Emergency Operations Manual
Volume I - Firefighting Procedures

Book 8: Water Supply for Suburban and Rural Firefighting

Fire and Rescue Departments of Northern Virginia
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PREFAE

Every year in the Northern Virginia area, fires occur in rural and non-hydrant areas that account for significant fire losses. These fires typically occur where hydrants are in excess of 2,000 feet from the occupancy on fire.

Historically, in the more rural areas, the dwellings and occupancies were small homes or outbuildings that did not require significant fire flows to accomplish extinguishment. However, in recent years, with the advent of lightweight construction and buildings with over 4,000 square feet of living space located in non-hydrant areas, water supply requirements have become critical. These incidents easily overwhelm the first-arriving companies and their ability to generate adequate water supplies.

This manual will discuss tanker operations in detail. It is important to note that tanker safety is critical to the success of the operation and, more importantly, the safety of firefighters, Figure 1. All too often, headlines appear in the news like: “Tanker Crash kills 14-Year-Old and Mother”, “Tanker Involved in Rollover Accident, Driver Trapped,” and, “Firefighter Killed in Rollover of Tanker”.

Chris Cavetter wrote the following excerpt in an article in Fire Chief Magazine:

“Tankers account for only a small portion of the apparatus operated by fire departments in the United States, yet they are involved in many of the accidents — a lot of them fatal. Here are 10 deadly mistakes that departments often make when specifying, building, operating and maintaining tankers.

1. Overloading the vehicle
2. Raising the center of gravity
3. Omitting the tank baffles
4. Cutting and splicing the frame
5. Not training drivers
6. Not limiting vehicle speed
7. Not wearing seatbelts
8. Not using ground guides when backing
9. Not following NFPA 1901
10. Not performing regular maintenance.”

[The entire article can be viewed at http://firechief.com/apparatus/ten-tanker-mistakes/.]

Tanker safety must be a priority to all jurisdictions. When a tanker is responding by itself, a minimum of two personnel should be assigned to the unit whenever possible.
OVERVIEW

The purpose of this manual is to:

- Reduce the potential life and property loss by developing an adequate water supply.
- Stress the importance to identify all rural/non-hydrant boxes by dispatch.
- Develop a standardized build-up of resources and tactics to combat fires in non-hydrant areas.
- Develop the appropriate Incident Command System (ICS) to successfully manage water supply operations in non-hydrant areas.
- Identify common terminology.
- Describe the equipment to be used for rural water supply operations
- Standardize the equipment to be used for all tanker companies.
- Develop standard deployment of operational units for fires in non-hydrant areas.
- Establish a Tanker Task Force response to be dispatched to all working fires in non-hydrant areas.
- Provide for a safe working environment for initial attack companies on these incidents.
COMMAND PROCEDURES FOR WATER SUPPLY

The following section outlines the command procedures for water supply operations.

Water Supply Group Supervisor (WSGS)

The roles and responsibilities of the Water Supply Group Supervisor (WSGS) include:

- Supervision of the Water Supply Group, which is responsible for providing adequate water to the incident.
- Establishing and coordinating the fill sites, dump sites, shuttle routes, and/or relay operations in both hydrant and non-hydrant areas.
- Determining with the incident commander the water supply needs of the incident.
- Keeping command apprised of the amount of water available upon request.
- Coordinating traffic control with law enforcement as required.
- Ensuring tankers get priority at the fill and dump sites.
- Ensuring adequate resources are available to support the water supply group.
- Consideration should be given for alternate radio channels for the water supply operation.

Dump Site Unit Leader

The roles and responsibilities of the Dump Site Unit Leader include:

- Managing all activities at the dump site.
- Keeping WSGS apprised of the amount of water available upon request.
- Coordinating traffic control with law enforcement as required.
- Ensuring that tankers get priority at the dump sites.
- Ensuring units are dumped in the timeliest and safest manner possible.
Fill Site Unit Leader

The roles and responsibilities of the Fill Site Unit Leader include:

- Managing all activities at the fill site.
- Keeping WSGS apprised of the fill site conditions upon request.
- Coordinating traffic control with law enforcement as required.
- Ensuring tankers get priority at the fill sites.
- Ensuring units are filled in the timeliest and safest manner possible.
OPERATIONAL PROCEDURES

The following sections outline the procedures necessary for the successful operation of a dump site and a fill site.

Dump Site Operations – *Tankers have Priority at Dump Sites!*

- The dump site is typically located near the end of the driveway leading to the structure unless otherwise noted.
- Exact dump site layouts shall be determined by the terrain; ensure tanks are not set up over ditches or on steep inclines.
- The engine company designated by the area map book/preplan should drop an appropriate appliance, such as a Siamese, at the dump site location and proceed to the incident, typically laying supply line.
- Companies arriving on the scene need to support the water supply through the appliance until the dump tanks can be set up for use by the supply engine.
- The first tanker either pulls past or stops short of the driveway to allow for the setting up of the dump tanks. Tanker driver attaches a line to the supply Siamese and provides water for the first (attack) engine. Tanker driver drops all dump tanks and sets up one to be used immediately. The hard sleeves with the low-level strainer will be left by the tanker driver at the dump site to allow the supply engine to readily hook up and begin water supply operations.
- Supply engine at the dump site sets up for a draft.
- Once a draft is established, tankers will drop the remaining water into the dump tanks then proceed to fill site.
- If a draft cannot be established in a reasonable amount of time consideration should be given to replacing the unit at the dump site.
- The dump site engine driver will temporarily be in charge of dump site until relieved by the third engine officer.
- The Dump Site Unit Leader needs to make sure ample numbers of tanks are set up at the dump site.
- When two or more dump tanks are set up, use of the jet siphon system is recommended. This allows for better use of the water on hand and prevents equalizing of the drafting tanks, which will bring the water below the minimum height for drafting.
- Tankers have the right-of-way in the dump site area; tankers will use their side and/or rear dumps.
- Engine companies involved in the shuttle operation will attach to supply lines away from the dump site and pump their water off. This should leave ample room for tankers to move through the dump site area.
- The Dump Site Unit Leader needs to be very cognizant of the fact that apparatus will be moving through the site. Safety of the personnel is paramount.
- Water is a very important resource! DO NOT WASTE WATER!
- Personnel at the dump site need to wear appropriate PPE, including traffic and command vests.
- Water supply or shuttling units may need to be staged and directed into the incident site as needed to keep the operation moving efficiently.
Fill Site Operations - *Tankers have Priority at the Fill Sites!*

- Typically, the fifth engine is responsible for setting up and maintaining the fill site; the engine OIC will be the Fill Site Unit Leader.
- The first engine shall communicate the fill site location to communications center. **Tankers have priority at the fill sites; they need to have a designated fill position that does not become encumbered by engines.**
- At least two lines will come from the Fill Site engine to facilitate the rapid filling of units coming to the fill site; **fill only one unit at a time.**
- Fill site engines with electronic governor controls need to always draft and fill in RPM mode. Pressure mode can cause damage to tanks!
- The fill site crew will connect and disconnect the fill lines as needed to facilitate a rapid turnaround for units coming and departing the fill site.
- The Fill Site Unit Leader needs to ensure apparatus moves efficiently through the fill site.
- The Fill Site Unit Leader is responsible for site safety ensuring all personnel know their assignments.
- The WSGS needs to STRONGLY consider more than one fill site.
- Personnel at the fill area need to wear the appropriate PPE to include traffic vests and shall wear PFDs if working around an open water source.
GENERAL CONSIDERATIONS

There are several general issues of importance when considering water supply for suburban and rural firefighting:

- Tanker and rural water supply (drafting) operations need to be practiced on a regular basis.
- The ability to build up and support these incident operations need to be identified early, and additional resources need to be called for at that time.
- Build-up and support for this operation is time consuming and calls for an extremely proactive approach by the initial Incident Commander (IC).
- Units and personnel at the dump and fill site need to be very conservative in their water management. Water should not be wasted at the fill or dump site; it needs to be handled efficiently so it can be transferred to the attack engine for use on the fire ground.
- Travel lanes between the dump and fill site(s) must remain open and where possible wide enough for tankers to pass.

Tanker Flow Calculations

The fire flow that can be obtained from a particular unit can be estimated using the following formula: Total Capacity of Tanker minus 20% divided by the round trip time.

Basic Example: A Tanker with 2,500 gallons of water and a travel and fill time of 10 minutes will typically provide 200 gallons per minute fire flow on the fire ground:

Capacity of 2,500 minus 20% (2,500 minus 500) = 2,000

2,000/10 = 200 gallons per minute.

This is the estimated fire flow based on this calculation.

Fire Flow Formula. The NOVA region has adopted the National Fire Academy’s Needed Fire Flow Formula for estimating the required fire flow for rapid fire control (1 to 2 minutes): (Length x Width divided by 3) x # of floors + 25% for each exposure = needed fire flow.

Example: 30’ by 50’ by two-story building, one floor with fire involvement and two exposures.

30 x 50 = 1,500 divided by 3 = 500
1 floor involved 500 x 1 = 500
500 + 2 exposures 250 GPM

Total Fire Flow 750 GPM
TOOLS AND EQUIPMENT

This section will discuss recommended tools and equipment for water supply operations. Equipment may vary in style and manufacture depending on jurisdiction.

**Dump Tanks**

Dump Tanks are portable water tanks that can be set up to augment the water supply in a tanker shuttle operation, Figure 3.

Typical sizes of dump tanks:

- 1,500 Gallons - 10’ 3” x 10’ 3” x 30”
- 2,100 Gallons - 11’ 3” x 11’ 3” x 30”
- 2,500 Gallons - 12’ 3” x 12’ 3” x 30”
- 3,000 Gallons - 13’ 3” x 13’ 3” x 30”

**Low-Level Suction Strainer**

Low-level suction strainers are for use in dump tanks, Figure 4. They allow the engine company drafting to make the best use of all available water in a dump tank down to a water level of approximately two inches.

**Low-Profile Jet Siphon Strainer**

Low-profile jet siphon strainers, Figure 5, allow engines the ability to get water from the dump tanks without having to draft. By charging the 1¾” hoseline, a continuous flow is established. This device can be used to transfer water from one tank to another.
Supply Line Holder

Supply line holders allow personnel assigned to the dump site to set up fill lines for the tanks using 3- or 4-inch hose, Figures 6 and 7. This holder will replace a firefighter typically needed to hold the line while it is discharging into the tank.

Sections of 3 or 4-inch hose are recommended to allow engines to connect and pump off water away from the draft site, which allow tankers easy access to the dump tank.
Jet Siphon

The jet siphon, Figure 8, is an auxiliary item that helps move water between dump tanks and helps with water conservation in the operation. By using the venturi effect, the siphon moves 500 gpm between the tanks as needed.

Floating Dock Strainer

A floating dock strainer, Figure 9, allows engines or tankers to draft from a static water source. The strainer floats on the surface of the water and does not need additional equipment to keep it off the bottom of the water source.
Gated Wyes/Siamese

Gated Wye Set up for LDH and two 3” lines for use at fill sites.

Gated Wye set up for LDH lines for use at dump sites when a LDH Siamese is not available.

LDH Siamese
Minimum Equipment to Be Carried on Units

Equipment to be carried on all tankers:
- Dump tanks – one or two, total size must be at least capacity of tank
- Two 6” hard sleeves
- 6” low-level strainer
- 4” Siamese, manifold, or wye
- Siphon device to move water from one tank to another
- Floating dock strainer
- Supply line (size and amount varies depending on unit)
- Adapters 2½” to 4” (All 4” to be Storz connections)
- Adapters 5” to 6”
- Adapters 4½” to 6”
- Salvage covers for under tanks
- Supply line holder – 3” or 4”
- Water Supply Officer bag
- Water supply preplan book

Equipment to be carried on engines at tanker stations:
- Two 6” hard sleeves
- 6” floating dock strainer
- Supply line – minimum 1,000’ LDH or 2,000’ 3”
- Siphon device to move water from one tank to another
- Adapters – 5” to 6”
- Adapters – 4½” to 6” double female
- Adapters – four 2½” male to 4” Storz
- Adapters – four 2½” female to 4” Storz
- Water Supply Officer bag

1 The Water Supply Officer bag includes: NOVA quick reference guide, tanker capacity guide, tanker resource guide, water supply worksheets, one notepad, two stop watches, one handheld calculator, Water Supply Group Supervisor vest, Fill Site vest, and Dump Site Vest.
- Water supply preplan book
- 4” Siamese, manifold, or gated wye set up for 4” Storz connections for dump site
- Two gated wyes or manifold set up for 4” to two 2½” connections for the fill site
- Personal flotation devices (PFDs) for staffing positions

Equipment to be carried on all engines:
- Two 6” Hard sleeves (strongly suggested)
- 6” Floating Dock Strainer (strongly suggested)
- Supply Line – minimum 1,000’ LDH or 2,000’ 3” (strongly suggested)
- 4” Siamese, manifold, or gated wye set up for 4” Storz connections for dump site operations
- Adapters – four 2½” to 4”
- PFDs for staffing positions

Equipment to be carried on all command vehicles:
- Water Supply Officer bag
- Jurisdiction’s water supply preplans
RURAL WATER SUPPLY AREA PREPLANNING

Preplanning areas where there are no hydrants is extremely important to allow operations to be initiated at the earliest possible moment. A comprehensive preplan needs to be developed. This preplan could be included on map book pages or be separate document.

Homes and other occupied structures in non-hydrant areas need to be identified and water supply area preplan needs to be completed to ensure adequate water supply can be established.

It is recommended preplans for all non-hydrant areas be completed and sent to the first six engine companies and the tanker stations for inclusion in a rural water supply preplan book. (Ensure neighboring jurisdictions are included in this effort.)

A rural water supply preplan book shall be maintained by the tanker stations. New streets and preplans shall be added in the book as they become available.
WATER USAGE AGREEMENT

The Code of Virginia (1989) Title 27 § 27-20 (Chapter 2 – Fire Departments and Fire Companies, Section 27-20) has been interpreted as allowing fire departments and fire companies the right to acquire water from whatever source is available, "to prevent the spread of fire."

It would be beneficial from a public relations perspective for the departments to have a water usage agreement with owner(s) of preplanned water sources. Therefore, every reasonable effort should be made to contact owners of privately owned water sources (with no public access). A Water Usage Agreement (Appendix B) should be filled out, signed by the respective parties, and kept on file. This shall apply to both static and non-static sources.
FIRE OPERATIONS

Tankers will be dispatched on all structure fire incidents in non-hydrant areas. If this is not done at dispatch through the communications center, then a Tanker Task Force should be added by the initial engine company or the battalion chief.

The recommended dispatch for a Tanker Task Force should consist of the following units:

- One engine
- Three tankers
- One Command Level Officer

If tankers are dispatched without engines, it is strongly recommended an additional firefighter is placed on the unit for a crew of two. This will increase the safety of the crew responding to the incident, as well as allow for greater efficiency when performing the tasks required on the scene or at the fill/dump site.

Size-Up and Situation Reports

The first-in company in a non-hydrant area must provide a good concise situation report to the balance of the assigned units coming to the scene. The first-arriving officer needs to do a very good risk benefit analysis to determine whether or not to commit to an offensive operation based on the visual cues available to them on arrival. Additionally, the OIC needs to base their tactics and fire flow requirements on the anticipated water supply.

Based on a risk benefit analysis, the first-in engine company officer must start to develop the appropriate organizational structure to manage the incident. This should be started early and needs to be correct for the incident at hand.

If there is a need to initiate interior offensive operations, it needs to be started as soon as feasible. (Consideration should be given to use CAFS, Class A foam solution, or Class B foam lines to maximize resources; by using foam, crews can effectively extend firefighting operations by using less water.)

While en route to the fire, the first-arriving engine officer needs to begin to set up for water supply operations. With the appropriate area preplan, the officer can designate fill sites, dump sites, or relay positions that will allow in-coming units to take their pre-determined positions.
ROLES AND RESPONSIBILITIES

Shuttle Operation (Typically lays less than 1,000 feet)  
(Includes a Tanker Task Force)

Note – Engines should be used to shuttle water only if needed.

First Engine
- Upon dispatch of a working fire in a structure in a non-hydrant area, a Tanker Task Force should be added at the discretion of the initial engine company or the battalion chief.
- Lay out supply line from the driveway to the incident. This should be done from where the supply pumper and dump tanks are to be located (the dump site). This may require a split lay.
- Assign fifth engine to fill site operation duties and designate fill site location.
- The lay out from the first engine should include a Siamese on the supply line whenever possible.
- Advise incoming units of the mode of attack and supply line position according to the pre-plan.

First Tanker
- Pump water to first engine through the Siamese.
- Drop dump tanks, hard sleeves, low level strainer, and other ancillary devices for dump site operations. Drop an additional Siamese and hose for the dump site engine.
- Once a draft is established from the dump tank by the dump site engine (normally the second engine), the tanker dumps its remaining water into dump tanks.
- Once the tanker is empty, this unit becomes part of the shuttle operation and proceeds to the fill site.

Second Engine (Typically Draft Engine)
- Engine driver sets up to supply water to the first engine from the dump site by hooking a line to the Siamese attached to the first engine’s supply line.
- Second engine positions at dump tank and establishes a draft. Once draft is established, tanker will drop their water into the dump tanks and shuttle.
- Crew then proceeds up the driveway to deploy a back-up line.
- Second engine must leave room for additional drafting tanks to expand the water supply if needed.

Third Engine [Reference Procedural Bulletin 2010-01 for Regional Deviation]
- Officer and crew arrive on the scene and assume control of the dump site.
- Crew from engine sets up and staffs the dump site.
- Third engine officer assumes position as Dump Site Unit Leader (DSUL).
- Engine driver drops water into the dump tank or sets up to flow water to the second engine via the Siamese. After off-loading water, unit proceeds to the designated fill site.
- The DSUL will head up water supply operations until the second Battalion Chief establishes the Water Supply Group. Once the Water Supply Group is established, the DSUL will only be responsible for dump site operations.
- Engine becomes part of the shuttle operation.

**Fourth Engine**
- Officer and two firefighters proceed to the incident scene and become the RIT.
  [Reference Procedural Bulletin 2010-01 for regional deviations.]
- Driver drops water at the dump site and proceeds to the designated fill site.
- Engine becomes part of the shuttle operation if needed.

**Fifth Engine (Fill Site Engine)**
- The fifth engine dispatched on the incident will most likely be directed to respond to the fill site location with the crew to begin fill site operations.
- At least two lines will come from the engine to facilitate the rapid filling of units coming to the fill site. (Tankers have priority and should have a designated fill position.)
- The officer will become the Fill Site Unit Leader and will be under the direction of the Water Supply Group Supervisor.

**First Truck**
- Position truck as close to the fire scene as possible for access by crew and equipment.
  - **Unit must not block travel lanes for shuttle operation.**
- Consideration should be given to use of adjacent driveways.

**First Rescue**
- Position as close to the incident scene as possible for access by crew and equipment.
  - **Unit must not block travel lanes for shuttle operation.**
- Consideration should be given to use of adjacent driveways.

**Second and Third Tanker**
- Arrives on scene at the designated dump site and drops water into the dump tanks.
- Drops additional equipment as required by the Water Supply Group Supervisor.
- Becomes part of the shuttle operation.

**Second Truck**
- Position truck as close to the fire scene as possible for access by crew and equipment.
  - **Unit must not block travel lanes for shuttle operation.**
- Consideration should be given to use of adjacent driveways.

**First EMS Unit (If Suppression Trained)**
- Follows direction of IC.
- If this unit is from a tanker station the crew can be used to augment the operation due to their familiarity with the system.
- If unit is used to assist in water supply operations and or firefighting an additional EMS unit needs to be called for immediately.
  - **Unit must not block travel lanes for shuttle operation.**
First Battalion Chief
- Takes over as the Incident Commander.
- **Unit must not block travel lanes for shuttle operation.** First EMS Supervisor/Command Aide - (If Suppression Trained)
  - Assists battalion chief or IC as needed.
  - **Unit must not block travel lanes for shuttle operation.**

Second Battalion Chief
- Takes over responsibility as the Water Supply Group Supervisor.
- **Unit must not block travel lanes for shuttle operation.**

Second EMS Supervisor/Command Aide - (If Suppression Trained)
- Assists battalion chief with Water Supply Group Operations.
- **Unit must not block travel lanes for shuttle operation.**

Third Battalion Chief/Command Level Officer from the Tanker Task Force
- Reports to command for assignment
- **Unit must not block travel lanes for shuttle operation.**

**Combination Operations**

There are multiple combination operations that can be set up; this manual will only cover a few. Unit assignments are given in the appendices of this manual to cover the operations shown. Unique water supply operations will dictate the use of equipment and personnel. Listed below are tasks assigned to units on every incident.

First-Engine Company
- Upon dispatch of a working structure fire in a non-hydrant area, a Tanker Task Force should be added by the initial engine company or the battalion chief.
- Lay out supply line from area preplan.
- Have the fifth-due engine company respond to a designated fill site.
- Advise incoming units of the mode of attack and supply line position according to the pre-plan.

Second Engine
- Driver performs water supply duties assigned per the preplan.
- Officer and crew to report to fire scene.

Third Engine [Reference Procedural Bulletin 2010-01 for Regional Deviation]
- Third engine officer assumes position as Dump Site Unit Leader (DSUL).
- The DSUL will head up water supply operations until the second Battalion Chief establishes the Water Supply Group. Once the Water Supply Group is established, the DSUL will only be responsible for dump site operations.
• Crew is used to facilitate water supply, the following are a few tasks that may need to be accomplished - set up the dump site, stretch supply lines, attach appliances to lines, connect and disconnect lines for shuttling pumper, set up portable pumps.

**Fourth Engine**
• Crew with officer proceeds to the incident site to become RIT. [Reference Procedural Bulletin 2010-01 for regional deviations.]
• Driver to stay with engine to shuttle if needed or pump during relay operations.

**Fifth Engine**
• The fifth–due engine dispatched on the incident will most likely be directed to respond to the fill site location with the crew to begin fill site operations.
• At least two lines will come from the engine to facilitate the rapid filling of units coming to the fill site; only one unit will be filled at a time. (Tankers have priority and should have a designated fill position.)
• The officer will become the Fill Site Unit Leader and will be under the direction of the Water Supply Group Supervisor.
• In relay operations, officer and crew will be given an assignment.

**Tankers**
• In a shuttle operation, if dump site is not established:
  o Tankers are to stop at dump-site location.
  o Hooks line up to siamese or wye and begins to supply water.
  o Assists third–due engine company crew with establishing dump site by dropping additional dump tanks and equipment.
  o When water drop is completed these units becomes part of the shuttle operation.

• In a shuttle operation, if dump site is established:
  o Tankers may need to drop additional equipment at the dump site or fill site as needed.
  o Tankers will shuttle.

• If in a relay operation:
  o Tankers will supplement the water supply until relay is operational.
  o Tankers may continue to be used to supplement the relay operation with a shuttle operation.

**First Truck**
• Positions truck as close to the fire scene as possible for access by crew and equipment.
  **Unit must not block travel lanes for shuttle operation.**
• Consideration should be given to adjacent driveways.

**Second Truck**
• Positions truck as close to the fire scene as possible for access by crew and equipment.
  **Unit must not block travel lanes for shuttle operation.**
• Consideration should be given to adjacent driveways.
First Rescue
- Positions as close to the incident scene as possible for access by crew and equipment.
- **Unit must not block travel lanes for shuttle operation.**
- Consideration should be given to use of adjacent driveways.

First EMS Unit (If Suppression Trained)
- Follows direction of IC.
- **Unit must not block travel lanes for shuttle operation.**
- If this unit is from a tanker station the crew can be used to augment the operation due to their familiarity with the system.
- If unit is used to assist in water supply operations and or firefighting an additional EMS unit needs to be called for.

First Battalion Chief
- Takes over as the IC.

First EMS Supervisor/Command Aide - (If Suppression Trained)
- Assists battalion chief or IC as needed.
- **Unit must not block travel lanes for shuttle operation.**

Second Battalion Chief
- Takes over responsibility as the Water Supply Group Supervisor.
- **Unit must not block travel lanes for shuttle operation.**

Second EMS Supervisor/Command Aide - (If Suppression Trained)
- Assists battalion chief with Water Supply Group Operations.
- **Unit must not block travel lanes for shuttle operation.**

Third Battalion Chief/Command Level Officer from the Tanker Task Force
- Reports to command for assignment
- **Unit must not block travel lanes for shuttle operation.**
Rural Water Supply Relay Operations

With proper preplanning, relay operations with 4” hose are feasible at distances over one mile. It is recommended a water shuttle supplement the relay as it is being set up due to the time parameters of laying large amounts of hose. The low friction loss makes long relays a viable option.

Relay operations need to be preplanned and the preplan needs to be followed.

The rural water supply relay operation is a time consuming operation and a Tanker Task Force needs to be dispatched to these incidents to ensure an adequate supply of engine companies to complete the hose lay.

Additional tankers and engines that are not needed to accomplish the relay can supply their water to the fireground through a designated relay engine. The Water Supply Group Supervisor shall designate which engine is to accept the water from the supplementing units. The third-arriving engine company officer shall assume the role of the Water Supply Group Supervisor until relieved by the second Battalion Chief [Reference Procedural Bulletin 2010-01 for Regional Deviation].
Fire Boat Operations

Fire boats can be used as a drafting unit to supply a relay, supplement an established water supply or supply a fill site for a shuttle operation.

Command should consider setting up a land based water supply operation by calling for a Tanker Task Force due to the limited number of fire boats and the possibility of extended response time. An engine company needs to be assigned to the fire boat’s location to assist with the setup.
NON-DOMESTIC HYDRANT WATER SOURCES

Dry Hydrants

Dry hydrants are typically installed in ponds, lakes, or streams but could also be found attached to swimming pools. Dry hydrants, when installed properly, will bring the water source to an accessible location. The water will not freeze in the winter due to the depth of dirt over the water level in the piping. Dry hydrants should be back flushed and tested by the local fire department every six months.

Local fire departments must have a contingency plan in times of drought.

(The Commonwealth of Virginia has had grants to facilitate the installation of the dry hydrant. Please view the following web site for more information http://www.dof.virginia.gov/fire/dry-hydrants.shtml. Additional information about dry hydrants can be found in Appendix D.)

Storage Tanks

The developers of subdivisions normally install storage tanks. Upkeep is a concern; in some areas, it is not clear who is responsible for maintenance and upkeep of the tanks.

Tanks are normally underground and set up for drafting operations. Tanks sizes can vary widely. Due to tank design, it is impossible to draft all water from the system.

Systems should be checked by the local fire department every six months for proper operation.

Due to typical tank sizes, these systems should not be used as the sole water source.

Static Water Sources (Ponds, Lakes, Bays, Rivers, Streams, Pools)

Static water sources can include ponds, lakes, bays, rivers, streams, and pools. The success of using a static water source depends on the accessibility and the water depth.

Weather can hinder the use of static water sources; in drought conditions, the water levels can be too low. In extreme cold weather, ice must be cut. In flooding conditions, debris can clog strainers.

Swimming pools can be used as a static water source. Many pools depend upon water weight to support the construction of the pool or to keep the pool in the ground. Consider the risk vs. benefit before using pool water - especially from a neighbor’s home.
APPENDIX A – DEFINITIONS

**Attack Engine:** The first-arriving engine on the scene of a working fire that deploys attack line(s).

**Dump Site:** The location for shuttle apparatus to dump their water. Typically, a portable tank and/or a supply pumper (dump-site engine) will be set up at this location.

**Dump Site Unit Leader (DSUL):** The officer in charge (OIC) from the third engine will be tasked as the Dump Site Unit Leader (DSUL) and will manage the water supply operations until the arrival of the second Battalion Chief. The DSUL reports to the Water Supply Group Supervisor (WSGS) once established. The DSUL is responsible for setting up and maintaining the operations at the dump site.

**Fill Site:** The location where shuttle apparatus fill their tanks for transport to the dump site. An engine at draft or at a hydrant will be at this location.

**Fill Site Unit Leader (FSUL):** The officer in charge (OIC) from the fifth engine supervises activities at the fill site. The fill site reports to the Water Supply Group Supervisor (WSGS) and is responsible for setting up and maintaining the operations at the fill site.

**Non-Hydrant:** Includes all known locations where hydrants are in excess of 2,000 feet from a given structure. The definition of a non-hydrant area should include areas where the infrastructure has failed and/or has limited-access highways where water supply operations may significantly affect the handling of the incident.

**Nurse Tanker:** A tanker that proceeds with the initial attack engine to the incident scene and provides water as needed for the initial attack. This is used in a combination operation scenario where the initial layout of hose would be over 1,000 feet.

**Relay Operations:** The process using two or more engines to supply the attack engine(s) directly from the water source through a supply line.

**Shuttle Operations:** A process using engines and tankers to move water from a specified source to the incident scene.

**Shuttle Route:** The most efficient route possible for shuttle apparatus to use in transporting water from the fill site to the dump site.

**Tanker:** Apparatus designed to carry water from a fill site to the incident scene. The NOVA recommendation for a tanker is a minimum 1000 gpm pump that carries 2,000 gallons of water.

**Tanker Task Force:** Three tankers and one engine.
Water Supply Group: is established by the Incident Commander and given the primary responsibility of supplying water to the incident scene in the needed gpm to meet the needs of the incident. It is recommended the second Battalion Chief be assigned as the Water Supply Group Supervisor.

Water Supply Group Supervisor (WSGS): It is recommended the second Battalion Chief be tasked with WSGS. The WSGS is assigned the role of developing an adequate water supply for the incident. The WSGS will need to secure their own radio channel for water supply operations. The third due Engine OIC will be responsible for the duties of the Water Supply Group from the Dump Site position until relieved by the WSGS.
APPENDIX B – WATER USAGE AGREEMENT

WATER USAGE AGREEMENT

I/We, the undersigned owner(s) of a lake, pond, creek or other fixed body of water located at _________________________________ do hereby grant the Fire Departments permission to utilize the body of water for emergency incident mitigation.

All other uses of said body of water shall be after notification and permission of the owner(s).

This contract can be cancelled at any time by written notice given thirty days in advance to the Fire Department.

_______________________________       ___/___/___
OWNER DATE

_______________________________       ___/___/___
OWNER DATE

_______________________________       ___/___/___
WITNESS DATE
APPENDIX C – WATER SUPPLY GRAPHICS

This section contains some graphic representations of certain water supply incidents.

Relay Operations

**Example shown is a 3,200' Relay**

1\(^{st}\) Eng: Lay from Higgins St. & Feaster Way to incident, crew to fire  
2\(^{nd}\) Eng: Lay from Cullers Ave. & Higgins St. to 1\(^{st}\) Eng’s LDH, crew to fire  
3\(^{rd}\) Eng: Lay from Legore Dr. & Cullers Ave to 2\(^{nd}\) Eng’s LDH. OIC to be the Dump Site Unit Leader, crew to assist with water supply  
4\(^{th}\) Eng: Lay from Hydrant on Legore Dr. To 3\(^{rd}\) Eng’s LDH, crew to fire  
5\(^{th}\) Eng: Hits the Hydrant, crew to fire  

**Additional Tankers & Engines** - Off load water through Engine designated by the Dump Site Unit Leader (in this scenario the 3\(^{rd}\) Eng. would be a good choice due to location) then shuttle.  

**Note:** If tanker is coming with first due units, the tanker can be located by first engine and used as a nurse tanker.
Shuttle Operation “Short Driveway” (Steps 1 through 3)

**Shuttle Operation** (Step 1 of 3)

Example shown is a 400' driveway

1st Eng Lay up drive to incident  
1st Tanker attach to Siamese at dump site point, pump water to 1st Eng., drop tank or tanks & start setting up a single tank dump site  
2nd Eng attach to Siamese, help set up dump site and establish draft. Once draft is established, pump water to 1st Eng. through Siamese, Tanker then drops water into tank and shuttles
### Shuttle Operation (Step 2 of 3)

**Example shown is a 400’ driveway**

1st Tanker – once 2nd Eng establishes draft, dumps remaining water into tank and shuttles
2nd Eng drafts water from tank, sets up second pit if needed, attaches 1 ¾” to jet siphon on hard sleeve to move water to drafting tank
3rd Eng OIC to be Dump Site Unit Leader, crew to staff dump site to insure dump site is set up, attach LDH to pit with the supply line holder, connect Siamese and LDH to tanks. Engine to shuttles as needed.

Additional pits may be added if needed.
Shuttle Operation (Step 3 of 3)

Example shown is a 400' driveway

**1st Eng** at incident crew to fire
**1st Tanker** shuttle, dump water directly into tanks
**2nd Eng** continues to draft from tanks, if needed more tanks can be set up. Crew to fire
**3rd Eng** shuttle, pump water into tanks through LDH, crew to staff Dump Site, OIC to be Dump Site Unit Leader
**4th Eng** shuttle as needed, pump water into tanks through LDH, crew to fire
**5th Eng** to establish fill site, crew to staff Fill Site, OIC to be Fill Site Unit Leader
All other Engines and Tankers Shuttle

**Note:**
Tankers are the only units to off load water directly into pits unless otherwise directed by the Dump Site Unit Leader or the Water Supply Group Supervisor.

**1st Eng**
**2nd Eng**
**3rd Eng**
**4th Eng**
**5th Eng**

Mullins Ave.
Monroe St.
2nd BC (WSGS)
Combination Operations

**Combination Operation (A) (step 1 of 2)**

"Relay Shuttle Combination"

Example shown is a 2,000' driveway

1st Eng Proceed to incident
2nd Eng Lay out from dump site to Tanker’s LDH
3rd Eng OIC to be the Dump Site Unit Leader, crew staff dump site, Eng. to attach to Siamese or Wye to LDH off load water then shuttle
4th Eng attach LDH to Siamese or Wye, off load water then shuttle as needed
5th Eng to establish fill site, OIC to be Fill Site Unit Leader
All other Eng. Shuttle as needed

1st Tanker drop tanks & establish dump site, off load water and shuttle (see step 2 of 2)

Additional Tankers to Shuttle
Combination Operation (A) (step 2 of 2)

“Relay Shuttle Combination”

Example shown is a 2,000’ driveway

1st Eng at incident, crew to fire
2nd Eng in relay, crew to fire
3rd Eng shuttles as needed, crew to staff dump site, OIC to be DSUL
4th Eng shuttles as needed, crew to fire
5th Eng to establish fill site, crew to staff fill site, OIC to be FSUL
1st Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

Additional Tankers Shuttle

1st Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

LDH Direct dump to pits for Engines

2nd Due Engine crew to staff Dump Site, OIC to be DSUL

3rd Due Engine crew to staff Dump Site, OIC to be DSUL

5th Due Engine to staff Fill Site, OIC to be FSUL
**Combination Operation (B) (step 1 of 2)**

"Relay Shuttle Nurse Combination"

Example shown is a 2,000' driveway in Tanker's first due

---

1st Eng Proceed to incident
1st Tanker drop equipment at dump site point, continue in, layout from Cooper Ct. and Artone Dr. and supply water to 1st Eng.
2nd Eng Lay out from dump site to Tanker’s LDH
3rd Eng OIC to be the Dump Site Unit Leader, crew staff dump site, Eng. to attach to Siamese or Wye to LDH off load water then shuttle as needed
4th Eng attach LDH to Siamese off load water then shuttle as needed
5th Eng to establish fill site, OIC to be Fill Site Unit Leader
All other Eng. Shuttle as needed
2nd Tanker drop tanks & establish dump site, off load water and shuttle (see step 2 of 2)
All other Tankers Shuttle
Combination Operation (B) (step 2 of 2)
“Relay Shuttle Nurse Combination”

Example shown is a 2,000’ driveway in Tanker’s first due

1<sup>st</sup> Eng at incident, crew to fire
1<sup>st</sup> Tanker supply 1<sup>st</sup> Eng.
2<sup>nd</sup> Eng in relay, crew to fire
3<sup>rd</sup> Eng shuttle as needed, crew to staff dump site, OIC to be DSUL
4<sup>th</sup> Eng shuttle as needed, crew to fire
5<sup>th</sup> Eng to establish fill site, crew to staff fill site, OIC to be FSUL
2<sup>nd</sup> Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

Additional Tankers Shuttle

1<sup>st</sup> Eng at incident, crew to fire
1<sup>st</sup> Tanker supply 1<sup>st</sup> Eng.
2<sup>nd</sup> Eng in relay, crew to fire
3<sup>rd</sup> Eng shuttle as needed, crew to staff dump site, OIC to be DSUL
4<sup>th</sup> Eng shuttle as needed, crew to fire
5<sup>th</sup> Eng to establish fill site, crew to staff fill site, OIC to be FSUL
2<sup>nd</sup> Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

Additional Tankers Shuttle

LDH Direct dump to pits for Engines

3<sup>rd</sup> Due Engine crew to staff Dump Site, OIC to be DSUL

2<sup>nd</sup> BC (WSGS)

1<sup>st</sup> Tanker

Cooper Ct.

2<sup>nd</sup> Tanker

Monaco St.

Artone Dr.

1,000’

2 Miles

1,000’

5<sup>th</sup> Due Engine to staff Fill Site, OIC to be FSUL
Combination Operation (C) (step 1 of 2)

"Relay Shuttle Nurse Combination"

Example shown is a 2,000' driveway in Tanker’s first due with limited LDH

1st Eng lay out from Artone Dr. & Cooper Ct to incident
1st Tanker drop equipment at dump site point, continue in, use extreme caution to miss 1st Eng.’s LDH
2nd Eng Lay out from dump site to 1st Eng.’s LDH
3rd Eng OIC to be the Dump Site Unit Leader, crew staff dump site, Eng. to attach to Siamese or Wye to LDH off load water then shuttle
4th Eng attach LDH to Siamese off load water then shuttle as needed
5th Eng to establish fill site, OIC to be Fill Site Unit Leader
All other Eng. Shuttle
2nd Tanker drop tanks & establish dump site, off load water and shuttle (see step 2 of 2)
All other Tankers Shuttle
Combination Operation (C) (step 2 of 2)
“Relay Shuttle Nurse Combination”
Example shown is a 2,000’ driveway in Tanker’s first due with limited LDH

1st Eng at incident, crew to fire
1st Tanker supply 1st Eng.
2nd Eng in relay, crew to fire
3rd Eng shuttle as needed, crew to staff dump site, OIC to be DSUL
4th Eng shuttle as needed, crew to fire
5th Eng to establish fill site, crew to staff fill site, OIC to be FSUL
2nd Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

Additional Tankers Shuttle

1st Eng
1st Tanker supply 1st Eng.
2nd Eng
3rd Eng shuttle as needed, crew to staff dump site, OIC to be DSUL
4th Eng shuttle as needed, crew to fire
5th Eng to establish fill site, crew to staff fill site, OIC to be FSUL
2nd Tanker drop tanks & establish dump site, off load water and shuttle, closest engine to be used for dump site draft

LDH Direct dump to pits for Engines

2nd BC (WSGS)

Monaco St.

1,000’

2 Miles

Cooper Ct.

Artone Dr.

1,000’

5th Due Engine to staff Fill Site, OIC to be FSUL

3rd Due Engine crew to staff Dump Site, OIC to be DSUL

2nd Tanker

2nd Eng
**Combination Operation (D)**

"Relay Operation supplemented by a Shuttle Operation"

*Example shown is a 3,200' Relay from low GPM Hydrant supplemented by a shuttle*

1st Eng lay from Fairfax Dr. and Arlington St. to incident, crew to fire
2nd Eng Lay from Alexandria Pkwy and Fairfax Dr. to 1st Eng LDH, crew to fire
3rd Eng lay from Prince William Hwy and Alexandria Pkwy to 2nd Eng’s LDH. OIC to be the Dump Site Unit Leader
4th Eng lay from Hydrant on Prince William Hwy to 3rd Eng LDH
5th Eng hit Hydrant
6th Eng in this specific situation go to establish fill site, OIC to be Fill Site Unit Leader since 5th Eng is in shuttle

**Additional Tanker** shuttle to supplement relay

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**Diagram:**

- 1st Eng
- 2nd Eng
- 3rd Eng
- 4th Eng
- 5th Eng
- Tanker
- Fairfax Dr.
- Alexandria Pkwy
- Loudoun Ct.
- Prince William Hwy
Fire Boat Operation

Fire Boat Relay Operation

“Relay from a Fire Boat”

Basic Relay operation supplied by a Fire Boat. The Fire Boat can be the water supply or it could be used as a supplemental water supply on large incidents. Depending on the jurisdiction and location, the Fire Boats may have a lengthy response or may be involved in another incident. Call for a Tanker Task Force and set up a land based operation until the Fire Boat relay is operational.

LDH to a land based water supply until the Fire Boat relay is operational

3rd Due Engine OIC to be the Dump Site Unit Leader

1st Eng
2nd Eng
3rd Eng

Fire Boat
Boat Dock

1,000'
Fill Site Operations

Tankers have priority over Engines

Draft or Hydrant

Note: For engines with Electronic Governor controls, always draft and fill in RPM mode. Filling in pressure mode can cause tank failure!

Fill Site Operations

Normally handled by the 5th Engine OIC to be Fill Site Unit Leader
Personnel must be ready to hook and unhook lines
Driver does not need to shut lines down if Wye is utilized
This could be set from a hydrant or from draft
APPENDIX D – DRY HYDRANTS AND STORAGE TANKS

Typical Dry Hydrant

Note: Back flush system prior to use.
**Typical Water Storage Tank**

Note: Tank sizes vary. This is not a sustainable water supply. Systems must be refilled after use.
## APPENDIX E – NOVA QUICK REFERENCE SHEET

<table>
<thead>
<tr>
<th>Unit</th>
<th>Shuttle Operation</th>
<th>Combination Operations</th>
<th>Relay Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Engine</td>
<td>Lay supply line from dump site to the incident, (split lay may be necessary). Advise incoming units of the mode of attack, supply line positioning, dump &amp; fill site locations. Command decision.</td>
<td>Announce water supply instructions to incoming units. On-scene report, size-up, command decision. Consider requesting additional resources.</td>
<td>Lay supply line from location &lt;1000' from incident. Advise incoming units of the mode of attack &amp; supply line drop preplanned positions. Command decision.</td>
</tr>
<tr>
<td>2nd Engine</td>
<td>Supply water to the 1st Engine via the Siamese. Establish dump site. Engine prepares to draft from tank. Officer &amp; crew report to the fireground. Assume Command if needed.</td>
<td>Complete split lay for relay operations or establish the Dump Site. Supply water to the 1st Engine. Officer &amp; crew report to the fireground. Assume Command if not established.</td>
<td>All Engines - Lay supply line from preplanned points to 1st Engine's supply line until at water source. 2nd Eng. - Officer &amp; crew report to the fireground. Assume Command as needed.</td>
</tr>
<tr>
<td>3rd Engine</td>
<td>Officer &amp; crew set up &amp; staff the dump site. Officer establishes the Dump Site. Engine driver pumps or drops water at the dump site &amp; enters the shuttle operation if needed. OIC will become the &quot;Dump Site Unit Leader&quot;</td>
<td>Officer establishes the Dump Site. Crew performs water supply operations as directed. Operations may include: establish dump site, set-up portable pumps, hand-lay additional supply lines etc. OIC will become the &quot;Dump Site Unit Leader&quot;</td>
<td>Officer establishes the Dump Site &amp; directs the off loading of supplemental shuttling units and coordinates water supply. Crew to assist with water supply as needed. OIC will become the &quot;Dump Site Unit Leader&quot;</td>
</tr>
<tr>
<td>4th Engine</td>
<td>Officer &amp; crew establish RIT. Engine Driver pumps or drops water at the dump site &amp; enters the shuttle operation if needed.</td>
<td>Officer &amp; crew establish RIT. Engine Driver shuttles or pumps as part of a relay depending on the operation being used.</td>
<td>Officer &amp; crew establish RIT. Engine Driver pumps in relay, supplemental shuttle, drafts or hits hydrant as needed</td>
</tr>
<tr>
<td>5th Engine</td>
<td>Establish &amp; staff the fill site at the designated location. OIC will become the &quot;Fill Site Unit Leader&quot;</td>
<td>Shuttle Ops: Establish &amp; staff the fill site. OIC will become the &quot;Fill Site Unit Leader&quot;</td>
<td>Officer &amp; crew to assist as needed. Engine Driver pumps in relay, supplemental shuttle, drafts or hits hydrant as needed</td>
</tr>
<tr>
<td>1st, 2nd Truck &amp; 1st Rescue</td>
<td>Position as close as possible for crew and equipment access. APPARATUS MUST NOT BLOCK THE TRAVEL LANES USED BY SHUTTLE APPARATUS. Consider the use of adjacent driveways.</td>
<td>Position as close as possible for crew and equipment access. APPARATUS MUST NOT BLOCK THE TRAVEL LANES USED BY SHUTTLE APPARATUS. Consider the use of adjacent driveways.</td>
<td>Position as close as possible for crew and equipment access. APPARATUS MUST NOT BLOCK THE TRAVEL LANES USED BY SHUTTLE APPARATUS. Consider the use of adjacent driveways.</td>
</tr>
<tr>
<td>1st Tanker</td>
<td>Supply the 1st engine via the Siamese. Drop all equipment needed to establish the dump site. Once draft is established from tank by 2nd Engine, dump any remaining water into tank and begin the shuttle.</td>
<td>Supply the 1st engine via a Siamese. Drop all equipment needed to establish the dump site. Once the dump site is established dump any remaining water into tank and begin the shuttle.</td>
<td>Supply the 1st engine via the Siamese or relay engine. If not locked in the relay, tanker will supplemental shuttle until continuous water source is established.</td>
</tr>
<tr>
<td></td>
<td>2nd Tanker</td>
<td>Same as 1st Tanker</td>
<td>1st BC</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>1st BC</strong></td>
<td>Assume Incident Command</td>
<td>Assume Incident Command</td>
<td>Assume Incident Command</td>
</tr>
<tr>
<td><strong>2nd BC</strong></td>
<td>Assumes responsibility as the Water Supply Group Supervisor near Dump Site area.</td>
<td>Assumes responsibility as the Water Supply Group Supervisor.</td>
<td>Assumes responsibility as the Water Supply Group Supervisor.</td>
</tr>
<tr>
<td><strong>1st EMS unit</strong></td>
<td>PPE, Establish Rehab, May be assigned to augment the operation-Request additional EMS unit when assigned to firefighting or supply operations.</td>
<td>PPE, Establish Rehab, May be assigned to augment the operation-Request additional EMS unit when assigned to firefighting or supply operations.</td>
<td>PPE, Establish Rehab, May be assigned to augment the operation-Request additional EMS unit when assigned to firefighting or supply operations.</td>
</tr>
<tr>
<td><strong>1st EMS Supervisor</strong></td>
<td>If suppression trained, assist the IC as needed.</td>
<td>If suppression trained, assist the IC as needed.</td>
<td>If suppression trained, assist the IC as needed.</td>
</tr>
<tr>
<td><strong>3rd BC</strong></td>
<td>Report to Command for Assignment with PPE and SCBA</td>
<td>Report to Command for Assignment with PPE and SCBA</td>
<td>Report to Command for Assignment with PPE and SCBA</td>
</tr>
</tbody>
</table>
## APPENDIX H – NOVA RURAL WATER SUPPLY WORKSHEET

### Incident Command System

**Rural Water Supply Officer**
Fire and Rescue Department of Northern Virginia

**Water Supply Group Supervisor**

## Task or Objectives | Done
---|---
Establish Dump Site with 1 Engine Company | 
Establish 1st Fill Site with 1 Engine Company | 
Establish 2nd Fill Site with 1 Engine Company | 
Establish Water Supply Radio Channel | 
Ensure shuttle units are being coordinated | 
Ensure shuttle routes are kept open | 

### Rural Water Supply Round Trip GPM Calculation Table

<table>
<thead>
<tr>
<th>Unit</th>
<th>Tank Size</th>
<th>Round Trip</th>
<th>GPM Delivered</th>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>750</td>
<td>60 GPM</td>
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<td>100 GPM</td>
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<td>3000</td>
<td>240 GPM</td>
<td>160 GPM</td>
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</table>

<table>
<thead>
<tr>
<th>Fire Attack GPM</th>
<th>Water Supply GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>