 Field Hygiene 2015)

2-11. Planning Factors for Equipment Washing and Maintenance Procedures

Ground Vehicles

Description of Function. Water usage for vehicles includes vehicle wash rack operations and emergency use such as coolant replacement and washing of windshield and lights.

Responsibilities. Commanders and planners at all levels, Units, and Operators

Water Quality Requirements. Water for vehicle maintenance and wash rack operations does not have to be potable. However, water with high salt content might cause corrosion or deposits in cooling systems. It might require some limited treatment, such as filtering, to remove foreign material.

Basis for Estimates.

a. Data for this estimate was established in coordination with Ordnance Division, Force Development Directorate, Combined Arms Support Command (CASCOC).

b. Estimate for emergency use is .36 gal/vehicle/day for hot climates and .19 gallon/vehicle/day for basic and cold climates.

c. Vehicle washing/cleaning procedures are required when forces are redeployed CONUS to avoid introducing exotic plants and animal pests that might be harmful to the public or to agriculture.

Table 2-90. Vehicle Wash-Rack Water Planning Factors

Water Usage (gal/vehicle/wash)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Wheeled Vehicles Emergency Use	.36	.36	.19	.19	NP	ALL	FDD OD
Wheeled Vehicles Primary Wash	275.00	275.00	275.00	275.00	NP	EAB	FDD OD
Wheeled Vehicles Rinse	220.00	220.00	220.00	220.00	NP	EAB	FDD OD
Armored Vehicles Primary Wash	330.00	330.00	330.00	330.00	NP	EAB	FDD OD
Armored Vehicles Rinse	220.00	220.00	220.00	220.00	NP	EAB	FDD OD

For operational planning, calculate totals and apply spillage factor of 10%

Watercraft

Description of Function. Water used in watercraft maintenance operations is required to prevent vessel deterioration because of constant exposure to salt water.

Responsibilities. Commanders and planners at all levels, Army Watercraft Units, and Army Field Support Brigades/Battalions

Water Quality Requirements. Fresh water is required for watercraft maintenance because salt water causes corrosion. The LSV and LCU produce their own potable water.

Basis for Estimates.

The data used in making these estimates was developed in coordination with the Army Watercraft Division, Requirements Development Directorate, Sustainment Capability Development Integration Directorate (S-CDID), U.S. Army Futures Command.

a. Data Table shows the wash requirement for the vessels that are currently in the inventory or are planned to be in the fleet by 2022. They require wash down about every three or four days as the mission permits.

b. The Army Watercraft Master Plan established a pre-positioned package to support worldwide deployment. The watercraft in this package are either area pre-positioned or forward-based.

c. Vessels in Army Pre-positioned Stock (APS) are washed every three to four days.

Table 2-101. Watercraft Water Planning Factors

Watercraft Water Usage (gal/vessel/wash)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Watercraft Maintenance (LSV)	2,200.00	2,200.00	2,200.00	2,200.00	P	EAB	AFC S-CDID
Watercraft Maintenance (LCU)	1,980.00	1,980.00	1,980.00	1,980.00	P	EAB	AFC S-CDID
Watercraft Maintenance (MSV-L)	1,320.00	1,320.00	1,320.00	1,320.00	P	EAB	AFC S-CDID
Watercraft Maintenance (Small Tug)	1,100.00	1,100.00	1,100.00	1,100.00	P	EAB	AFC S-CDID
Watercraft Maintenance (Pusher Tug)	550.00	550.00	550.00	550.00	P	EAB	AFC S-CDID

For operational planning, calculate totals and apply spillage factor of 10%.

Aircraft Maintenance

Description of Function. Water is used for turbine wash, aircraft wash, and flight operations. Engines of aircraft operating over salt water or in dusty conditions should be flushed after each day's flight.

Responsibilities. Commanders and planners at all levels, Unit, and Operators

Water Quality Requirements. Fresh water with low chloride content for aircraft washing and rinsing (chloride content should be less than 400 ppm, approximately the same limit as that for potable water) or as directed by TM 1-1500-344-23-1.

Basis for Estimates.

a. The data used for this estimate was coordinated with the senior aircraft maintenance personnel assigned to HQDA G44M-AVN. Water consumption can be estimated using the factors shown below. The categories of water used in aircraft maintenance are listed below.

b. Daily engine rinse. Depending on the number of engines and whether or not an aircraft has an on-board auxiliary power unit, 10 to 25 gallons are required/day/aircraft. Specific aircraft requirements are as follows:

Daily engine rinses are not required unless operated within 200 miles of volcanic activity or within 10 miles and 1000ft Above Ground Level (AGL) of salt water for AH-64 and H-60 aircraft in accordance with TM 1-2840-248-23&P.

Daily engine rinses are not required unless operated within 200 miles of volcanic activity or in a salt laden environment for CH-47 aircraft in accordance with TM 1-1520-271-23&P.

Daily aircraft rinse. In accordance with TM 1-1520-271-23&P, a complete aircraft rinse is required for CH-47 aircraft when operating over salt water using approximately 300 gallons/rinse.

c. Monthly wash. A complete aircraft wash is based on the size of the aircraft and ranges from 300 to 1,200 gallons/wash.

d. Scheduled maintenance. Consumption for scheduled maintenance requires six gallons/day/aircraft for Aviation Maintenance Companies (AMCs) and four gallons/day/aircraft for Aviation Support Companies (ASCs). An additional two gallons/day/aircraft is required for maintenance cleanup.

e. Unscheduled maintenance. Consumption for unscheduled maintenance requires six gallons/day/aircraft for AMCs and four gallons/day/aircraft for ASCs. An additional two gallons/day/aircraft is required for maintenance cleanup.

f. Shop cleanup and mechanic hand-wash. Safety requirements and shop cleanup require 10 gallons/day.

Table 2-11. Aircraft Water Planning Factors

Aircraft Water Usage (gal/aircraft/wash)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Aircraft Maintenance (Daily Wash CH47)	25.00	25.00	25.00	25.00	NP	EAB	HQDA G44M-AVN
Aircraft Maintenance (Daily Wash AH-64)	22.00	22.00	22.00	22.00	NP	EAB	HQDA G44M-AVN
Aircraft Maintenance (Daily Wash UH-60)	22.00	22.00	22.00	22.00	NP	EAB	HQDA G44M-AVN

Aircraft Water Usage (gal/aircraft/wash)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsi- bility	Source or Reference
Scheduled Maintenance (AMC)	6.60	6.60	6.60	6.60	NP	EAB	HQDA G44M-AVN
Scheduled Maintenance (ASC)	4.40	4.40	4.40	4.40	NP	EAB	HQDA G44M-AVN
Unscheduled Maintenance (AMC)	6.60	6.60	6.60	6.60	NP	EAB	HQDA G44M-AVN
Shop Cleaning and Mechanic Hand-wash (per a/c per maintenance)	11.00	11.00	11.00	11.00	NP	EAB	HQDA G44M-AVN

For operational planning, calculate totals and apply spillage factor of 10%.

2.12 Planning Factors for Engineer Operations

Description of Function. The U.S. Army engineer units locate and develop water resources; provide well drilling; and construct, maintain, and operate permanent and semi-permanent water utility systems in the AO. U.S. Army general engineer tasks include the planning, design, construction, repair, maintenance, and operation of permanent and semi-permanent water facilities. This includes water supply and distribution systems within base camps, facilities, or buildings. The facility engineer manages water utilities on an installation or base camp (ATP 3-34.40, General Engineering and ATP 3-37.10, Base Camps).

Responsibilities. Commanders and planners at all levels, Units, and Operators

Water Quality Requirements. Most engineer activities do not require potable water. However, water with high salt content might cause long-term corrosion. In most cases, the amount of organic matter in the non-potable water must be minimized. In cold climates, water might need to be heated for use.

Basis for Estimates.

a. U.S. Army Engineers are responsible for maintaining an adequate ground lines of communications (LOC) network, which is critical to sustainment/combat service support operations. General engineers have the capability to plan, design, construct, and maintain military roads. General engineers possess horizontal and vertical assets, which expand and enhance their capabilities beyond combat engineers. They can construct and repair roads, MSRs, and railroads and handle large-scale projects. They possess specialized expertise, such as the ability to perform quality road construction and pave road surfaces and include surveyors and soil analysts (ATP 3-90.4).

b. Well drilling can be performed by specialized engineer units and contractors. Planners must determine the availability of well drilling capabilities and the viability of drilling based on a hydrogeological analysis of the area. Initial information on the hydrogeology of an area is available through geospatial engineering channels or reach-back to USACE. Drilled wells may be integrated into a water distribution system within the base camp, or water may go into storage tanks or bladders for distribution by vehicles. After

PM personnel test groundwater and approve a groundwater source, treatment is not usually required; however, chlorination is recommended.

c. The stationary 16-cubic-feet mixer and the M919 Concrete Mobile-Mixer unit are table of organization and equipment (TOE) equipment in engineer construction battalions and are well-suited for troop construction projects. These power-concrete mixers normally produce one batch about every 3 minutes, including charging and discharging. Actual hourly output varies from 10 to 20 batches per hour. A mixer's cubic foot rating usually reflects the number of cubic feet of usable concrete that the machine mixes in one batch. (TM 3-34.44)

d. Engineer Quarry Operations using rock crushing equipment are covered in TM 3-34.65. Planners must be aware that moving and establishing a rock-crushing capability is a time- and labor-intensive operation that must be well planned to meet specific project time constraints. The plant should be located on level ground with good drainage and adequate space for equipment, stockpiles, and maintenance areas. An adequate supply of water must also be available for the washing process. This water may require a settling basin or some other method to mitigate the environmental impacts of the operation.

e. Engineer Construction Company (ECC) and Engineer Vertical Construction Company (EVCC) are assigned the Engineer Mission Module-Water Distributor (EMM-WD) Type II system (LIN#E05007). EMM-WD is a 3,000-gallon water distributor used to provide distribution of clean non-potable water for construction of airfields, railways, roads, base camps and infrastructure as well as Defense Support of Civil Authorities (DSCA). The EMM-WD consists of a tank rack (modified M1077 flatrack), water pump unit connected to a diesel engine, water turret, sprinkler nozzles hose reels, engine control panels and cab control box. One tank per associated support items (ASIOE) Palletized Loading System (PLS) transport and PLS Trailer is required. The basis of issue for EMM-WD is as follows:

Engineer Construction Company (ECC): Two (2) per 2nd Horizontal Squad, 1st Horizontal Platoon, Two (2) per 2nd Horizontal Squad, 2nd Horizontal Platoon

Engineer Vertical Construction Company (EVCC): Two (2) per 2nd Equipment Squad, Equipment Support Platoon

Two (2) per Surface Section, Asphalt Detachment

Two (2) per Concrete Section

Two (2) per Plant Section, Quarry Platoon

f. Base camp operations covered in ATP 3-37.10 include water requirements related to water production, storage, and distribution as well as requirements for toilet and shower facilities, dining facilities, medical support, motor pool operations, and wastewater removal. Base camp levels of service are:

- Basic services are established as part of the initial entry and are primarily implemented using organic capabilities and pre-positioned stock. Basic services are those functions and services that are considered essential for sustaining operations for a minimum of 60 days.

- Expanded services are those that have been improved to increase efficiencies in the provision of base camp support and services and expanded to sustain operations for a minimum of 180 days. Expanded facilities are constructed from additional engineer efforts above the basic facility standards. They are intended to increase operational efficiency for up to 2 years and may be used to fulfill requirements for up to 5 years.
- Enhanced services surpass expanded services. They have been improved to operate at optimal efficiency and sustained operations for an unspecified duration. These services are flexible, durable, nearly self-sustaining, and primarily implemented through contracted support. Enhanced facilities are intended for a life expectancy of 2–10 years.

Table 2-12. Engineer Operations Water Planning Factors (Engineer Construction)

Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Road Construction Paving (gal/day)	1,800	1,800	1,800	1,800	NP	EAB	ATP 3-34.40
Road Construction Dust Control (gal/day)	18,800	18,800	18,800	18,800	NP	EAB	ATP 3-34.40
Road Construction Compaction (gal/day)	122K-245K	122K-245K	25K-122K	25K-122K	NP	EAB	TM 5-822-14
Road Construction Soil Stabilization (gal/day)	100K-850K	100K-850K	100K-850K	100K-850K	NP	EAB	TM 5-822-14
Airfield Construction Paving (gal/day)	2,000	2,000	2,000	2,000	NP	EAB	ATP 3-34.40
Airfield Construction Dust Control (gal/day)	93,400	93,400	23,400	23,400	NP	EAB	ATP 3-34.40
Airfield Construction Compaction (gal/day)	150K-300K	150K-300K	30K-150K	30K-150K	NP	EAB	TM 5-822-14
Airfield Construction Soil Stabilization (gal/day)	140K-700K	140K-700K	140K-700K	140K-700K	NP	EAB	TM 5-822-14
Engineer Quarry Operations, Rock Crusher (gal/hr)	22,500	22,500	22,500	22,500	NP	EAB	TM 3-34.65
16 cu in Concrete Mixer (gal/hr)	26	26	26	26	NP	EAB	TM 3-34.44
M919 Concrete-mobile-mixer unit (gal/hr)	400	400	400	400	NP	EAB	TM 3-34.44
Pipeline Testing Operations (gal/cu ft.)	7	7	7	7	NP	EAB	ATP 3-34.40
Well Drilling (gal/day)	2,000	2,000	2,000	2,000	NP	EAB	ATP 3-34.40
Base Camp (gal/person/day)							
Base Camp Expanded (gal/person/day)	30	30	30	30	P	EAB	ATP 3-37.10
Base Camp Enhanced (gal/person/day)	50	50	50	50	P	EAB	ATP 3-37.10

Water Usage	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Sewage treatment (gal/person/day)	2.5	2.5	2.5	2.5	NP	EAB	ATP 3-37.10
Waste-Water (gal/person/day)	16–40	16–40	16–40	16–40	NP	EAB	ATP 3-37.10

For operational planning, calculate totals and apply spillage factor of 10%.

2.13 Planning Factors for Mortuary Affairs

Description of Function. Water used in MA operations is primarily for facility cleaning, sanitation of equipment and instruments, and personal hygiene after handling human remains (HR) and personal effects to protect MA personnel from potentially infectious materials and blood-borne pathogens.

Water Quality Requirements. Water for showers for MA personnel must be potable. Therefore, it is recommended that potable water be supplied to MA points. The water trailer is the only source for MA points and only use potable water for personal hygiene use, maintaining facilities, for ice that is used to slow HR decomposition during transport and mitigate contamination of HR and equipment.

Basis for Estimates.

a. These estimates were computed in coordination with the Joint Mortuary Affairs Center, Fort Lee, VA.

b. The water consumption rate will support the DOD Mortuary Affairs Program according to DODD 1300.22, Mortuary Affairs Policy (2 September 2021); JP 4-0 Joint Logistics, Appendix M (May 2019); ATP 4-46/ MCRP 3-40G.3/NTTP 4-06/AFTTP 3-2.51, *Multi-Service Tactics, Techniques, and Procedures for Mortuary Affairs in Theaters of Operations*, (Approved Draft 2022); and Army Public Health Center, Technical Guide (TG) 195 (Nov 2009) and TG 195A (Nov 2015), Safety and Health Guidance for Mortuary Affairs Operations: Infectious Materials and CBRN Handling.

c. Access to available water support is critical during MA operations site selection and to a functional facility layout. Environmental conditions must be considered with the potential runoff of biohazard-contaminated water and the proximity to a populated area. MA personnel should be provided one shower per day per person when handling HR and additional laundry support to address the occupational exposure to potentially infectious material and blood-borne pathogens. Field expedient measure may be used periodically when shower facilities are not available. MA specialists are also required to wash their hands immediately after handling any equipment that may have been in contact with HR and personal effects. Water requirements for these additional functions are shown in the tables below.

d. Mortuary Affairs operations may operate from a fixed or mobile facility using the MA common user refrigeration equipment, the Mobile Integrated Remains Collection System (MIRCS). The MIRCS has a hand wash station that pumps out water in a basin

connected to a water trailer or other source. MA personnel use water to sanitize the MIRCS once HR are stored or evacuated. The biohazard-contaminated water is collected in two 10-gallon containers that are connected to the MIRCS drain. Each MIRCS has four containers to collect the wastewater, which is properly disposed of as hazmat regulated waste.

e. Mortuary Affairs Collection Point (MACP) and Theater Mortuary Evacuation Point (TMEP) factors are shown in the Standard Planning Factors Table.

Ice is used to slow decomposition of HR during transportation. Units are directed to transport HR by the quickest means possible to the closest MACP or TMEP for processing and evacuation to CONUS. If transportation of HR from the incident location or medical treatment facility cannot be accomplished within four hours of death, HR are moved to an alternate location for cooling to a temperature of 32 to 40°F and proper preservation. Re-icing should occur every 8–12 hours and should be changed immediately before the HR are transported from the MACP and/or TMEP. Non-potable water is acceptable for making ice to slow the rate of decomposition of HR.

Each HR requires a minimum 90 pounds of ice in all climates. This equates to 10.8 gallons of water to make the ice (if produced on site). Ice is required at the initial point where the HR are processed. The amount of ice required is based on the 24-hour processing capacity of the CMA unit.

MA units do not currently have ice-making capability. When ice or ice-making machines are required by the TMEPs and MACPs, actions should be taken to obtain them from available sources, such as contracting, host nation support, or Logistics Civil Augmentation Program (LOGCAP).

f. When required, a Mortuary Affairs Contaminated Remains Mitigation Site (MACRMS) is established in accordance with DODD 1300.22, MA Policy, JP 4-0 Joint Logistics (Appendix M), and under development ATP 4-46.2, *Contaminated Human Remains (CHR) in a Theater of Operations* (Draft) to process CBRN-contaminated HR.

(1) The MACRMS operations may be configured for biological, chemical, radiological, and nuclear CHR using an Interim Remains Decontamination System (IRDS). These configurations are for small-scale mitigation of up to 10 CHR in a 12-hour day. The core component of the IRDS is designed to mitigate the effects of contamination, support CHR positive identification process, and ensure CHR are safely prepared by MA personnel for evacuation from the MACRMS following a CBRN event.

(2) Water planning factors for MACRMS operations are based on processing, mitigation, packaging, and evacuation of CHR. MACRMS operations require all personnel to don Individual Personal Protective Equipment (IPPE) or Personal Protective Equipment (PPE) for extended periods; all MACRMS personnel are recommended to receive personal hygiene showers daily.

(3) During MACRMS operations, equipment must be cleaned frequently due to sloughing of biological matter and body fluids. An additional factor of 20 gallons per HR has been added to clean equipment such as the conveyors, litters, tent flooring, and

other items that require cleansing. Potable bulk water delivery is required for the 1,200 gallon collapsible water tank (blivet) supporting the MACRMS operations equipment.

Mortuary Affairs Planning Factors (derived from MACRMS data):

Table 2-13. Mortuary Affairs (MA) Water Planning Factors

Water Usage (gal/remains)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non-Potable	Responsibility	Source or Reference
Non-contaminated human remains (HR)							
MA remains processing	2.5 gal/HR				NP	Sust. BDE/DSB	ATP 4-46
MA remains processing daily consumption (for 20 HR)	60 gal				NP	Sust. BDE/DSB	ATP 4-46
MA hand wash/eyewash	1.20 gal				NP	Sust. BDE/DSB	ATP 4-46
MIRCS Refrigeration Unit Sanitation	5.5 gal				NP	Sust. BDE/DSB	ATP 4-46
MA Facility Cleaning/Maintenance	3.3 gal				NP	Sust. BDE/DSB	ATP 4-46
MA Litter Wash	1.1 gal				P	Sust. BDE/DSB	ATP 4-46
MA Transfer Case Sanitation	2.2 gal				P	Sust. BDE/DSB	ATP 4-46
MA Vehicle Sanitation	3.3 gal				P	Sust. BDE/DSB	ATP 4-46
MA Equipment Sanitation	1.1 gal				NP	Sust. BDE/DSB	ATP 4-46
Wet Ice preparation	10.8 gal (90 lbs.)				NP	Sust. BDE/DSB	ATP 4-46
MACRMS Operations							
MA Remains Processing Chemical	20 gal/HR				NP	EAB (GCC)	ATP 4-46
MA Remains Processing Biological	20 gal/HR				NP	EAB (GCC)	ATP 4-46
MA Remains Processing Radiological/ Nuclear	20 gal/HR				NP	EAB (GCC)	ATP 4-46
MA Equipment Cleaning CBRN (Storage/Refrigerator)	5.5 gal				NP	EAB (GCC)	ATP 4-46
MA Instrument Sanitation	2 gal/HR				NP	EAB (GCC)	ATP 4-46
MA Personnel Specific Water Requirements							
Hand Wash	0.17 gal				P	EAB (GCC)	ATP 4-46
Eye Rinse	1.1 gal				P	EAB (GCC)	ATP 4-46
Showers	6.00 gal				NP	EAB (GCC)	ATP 4-46

For operational planning, calculate totals and apply spillage factor of 10%.

2.14 Planning Factors for Detainee Operations

Description of Function. Requirements include water for detainees (Enemy Prisoner of War (EPW), Retained Personnel, Civilian Internees, and Detained Persons). FM 3-63 (Jan 2020) provides detailed requirements for maintaining general health and welfare

while under the protection of Army forces. Water in this case is required for drinking, food preparation, personal hygiene, central hygiene, laundry and medical treatment.

Water Quality Requirements. Except for central hygiene, all water should be potable.

Basis for Estimates.

a. Water consumption factors are same as requirements for U.S. Army personnel. In certain situations, factors might require modification because of local ethnic, cultural, dietary, sanitation, or religious beliefs.

b. The Third Geneva Convention, Protection of Prisoners of War, requires humane treatment of enemy prisoners of war at all times. It also sets forth requirements as to quarters, food, clothing, hygiene, and medical attention.

Detainee Operations Planning Factors. Utilize the same planning factors as applicable to U.S. Troops. The factors are based on light physical exertion, one shower per person per week, and the ration cycle as provided by the field feeding planners.

Table 2-14. Detainee Operations Water Planning Factors

Water Usage (gal/person/day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Drinking	2.10	2.10	1.90	1.93	P	EAB	para. 2-1
Personal Hygiene	1.73	1.73	1.73	1.73	P	EAB	para. 2-3
Shower (one shower/week)	6.00	6.00	6.00	6.00	P	EAB	para. 2-4
Laundry (one load/week)	1.08	1.08	1.08	1.08	NP	EAB	para. 2-4
Food Preparation (varies)	1.78	1.78	1.78	1.78	P	EAB	para. 2-5

For operational planning calculate totals and apply spillage factor of 10%

2.15 Planning Factors for Force Provider

Description of Function. Force Provider Expeditionary is a modular base camp life support capability that supports 150 personnel with environmentally controlled billeting, food service, hygiene, power generation and distribution, petroleum and water storage and distribution, and shower water recycling.

Water Quality Requirements. Except for laundry, all water should be potable.

Basis for Estimates

U. Force Provider Expeditionary sets have been used to provide high-quality living conditions in Guatemala, Honduras, Haiti, Guantanamo Bay, Bosnia, Afghanistan, Africa, Iraq, and Kuwait (see detailed explanation in Appendix G).

Force Provider Planning Factors. Provided by the Product Manager Force Sustainment Systems based on the 2014 testing data:

Table 2-15. Force Provider Water Planning Factors

Water Usage (gal/person/day)	Hot Arid (dry)	Hot Tropical (humid)	Temperate	Cold	Potable/ Non- Potable	Responsibility	Source or Reference
Drinking	2.10	2.10	1.90	1.93	P	EAB	PM FSS
Food Preparation	1.78	1.78	1.78	1.78	P	EAB	PM FSS
Central Showers	15.33	15.33	15.33	15.33	P	EAB	PM FSS
Central Laundry	3.33	3.33	3.33	3.33	NP	EAB	PM FSS
Latrine Operations	2.33	2.33	2.33	2.33	NP	EAB	PM FSS

For operational planning, apply a spillage factor of 10%.

2.16 Planning Factors for Evaporation, Waste, and Spillage

Description of Function. When computing consumption for any field force, the loss factor must be added to each planning factor to cover evaporation, waste, and spillage. Water is not accounted for as petroleum products are, and it does not cause environmental hazards when spilled. Evaporation occurs in all climates. No comprehensive studies have been conducted to accurately determine losses through evaporation, waste, and spillage throughout a theater of operations in all climates. Until a reliable factor can be determined by an in-depth study, the presumptive factor of 10% that was established in 1980 should continue to be used. This factor is comprised of 4% evaporation and 6% waste and spillage.

Water Quality Requirements. This factor applies to both potable and non-potable water. Discipline should be applied to ensure that water waste is minimized.

Basis of Estimates.

- a. These estimates were established in coordination with scientific and technical journals, subject matter experts, and field observations.
- b. Evaporation. Water is lost by evaporation in all climates, including cold climates. Water is especially vulnerable to evaporation when stored in large, open tanks. These tanks are popular and are used in a variety of missions, such as water purification, showers and laundry, and engineer operations.
- c. Waste and spillage. Some water is wasted because, unlike fuel, it has no innate hazards that require immediate attention to seepage from tanks, couplings, water buffaloes, and other water containers. Waste and spillage also occur during canteen filling operations from large containers, such as 5-gallon cans. The practice of dumping water from grounded containers prior to a unit move is accepted because of the lack of safety and environmental hazards associated with water. The SMFT can also contribute to waste. As it is unsafe to haul water in a SMFT that is not full, when a SMFT is used to make a delivery, any water that cannot be accepted by the customer must be dumped. Packaged and bottled water can be lost due to a number of factors, such as damage

during shipment or insufficient transport assets during a unit move. Using large bottles for water can also lead to waste because partially full bottles are often abandoned.

Wastewater from water treatment systems can be categorized as brine wastewater, filter backwash wastewater, and membrane cleaning wastewater. Each type of wastewater carries different treatment byproducts, and therefore poses different individual risks to the environment. Water treatment personnel must consider local environmental laws and regulations when executing water support operations. Typically, the theater command will issue environmental compliance guidelines. The pace of tactical operations (depending on the type or stage of an operation) may limit a unit's ability to adhere to local laws and regulations. Water treatment specialists have a responsibility to advise the chain of command when unit actions do not comply with environmental guidelines.

Note: Commanders should take measures to ensure that appropriate discipline is applied to minimize waste.

Part 3

Water Planning Resources

Appendix A Water Planning Tools

Operational Logistics (OPLOG) Planner

OPLOG Planner is a stand-alone interactive tool that helps commanders and staff develop a logistics estimate. The planner is updated annually with the DA G-4 approved logistics planning rates and the standard requirements codes (SRCs). The rates and the SRCs reflect the equipment and personnel found in the objective tables of organization and equipment designed by Training and Doctrine Command and maintained by the U.S. Army Force Management Support Agency. Logistics planners answer a series of questions about mission, enemy, terrain, weather, troops, time available, civil considerations, informational considerations, and task organizations to generate a supply estimate for each class of supply.

OPLOG Planner is used in water planning to estimate the amount of water required for a contemplated operation. The estimate is based on unit size, the operational environment, duration, etc. All reports are easily exportable in multiple formats to ease staff planning, analysis, and chart making. OPLOG Planner may be accessed on MS Teams by joining the OPLOG Planner and Log Planning Tools team, located at: <https://dod.teams.microsoft.us/j/team/19%3adod%3adac78ac628474130b87a5ac4393fa430%40thread.skype/conversations?groupId=491b4bc5-31f1-484b-9df0-2ac185e9df75&tenantId=fae6d70f-954b-4811-92b6-0530d6f84c43>.

The Quick Logistics Estimation Tool (QLET), is a lighter, quicker version of OPLOG Planner and provides requirements for one or multiple SRCs for each class of supply. Although not as detailed as OPLOG Planner, users can select the SRCs, joint phase, climate, and platform requirements, and the tool provides a logistics estimate. It determines the total weight, short tons, gallons, pallets, and platforms from the SRCs chosen.

HQDA G-4 has given the CASCOM Planning and Development Branch the responsibility to periodically update QLET. Liquid Logistics planners can gain access to the QLET by joining the OPLOG Planner and Log Planning Tools team, located at: <https://dod.teams.microsoft.us/j/team/19%3adod%3adac78ac628474130b87a5ac4393fa430%40thread.skype/conversations?groupId=491b4bc5-31f1-484b-9df0-2ac185e9df75&tenantId=fae6d70f-954b-4811-92b6-0530d6f84c43>.

Food and Water Tool

This tool can assist with detailed food and water planning. Planners can use it to develop different meal plans and the water planning factors contained in this guide are also contained in the tool. The Food and Water Tool may be accessed on MS Teams by joining the OPLOG Planner and Log Planning Tools team, located at: <https://dod.teams.microsoft.us/j/team/19%3adod%3adac78ac628474130b87a5ac4393fa430%40thread.skype/conversations?groupId=491b4bc5-31f1-484b-9df0-2ac185e9df75&tenantId=fae6d70f-954b-4811-92b6-0530d6f84c43>.

430%40thread.skype/conversations?groupId=491b4bc5-31f1-484b-9df0-2ac185e9df75&tenantId=fae6d70f-954b-4811-92b6-0530d6f84c43.

Sustainment Planners Reference Book

The Sustainment Planners Reference Book is a data reference and resource that provides a snapshot of sustainment organizations by SRC. This snapshot includes a brief statement of the organization's mission and functions, capabilities, employment, basis of allocation, doctrinal mobility and dependencies derived from its base TOE. The information provided on sustainment organizations reflects a fully modernized and approved organizational structure for personnel and equipment. Modification Table of Organization and Equipment (MTOEs) for each organization will vary based on force management guidance and priorities. Available on the Army Sustainment Resource Portal, located here: <https://cascom.army.mil/asrp/>

Force Management System Website (FMSWeb)

The Force Management System Website (FMSWeb) is maintained by the U.S. Army Force Management Support Agency, the website address is in the glossary. Planners can use FMSWeb to determine capabilities. FMSWeb provides Basis of Issue Plans, TOEs, MTOEs, Common Tables of Allowance, Table of Distribution and Allowances, and Joint Tables of Allowance.

The MTOE is likely to be the most up-to-date for determining capabilities. Users can search for unit data by name, unit identification code, or SRC. Planners can gain access to FMSWeb at: <https://fmsweb.fms.army.mil>

Host Nation Support

Planners at strategic echelons identify and negotiate whether host-nation water will be made available in order to leverage pre-established agreements or establish contracts with local vendors. The theater commander may authorize contingency contracting if circumstances require consumption of host-nation supplied water for a protracted period. The Army Contracting Command is a major subordinate command within United States Army Material Command (USAMC) that provides Army forces with both theater support contracting and installation contracting support through its two subordinate commands, the Mission and Installation Contracting Command and Contracting Support Brigade, respectively. The Army Contracting Command also provides support to deployed Army forces via reach-back contracting support from its CONUS-based acquisition centers. See ATP 4-71 for more information.

Minimal water sources and poor water quality will limit any operation that depends on host-nation support. During the initial phase of an operation, host-nation water, either processed or bottled, may be procured to meet the basic consumption needs of advance party elements of the deploying force. Preventive Medical personnel must certify all water as potable before it is consumed, regardless of how it is packaged, produced, or procured. Worldwide Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement is published by the U.S. Army Public Health Center at: <https://phc.amedd.army.mil/topics/foodwater/ca/Pages/DoDAApprovedFoodSources.aspx>

Joint Acquisition CBRN Knowledge System (JACKS)

JACKS provides the servicemember and other customers with a centralized, authoritative, and comprehensive source of CBRN equipment information. It contains an intuitive search capability and provides total asset visibility for fielded equipment. The user can access CBRN equipment specifications and standards, fact sheets, shelf life information, advisory messages, new equipment training, and contact information. CBRN Planners use the JACKS Automated Decontaminant Calculator to estimate water quantity required for specific missions. This tool is web-based and accessible through any standard internet browser using DoD CAC, Federal PIV, or ECA authentication at: <https://pki.jacks.jpeocbrnd.army.mil/Jacks/Secure/Equipment/DeconCalculator.aspx>

Joint Construction Management System (JCMS)

JCMS View provides users access to the latest Army Facilities Components System (AFCS) and the Theater Army Construction Automated Planning System (TACAPS) design production data. Engineer Planners have the capability to search and view AFCS Hierarchical designs and Reference data, view and export reports, plus view and export support and drawing files. The work division section is the label AFCS uses to identify different levels of the construction estimating data. The work division section is the breakdown of the work division into more distinct materials and construction requirements. USACE is responsible for JCMS VIEW application support. Engineer Planners can gain access to the JCMS at: <https://jcms.army.mil/>

Water Resources Database (WRD)

The Hydrologic Analysis Program, executed at the Army Geospatial Center (AGC), provides timely and accurate water resources information, reach-back support, and expert hydrologic analysis enabling combatant commanders, Joint Logistics Staff, and other key stakeholders, to coordinate and resolve water support issues. The Hydrologic Analysis Program develops and maintains the DoD WRD, the approved Army and DoD Enterprise Authoritative Data Source (ADS) for water resources information and the sole source of water resources information for DoD. The USACE Army Geospatial Center executes this program.

WRD uses Geospatial technology to depict surface water, ground water and existing water facility locations and provides information on water quantity, quality/chemistry (based on TBMED 577), and accessibility in high-priority OCONUS areas. The WRD also includes ground water evaluations of aquifers/areas to support military well drilling operations and includes a repository for DoD well logs. The WRD provides direct support to the point of need on a 24/7 basis via secure communication links. Reach back support for hydrologic analysis is available on a quick response basis. Well drilling site assessments are available through this service and help determine the feasibility of installing a successful well at a particular location. Well logs of each mission should be returned to AGC's Hydrologic Analysis Team for inclusion into the WRD to aid in future mission planning.

The WRD can be accessed at the CAC-enabled URL below. Please note that the data within this geospatial portal was last updated in 4th QTR FY19. Upon re-establishment of the WRD in FY23 users will be redirected to the new dataset:

<https://agewebportal.erdcdren.mil/portal/apps/Styler/index.html?appid=fc67c9a6f82b42f7b7132ccba15537a6>

The Soldier Water Estimation Tool (SWET)

USARIEM has developed a smartphone app and a mission planning tool that can predict average water needs for groups of Soldiers for defined periods of time. The app uses a validated, updated sweat prediction equation based on five decades of USARIEM's research on sweat loss and hydration. A unit leader can plug in the temperature, humidity, cloud cover, type of clothing worn, and Soldiers' workload. The app does the rest of the work. SWET supports the use of real-world planning in military settings in a variety of outdoor conditions. The app is available on the TRADOC app store:

https://rdl.train.army.mil/catalog/tag/apps/search?current=true&search_terms=SWEAT

Note: The SWET application download from the TRADOC app store requires unit IT administrator support.

Army Pre-positioned Stock (APS)

The APS program is a cornerstone of the Army's ability to rapidly project power. The Army has dedicated significant priorities and resources to ensure the readiness and availability of APS. It has become a significant enabler of the Army's rapid response to recent contingencies. APS—identified as APS-1 continental United States (CONUS), APS-2 (Europe and Africa), APS-3 (Afloat), APS-4 (Pacific/Northeast Asia), APS-5 (Southwest Asia), and APS-6 (Central America/South America/Caribbean)—are available to support all combatant commanders' (CCDR) missions, not only in contingencies, but also for major exercises and humanitarian assistance support (CAC enabled): <https://battleweb.army.mil/login.aspx>

The US Army Quartermaster School, Petroleum & Water Department (PWD)

The PWD is proponent for petroleum and water training and doctrine; provides responses to the field on all petroleum and water issues; and develops the military occupational skill (MOS) related materials. The PWD also provides up to date operation and planning tools (files, national stock numbers and basic issue items, information papers) at the following link: https://quartermaster.army.mil/pwd/pwd_downloads1.html

Appendix B Environmental Conditions

Hot Tropical

Tropical areas of the world have an annual mean daily temperature of more than 80°F. In tropical regions, water sources are expected to be abundant. Dense vegetation and lack of roads may pose significant problems to exploiting water sources. Poor ground lines of communication may inhibit water distribution by truck and place greater reliance on aerial resupply. Individual consumption will increase because of the high temperatures and humidity. Cool water should be provided when feasible to encourage Soldiers to drink large quantities of water to prevent heat injuries.

Hot Arid

Arid areas of the world have an annual daily temperature of more than 80°F. In arid regions, available water sources are limited and widely dispersed. The lack of water sources will result in a large storage and distribution requirement. Potable water is used to meet non-potable water requirements when raw water is unavailable. Individual consumption will increase because of the high temperatures. Cool water should be provided when feasible to encourage Soldiers to drink large quantities of water to prevent heat injuries. Planners should assume no host nation water is available in arid regions. Minimal water sources and poor water quality will limit any operation that depends on host nation support. In the early days of deployment, host nation processed or bottled water may be used if certified as potable by PM personnel. Use of host nation municipal or private fixed facilities is dependent on the above stipulations and local policies as directed by the theater commander.

Table B-1. Fluid Replacement & Work/Rest Guidelines for Warm Weather Training

Heat Category	WBGT ^{6,7} Index (° F)	Easy Work (250 W)		Moderate Work (425 W)		Hard Work (600 W)	
		Work/Rest ^{1,3}	Water ^{4,5} Intake (qt/hr)	Work/Rest	Water Intake (qt/hr)	Work/Rest	Water Intake (qt/hr)
1	78 – 81.9	No Limit (NL) ²	½	NL	¾	40/20 min	¾
2 (green)	82 – 84.9	NL	½	50/10 min	¾	30/30 min	1
3 (yellow)	85 – 87.9	NL	¾	40/20 min	¾	30/30 min	1
4 (red)	88 – 89.9	NL	¾	30/30 min	¾	20/40 min	1
5 (black)	>90	50/10 min	1	20/40 min	1	10/50 min	1
		Easy Work		Moderate Work		Hard Work	
		<ul style="list-style-type: none"> • Weapon maintenance • Walking hard surface at 2.5 mph, <30 pound (lb) load • Manual of arms • Marksmanship training • Drill and ceremony 		<ul style="list-style-type: none"> • Walking loose sand at 2.5 mph, no load • Walking hard surface at 3.5 mph, <40 lb load • Calisthenics • Patrolling • Individual movement techniques, that is low crawl, high crawl • Defensive position construction 		<ul style="list-style-type: none"> • Walking hard surface at 3.5 mph, ≥40 lb load • Walking loose sand at 2.5 mph with load • Field Assaults 	

Notes:

1. The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Fluid needs can vary based on individual differences ($\pm \frac{1}{4}$ qt/hr) and exposure to full sun or full shade ($\pm \frac{1}{4}$ qt/hr).
2. NL equals no limit to work time per hour (up to 4 continuous hours).
3. Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
4. CAUTION: Hourly fluid intake should not exceed 1 ½ quart.
5. Daily fluid intake should not exceed 12 quarts.
6. If wearing body armor, add 5° F to WBGT index in humid climates.
7. If wearing NBC clothing (mission-oriented protective posture (MOPP 4)), add 10° F to WBGT index for easy work, and 20° F to WBGT index for moderate and hard work.

Source: TB MED 507 (Table 2-1)

Temperate

Temperate areas of the world have an annual mean daily temperature ranging from 32°F to 80°F. In temperate regions, water sources are normally abundant. Sources convenient for water supply operations should be easy to locate and develop. Drinking water typically does not need to be cooled.

Cold

Cold areas of the world have an annual mean daily temperature of less than 32°F. In arctic regions, dominant water sources are unfrozen water underlying frozen rivers and lakes, or civilian and military constructed wells. Location and exploitation of water sources convenient for water supply operations may be difficult. The dispersion of suitable water sources will result in a large distribution requirement. Water treatment, storage, and distribution systems may require augmentation with additional equipment to prevent freezing. Individual consumption should be greater than in temperate regions to prevent dehydration.

Summary of climatic conditions and daily cycles of temperature, solar radiation, and relative humidity as described by North Atlantic Treaty Organization Standardization Agreement (NATO STANAG) 4370, Allied Environmental Conditions and Test Publication (AECTP)–230, MIL–HDBK–310, and MIL–STD–810

Table B-1. Summary of Climactic Conditions, AR 70-38 (26 June 2020), pg. 6-7

Climatic		Operational Conditions				Storage and Transit Conditions			Natural Environment Exposure
		Ambient Air Temperature		Solar Radiation	Ambient Relative	Induced Air Temperature C (°F)		Induced Relative	
Design Type	Daily Cycle	Daily Low	Daily High	W/m2 (Bph3)	Humidity %RH4	Daily Low	Daily High	Humidity %RH	C (F)
Hot	Hot Dry (Arid)	32 (90)	49 (120)	0 to 1120 (0 to 355)	8 to 3	33 (91)	71 (160)	7 to 1	32 to 49 (90 to 120)
	Hot Humid (Tropical)	31 (88)	41 (105)	0 to 1080 (0 to 343)	88 to 59	33 (91)	71 (160)	80 to 14	Coastal Desert
Basic (Temperate)	Basic Hot	30 (86)	43 (110)	0 to 1120 (0 to 355)	44 to 14	30 (86)	63 (145)	44 to 5	0 to 43
	Intermediate 6	28 (82)	39 (102)	0 to 1020 (0 to 323)	78 to 43	28 (82)	58 (136)	See note 5	(32 to 110)
	Variable High Humidity	26 (78)	35 (95)	0 to 970 (0 to 307)	100 to 74	30 (86)	63 (145)	75 to 19	Humid
	Constant High Humidity	Nearly Constant 24 (75)		Negligible	95 to 100	Nearly Constant 27 (80)		95 to 100	Tropics
	Mild Cold 6	–19 (–2)	–6 (21)	Negligible	Tending toward saturation	–21 (–6)	–10 (14)	Tending toward saturation	0 to –32

Climatic	Daily Cycle	Operational Conditions				Storage and Transit Conditions			Natural Environment Exposure
		Ambient Air Temperature		Solar Radiation	Ambient Relative	Induced Air Temperature C (°F)		Induced Relative	
		Daily Low	Daily High	W/m2 (Bph3)	Humidity %RH4	Daily Low	Daily High	Humidity %RH	C (F)
	Basic Cold	-32 (-25)	-21 (-5)	Negligible	Tending toward saturation	-33 (-28)	-25 (-13)	Tending toward saturation	(32 to -25)
Cold	Cold	-46 (-50)	-37 (-35)	Negligible	Tending toward saturation	-46 (-50)	-37 (-35)	Tending toward saturation	-32 to -46 (-26 to -50)
	Severe Cold	-51 (-60)	-51 (-60)	Negligible	Tending toward saturation	-51 (-60)	-51 (-60)	Tending toward saturation	< -46 (< -50)
	Extreme Cold	-57 (-70)	-57 (-70)	Negligible	Tending toward saturation	-57 (-70)	-57 (-70)	Tending toward saturation	< -46 (< -50)

Figure B-2. Global Operational Environments, AR 70-38 (26 June 2020) pg. 26

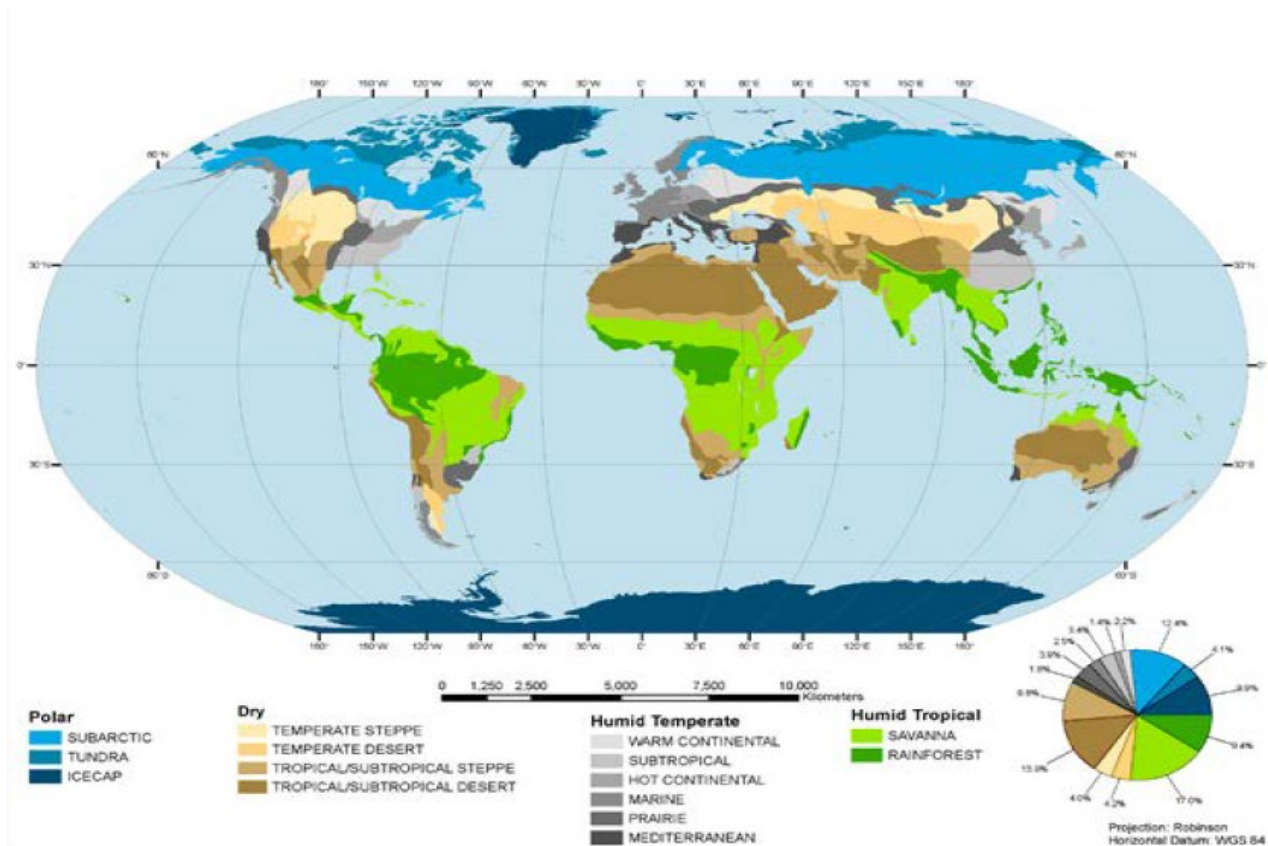


Figure 4-2. Global operational environments subdivided to the operational environments level

Planning Considerations for Extreme Cold Weather

Personnel

The TB MED 508, Prevention and Management of Cold-Weather Injuries (April 2005) published by the U.S. Army Research Institute of Environmental Medicine, highlights the following considerations related to the extreme cold weather water planning:

- Fluid requirements during cold-weather training will vary according to physical activity levels, but for most people, about 3 to 6 quarts per day need to be consumed. This includes the water that is in food. MREs only average about 7 ounces of fluid per meal (less than $\frac{1}{4}$ quart), so Soldiers will get less than 1 quart total fluid from three MREs. The best time for Soldiers to rehydrate is at mealtime. Soldiers usually drink most of their water with meals, and eating food improves water consumption. Soldiers must be provided with adequate time for meals and fluids. During mealtime, Soldiers can drink a variety of fluids (juice, tea, sports drink, coffee), as each will be equally effective in replacing body water. In addition, meals provide the salt intake necessary to retain body water. In addition to the water from MREs, Soldiers need to consume $\frac{1}{2}$ quart of fluid with breakfast, lunch, and dinner. Depending on the level of physical activity, Soldiers need to drink 1 to 4 quarts more fluid throughout the day. As stated in paragraph 3-7d, three canteens of water are needed to rehydrate the food when using MCWs. An additional 1 to 3 quarts need to be drunk throughout the day when using MCWs.
- Soldiers with access to water and time allowed to drink will maintain their hydration status during cold weather field training exercises. Dehydration becomes a problem when water is unavailable, there is insufficient time to drink, and workloads are very high. Drinking schedules need to be established and drinking needs to be encouraged and monitored. Providing water in the field can be logistically difficult due to the freezing of canteens, 5-gallon metal containers, and the tubing and mouthpiece of personal hydration systems. It is the responsibility of Soldiers to ensure that freezing of these containers does not occur. Canteens must be carried within clothing, and metal containers must not be left outside in below-freezing temperatures; adapters can be used to prevent freezing of tubing in personal hydration systems. Accordingly, there must be sufficient time planned for melting and purifying snow/ice. Unmelted snow must not be consumed because it can lower body temperature and may not be potable.
- Soldiers can monitor hydration status by noting the color and volume of their urine. Dark, low volume, and infrequent urination indicates that fluid consumption needs to be increased. Likewise, frequent and large volumes of clear urine indicate that fluid replacement needs to be reduced. Soldiers must not avoid urination during cold-weather operations, because a full bladder can prevent individuals from getting restful sleep. Full bladders can also be an irritant and interfere with a Soldier's ability to sustain physical performance
- Movement in cold terrain results in added metabolic cost which means that planners should consider heavy load drinking water factors. For example the cost of movement in soft snow can be 2.5 to 4.1 times greater than performing the same activity on a blacktop surface.

- Importance of layering: wearing bulky, cold weather clothing could contribute to water loss; during more vigorous activities, sweating rates can achieve levels in excess of 1 L/h.

Equipment

The Center for Lessons Learned collection and analysis team from across the Centers of Excellence conducted a DOTMLPF study during U.S. Army Alaska's annual Arctic Warrior exercise (FEB 2021). The U.S. Army Quartermaster School, Petroleum and Water Department Observation captured the following observations related to the water production and distribution equipment performance in extreme cold environment:

- Water assets require tents and heating operate. Water supply and treatment is especially challenging in the cold. U.S. Army tactical water purification systems require a winter kit to operate between 32 and -25°F (0 and -32°C). Water storage may require heating. Water source exploitation may require anchoring or drilling through ice. This proved to be challenging as the water source exceeded the length of the TWPS suction hoses and pumps. Additionally, the auger that comes with the system proved to be inadequate to navigate through the thick layer of ice. A commercial off the shelf (COTS) auger had to be used, and even that presented challenges as the hole kept freezing over from the low temps.
- Water distribution assets (Hippos) do not operate well in extreme temperatures. Water distribution systems are subject to freezing and clogging from frazil ice. The heater in the Hippo is not capable enough to keep the water from freezing, and because the unit lacked the PLS, it was forced to use the LHS and therefore to put less water into the Hippos (to reduce the weight), further facilitating the water freezing.

(*source: After Action Review published by SGM Eduardo Carranza, Petroleum and Water Department Observation, para 5.1: Water Storage/Distribution)

ATP 4-44, Water Support Operations, Appendix C, Arctic and Extreme Cold Weather Considerations, provides more details with regards to personnel and equipment.

Appendix C Water Acceptability and Water Inspection

Potable water is treated (including disinfection) water that has been determined to meet potable water quality standards, and certified as so, by Preventive Medicine (PM) personnel. PM personnel review the results of water quality tests that are performed in the field as well as at approved remote laboratories, and compare those results to the appropriate Military Field Water Standards. If the water meets the standard, the evaluating PM personnel will declare it to be potable and approve it for distribution to personnel for drinking and all other water uses.

Potable water is required for the following activities: drinking, ice making, food preparation and equipment cleaning, medical treatment and equipment sanitization, personal hygiene (brushing teeth, shaving, and showering), mortuary affairs operations, and CBRN decontamination (refer to TB Med 577).

Non-potable water is water that has not been determined to be safe for human consumption. Any water in the field, whether raw or treated, that has not been approved for consumption by the theater/command surgeon's representative (normally a PVNTMED specialist) is considered non-potable. PVNTMED or using-unit personnel will identify non-potable water sources (such as taps or spigots) with signs that read "NONPOTABLE WATER. DO NOT DRINK."

PM personnel may approve the use of non-potable water for certain activities. If non-potable water is used, it is preferable to use fresh water whenever possible. Brackish and saltwater are minimally acceptable and may lead to significant corrosion if used. Non-potable water, as outlined in TB MED 577, falls into different classes based on filtration and suitability for the following activities: laundry (water must meet quality standards outlined in TB MED 577), engineer construction, vehicle and aircraft maintenance (water must meet quality standards outlined in aircraft technical manual), vehicle and cargo washing, CBRN decontamination (refer to TB MED 577), firefighting, pest control, dust control.

CBRN-contaminated water will be treated only as a last resort if no other source exists. If water must be treated in a contaminated environment (that is, CBRN weapons have been extensively used on the battlefield and uncontaminated areas are nonexistent), containerize the treated water to prevent further post-treatment contamination. Surface water sources should be avoided, and ground-water sources should be used if possible. If contaminated source water must be treated, the treatment equipment must be thoroughly decontaminated before it is used again. Chemical corps and PVNTMED personnel should be consulted for proper decontamination procedures for the equipment and for protective measures for individuals performing the decontamination.

Acceptable uses of different classes/quality of water in the field and associated caveats in accordance with TB MED 577 (Table 2-12)

The Military Field Water Standards (MFWS) consist of short- and long-term drinking water standards with no reference to the amount of water ingested each day.

(1) The Short-Term Potability (STP) standards are designed to prevent acute illness and support mission readiness. Most of the STP standards can be tested for using field test

equipment. Samples must be collected and delivered to a DOD-approved laboratory capable of performing the required tests for those contaminants or properties that cannot be adequately evaluated using field test equipment. ROWPU-treated water that meets the STP standards may be used for drinking water (including packaged field water) during at least the first 30 days of deployment without adverse health effects. (TB MED 577, Table 4-2)

(2) Beyond 30 days, the Long –Term Potability (LTP) standards apply for bulk potable water production sites and for military packaged field water. In practice, deployed personnel usually drink commercially bottled water in deployments at least until adequate military or contract water treatment and distribution systems, including bottling and packaging systems, are established. (TB MED 577, Table 4-4)

Figure C-1. Water Acceptability

Water Class/Quality	Acceptable Activities
Class I – Potable a. ROWPU Treated Water b. Bottled Water c. Packaged Field Water d. Approved Municipal Water e. Approved Ground Water	a. Drinking water b. Brushing teeth c. Showers and personal sanitation ¹ d. Dining facility operations e. Ice production for food preservation and cooling f. Medical treatment g. Potable water hose and pipeline testing and flushing
Class II² a. Disinfected³ Filtered⁴ Fresh Water b. Disinfected³ Fresh Water c. Treated Shower and Laundry Water⁵	a. Decontamination of personnel ¹ b. Heat casualty body cooling ¹ c. Well development d. Graves registration personnel sanitation e. Retrograde cargo washing
Class III – Not Potable a. Untreated Fresh Water	a. Vehicle coolant b. Aircraft washing c. Pest control d. Field laundry e. Concrete construction f. Well drilling
Class IV⁶ – Not Potable a. Brackish Water b. Seawater	a. Vehicle washing b. Electrical grounding c. Fire fighting d. Chemical, biological, radiological, and nuclear (CBRN) decontamination of materiel e. Dust control ⁷

Notes:

¹ Permission to use other than potable water for these activities requires a risk assessment by PM assets and approval by the commander.

² For some surface and ground water sources, class II a and II b waters may meet short- and/or long-term potability standards, and may be used for drinking water, with PM and command approval. Such use would require a 2 mg/L FAC residual after a 30- min contact time prior to distribution.

³ For nonpotable water, disinfected means having at least a 1 mg/L FAC residual after a 30-min contact time and at the time of use.

⁴ Fresh water that has been filtered through multimedia filters, microfilters, or ultrafilters, and possibly RO concentrate water from fresh water treatment operations, depending on its quality, may be disinfected and used in lieu of or in preference to disinfected fresh water, with PM and command approval.

⁵ Applies to Force Provider operations only, and has specific treatment and operational monitoring requirements specified in a 2004 Office of The Surgeon General memorandum and USACHPPM Information Paper (IP) 31-027.

⁶Brackish and seawater are minimally acceptable and may lead to significant corrosion if used; therefore, fresh water should be used if possible. ROWPU brine from seawater desalination operations may not be used.

⁷Use of nondisinfected water or any kind of wastewater, treated or not, for dust suppression requires the approval of the area medical authority, and is dependent on the quality of the water and on the potential it poses for human contact with pathogenic microorganisms.

Bulk Field Water Sampling and Testing

Water treatment system operators should notify the appropriate PM element as soon as possible after field water treatment and disinfection operations are fully functional. PM personnel inspect the water treatment system and test the treated water using field test equipment to ensure that it meets short term potability (STP) standards. If the field test results confirm that the water meets the STP Standards, PM personnel will declare the water potable for short-term (30 day) usage and approve it for distribution for drinking and all other uses. It takes PM personnel approximately 24 hours after inspecting the site and collecting water samples to complete the field testing and initially approve a water production point.

At the same time as STP testing, the inspecting and testing PM personnel should collect and submit raw water source samples as well as treated water samples for initial Long Term Potability (LTP) testing using the appropriate Advanced Water Test (AWT) kit. LTP testing is required to evaluate the suitability of treated water to be used for drinking water for longer than 30 days. If a water production site has been approved for potable water distribution under the STP Standards and samples for LTP testing have been collected and submitted, but the results are not received before the 30th day of operation, PM should again test the water to confirm it meets the STP Standards then declare it potable for an additional 30 days of use. This may be repeated, as necessary, until AWT results are received. If PM personnel are not available then Senior Water Treatment Specialists can distribute the water based proper treatment system operation and their water quality testing capabilities. In this case, the local medical authority or reach back Surveillance Center should be consulted.

Following initial STP and LTP testing, PM personnel should test product water using field test equipment at established potable water production points at the frequencies recommended in table 4-6 of TB MED 577

Recommended frequencies for periodic PM testing of potable water production, storage, and distribution systems in accordance with TB MED 577 (Table 4-6)

Table C-1. Water Sampling Frequency

Parameter	Sampling Frequency				Recommended test method
	ROWPU water production points	Distribution systems ³	Stand-alone storage ⁴	Bottled/ packaged field water	
Coliforms ¹ (total and <i>E. coli</i>)	Weekly/monthly	Monthly	Weekly/Monthly	Monthly ⁵	P/A
TDS ¹	Weekly/monthly	-	-	-	TDS meter
Chlorine residual ¹	Weekly/monthly	Weekly	Daily	-	DPD test
Temperature ¹	Weekly/monthly	Monthly	-	-	Thermometer
pH ¹	Weekly/monthly	Monthly	Daily	-	pH tester/ phenol red test
Color/odor ¹	Weekly/monthly	-	-	-	Color disk
Turbidity ¹	Weekly/monthly	-	-	Monthly/ visual	Turbidimeter
Arsenic	Quarterly	-	-	-	Test strips
Cyanide	Quarterly	-	-	-	Test strips
Magnesium	Quarterly	-	-	-	Titration/test strips
Chloride	Quarterly	-	-	-	Test strips
Sulfate	Quarterly	-	-	-	Test strips
Radiological	Quarterly	-	-	-	Laboratory analysis
AWT ²	Semiannually/ annually	Semiannually/ annually	-	Event-driven	Laboratory analysis
Chemical agents	Threat-related ⁶	-	-	-	M272 chemical agent test kit

Legend: TDS = total dissolved solids; P/A = presence/absence; DPD = N,N- diethyl-p-phenylenediamine; AWT – advanced water testing

Notes:

¹ These parameters should be monitored weekly during the initial phase of field operations, and monthly as the theater matures and the water system is stabilized.

² AWT samples are collected using the deployment field water sample kit available from USACHPPM, described in para 4-12, and submitted to a fixed facility laboratory for analysis.

³ Where a host nation distribution system or the tactical water distribution system (TWDS) is used.

⁴ Includes representative sampling of Water Buffalos, Hippos, and other storage tanks not connected to or part of a distribution system (e.g., 10%).

⁵ See para 4-14d for detailed information.

Field Water System Inspection Requirements

Preventive medicine personnel should participate in all phases of operational planning and preparation of the plan to provide potable water during deployments. Preventive medicine participation is important because it helps ensure successful execution of the water support mission. In accordance with TB MED 577, field water treatment systems should be inspected by preventive medicine at least semiannually in the operating mode in garrison to ensure deployment readiness. Potable water containers such as water trailers, tank racks, and fabric tanks or drums should also be inspected prior to deployment, and then periodically throughout the deployment. During deployments, PM assets should inspect components of field water systems at the frequencies recommended in TB MED 577 (shown in Table 16-1 below).

Recommended inspections and frequencies during deployments in accordance with TB MED 577 (Table 16-1)

Table C-2. Field Water Inspection Frequency

WHAT	WHO			WHEN		
	PM	Owners	Operators	Initial	At and after 30 days	Additional Notes
Raw water sources	X			X		Annual Sanitary Survey Annual AWT
Water purification points	X			X	Monthly	Semiannual AWT
			X	X	Hourly	FAC, Turbidity, TDS, pH
Storage and distribution facilities	X			X	Monthly	Inspect and FAC
		X	X	X	Daily	Inspect and FAC
Bottled water storage	X			X	Monthly	10 bottles/lot sampling until lot is exhausted
Unit potable water containers	X			X	Monthly	Inspect and direct cleaning and disinfection as needed
		X			2 x Daily	FAC
Bulk storage	X			X	Monthly	Disinfection
		X	X	X	Daily	FAC
Mobile water storage and delivery	X			X	Monthly	Semiannual Disinfection
		X	X	X	Daily	Logs
Fabric tanks and drums	X			X	Monthly	
		X		X	Hourly, Daily	FAC
Showers and personal sanitation points	X			X	Monthly	Cleanliness, FAC
		X	X	X	Daily	Cleanliness, FAC
Supplies		X		X	Weekly	Order early

Preventive Medicine Responsibilities

Army PM support is organized into five levels based on level capability, rather than echelon or location in the operational environment. The field water-related tasks for each level of PM support are shown in Table 12-2 of TB MED 577.

Levels of PM support to field water operations in accordance with TB MED 577 (Table 12-2)

Table C-3. Preventive Medicine Responsibilities

Level	Description	Roles	Tasks
I	Unit FST	Assess local unit treated water supplies.	Inspect water containers and trailers; test unit water supplies for chlorine and add additional chlorine when needed; report problems and concerns to unit commander and supporting PM section (Level II).
II	PM sections of divisions, separate brigades, armored cavalry regiments, and area support medical battalions	Identify/assess medical threats; oversight surveillance of potable water supplies and related contracts; train FSTs; provide commanders with recommendations to minimize adverse health effects arising from water-related risks.	Identify and coordinate with logistical elements for needed PM materials; use field test kits to screen water supplies and certify them as potable; conduct sanitary surveys and perform additional sampling; coordinate with Levels III–V to characterize risks associated with identified water contaminants; recommend C/ORM strategy and courses of action to command elements to minimize health risks.
III	Medical detachments, PM	Augment and support FST and Levels I and II PM personnel and provide unique capabilities.	Collect and analyze samples; conduct epidemiological investigations; provide technical consultation.
IV	AML PM support (normally allocated based on the anticipated medical threat); other military units/organizations for specific technical support	Augment and support PM Levels II and III, and provide unique capabilities.	Provide more advanced laboratory analytical support and technical consultative services.
V	USACHPPM – resource for technical information, sampling assistance, and laboratory support	Maintain all deployment-related environmental (including drinking water) data; augment and support PM Levels II–IV and provide unique capabilities.	Archive exposure data and provide more advanced laboratory analytical support and technical consultative services regarding health risks and preventive measures.

Appendix D Water Production

The Army has three water purification systems, each with different capabilities, designed for different type of units based on their mission and support requirements. The three systems are the 125 gallons-per-hour (GPH) Lightweight Water Purifier (LWP), the 1,500 GPH Tactical Water Purification System (TWPS), and the 3,000 GPH Reverse Osmosis Water Purification Unit (ROWPU).

125 GPH Lightweight Water Purifier (LWP)

The LWP gives sustainment and composite supply companies the ability to produce a safe, reliable supply of potable water to support early entry, highly mobile forces across the range of military operations, entailing everything from humanitarian assistance, limited contingency operations, or large-scale combat operations. The LWP provides quality water support to small units and detachments where distribution of bulk water is not feasible, necessary, or practical. The LWP provides water support without committing larger water production assets from the logistics support structure. It tailors water production flow rates to the demands of independent special operations forces, detachments, and units typically engaged in remote site missions. The system includes a potable water dispensing capability that interfaces with military fixed holding tanks. The LWP can purify water from all water classifications, to include CBRN contaminated water. See TM 10-4610-310-13 for more information.

Figure D-1. Lightweight Water Purifier (LWP)



LWP Characteristics, Capabilities, and Features

System Description:

- Uses ultra-filtration and reverse osmosis (RO) technology to produce potable water from virtually any raw water source.
- Produces 125 GPH from freshwater and 75 GPH from saltwater of 20,000 mg/l.

- Includes a 3kW Tactical Quiet Generator Set.
- 1000 gal potable water storage capacity.
- The LWP can be transported in a high mobility multipurpose-wheeled vehicle or TRICON storage container to the operational site. It can be sling-loaded by helicopter or transported in fixed wing aircraft.
- The LWP is designed for operation from -25°F to 120°F (-32°C to 49°C). At freezing temperatures, a cold weather kit is necessary and requires an additional 3kW Tactical Quiet Generator and tent for operation. At temperatures higher than 120°F (49°C), the LWP may not function properly because of a possible decrease in power output from the 3kW Tactical Quiet Generator.
- The complete LWP unit weighs less than 1833 lbs. (831.45 kg) without the cold weather kit and 1995 lbs. (904.93 kg) with the cold weather kit.

Personnel Requirements:

- Equipment can be unloaded with four to six personnel and set up and operated with at least two personnel.

Consumable Requirements (Chemicals, Filters, and RO elements) expressed in 5-day/100 operational-hour increments:

- Table D-1 lists the expendable and durable materials items needed to operate and maintain the LWP.

Table D-1. LWP Consumable Requirements
(Estimated Consumable Requirements for 125 GPH LWP, 100 Hours of Operation)

NSN/Part Number	Nomenclature	Unit of Issue	Quantity
6810-01-527-4039	Acid, Citric, M217, Powder Form, 5.5 Pound Box	BX	1
6850-01-527-4119	Antiscalant, M321, Liquid Form, 32 Ounce Bottle	BT	1
6810-01-527-4028	Bisulfite, Sodium, M323, 980 Gram Container	BX	1
6850-01-527-4116	Cleaner, RO Membrane, M326, High pH, 6 Pound Box	BX	1
6850-01-527-4111	Cleaner, RO Membrane, M326, High pH, 6 Pound Box	BX	1
6850-01-527-4102	Coagulant (Flocculant), M322, Liquid Form, 32 Ounce Bottle	BT	1
6850-00-294-0860	Compound, O-ring, Lubricant, Dow Corning 111	TU	2
PN: 4100334105 (MECO)*	Detergent, M334, Powder Form,	LB	1
PN: 4100333001 (MECO)*	Detergent, M331, 32 Ounce Bottle Cleaning Comp. Membrane	BT	1
6840-00-255-0471	Hypochlorite, Calcium (HTH), 6-ounce bottle (Disinfectant)	BT	1
PN: 02450 (Clorox)*	Hypochlorite, Sodium (Bleach), 24 Ounce Bottle	QT	1
6810-01-527-4074	Solution, Buffer, 15 ppm, 1 Pint (Solution, Standard)	QT	1
6810-01-399-1289	Solution, Buffer, 30,000 ppm, 1 Pint (Solution Standard)	QT	1
6850-01-487-8860	Solution, Calibration, Turbidity Meter	BT	1
6850-01-487-8875	Solution, Calibration, Turbidity Meter	BT	1
6850-01-487-8862	Solution, Cleaning, Turbidity Meter	BT	1

NSN/Part Number	Nomenclature	Unit of Issue	Quantity
6810-01-528-3706	Solution, Storage, pH Cell	QT	1
NA	Unit Package, chemical, for 140 hours of Operations	PG	1
7920-00-543-6492	Wipes, Disposable (Towel, Paper)	BX	1

* NSN listed in TM is obsolete. Listed are either the new replacement NSNs OR part numbers (if there's no replacement NSN). Recommend validating listed part numbers as they could change.

Note: Unit of Issue (U/I): BT = Bottle, BX = Box, EA = Each, PG = Package, CO = Container, PN= Part Number, QT = Quart

Area Requirements:

- Positioned no greater than 50 feet from raw water source.
- Area requirement is 75 feet by 75 feet.

1,500 GPH Tactical Water Purification System (TWPS)

The TWPS gives Distribution, Composite, and Water Support Companies a fully contained mobile water purification system that is capable of purifying, storing and dispensing water that meets Military Field Water Standards for long-term consumption. The TWPS is intended to supply potable water to ground, amphibious and air-mobile units of the U.S. Army and Marine Corps. It can also be used to provide potable water support to civilian agencies or host nations for emergencies, disaster relief, humanitarian efforts, and peacekeeping missions. The TWPS can purify water from all water classifications, including CBRN contaminated water. There are two versions of the TWPS; A-TWPS (Army) and MC-TWPS (Marine Corps). See TM 10-4610-309-10 for more information.

Figure D-2. Tactical Water Purification System (TWPS)



TWPS Characteristics, Capabilities, and Features

System Description:

- Utilizes micro-filtration and RO technology to produce potable water from virtually any raw water source.
- Produces 1,500 GPH from freshwater and 1,200 GPH from saltwater (temperature dependent).
- The A-TWPS includes a 60 kW Tactical Quiet Generator.
- A-TWPS has an extended distribution kit that increases potable water storage capacity from the standard 6,000 gallons to a total capacity of 15,000 gallons and increase total distribution flow from two nozzles to four nozzles.
- The TWPS can be mounted on Army (LHS, PLS, trailers) and Marine Corps (medium tactical vehicle replacement-MTVR) transport vehicles. The system frame is ISO compatible.
- The TWPS is designed for operation from -25°F to 120°F (-32°C to 49°C). The winterization kit must be used if the operating temperature is below 32°F (0°C) and source water cannot be a temperature greater than 100°F (38°C).
- A fully packed A-TWPS weighs 22,588 lbs. less fuel.

Personnel Requirements:

- Equipment can be set up and operated with at least three personnel.

Consumable Requirements (Chemicals, Filters, and RO elements) expressed in 5-day/100 operational-hour increments:

- Table D-2 lists the expendable and durable materials items that are needed to operate and maintain the TWPS.

Table D-2. TWPS Consumable Requirements
(Estimated Consumable Requirements for 1500 GPH TWPS, 100 Hours of Operation)

NSN	Nomenclature	UI	Quantity
6850-01-528-9972	Antiscalant	BX	1.72
6840-00-238-8115	Calcium Hypochlorite, Disinfectant, 5 lb. bottle	BT	4.225lb
6810-01-527-0515	Citric Acid, 20-Pound Bucket	CO	7lb
PN: 803-A-7884 (AquaChem)*	High pH Cleaner, 50-lb	BX	50
6810-01-527-4590	Sodium Bisulfite, 12 oz bags, container of 10	BX	12oz
The following items provide an additional 100 hours of operation if treating water contaminated by Radiological or CW agents.			
6810-01-527-0524	Media, Resin, Package of 6 Bags Ion Exchange Compound	PG	1
6810-01-527-0537	Media, Carbon, Package of 4 Charcoal, Activated	PG	1
6810-01-527-0510	Sodium Hydroxide (Caustic), 1 Gallon Bottle	BX	2
The following items provide an additional 100 hours of operation if operating on a chlorinated water source.			

NSN	Nomenclature	UI	Quantity
6810-01-527-4590	Sodium Bisulfite, 12-Ounce Bags, Container of 10	BX	1
The following items are additional items required to perform the Preventive Maintenance Checks and Services every 100 hrs.			
4310-01-460-7980	Cartridge, purifier	EA	0.33
4310-01-460-3415	Filter element, air	EA	0.11
2910-01-310-6566	Filter, Fuel, Diesel Pump	EA	2
2940-01-310-4495	Filter, Air, Diesel Pump	EA	2
9150-01-421-1427	Lubricating Oil, Engine, 1 qt bottle, SAE 15W-40	QT	2
	Filter Element, Water (MF) 4610-01-526-3570 12ea		
	Filter Element, Fluid (RO) 4330-01-454-5502 10ea		

* NSN listed in TM is obsolete. Listed are either the new replacement NSNs OR part numbers (if there's no replacement NSN). Recommend validating listed part numbers as they could change.

Note: Unit of Issue (U/I): BT = Bottle, BX = Box, EA = Each, PG = Package, BG = Bag, CO = Container, PN= Part Number, QT = Quart

Area Requirements:

- Positioned no greater than 330 feet from raw water source.
- Area requirement is 75 feet by 100 feet.

3,000 GPH Reverse Osmosis Water Purification Unit (ROWPU)

The 3,000 GPH ROWPU gives sustainment and distribution companies a fully contained mobile water purification system capable of purifying, storing, and dispensing water that meets Military Field Water Standards for long-term consumption. A ROWPU is contained in a special 8 ft. x 8 ft. x 20 ft. ISO container with skid-mounted external components, all mounted on a M871 30-foot trailer. ROWPUs are used to support large-scale military operations because the ROWPUs have the highest production capability of all three water purification systems. The ROWPU purifies all classifications of raw water to make potable water, including CBRN contaminated water. See TM 10-4610-232-13-1 and TM 10-4610-232-13-2 for more information. (Note: The 600 GPH ROWPU is no longer used but may be referenced in some other literature)

Figure D-3. Reverse Osmosis Water Purification Unit (ROWPU) 3,000 Gallons



ROWPU Characteristics, Capabilities, and Features

System Description:

- Utilizes media filtration and RO technology to produce potable water from virtually any raw water source.
- Produces 3,000 GPH from temperature dependent.
- ROWPU is powered by a 60 kilowatt (kW) utility diesel generator.
- The distribution system includes three 3,000-gallon storage tanks, a distribution pump, and two distribution nozzles.
- ROWPU is mounted on standard 30 ft. (9.5 m) M871 military trailer for simplified relocation and can be shipped by military aircraft.
- Contained in a special 8 ft. x 8 ft. x 20 ft. (2.4m x 2.4m x 6.1m) ISO container with skid-mounted external components.
- Operates in temperatures from -25°F to 110°F (-32°C to 43°C). Winterization kit must be used if the operating temperature is below 32°F (0°C), and the source water temperatures cannot be greater than 110°F (43°C).
- Model WTA-060 weighs 37,960 lb. and ROWPU-1 weighs 37,650 lb., ready for transport and deployment.

Personnel Requirements:

- A three-person team that includes an NCO sets up and operates the 3000 GPH ROWPU.

Consumable Requirements (Chemicals, Filters, RO) elements expressed in 5-day/100 operational-hour increments:

- Table D-3 lists the expendable and durable materials items that are needed to operate and maintain the 3,000 GPH ROWPU.

Table D-3. ROWPU Consumable Requirements
(Estimated Consumable Requirements for 3,000 GPH ROWPU, 100 Hours of Operation)

NSN	Nomenclature	Unit of Issue (U/I)	Quantity
PN: ABA-PLUS (Fendall Co) OR PN: C2128 / Cage: 6M644	<u>Eyewash Additive Fungicide</u>	BX	1
PN: KOCHKLEEN901 (Koch)*	<u>Cleaner, Membrane Low PH</u>	CO	1
6850-01-369-7897	Coagulant (Polyelectrolyte)	GL	4
6810-01-359-4918	Sodium Bisulfite	PG	7
6850-01-446-9518	<u>Cleaner, Membrane High PH</u>	CO	1
6810-01-359-5011	Citric Acid	BG	4
6810-01-358-4336	Hypochlorite, Calcium	BG	50
PIN G617318/CAGE: 53390*	Color Reagent	BT	1

NSN	Nomenclature	Unit of Issue (U/I)	Quantity
6850-01-362-2182	Sequestrant	BT	1
6810-01-200-8010	Sulfamic Acid Reagent	BX	1
6810-01-200-8009	Sulfite Reagent	BX	1
6810-01-358-4381	Sodium Thiosulfate	BT	1
<u>CLASS IX*</u>			
4330-01-350-9102	<u>CARTRIDGE FILTER ELEM 30"</u>	BX	5
<u>OR</u>			
4610-01-517-6621	<u>CARTRIDGE FILTER ELEM 40"</u>	BX	5
4330-01-350-9101	<u>AIR FILTER ELEMENT</u>	EA	5
4330-01-454-5502*	<u>RO ELEMENT (8-INCH)</u>	EA	12

* NSN listed in TM is obsolete. Listed are either the new replacement NSNs OR part numbers (if there's no replacement NSN). Recommend validation of listed part numbers as they could change.

Note: Underlined items must be ordered separately due to shelf life, transportation, low usage, or specific application purposes.

Estimated requirement for Membrane Cleaner is one 45-pound and one 40-pound drum each to complete two cleanings.

Legend: Unit of Issue (U/I): BT = Bottle, BX = Box, EA = Each, PG = Package, BG = Bag, CO = Container, PN= Part Number, QT = Quart.

Area Requirements:

- Positioned no greater than 200 feet from raw water source.
- Area requirement is 35 feet by 70 feet.

Appendix E Shower and Laundry Equipment

12-Head Shower System

Figure E-1. Shower System, 12-Head



System Description:

- The shower is a portable shower designed to be used in environments where ambient air temperature is above 32°F (0 °C). A portable hot water system provides heated water to the shower heads. An electric supply pump is used to supply the shower with water. An electric reciprocating pump is used to drain the water.
- With an unlimited water supply and continuous operation of the AWH-400 water heater, the 12-head shower can provide 7-minute showers for 500 people in a 20-hour period (4 hours must be set aside for maintenance). It can also produce 9 gallons of water per minute heated between 95 °F (35 °C) and 110 °F (43 °C)."

Personnel Requirements:

- Equipment can be set up by a team of six people and operated with at least three personnel.

Area Requirements:

- 30 ft. wide x 90 ft. long
- Overhead clearance higher than the TEMPER tent, Type II (10 ft. x 16 ft. x 32 ft.).

CAUTION: Special precautions must be taken to prevent damage to equipment when operating in temperatures below 32° Fahrenheit.

Laundry Advanced System (LADS)

Figure E-2. Laundry Advanced System (LADS)



System Description:

- LADS consists of two washing/drying drums. Each drum is capable of washing, rinsing, extracting, and drying 350–400 lbs. of laundry per hour to produce approximately 7,500 lbs. of laundry in a 20-hour day.
- In a field environment, it is more realistic to expect daily laundry outputs of approximately 5,000 lbs. per drum per day after accounting for laundry processing and over/undersized bags.
- Water Tank: 3,000 gallons.
- Water Capacity (initial charge): 460 gallons.
- Water Consumption per day: 540 gallons.

Personnel Requirements:

- Equipment can be set up by a team of five people lead by an NCO and operated with at least three personnel including one NCO.

Area Requirements:

- From Curbside: 4 feet (minimum)
- From Roadside: 8 feet (minimum)
- External Fuel Tank: at least 70 feet from LADS fuel connection point. Water Tank: within 100 feet from LADS water connection point. External Power Source: 100 feet (maximum) from LADS power connection point.

NOTE: LADS is scheduled to be removed from the CSC MTOE in FY25.

Containerized Batch Laundry (CBL)

Figure E-3. Containerized Batch Laundry



System Description:

- The CBL is the laundry system normally assigned to an Army Field Hospital and is designed to provide laundry services for direct patient-related linen, for ambulatory patients and direct patient care providers.
- It provides capability to wash and dry 150–200 lbs. of laundry per hour in an ISO Frame containerized system.
- The water reuse system recovers over 50% of the laundry waste water. It is capable of collecting gray water and transferring it to an approved gray water source.
- The CBL consists of two commercial 50-lb washers/extractions and 75-lb dryers mounted in an 8 ft. x 8 ft. x 20 ft. ISO container.

Personnel Requirements:

- Equipment can be set up by a team of five people lead by an NCO and operated with at least three personnel including one NCO.

Area Requirements:

- From Curbside: 4 feet (minimum)
- From Roadside: 8 feet (minimum)

Appendix F Water Storage

Bulk Water Storage Systems

The potable water storage and distribution system (WSDS) is the primary system used to store bulk water in a theater of operations. There are three types of WSDSs: a 40,000-gallon WSDS sometimes called the 40,000-gallon potable water distribution system (PWS/DS), a 100,000-gallon WSDS, and an 800,000-gallon WSDS. The systems can be configured in many different ways based on storage requirements and available terrain. The Force Provider water storage and distribution subsystem and gray water collection subsystem are expeditionary modular equipment sets that may be fielded to deployed units as part of a prepackaged base camp.

40,000-gallon WSDS (PWS/DS) Characteristics, Capabilities, and Features

System Description:

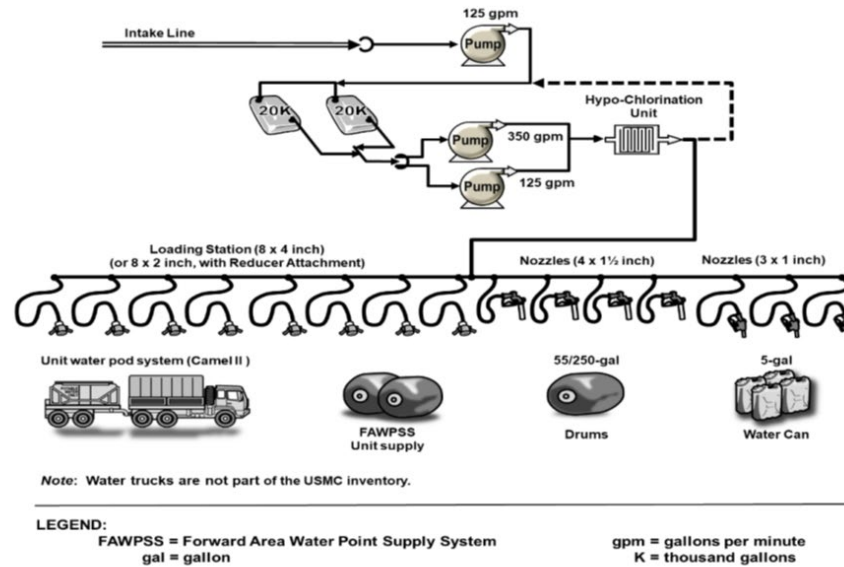
- The total capacity of each PWS/DS depends on the number and size of fabric tanks assigned and used.
- The 40K system has two 20,000 gallon tanks, a hypo-chlorinator, two 125 gallon-per-minute (GPM) pumps, and one 350 GPM pump (Figure F-1).
- The PWS/DS has the capability of receiving and distributing water to and from both the hose line and tank truck.
- Stored in multiple wooden crates and two water tank storage chests (two bags in each chest).
- No outside power requirements needed.

Personnel Requirements:

- PWS/DS is set up and operated by an 11-person crew.

Area Requirements:

- 120 ft. wide x 275 ft. long
- Square Footage: 33,000 sf (0.75 acres)

Figure F-1. Water Storage and Distribution System (WSDS), 40K

100,000 To 800,000 Gallon Water Storage & Distribution System

The WSDS is a modular storage system, which means that any combination of storage tanks may be used collectively or individually. The WSDS can be divided into four basic components: tanks, pumps, hypo-chlorinator, and distribution equipment. The 100,000-gallon system is equipped with two 50,000-gallon collapsible fabric tanks. The 800,000-gallon system is equipped with sixteen 50,000-gallon collapsible fabric tanks. Water can be issued to tank trucks, water trailers, FAWPSS, or small unit containers, such as five-gallon cans. EAB quartermaster water units are authorized to order, maintain, and operate WSDSs. WSDSs are assembled by ordering items from DLA or USAMC. See TM 5-4610-228-13 for more information.

WSDS Characteristics, Capabilities, and Features

System Description:

- The total capacity of each WSDS depends on the number and size of fabric tanks assigned and used.
- The 100K system has two 50K gallon tanks, one hypo-chlorination unit, one 350 GPM pump, one 125 GPM pump, and associated equipment (Figure F-2).
- The 800K system has sixteen 50K gallon tanks, two hypo-chlorination units, two 125 GPM pumps, and three 350 GPM pumps (Figure F-3).
- The WSDS has the capability to receive and distribute water to and from the hose line and the tank truck.
- Stored in TRICONS and water tank storage chests.
- No outside power requirements.

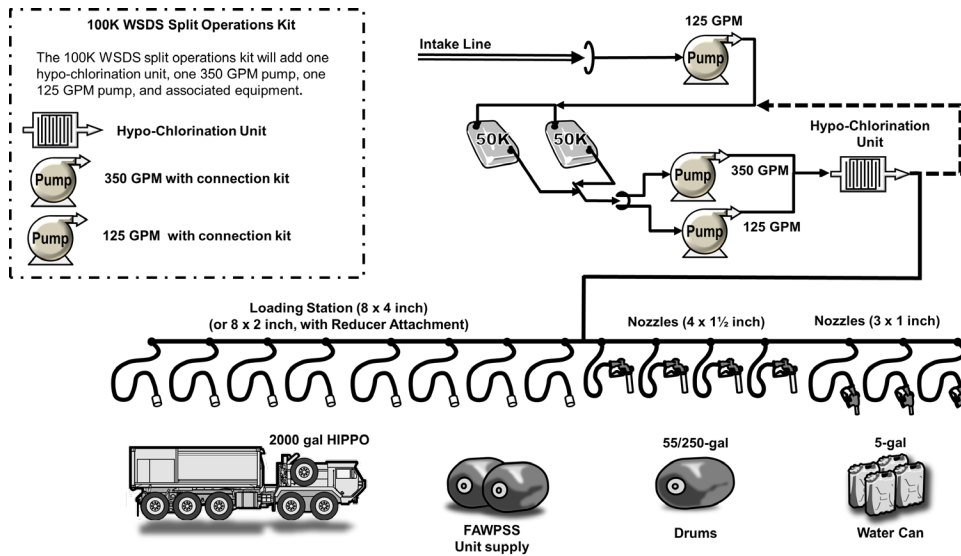
Personnel Requirements:

- WSDS is set up and operated by an 11-person crew.

Area Requirements:

- 260 ft. wide x 275 ft. long (minimum)
- Square Footage: 71,500 sf (1.6 acres)

Figure F-2. Water Storage and Distribution System (WSDS), 100K (emerging system projected fielding in FY25)



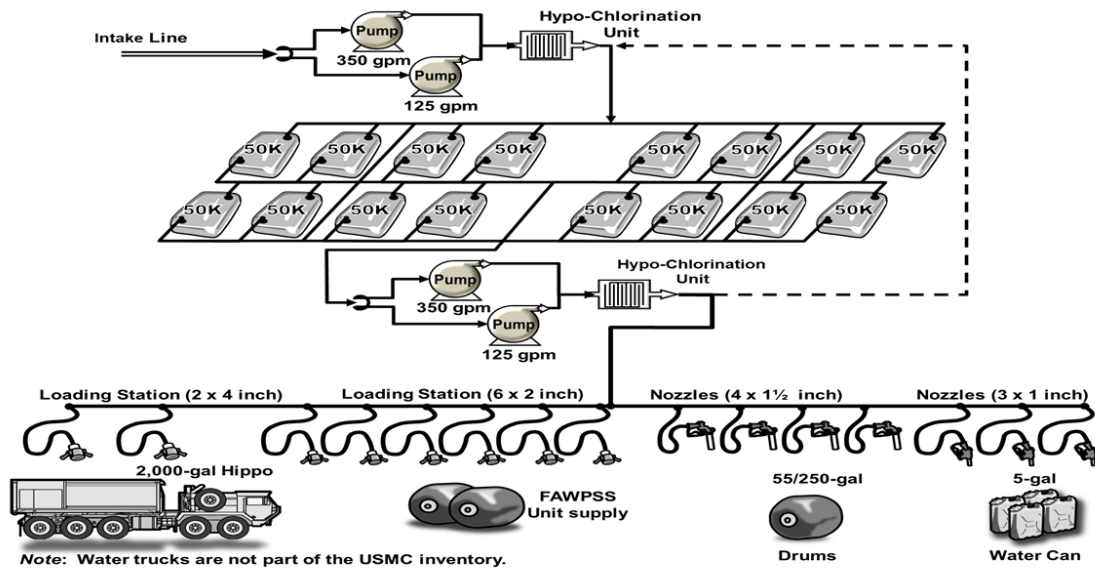
Note: Water trucks are not part of the USMC inventory.

LEGEND:

FAWPSS = Forward Area Water Point Supply System
gal = gallon
K = thousand gallons

GPM = gallons per minute
HIPPO = load handling system compatible water tank rack

Figure F-3. Water Storage and Distribution System (WSDS), 800K



LEGEND:

FAWPSS = Forward Area Water Point Supply System
gal = gallon
gpm = gallons per minute

Hippo = Load Handling System Compatible Water Tank Rack
K = thousand gallons

Appendix G Water Distribution Systems

The critical link in water supply operations is distribution to consuming units. Historically, each line company has been assigned water distribution equipment authorized by unit MTOE to use supply point distribution. Dispersed units carry water when they deploy and replenish by visiting a local approved water point or receive resupply via air-drop.

In a Division centric fight the organic Forward Support Companies and the Brigade Support Battalions coordinate, synchronize, and integrate each brigade's water requirements with the Division Sustainment Brigade (DSB) and its subordinate Division Sustainment Support Battalions (DSSB). In multidomain operations, the majority of water resupply to the maneuver brigades comes from the DSB and the Corps level Sustainment Brigade.

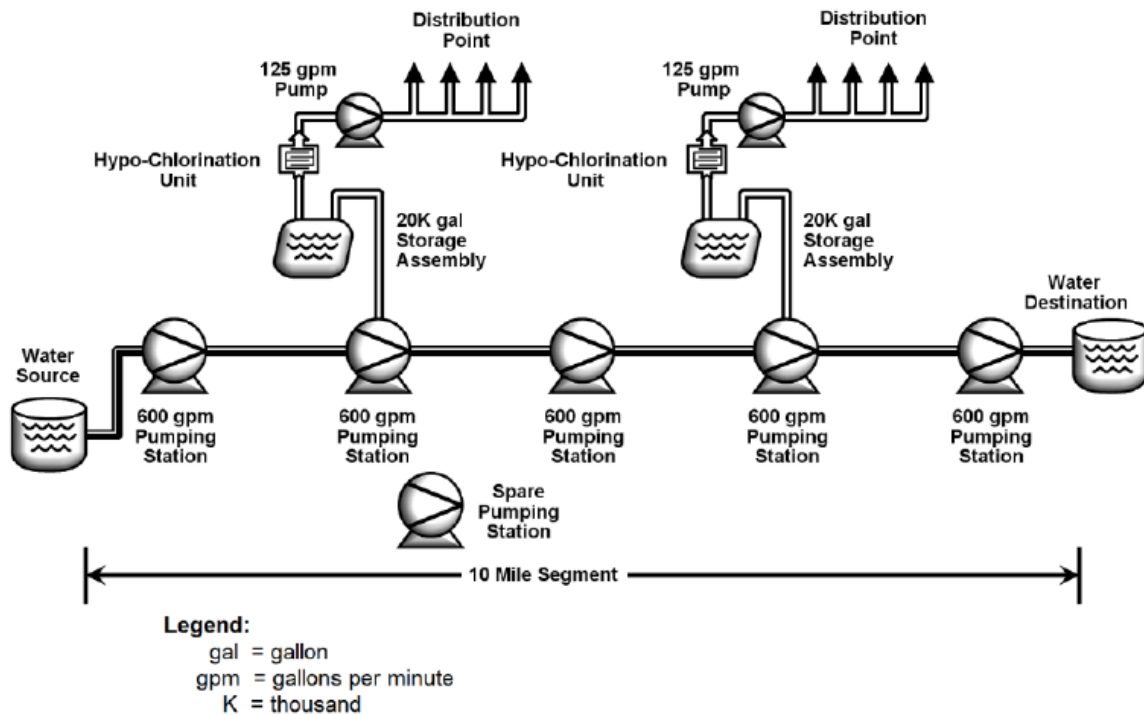
Water distribution systems range from a Tactical Water Distribution System (TWDS) to a five gallon water can. The type of distribution system employed depends on several factors:

- Consumption requirements
- Water purification and storage capability
- Location of supported units
- Distance from potable water source to issue point
- Environment and weather
- Physical space and security
- Other mission variables.

Tactical Water Distribution System (TWDS)

A TWDS is employed when large volumes of water must be moved from a water treatment area to a storage or distribution area. TWDSs are organic to Tactical Water Distribution (hoseline) Detachments that exist in the Army Reserve and Army National Guard. The mission of the tactical water distribution detachment is to distribute potable water via hoseline to corps and theater level units. Hoseline detachments typically lay, operate, and recover TWDSs for a water support company. See TM 10-4320-303-13 for more information.

Figure G-1. Tactical Water Distribution System, TWDS



TWDS Characteristics, Capabilities, and Features

System Description:

- The system consists of six 600 GPM pumping stations, a 10-mile hoseline segment, two storage assemblies, and two distribution points.
- The TWDS can transport 720,000 gallons of water within a 24-hour period (20 operational hours).
- 132 Flaking boxes: each with 500 feet of 6-inch discharge hose (10 miles).
- Capable of storing, distribution, and re-chlorinating 40,000 gallons of potable water
- No outside power requirements needed.
- The TWDS is stored in 33 TRICON and 6 ISO Containers.

Personnel Requirements:

- A TWDS is set up by a team of 8–15 personnel and operated by an 8-person crew.

Forward Area Water Point Supply System (FAWPSS)

The FAWPSS is a potable water distribution system that can receive, store, and issue drinking water. The system consists of 6 500-gallon fabric drums, 1 125 GPM pump unit, hoses, and dispensing nozzles. Two water drums (Model LAB 9095) or three water

drums (Model M105) are connected to the system at one time. These drums provide water by the suction of the pump to four distribution nozzles where the water is manually discharged. It is packaged and transported in a triple container. Fabric drums can be line hauled or sling loaded to forward units. Three fabric drums can fit on a PLS flat rack for movement. See TM 10-4320-346-12&P for more information.

Figure G-2. Forward Area Water Point Supply System (FAWPSS)

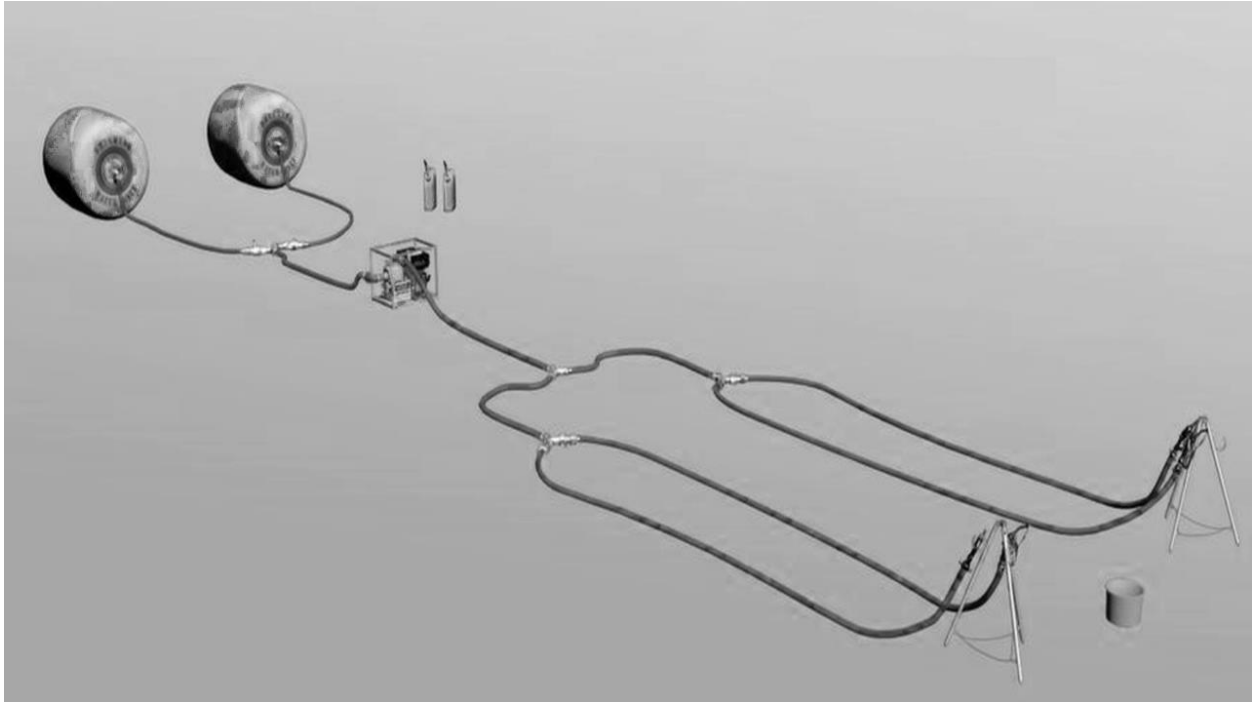
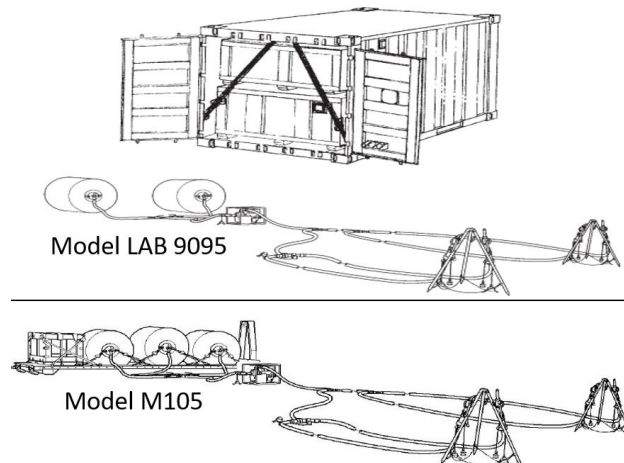


Figure G-3. Forward Area Water Point Supply System (FAWPSS)



FAWPSS Characteristics, Capabilities, and Features

Personnel Requirements:

- FAWPSS requires two personnel for set up, but can be operated by one person.

Area Requirements:

- 30 ft. wide x 120 ft.

2,000 Gallon Load Handling System (LHS) Compatible Water Tank Rack System (HIPPO)

The HIPPO is a mobile hard wall system used to perform bulk and retail potable water distribution and storage. The HIPPO consists of a 2,000 gallon capacity water tank rack with pump, filling station, 70 ft. hose reel, and bulk suction and discharge hoses. The filling station is capable of discharging water by gravity or using the on-board pump system. It is fully functional whether mounted or dismounted, and is mobile when it is full, partially full, or empty. The HIPPO prevents water from freezing during temperatures as low as -25°F. The tank consists of an inner shell, heating blankets, and an outer shell, secured by tank banding straps. It is compatible with the Heavy Equipment Mobility Tactical Truck, LHS truck, PLS truck, and PLS trailer. The LHS truck cannot lift the Hippo from the ground when fully loaded because the HIPPO weight exceeds the LHS maximum lifting capabilities and may damage the hydraulics system. See TM 10-5430-244-10 for more information.

Figure G-4. HIPPO, 2,000 gallon



System Description:

The HIPPO has the ability to store and distribute 2,000 gallons of potable water (both unit and supply point distribution) and is capable of being transported by highway, rail, marine, and air worldwide without disassembly.

- Can be transported using the HEMTT-LHS truck, PLS truck, and PLS trailer.
- Along with the Filling Station, the Hippo can dispense water using the two-inch nozzle and 70 ft. of discharge hose in 3 sections—35 ft., 20 ft., and 15 ft.
- The on-board centrifugal pump has a capacity of 125 GPM.

Weight:

- HIPPO empty 9,060 lb.
- HIPPO with 2K gallons of water: 25,942 lb.

Personnel Requirements:

- HIPPO requires two personnel for set up, but can be operated by one person.

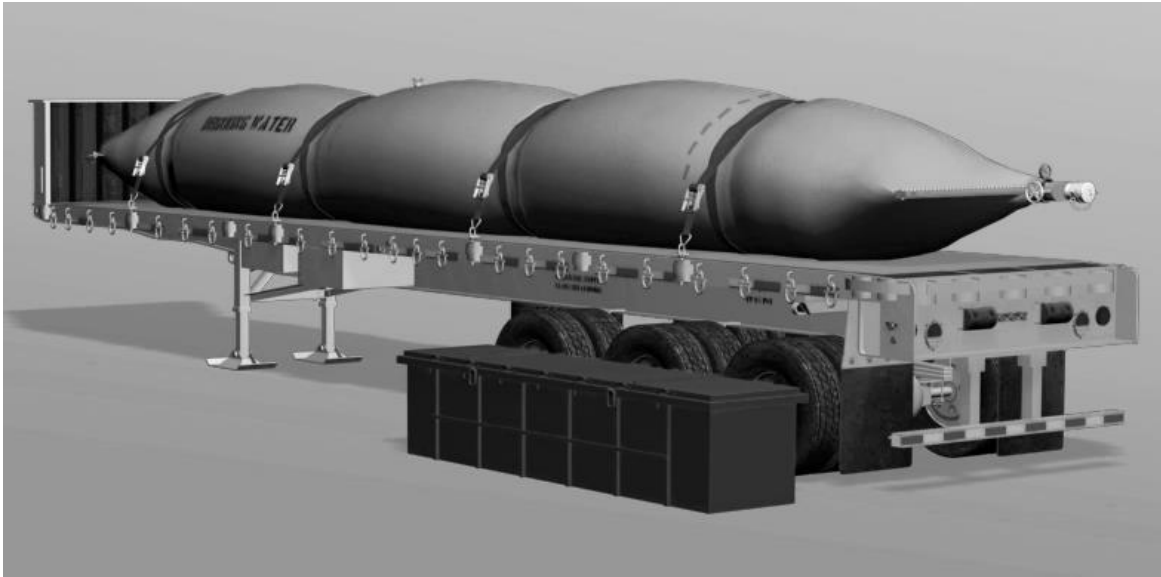
Area Requirements:

- 8 ft. wide x 20 ft. long (30 ft. wide x 40 ft. long on the ground)

WARNING: The LHS truck cannot lift the Hippo from the ground when fully loaded because the HIPPO weight exceeds the LHS maximum lifting capabilities and may damage the hydraulics system. The HIPPO water load needs to be reduced to 1,765 gallons to be safely lifted by the LHS arm. After the HIPPO is positioned on the LHS, it can be topped off to 2,000 gallons.

Semitrailer Mounted Fabric Tank (SMFT)

The 5,000-gallon SMFT is not organic equipment to any quartermaster or transportation units. These must be requisitioned and prepared so that truck companies can haul them on M872 trailers. The SMFT is used to increase a sustainment unit's water distribution capability in a theater of operations. See TM 10-5430-240-13&P more information.

Figure G-5. Semitrailer Mounted Fabric Tank, 5,000 gallons**System Description:**

The tank is used to store or transport 4,600 / 4,750 gallons of potable drinking water. The assembled unit consists of a collapsible tank with pressure gage, end fittings, tie-down straps, emergency repair kit items, hose, and tools to secure the tank safely on the M872 semitrailers. When laid flat while empty, the SMFT is 39 ft. long x 7.3 ft. wide x 0.3 ft. high. When filled, it assumes a pillow-like shape approximately 38 ft. long x 5.2 ft. wide x 4.5 ft. high. Handles are provided to facilitate positioning the tank while empty. When not in use, the tank may be folded or rolled and stored in the shipping container.

Personnel Requirements:

- SMFT requires three personnel for set up, but can be operated by one person.

WARNING: The SMFT tank can only be transported full or empty. Transporting a partially filled tank will result in load shifting (surge) that will reduce vehicle control.

Unit Water Pod System (Camel II)

The unit water pod system (Camel II) is an 800-gallon system that provides modular forces a capability to receive and issue potable bulk water. The system consists of an 800-gallon capacity baffled water tank with integrated freeze protection mounted on an M1095 medium tactical vehicle trailer, allowing the Camel II to fit the mission profile and mobility of the Family of Medium Tactical Vehicle (FMTV) truck variants as its prime mover. The integrated freeze protection is operational from -25°F to 130°F (-32°C to 54°C). The Camel II contains a single point for dispensing water in a cold environment and six filling positions for filling canteens and 5-gallon water cans in temperate operating conditions. See TM 10-2330-402-13&P for detailed operating information for this system.

Figure G-6. Unit Water Pod System (Camel II), 800 gallons



Personnel Requirements:

- Camel II requires two personnel for set up, but can be operated by one person.

400 Gallon Water Trailer (Water Buffalo)

The M149, 400-gallon water trailer (Water Buffalo) provides modular forces a capability to receive and issue potable bulk water. Medium tactical vehicle and heavy expanded mobile tactical truck variants, as well as other prime movers that have appropriate tow capacity and electrical connectors can tow the system. See 3739 TM 9-2330-267-13&P for more information.

Figure G-7. Water Trailer (Water Buffalo), 400 Gallons



System Description:

- The purpose of the Water Buffalo is to carry 400 gallons of potable water for administrative and tactical operations.
- The M149A2/M107A1 trailer is designed to be towed by the following vehicles: M813, M814, M923, M927, and M939 Series Trucks and M1078, M1079, M1081, M1083, M1084, M1085, and M1086 Family of Medium Tactical Vehicles (FMTV).
- The M1112 trailer is designed to be towed by the M939 Series 5-ton and other equivalent Prime Movers.

Personnel Requirements:

- Water Buffalo requires two personnel for set up, but can be operated by one person.

500 Gallon, 250 Gallon, and 55 Gallon Collapsible Water Drums

Collapsible water drums are used to store and transport potable water. Water drums are constructed of water-resistant synthetic rubber-impregnated rayon. Water drums can move on all modes of transportation, including sling load. The components of the 500 gallon and 250 gallon drums include a towing and lifting yoke, tie-down kit, and repair kit. The 55-gallon drum is equipped with D-ring fitted end plates. A tie-down kit and repair kit are components of the 55-gallon drum.

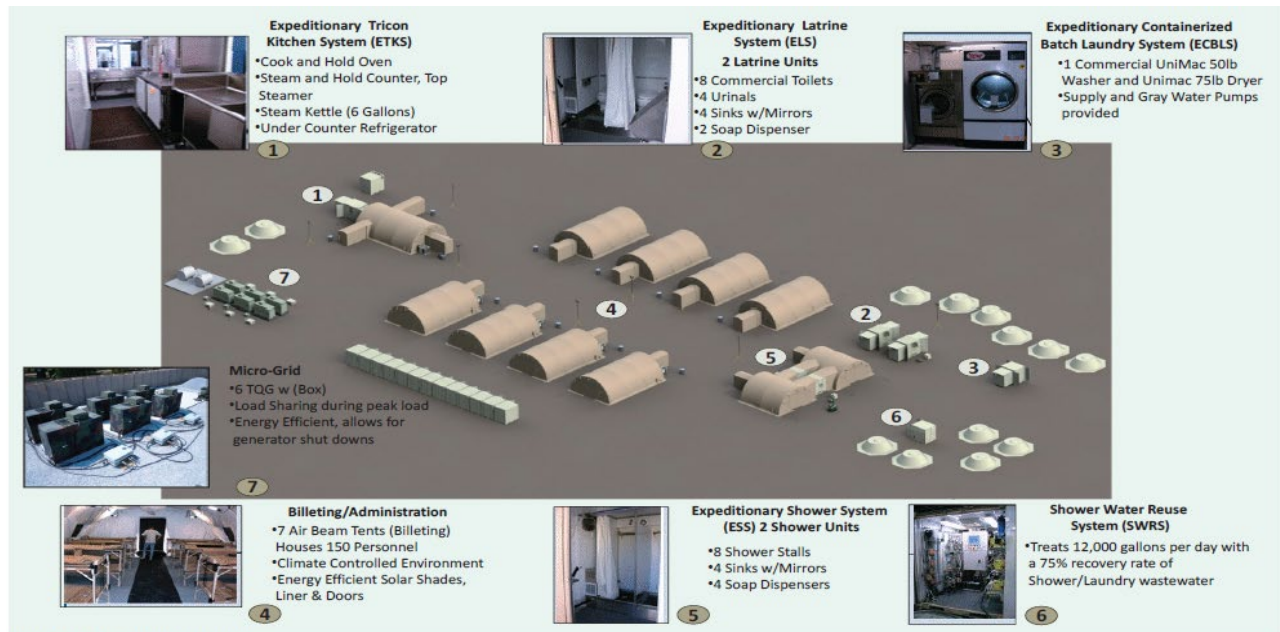
5-Gallon Water Can

The 5-gallon water can is part of all unit water distribution capabilities to enable individuals to move 5 gallons of water over short distances. Water cans are ordered through the supply system using national stock number 7240-00-089-3827. The national stock number for replacement lids is 7240-00-089-7312.

Appendix H Force Provider Equipment

Force Provider Module (FPM)

Figure H-1. Force Provider



System Description:

- Force Provider Expeditionary (FPE) is a modular base camp life support capability that supports 150 personnel with environmentally controlled billeting, food service, hygiene, power generation and distribution, petroleum and water storage and distribution, and shower water recycling.
- Expeditionary Base Module Components:
 - Expeditionary Base Camp (150 Soldier)
 - Water Management System
 - TRICONS: 22 Rev D
 - Expeditionary Latrines System: 2 each
 - Expeditionary Showers System: 2 each
 - Expeditionary Batch Laundry: 1 each
 - Expeditionary TRICON Kitchen System: 1 each
 - Generators (MEP806B/MEP1070A): 6 each
- Optional Add-On Equipment for Force Provider:
 - Morale, Welfare, and Recreation Complex
 - Administration Complex

- Cold Weather Kit (provides freeze protection down to -15°F)
- Prime Power Kit (U.S. Army Prime Power Battalion high power generator support)
- Electric Kitchen Complex (1800 A rations per day for 600 man camp support)
- Waste Water Trailer (1K waste evacuation trailer for 600 man support)
- Site Preparation Equipment (skid steer loader for 150/600 man camp support)
- Quality of Life Equipment (to meet Senior leader guidelines)
- Water Reuse System (to reduce dependence on water resupply missions)

Personnel Requirements (FPE Base camp):

- Equipment requires a team of eight Soldiers and can be set up in 4 hours

Expeditionary Water Packaging System (EWPS)

NOTE: This is a Force Provider item, but is contractor-operated.

Figure H-2. Force Provider Expeditionary Water Packaging System (EWPS)



System Description:

- The Expeditionary Water Packaging System (EWPS) supports the Army's mission to provide life and mission water sustainment to Soldiers and remote units in tactical environments.
- Capable of supplying 600 one 1-liter bottles per hour.
- Water supply from a potable water source such as the 3K ROWPU or larger.

EWPS System Fielding:

The EWPS is housed inside one ISO container and four other ISO containers are required to store consumables, spare parts, and support equipment (5 total ISO containers).

Personnel Requirements:

- Equipment requires a team of 5-10 personnel for set-up and can be operated by 3 personnel

Area Requirements:

- 90 ft. wide x 150 ft. long

Force Provider Water Reuse System (WRS)

Figure H-3. Force Provider Water Reuse System

**System Description:**

The Force Provider Water Reuse System purifies shower waste water for reuse with showers:

- Recycles 75% of gray shower water produced

- 12,000 gallons per day capacity
- System operational temperature from -15°F to 120°F (-26°C to 49°C)
- Unattended automatic operation after start-up
- Power requirements: 100A, 208V, 3PH
- Shipping Size: Tricon 8ft. x 8ft. x 6.5ft.

Personnel required:

- Set up can be accomplished by one person in 30 minutes

Appendix I Water Testing Equipment

Water Quality Analysis Set - Purification (WQAS-P)

Figure I-1. WQAS-P (LIN:W47475)



System Description:

The WQAS-P is a one-person portable suitcase kit containing equipment for testing water quality. The test kit is used in recon and the following tests are performed for physical properties (Turbidity, Temperature) & chemical properties (Ph, Chlorine, Total Dissolved Solids). Kit includes the M272 water test kit-chemical agent.

M272 Chemical Agent Water Testing Kit

Figure I-2. M272 (NSN: 6665-01-134-0885)



System Description:

The M272 Chemical Agent Water Testing Kit is a one-person portable, lightweight kit that will detect and identify harmful amounts of CW agents when present in raw or treated water. The test kit is used to detect cyanide, mustard, lewisite, and nerve agents when present in water in dangerous amounts. Only about 20 minutes are needed to run the four tests, depending on ambient weather conditions. Full kit contains enough supplies to run 25 tests for each agent. Simulants (simulated CW agents) are included in the kit for training use. Kit is disposable; no refills or repairs are needed.

M329 Joint Chemical Biological Radiological Agent Water Monitor (JCBRAWM)

Figure I-3. M329 (NSN: 6665-01-560-2158)

**System Description:**

The M329 CBR Agents Water Testing Detector Kit is a single-operator portable kit for detecting and presumptively identifying biological agents and quantifying the presence of radiological contamination in water. It consists of the radiac meter PDR-77 and the PDR-77 beta probe for detecting gross alpha and beta radiological contamination. A handheld assay (HHA) is used for detecting two biological agents: Ricin and Staphylococcal Enterotoxin B (SEB). This kit is used to supplement the M272 Chemical Agents Water Testing Kit.

Appendix J Emerging Water Equipment

Water Bison

Figure J-1. Water Bison



System Description:

The Water bison will provide average company sized units (110–142 personnel) the water storage capacity to support one day of supply of their universal unit needs without field feeding operation. It will also, provide two days of supply to support field feeding water requirements of the Mobile Kitchen Trailer and Battlefield Kitchen. The Water Bison will be used by all Army unit echelons and will be the primary system for providing a more sustainable and efficient way of receiving, storing, and issuing potable water by means of gravity flow.

3K Tactical Water Purification System (3K TWPS)

System Description:

Replaces the 3,000 Gallons per Hour Reverse Osmosis Water Purification Unit (3k ROWPU). The 3K TWPS will be the primary bulk water purification capability supporting Echelons Above Brigade (EAB) and will be the primary water purification capability for tactical laundry and shower facilities. The 3K TWPS is a complete water purification system consisting of feed water pumps, hoses, media & cartridge filters, high pressure pump, reverse osmosis elements, 3,000 gallon/hour water storage & distribution system. It will be configured within an ISO container and mounted on a trailer towable by a M1088 truck. The system retains the capability to produce potable water from all surface

and ground sources including CBRN-contaminated water. (First Unit Equipped Target in FY27)

Water Storage Distribution System (WSDS)

Figure J-2. Water Storage Distribution System

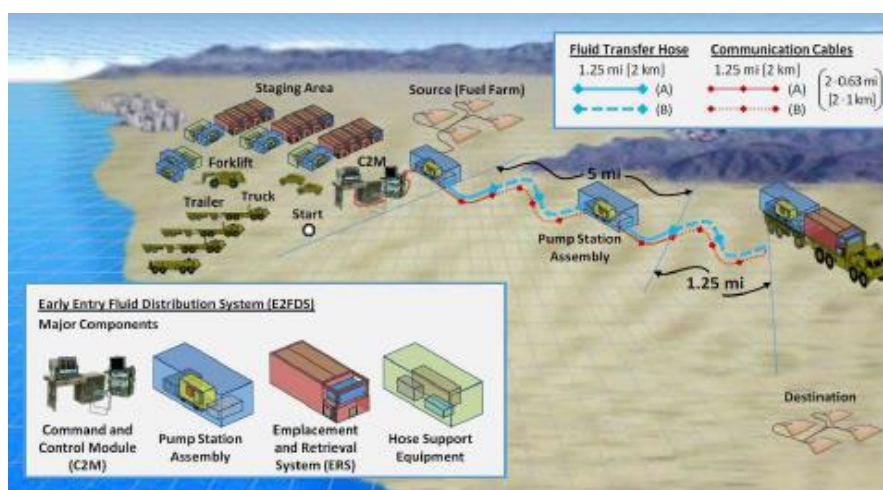


System Description:

The purpose of the water system is to receive, store and distribute potable water to individual water bags, tanker trucks, and trailer mounted water tanks. The WSDS is a self-contained engine driven pumping system. It includes quick disconnect couplings and hose kits for rapid setup and take down, a hypo-chlorination unit, 350 GPM pumps, 125 GPM pumps, and 40,000 and 50,000 gallon collapsible water tanks.

Early Entry Fluid Distribution System (E2FDS)

Figure J-3. Early Entry Fluid Distribution, System



System Description:

The Early Entry Fluid Distribution System (E2FDS) is a high throughput flexible conduit system for the bulk transport of petroleum or water on the modular battlefield. It is a rapidly-emplaced conduit system capable of transferring 650,000 gallons of raw non-potable water per 20-hour operational day through a trace up to 50 miles long. It is a new materiel system that enhances the Inland Petroleum Distribution System (IPDS) pipeline and rapidly establishes new or extends existing pipeline traces. E2FDS requires little to no engineer support to emplace the conduit or pump stations. Pump stations are fully automated and centrally controlled.

Containerized Ice Making System (CIMS)

NOTE: This is a Force Provider item that is projected for initial fielding in FY25.

System Description:

- The CIMS is capable of supporting a 600 person Force Provider base.
- It is capable of supplying 3600 lbs. of ice per day.
- The ice is bagged and sealed in 10lbs bags and moved to an internal storage area capable of storing 1200 lbs.
- Water must be supplied from a potable water source.
- It uses a 208V, 3-phase, 50/60HZ power supply, and requires an external power source that can provide approximately 16kw spike and 9–10kw nominal power.

The EWPS Systems Are Fielded In:

The CIMS is housed inside one ISO container and four other ISO containers are required to store consumables, spare parts, and support equipment (5 total ISO containers).

Personnel Requirements:

- MOS immaterial

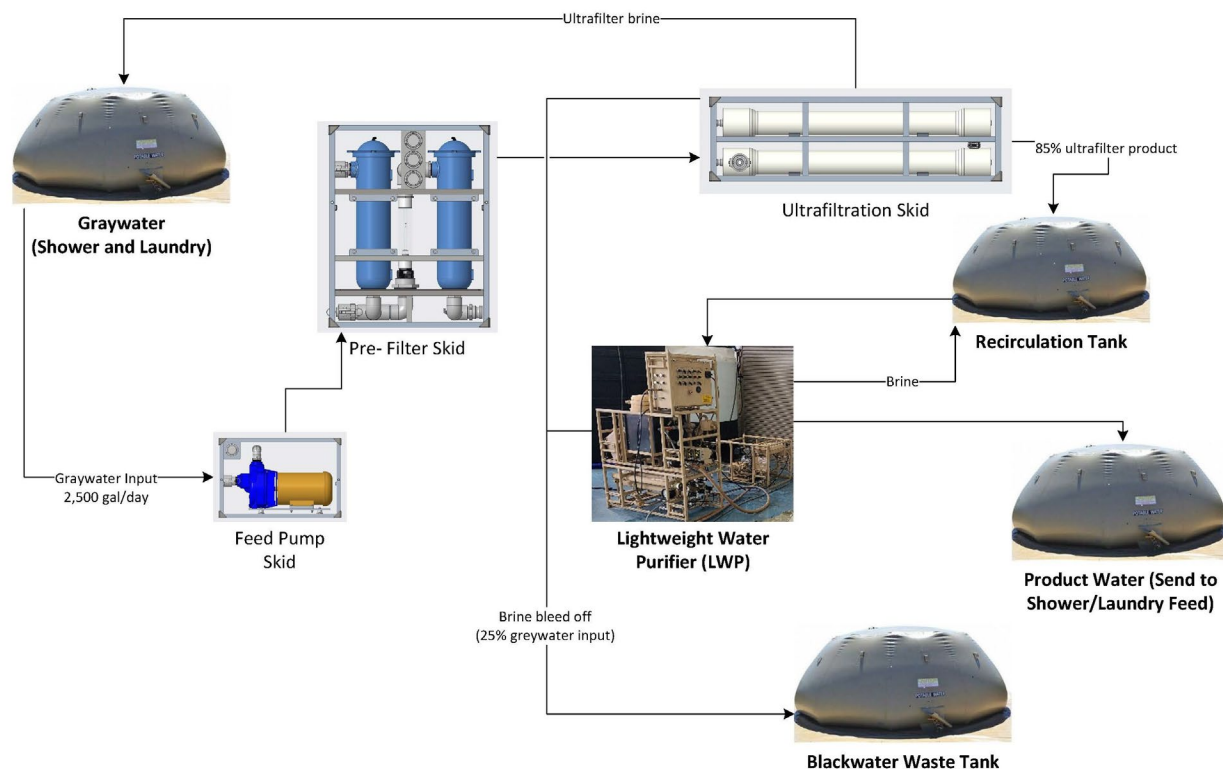
Area Requirements:

- 90 ft. wide x 150 ft. long

Graywater Pretreatment System (GWPS) prototype

The Army should be able to use the pretreatment module in front of the Army's LWP for graywater reuse. Laundry and shower account for 50–80% of the water demand for a contingency base. The pretreatment module will recover 75% of the graywater, reducing the water demand and resupply requirements of a contingency base by 38–60%. This will significantly reduce costs and risks associated with supplying the water requirements of a contingency by convoy.

Figure J-4. Graywater Recycling Pretreatment Module for the Lightweight Water Purifier



Small Unit Water Purifier (SUWP) Prototype

The SUWP was designed using ARMY/USMC requirements to enable platoons and small units to purify water from any water source at the point of need by a non-MOS specific operator. The SUWP will provide self-sustaining capacities, enabling units to produce potable quality water near the point of use, reducing the logistics of resupply.

Figure J-5. Small Unit Water Purifier

Purification Power



Water on the Move Prototype

The Water on the Move prototype leverages existing COTS technologies for semi-automated purification on a small to medium vehicle. This system will provide mobile water purification reducing burden of water purification, transport logistics to the front line, and the time Soldiers are stationary and in danger. It will also provide new capabilities for point of use water generation for all MOSs. Modular payload capabilities allow for flexibility on different vehicle platforms and independent use.

Figure J-6. Water on the Move



Atmospheric Water Extraction (AWE) Prototype

The Defense Advanced Research Projects Agency (DARPA) is currently pursuing two general options for water harvesting from air:

1. Ambient air can be cooled below its dew point and the condensed liquid water can be collected. Large volumes of air and low temperatures at the condenser are required, especially in regions of low relative humidity (r.h.). The cooling of the heat sink for the condensation can be energy consumptive, since a difference in temperature between the condensation unit and the ambience has to be maintained. Additionally, the heat of condensation of the collected water has to be discharged.
2. Humidity can be adsorbed or absorbed (taken up) by desiccant materials, and in a second step desorbed at elevated temperatures followed by condensation of the hot water vapor at ambient conditions. Usually water is taken up during the colder nighttime when the relative humidity is higher and desorbed during daytime. The necessary heat for desorption is ideally provided by solar radiation. The resulting heated water vapor can be brought below its dew point and condensed at ambient temperatures, making an energy expansive auxiliary heat sink redundant. When the ambient air is used as coolant, a sufficient airstream has to be maintained to reject the heat of condensation.

Figure J-7. AWE concept



Appendix K Water Site Reconnaissance and Selection

Proper planning is essential to water site selection and should be foremost in the minds of the reconnaissance personnel. The planning for a water site, whether it be for treatment, storage, or distribution, begins with mission guidance from the tactical commander. Whenever possible, include the water site within logistics areas (such as a Brigade Support Area) or base camp. At the very least, laundry, shower, and personnel decontamination units should be near water supply operations for mutual support. To enhance resupply operations, co-locate Class I and water points.

A reconnaissance team assesses the following areas related to water source and water site development:

- Type of water source
- Amount of water available, including rate of replenishment
- Quality of raw water
- Survey two miles upstream for possible contamination
- Route of water from original source to proposed extraction point
- Feasibility of impounding water by constructing dams, embankments, or infiltration trenches (for springs, streams, and rivers)
- Available Space
- Site layout requirements to ensure proper land use (consider treatment, storage, and distribution system requirements)
- Suitability of terrain
- Avoid sloped ground
- Avoid low areas where vapors can collect
- Seek firm ground, free of surface rocks and large stones
- Soil conditions for proper draining
- Road networks
- Hazards
- Existing facilities available for use
- Bivouac for personnel
- Security, to include cover and concealment.

Appendix L Wastewater Management

When operating in a field or garrison environment, commanders must comply with EPA, state, local, or host nation standards. Commanders with field water purification units participating in field training exercises or contingency operations in the U.S. or its possessions must coordinate with the appropriate environmental office to determine how to legally dispose of wastewater and other treatment wastes. Outside the U.S., commanders must meet wastewater disposal requirements by coordinating with the appropriate Installation Management Agency, Area Support Group, base support battalion, or local command engineer.

Procedures

Regulated discharges. In cases where a discharge permit has been secured, the commander of the QM unit responsible for water supply will comply with the permit to prevent contamination of the receiving water body. In cases where a permit has been denied, the QM unit's designated representative will contact the installation environmental officer to determine if wastewater could be discharged into a sanitary sewer system, or held in a tank at the point of production, pumped into a truck, and transported to the wastewater treatment plant (WWTP). Such action will also involve coordination with the chief of the WWTP.

Unregulated discharges. If a discharge permit is not required, the water purification section chief will take precautions to avoid contaminating any receiving body of water.

Regulatory Information

In the U.S., the EPA (or a State with an EPA-approved program) establishes rules and regulations for wastewater discharges under the National Pollutant Discharge Elimination System (NPDES) established under the Clean Water Act. Dischargers, with close coordination, support, and representation by the installation's environmental office, must apply for and obtain a site-specific NPDES permit (or State equivalent) or general NPDES permit. These permits set limits for discharges. Water purification operations must meet these limits. The Resource Conservation and Recovery Act, reflected in 40 CFR 260–280, defines hazardous wastes and provides regulatory controls for handling and managing hazardous wastes. To be considered a hazardous waste, spent cartridge filters must display one of the following characteristics as defined in 40 CFR 261: ignitability, corrosivity, reactivity, or toxicity. Under most circumstances, RO, ultra-filtration, or micro-filtration membranes and cartridge filters will not meet these criteria and thus will not be considered hazardous. Questions should be directed to the appropriate environmental staff with jurisdiction in the training or operating area. Contact higher echelon PM organizations for additional information.

Foreign countries have their own rules and regulations on disposal of wastes as well as ambient water quality criteria. Usually, the host nation Final Governing Standards (FGS) and the host nation standards contain these requirements. If FGS have not been developed, the DoD Overseas Environmental Baseline Guidance Document should be consulted. Planners must always consult and coordinate with the appropriate environmental office or equivalent organization prior to operations to determine the requirements for discharges. In foreign countries, coordinate with the installation point of contact or the environmental coordinator in the host nation and the host nation

environmental authorities to obtain information on disposal of spent RO, ultra-filtration, or micro-filtration membranes and cartridge filters. Contain and collect spent membranes and cartridge filters in a central location. The spent membranes and cartridge filters may have to be transported back to the U.S. for disposal.

Brine (RO reject water) Management

Table, K-1. Wastewater production guidelines for ROWPU systems

Wastewater production guidelines for various ROWPU systems							
ROWPU Unit	Source Water	Raw Water flow rate (gph)	Product Water (gph)	Brine (gph)	Backwash (gal/cycle)	ROM cleaning (gal)	Ultra filter (UF)/micro filter (MF) cleaning (gal)
3,000 gph	Fresh	6000	3000	3000	1000	350	0
	Brackish/Sea	6000	2000	4000	1000	350	0
TWPS	Fresh	4200	1500	1750	240	260	260
	Brackish/Sea	4200	1200	2050	240	260	260
LWP	Fresh	300	125	90	20	40	40
	Brackish/Sea	300	75	140	20	40	40

Wastewater from water treatment systems can be categorized as brine wastewater, filter backwash wastewater, and membrane cleaning wastewater. Water that has been chlorinated is considered wastewater when being disposed. Each type of wastewater carries different treatment byproducts and therefore poses different individual risks to the environment. Water treatment personnel must consider local environmental laws, Environmental Protection Agency regulations, and appropriate standard operating procedures when executing water support operations. Typically, the theater sustainment command or TSC will issue environmental compliance guidelines. The pace of tactical operations (depending on the type or stage of an operation) may limit a unit's ability to adhere to local laws and regulations. Water treatment specialists have a responsibility to advise the chain of command when unit actions do not comply with environmental guidelines. In addition hazardous material and hazardous waste spills should be reported immediately so that contaminated sites are restored as quickly as possible. Consult TB MED 593 for more information.

Recycled Gray Water Standards

Recycling wastewater involves using it again in the process that generated it, usually by treating it and returning it to the beginning of the operation. Reject water from ROWPU operations and gray water from showers and laundries can, under certain circumstances, and only when approved by the area medical authority, be treated and recycled in ROWPU and shower or laundry operations, respectively. RO reject water may be recycled and run through the ROMs either internally or externally. Shower and laundry wastewater (gray water) may be collected, treated, disinfected, and pumped back to the shower or laundry unit. While shower and laundry gray water recycling equipment may include RO and produce water that meets drinking water standards, it

may not be used for drinking water, but only recycled and used as shower or laundry water.

Purpose

The purpose for establishing standards for recycled water is to protect the health of personnel, including prevention of skin and eye irritation from recycled shower water.

General standards

These standards represent the acceptable range or maximum allowable limit for each constituent.

- pH: 5 to 9
- Turbidity: 1 NTU
- Hardness: 500 mg/L
- Total dissolved solids (TDS): 1000 mg/L
- Coliforms: absent
- FAC chlorine residual: 1 mg/L after 30 minutes.

Specific standards. Standards have been developed for recycling shower and laundry gray water to shower facilities in Army Force Provider transportable base camp systems. They are described in USACHPPM IP 31-027, Criteria for Recycle of Gray Water for Shower Use, and implemented in Army Surgeon General Memorandum DASG-PPM-NC, 13 August 2004. They represent good guidance for any field laundry and shower recycle operations.

Filter Backwash Management

Multimedia filter backwash. The potentially high total suspended solids concentrations in the filter backwash water from the 3000 GPH ROWPUs makes recycling the backwash waters to the raw water sources an unlikely option. For training exercises in CONUS, these backwash waters should be discharged directly to a sanitary sewer manhole, or if that is not possible, they could be collected and hauled to an STP. During deployments, the backwash water should be discharged downstream from the source water intake of a flowing source, or to soaking pits, trenches, or other similar ground disposal options.

TWPS and LWP backwash. Backwash waters from the TWPS and LWP microfilters and ultrafilters have comparatively lower suspended solids levels and may be disposed of in the same manner as multimedia filter backwash. With approval of the local medical authority, they also may be recycled to the raw water source because the suspended solids concentrations are lower than the backwash waters from the 3,000 GPH ROWPU.

Membrane Cleaning Wastewater Management

1. The RO, ultra-filtration, and micro-filtration membranes are cleaned with citric acid, detergents, or hypochlorite solutions. For the TWPS that uses copper-nickel alloy tubing in conveying water, wastewater produced during the citric acid cleaning may contain high levels of copper, nickel, lead, and zinc. The

concentrations will diminish over successive citric acid element cleaning cycles for the lifetime of the equipment.

2. Direct discharge of wastewaters generated during either citric acid, detergent, or hypochlorite cleaning cycles to surface waters is unlikely to be allowed because of the high 5-day biochemical oxygen demand, the high or low pH, the presence of hypochlorite, the presence of surfactants, and the high suspended solids in the wastewaters.
3. As with backwash water, the membrane cleaning solutions should be discharged to a sewer or hauled to a WWTP. For high or low pH wastewaters it may be necessary to adjust the wastewater pH before discharging to the sewer. To reduce the potential impact of the concentrated wastewater on the WWTP processes, it can be discharged to the sewer or WWTP slowly rather than being discharged all at once. The elevated metal content in wastewater generated during citric acid cleaning of new ROWPUs using a copper-nickel alloy tubing to convey water could negatively impact the biological processes at the WWTP depending on its size in relation to the volume and rate of wastewater discharged to it.

Land disposal methods for wastewater generated during membrane cleaning should not be used.

Product Water

The amount of product water that personnel drink during an exercise that includes actual or simulated ROWPU water treatment varies from barely any that is produced to nearly all of it. If personnel do not drink it or use it for some other purpose, and it has been treated and chlorinated, permission must be obtained to dispose of it like any other form of wastewater. Optimally, the treated water can be discharged back to the source from which it was taken; however, a permit to do so will likely be required. A permit may or may not be required to discharge to a sanitary or storm sewer or perhaps even to discharge directly on the ground.

Appendix M Lessons Learned

U.S. Army Europe, Southern Exercise Campaign 2019 (SEC 19) report

(U) Sustainment (pg. 2)

Water supply units are not being utilized to support field exercises. SEC19 and previous exercises have been supported with bottled potable water, supplied by contracted civilian sources, instead of conducting water support operations that develop capability to treat, store, distribute, and issue water.

(U) TOPIC: Water support operations

(U) OBSERVATIONS: USAREUR SEC19 and previous exercises were supported with bottled potable water supplied by contracted civilian sources instead of conducting water support operations that develop capability to treat, store, distribute, and issue water.

(U) DISCUSSION: Water supply units are not being utilized to support field exercises. It is uncertain if civilian supplies of bottled water would be available during a large scale combat operation. Observers at SEC19 noted the absence of unit-level water trailers (Water Buffalos), lister bags, or canteens. Units habitually receive pallets of bottled water, and high levels of waste were observed, as 1-liter bottles were often opened, drunk from once or twice, and then discarded. The ESC in charge of supporting the exercise utilized a water supply unit during the exercise, achieving one of its training objectives, but the exercise construct did not require or resource water supply sustainment for the broader exercise population. Supported units did not validate their ability to receive water or conduct required maintenance of water at proper levels of hypo-chlorination. Soldiers and NCOs who were questioned about supplies and their training on how to conduct unit level water distribution and maintenance responded that it was not a task they trained on often, or at all. This matched other observations about the loss of NCO knowledge on field sanitation standards. Center for Army Lessons Learned (CALL) Handbook 04-11, Field Sanitation Handbook, 01 JUN 2004, (<https://call2.army.mil/toc.aspx?document=121>), provides an overview of doctrine on the subject.

(U) RECOMMENDATION: Army Service component command exercise planners should consider requiring water support operations during annual exercises to develop capability at all echelons of suppliers and users of water.

The Arctic Gap Quick-look report (pg. 40)

GAP 19

The Army requires reliable ECW Class I (subsistence materiel) water distribution and storage methods.

Implications

Water distribution from the combat service support battalion (CSSB) to the maneuver battalions is problematic. Water freezes as heating and recirculation systems on load handling system compatible water tank racks (Hippas), unit water pod systems (Camels), and Water Buffalos fail to meet design specifications. An airborne infantry

BCT operating in Arctic, ECW, and HA conditions will require roughly 16,000 gallons of potable, liquid water each day. The Army needs to develop or acquire a water storage and distribution method for severe and extreme cold to prevent disruption of supply chain and meet consumption demands.

The heater in the Hippo is not able to keep the water from freezing and may need an upgrade. Additionally, the lack of a palletized load system (PLS) forced the unit to use load-handling systems (LHS). This meant less water (to reduce the weight), which allowed the water to freeze faster. Water distributed in five-gallon water cans froze within a few hours. In addition to water, the availability of sufficient food rations is a point of concern. The ration, cold weather (RCW) sustains individuals during operations in Arctic, ECW, and HA environments. The RCW is a self-contained operational ration consisting of one full day feeding packaged in a flexible meal bag. The Army needs to acquire sufficient stocks of RCW to ensure sustainable operations.

Risk

Without adequate rations and water, Arctic, ECW, and HA operations will be unsustainable. Inadequate storage solutions will delay water distribution and increase the risk to the force.

Options

Test current equipment to ensure it meets cold weather operations specifications. Stationary water sources should be sheltered for added insulation. Evaluate mission requirements and procure sufficient RCW to sustain Arctic, ECW, and HA operations. Research durable and flexible water containers that can be worn by Soldiers close to the body to prevent freezing. Identify and procure equipment to thaw ice at the individual or squad level.

Brigade Sustainment in Decisive Action Operations, National Training Center (Feb 2018)

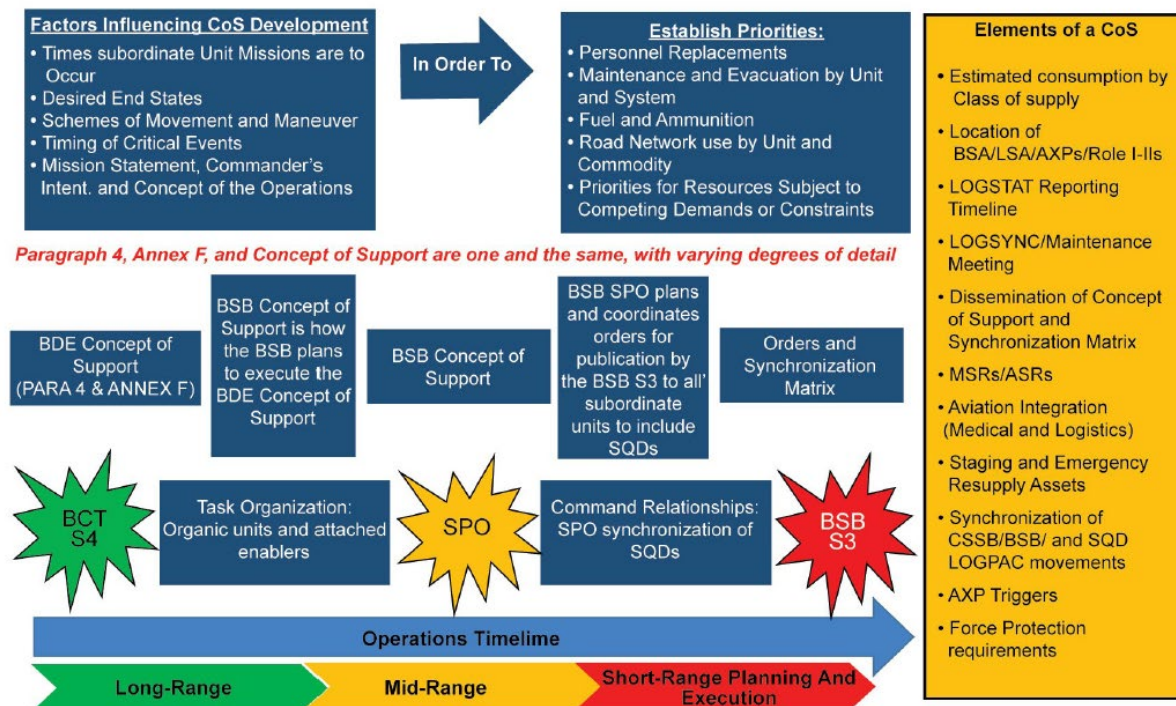
BCT Planning process and Concept of Support Development

Key personnel

- The BSB CDR executes the BCT's concept of support and advises the BCT CDR on all aspects of sustainment support to the BCT. The BSB CDR coaches both the BSB and BCT staff on the importance of synchronized logistics and health service support. As the senior logistics CDR charged with responsibility to sustain the BCT, the BSB CDR must retain the ability to surge, mass, and re-allocate logistics capabilities according to the BCT CDR's intent and concept of the operation. Recommendations for logistics task organization for support to each maneuver battalion and squadron, the brigade engineer battalion, and the field artillery battalions are made by the BSB CDR to the BCT CDR.
- The BCT S-4 and SPO work together on paragraph 4 and Annex F, which are synonymous with the concept of support. They are one in the same and not separate and distinct products. Some BCTs have the BCT S-4 who is the logistics planner responsible for the concept of support, while others push it to the SPO who is the logistics executor.

- The maneuver battalion S-4 is the logistics planner and is responsible for developing the battalion concept of support which should be nested with the BCT concept of support. The FSC CDR is the executor of the missions derived from the concept of support.

Figure M-1. Creation and elements of the Concept of Support



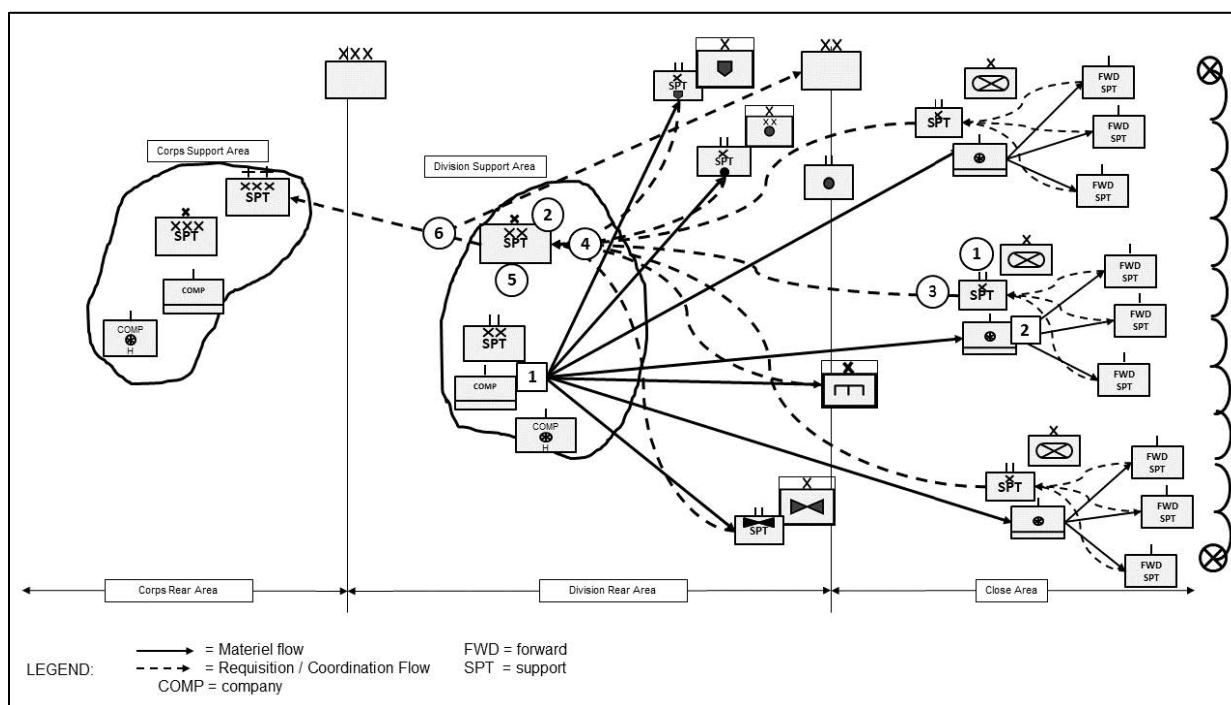
The Sustainment planners use the logistics synchronization meetings in order to validate LOGSTAT reports, and confirm requirements, method of distribution, times for resupply, and location.

Figure M-2. BCT LOGSTAT example communicated via Joint Capabilities Release (JCR)/Secure Voice Over the Internet Protocol (SVOIP)

LOG STAT JCRI/ SVOIP				
LINE By CL	CAP	OH (DOS)	Next 24	Next 48
Line 1A: (Class 1) MRE				
Line 1B: (Class 1)UGR-A				
Line 1C: Bulk Water				
Line 1D: Bags of ice				
Line 2: Class 2 Supplies				
Line 3A: CLIIIP				
Line 3B: CLIIIB				
Line 4: CLIV By Type or CCL				
Line 5: CLV By DODIC				
.50 CAL/M2 (A598)				
7.62/240B (A111)				
5.56/M4 (A080)				
5.56/M249 (A075)				
SIM ATWIS (BFV) (L367)				
SIM Tank-M1A2/Paladin-M109A6 (LA06)				
Line 7: CLVII BY LIN:				
Line 9: CLIX: Major items				

Appendix N Bulk Water Request Process

Figure N-1. Bulk Water Request Process, ATP 4-42



The bulk water requirements determination and request process includes the same basic process as all classes of supply, but is managed manually through coordination and communication. Figure M-1 represents the requirements determination process for bulk water in a BSB. However, please note that this process works the same for all sustainment units at all echelons. It is the focus that changes. The circle points represent requisition and coordination actions between organizations. The square points represent distribution actions. The dotted lines represent transmission of information. The solid lines represent the physical movement of materiel.

Circle 1

The BSB provides bulk water support to its parent brigade with organic storage and distribution capability. The BSB is dependent upon the DSB and DSSB for bulk water production. The BSB's water platoon does not have the capability to produce bulk water and the FSCs do not have the capability to store and distribute bulk water.

Circle 2

Concurrently, the DSB SPO fuel and water section maintains awareness of division current and future operations to forecast bulk water requirements. The DSB SPO fuel and water section anticipates the division's bulk water requirements for the next 96-120 hours and plans bulk water production and resupply based on the division commander's priorities.

Circle 3

The BSB SPO supply and field services section receives daily LOGSTAT reports showing bulk water consumption and requirements from their supported FSCs. The BSB supply and field services section analyzes the FSC's on-hand quantities, expected consumption, and capacity. The BSB supply and field services section anticipates the brigade's bulk water requirements for the next 96 hours to plan bulk water resupply based on brigade priorities. The BSB SPO supply and field services section sends current consumption information and forecasted bulk water requirements to support future brigade operations to the DSB SPO fuel and water section for resupply.

Circle 4

The DSB SPO fuel and water section receives and analyzes the BSBs' daily LOGSTAT, showing on-hand quantities, expected consumption, and expected capacity for the next 96 hours. The DSB SPO fuel and water section validates their forecasts and production throughput against the BSBs' bulk water requirements to verify proper amounts and identify discrepancies with estimates.

Circle 5

The DSB SPO fuel and water section provides the DSB DIB with the division's current bulk water on-hand quantities by unit, bulk water requirements by unit and storage capacity for the next 96 hours. The DSB SPO fuel and water section also provides bulk water production, storage and distribution assets at the division support area. The DSB SPO DIB synchronizes and plans bulk water distribution to all supported units with other commodity requirements in accordance with division priorities and within the constraints of division movement corridors.

Circle 6

The DSB SPO fuel and water section consolidates the division's daily bulk water consumption and daily requirements, and provides the information to the ESC DMC fuel and water section. The information also provides the ESC DMC awareness of any DSB production, storage or distribution capability shortfalls. The DSB SPO fuel and water section also provides a copy of the bulk water information to the division G-4 for visibility.

The DSSB composite truck company transports water distribution assets belonging to the DSSB CSC and resupplies the BSB Distribution Company water distribution assets. The BSB Distribution Company resupplies FSC and Maneuver Battalion Water Buffaloes. 5–19. The DSSB composite truck company transports water distribution assets belonging to the DSSB CSC and resupplies the BSB Distribution Company water distribution assets. The DSSB composite truck company throughputs bulk water to FSC and maneuver battalion Water Buffaloes.

Appendix O Applicable Forms

Water Reconnaissance Report (DA 1712)

WATER RECONNAISSANCE REPORT		DATE	TIME OF RECONNAISSANCE
For use of this form, see ATP 4-44; the proponent agency is TRADOC		12 DEC 16	09:00
REPORTED BY (Name, Grade, Organization)			
Erd L. Ator, SGT, 20 S&S Co. Water Platoon			
FORWARDED TO (Name and Organization)			
Platoon Leader, 20 S&S Co.			
MAP COORDINATES OF WATER SOURCE: QM 16061775			
1. Quality-Quantity			
TYPE OF SOURCE	TDS	TEMPERATURE	
River	500	60°	
TURBIDITY (Estimate)	pH TEST	QUANTITY	
10	5	30,000 GPH	
2. Site Conditions			
SECURITY			
Good cover and concealment, .5 km from MSR.			
DRAINAGE-SOIL TYPE			
Muddy banks, clay soil, poor drainage.			
TERRAIN			
Dense vegetation, flat landscape.			
BIVOAC			
Sufficient area for bivouac down stream.			
DISTANCE TO CONSUMERS		ROADS	
10 km		Gravel road to site off of MSR; MSR is asphalt	
3. SKETCH OF AREA (Show road net and traffic circulation.) (Use reverse side for additional sketches, if necessary.)			

DA FORM 1712, SEP 2015

PREVIOUS EDITIONS ARE OBSOLETE

AFD 1C v1.00

DA FORM 1714, SEP 2015 EDITION OF MAY 91 IS OBSOLETE APD LC v1.00

3-64

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3-66

Potable Water Container Inspection (DA 5457)

POTABLE WATER CONTAINER INSPECTION		REPORT DATE
<i>For use of this form see TB MED 577; the proponent of this form is the Office of The Surgeon General.</i>		
TO		FROM
INSPECTION RATING	SERIAL NUMBER	MAP COORDINATE LOCATION
OWNING UNIT	MAINTENANCE NCO	UNIT REPRESENTATIVE
INSPECTION UNIT	DATE/TIME GROUP	INSPECTED BY

SECTION I. WATER TRAILER INSPECTION CRITERIA

		YES	NO
1. CONTAINER EXTERIOR	a. Marked "POTABLE WATER ONLY"	<input type="checkbox"/>	<input type="checkbox"/>
	b. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
2. MANHOLE COVERS	a. Rubber Gasket Intact	<input type="checkbox"/>	<input type="checkbox"/>
	b. Locking Mechanism Functions	<input type="checkbox"/>	<input type="checkbox"/>
	c. No Rust/Insulation Intact	<input type="checkbox"/>	<input type="checkbox"/>
	d. Pressure Relief Valve Operates	<input type="checkbox"/>	<input type="checkbox"/>
3. DISPENSING SPIGOTS	a. All Spigots Function	<input type="checkbox"/>	<input type="checkbox"/>
	b. "T" Handle Operates Easily	<input type="checkbox"/>	<input type="checkbox"/>
	c. Protective Box Intact	<input type="checkbox"/>	<input type="checkbox"/>
	d. Locking Devices Function	<input type="checkbox"/>	<input type="checkbox"/>
4. DRAIN	a. Plug Installed Hand-Tight	<input type="checkbox"/>	<input type="checkbox"/>
	b. Cracks Do Not Expose Fiberglass	<input type="checkbox"/>	<input type="checkbox"/>
	c. Plug/Hole Threads Undamaged	<input type="checkbox"/>	<input type="checkbox"/>
	d. Threads Not Rusty	<input type="checkbox"/>	<input type="checkbox"/>
5. CONTAINER INTERIOR: STAINLESS STEEL AND ALUMINUM	a. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
	b. No Rust	<input type="checkbox"/>	<input type="checkbox"/>
	c. Not Painted/Coated	<input type="checkbox"/>	<input type="checkbox"/>
	d. No Cracks/Dents Exposing Polyurethane	<input type="checkbox"/>	<input type="checkbox"/>
6. CONTAINER INTERIOR: FIBERGLASS	a. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
	b. Cracks/Chips Less Than 10%	<input type="checkbox"/>	<input type="checkbox"/>
	c. Fiberglass Exposed	<input type="checkbox"/>	<input type="checkbox"/>
	d. Paint Surface Not Flaking	<input type="checkbox"/>	<input type="checkbox"/>

SECTION II. WATER TANK TRUCK INSPECTION CRITERIA

1. CONTAINER EXTERIOR	a. Marked "POTABLE WATER ONLY"	<input type="checkbox"/>	<input type="checkbox"/>
	b. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
2. MANHOLE COVERS AND FILLING PORTS	a. Rubber Gaskets Intact	<input type="checkbox"/>	<input type="checkbox"/>
	b. Locking Mechanisms Function	<input type="checkbox"/>	<input type="checkbox"/>
	c. No Rust/Insulation Intact	<input type="checkbox"/>	<input type="checkbox"/>
3. DISPENSING VALVES	a. Valves Operate Easily	<input type="checkbox"/>	<input type="checkbox"/>
	b. Hose Coupling Threads Undamaged	<input type="checkbox"/>	<input type="checkbox"/>
	c. Dust Caps Attached to Valve Ports	<input type="checkbox"/>	<input type="checkbox"/>
4. TANK INTERIOR	a. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
	b. No Rust	<input type="checkbox"/>	<input type="checkbox"/>
	c. Steel/Aluminum Not Painted	<input type="checkbox"/>	<input type="checkbox"/>

SECTION III. FABRIC TANK/DRUM INSPECTION CRITERIA

		YES	NO
1. CONTAINER EXTERIOR	a. Marked "POTABLE WATER ONLY"	<input type="checkbox"/>	<input type="checkbox"/>
	b. Clean/Good Repair	<input type="checkbox"/>	<input type="checkbox"/>
	c. Plugs/Patches Secure	<input type="checkbox"/>	<input type="checkbox"/>
2. VALVE ASSEMBLY	a. Check-Valve Adapter Undamaged	<input type="checkbox"/>	<input type="checkbox"/>
	b. Coupler Valve Operates Easily	<input type="checkbox"/>	<input type="checkbox"/>
	c. Dust Cap Attached to Coupler	<input type="checkbox"/>	<input type="checkbox"/>

SECTION IV. CONTAINER LOCATION (FIELD USE) INSPECTION CRITERIA

1. SITE CONDITIONS	a. Manholes/Parts Closed	<input type="checkbox"/>	<input type="checkbox"/>
	b. Soakage Pits Constructed Beneath Spigots	<input type="checkbox"/>	<input type="checkbox"/>
2. WATER CONDITIONS	a. Chlorine Residual Adequate (<input type="text"/> ppm)	<input type="checkbox"/>	<input type="checkbox"/>
	b. Procured From: <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

COMMENTS AND RECOMMENDATIONS:

PRINTED/TYPED NAME AND GRADE OF PVNTMED INSPECTOR:

SIGNATURE:

APOLCv1.0168

WATER POINT INSPECTION			YES	NO
11. WATER STORAGE	a. Tanks Level b. Safety Bottom Apron Used c. Open Top Tanks Covered d. Tanks Clean and Sanitary e. Capacity Sufficient for Issue			
12. WATER DISTRIBUTION	a. Standpipe Hose \geq 4 Ft Above Ground b. Hose Nozzle Clean/Off Ground c. Operators Check Containers for Cleanliness			
13. RECORDS	a. Production Log Maintained b. Distribution Log Maintained c. Blank Forms Sufficient			
14. SUPPLY STORAGE	a. Fuel and Chemicals Sufficient b. Chemical Containers Labelled/Capped/Dry c. Activated Carbon & Calcium Hypochlorite Stored Separately			
15. PRODUCT WATER SAMPLE	a. Chloride (\leq 600 mg/L) b. Chlorine Residual Adequate (_____ ppm) c. Color (\leq 50 Units) d. Hardness (Magnesium \leq 150 mg/L) e. pH (Between 5 and 9 Units) f. Sulfate (\leq 400 mg/L) g. TDS (\leq 1500 mg/L) h. Turbidity (\leq 5 NTU) i. Chemical Agents Present j. Radioactivity Present k. Coliforms (\leq 1/100 mL); Results on DO Form 686			
COMMENTS AND RECOMMENDATIONS:				

PRINTED/TYPED NAME AND GRADE OF PVNTMED INSPECTOR:

SIGNATURE:

Other applicable forms available on the APD Website (<https://armypubs.army.mil/ProductMaps/PubForm/DAForm.aspx>) include:

- DA FORM 5458, Shower/Decontamination Point Inspection
- DA FORM 7575, FWSVA Worksheet
- DA FORM 7576, FWSVA Summary Data Sheet
- DA FORM 7577, Treated Water Sampling Field Data Sheet.

Appendix P Abbreviations

AFC S CDID	U.S. Army Futures Command Sustainment Capabilities Development Integration Directorate
AMC	Aviation Maintenance Company
AO	area of operation
AOR	area of responsibility
APS	Army Pro-positioned Stock
ASC	Aviation Support Company
ASCC	Army Service Component Command
ASWBPL	Armed Service Whole Blood Processing Laboratory
AWT	advanced water testing
BCT	Brigade Combat Team
BMSC	Brigade Support Medical Company
BSB	Brigade Support Battalion
CASCOM	U.S. Army Combined Arms Support Command
CBL	Containerized Batch Laundry
CBRN	chemical, biological, radiological and nuclear
CHR	contaminated human remains
CIMS	Containerized Ice Making System
COA	course of action
COCOM	Combatant Command
CSC	Composite Supply Company
CSSB	Combat Sustainment Support Battalion
DCAS	Dental Company Area Support
DLA	Defense Logistics Agency
DLA-E	Defense Logistics Agency Energy
DoD	Department of Defense
DSB	Division Sustainment Brigade
DSSB	Division Sustainment Support Battalion
E2FDS	Early Entry Fluid Distribution System
EAB	echelons above brigade
ESC	expeditionary sustainment command
EWPS	Expeditionary Water Packaging System
FAWPSS	forward area water point supply system

FSC	Forward Support Company
Hippo	2,000 gallon load handling system compatible water tank rack system
HQDA	Headquarters, Department of the Army
HR	human remains
ISO	International Organization for Standardization
ISSA	Inter-Service Support Agreements
JACKS	Joint Acquisition CBRN Knowledge System
LOC	Lines of Communication
LOGSTAT	Logistics Status
LWP	125 GPH Lightweight Water Purifier
MA	Mortuary Affairs
MACRMS	Mortuary Affairs Contaminated Remains Mitigation Site
MDBS	Medical Detachment Blood Support
MRE	Meal Ready to Eat
MTOE	Modification Table of Organization and Equipment
NP	non-potable
OPLANS	Operational Plans
OPLOG	Operational Logistics
OPORD	operations order
P	potable
P/A	presence/absence
PM	Preventive Medicine
QLET	Quick Logistics Estimation Tool
ROWPU	3,000 GPH Reverse Osmosis Water Purification Unit
SMFT	Semitrailer Mounted Fabric Tank
SPO	support operations
SRC	standard requirements codes
STP	short-term potability
SUL	Sustaining Unit Level
SWET	Soldier Water Estimation Tool
TPC	Theater Petroleum Center
TRADOC	U.S. Army Training and Doctrine Command
TSC	Theater Sustainment Command

TWDS	Tactical Water Distribution System
TWPS	1,500 GPH Tactical Water Purification System
USACE	U.S. Army Corps of Engineers
USARIEM	U.S. Army Research Institute of Environmental Medicine
UUL	Universal Unit Level
WB	whole blood
WRD	Water Resources Database
WSDS	water storage and distribution system
WWTP	wastewater treatment plant

References

DoD Directive 4705.01E, Management of Land-Based Water Resources in Support of Contingency Operations, 3 Jun 2015, as amended

Army Regulations (ARs)

- AR 30-22, Army Food Program, Jul 2019
- AR 70–38, Research, Development, Test and Evaluation of Materiel for Worldwide Use, Jun 2020
- AR 700-136, Tactical Land-Based Water Resources Management, Jun 2009

Army Techniques Publications (ATPs)

- ATP 3-11.32, CBRN, May 2016
- ATP 3-34.40, Engineer Ops, Feb 2015
- ATP 3-35.1, Army Pre-Positioned Operations, Apr 2022
- ATP 3-37.10, Base Camps, Jan 2017
- ATP 4-02.1, Army Medical Logistics, Oct 2015
- ATP 4-02.4, Medical Platoon, May 2021
- ATP 4-02.7, Multi-Service Tactics, Techniques, and Procedures for Health Service Support in a Chemical, Biological, Radiological, and Nuclear Environment, Mar 2016
- ATP 4-02.10, Theater Hospitalization, Aug 2020
- ATP 4-25.12, Unit Field Sanitation Teams, Apr 2014
- ATP 4-41, Army Field Feeding and Class I Operations, Dec 2015
- ATP 4-42, Materiel Management, Supply, and Field Services Operations, Nov 2020
- ATP 4-44, Water Support Operations, Oct 2015

Joint Publications (JPs)

- JP 3-34, Joint Engineer Operations, Jan 2016
- JP 4-0, Joint Logistics (Appendix M, Mortuary Affairs Planning), May 2019
- JP 4-02, Joint Health Services, Sep 2018
- JP 4-03, Joint Bulk Petroleum and Bulk Water Doctrine, Nov 2017
- JP 4-04, Contingency Basing, Jan 2019

Technical Bulletins

- TB MED 507, Heat Stress and Casualty, Apr 2022

- TB MED 577, Sanitary Control and Surveillance of Field Water Supplies, May 2010

Training Circulars (TCs)

- TC 4-02.3, Field Hygiene and Sanitation, May 2015
- TC 8-13, Tactical Hospital Infrastructure, Feb 2021

Training Manuals (TMs) and Training Guides (TGs)

- Company Grade Guide to Shower and Laundry (S&L) Operations, Oct 2021
- Technical Guide 364a, Water Reuse in Contingency Operations, U.S. Army Public Health Command, Mar 2014
- TM 8-227-12, Armed Services Blood Program, Joint Blood Program Handbook, Dec 2011

Field Manuals (FM)

- FM 3-0, Operation, Oct 2017
- FM 3-63, Detainee Operations, 2 January 2020
- FM 4-02, Army Health System, Nov 2020
- FM 4-40, Quartermaster Operations, Oct 2013

TRADOC Pamphlets

- TRADOC PAM 525-3-1, U.S. Army Multi-Domain Operations, Dec 2018
- TRADOC PAM 525-4-1, The U.S. Army Functional Concept for Sustainment, Feb 2017

Published Research and Other References

- Brebbia, D. R., R. F. Goldman, and E. R. Buskirk. 1957. "Water vapor loss from the respiratory tract during outdoor exercise in the cold." *Journal of Applied Physiology* 11 no. 2 (September): 219–222.
- Center for Army Lessons Learned. Extracted Nov 2021. <https://call2.army.mil/>
- Charkoudian, Nisha, Robert W. Kenefick, Anthony J. Lapadula, Albert J. Swiston, Tajesh Patel, Laurie A. Blanchard, Elizabeth M. Caruso, Anthony J. Luippold, and Samuel N. Cheuvront. 2016. "Planning Military Drinking Water Needs: Development of a User-Friendly Smart Device Application." *Military Medicine* 181, issue 9 (September): 1142–1150. <https://doi.org/10.7205/MILMED-D-15-00291>
- Department of the Army, Office of the Assistant Secretary of the Army for Installations, Energy and Environment. 2022. *United States Army Climate Strategy*. Washington, DC: Army Publishing Directorate.

- Erdman, Jr., John W., and Lawrence J. Appel. 2005. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: The National Academies Press, 73–185.
- Health.mil. 2021. *Update: Heat Illness, Active Component, U.S. Armed Forces, 2020*. Accessed January 26, 2022.
<https://www.health.mil/News/Articles/2021/04/01/Update-Heat-MSMR-2021?type=All>
- “Water Requirements and Soldier Hydration.” 2012. In *Military Quantitative Physiology: Problems and Concepts in Military Operational Medicine*, edited by Karl Friedl and William R. Santee. Fort Detrick: Borden Institute