# Swiftwater / Flood Rescue Technician Level

Student Workbook

DELIVERY OF THIS PROGRAM BY THE VERMONT FIRE ACADEMY WAS MADE POSSIBLE THROUGH A COOPERATIVE EFFORT BETWEEN THE NYS OFFICE OF FIRE PREVENTION AND CONTROL AND THE NYS OFFICE OF HOMELAND SECURITY.

# Swiftwater/Flood Rescue

# Student Workbook

VERMONT FIRE ACADEMY

Division of Fire Safety

SWIFTWATER/FLOOD RESCUE

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# Introduction to Swiftwater Rescue

Water rescue incidents can happen in any jurisdiction. These are low frequency incidents, but can pose an extreme high risk to first responders. Due to the low frequency nature of these events most fire departments do not allocate sufficient time for training or funds for equipping their personnel to handle water rescues. However the hazardous nature of these incidents can place firefighters at extreme risk. Often the situation is desperate and when rescuers attempt a rescue anyway they can, they become victims themselves.

## *Drowning Facts*

Drowning is the second leading cause of accidental death in the US

- Over 4000 lives lost annually/300,000 worldwide
- Over half of victims are children
- Most victims did not wear a Personal Floatation Device
- Alcohol and hypothermia are often contributing factors

➢ Many would be "rescuers" become victims themselves due to lack of proper training and equipment

➢ Rescuers should always wear a PFD if within 10 feet of the water. While it is possible to drown while wearing a PFD, it is the best way to protect against drowning.

## *Swiftwater Rescue Incidents*

Swiftwater rescue incidents may occur at diverse events and locations.

➢ Recreational Accidents: fisherman, kayakers, tubers, rafters and others use whitewater rivers for recreation. While some are highly skilled, others may have little training or experience. Recreational accidents usually have only one or two victims, but may occur in remote or inaccessible locations.

- Flash Floods can cause normally small streams to become swollen torrents in flood conditions. Flooding claims move victims than any other natural disaster. Flash Floods may result in extraordinary high volume of rescue calls in a very short time; overwhelming even the best trained and equipped teams. Most deaths happen when people try to cross moving water on foot or in vehicles

- Transportation accidents involving water can happen without warning, in just about any location, and generate multiple victims many who may be entrapped and injured. While many agencies are well prepared for mass causality incidents on land, few plan for these events occurring on the water.

- Incidents which occur on or near swiftwater often lead to searches. These searches often become extended events with a large numbers of searchers, who often lack swiftwater training or equipment. This high exposure of manpower to the hazards of Swiftwater Rivers can result in responder injury or death.

## *Why do Firefighters need to train for Swiftwater Rescue?*

Most firefighters are not adequately trained or equipped for swiftwater rescues. Because water rescues are infrequent events, fire departments often do not have the training and equipment needed to safely effect rescues in the swiftwater environment. However, as in most rescue incidents, it is the fire department that is called on to respond when these events do occur. The lack of proper training and equipment will put first responders at greater risk when these events happen

While agencies with high numbers of water related calls are often well prepared for water rescues, floods can create water rescue problems in locations that usually have little if any moving water. Fire departments should have, as a minimum, awareness level training for responding to water rescue incidents. Like confined space and haz-mat incidents the special hazards of water rescue can put the untrained & poorly equipped rescuers at an extreme high risk.

At certain incidents we will have time to plan how to deal with the hazards, but the urgent nature of water rescues do not usually give us this opportunity. Unlike many technical rescue incidents, with water rescue incidents there is often no time to wait for a specialized team to respond. Most successful water rescues are made by first arriving units. On scene responders often are under great pressure to make rescue attempts, without proper training and equipment this can result in injury and death of the responders.

## *Risk Paradox*

High hazard – Low Frequency events. The risk paradox matrix illustrates the relation of hazard level and frequency to risk. Events such as structure fires & motor vehicle accidents are frequent events for firefighter and as such we develop recognition based decision making skills, which allow us to mitigate the high hazards which they present.

However events which are low frequency do not occur often enough for responders to build the level of competence needed to overcome the hazards.

Low frequency /High Hazard incidents such as water rescue present a clear risk to responders and therefore are a critical training function. Only through frequent training can we master the skills needed to safely perform these tasks.


### *Rescuers Drownings*

Rescuers often drown because of:

- Failing to wear a PFD
- Over estimating their skills or abilities
- Inadequate training and equipment
- Feeling of urgency/need to act
- Under-estimate effects of cold &/or moving water

First responders often lack an understanding of the risks involved in water rescue as well as basic equipment such as a PFD & helmet. In addition many drowning victims are children – this often leads to adults taking far greater risks to attempt a rescue then they normally would. Compassion can kill!

### *Absolute Water Rescue Rules*

Some rules are absolute in surface water rescue. While there are some exceptions, these rules form the basics of most water rescue training programs.

These rules are:

- Never wear Firefighting PPE for water rescue
- Always Wear a PFD within ten feet of water
- Don't enter moving water except as a last resort.
- Don't tie directly into a rope in moving water
- Never risk your life to recover a body or equipment

## *Case Histories – Rescues Gone Bad*

These are a few case studies of water rescue incidents where the outcomes were disastrous. Note: Review a few of these case studies with students. These accident reports are included in the appendix of this lesson as well as the student manual.

- Binghamton, NY
- Slippery Rock, PA
- Ohio 2006
- Vermont/New Hampshire 2006
- Hurricane Irene – 2011 NJ LODD

## *Case History: Firefighter LODD Binghamton Incident*

This is video footage of the 1975 Binghamton LODD of three firefighters at a low head dam incident.

- Discuss safety issues presented by the incident such as:
- Lack of understanding of the hazard created by the low head dam
- Lack of appropriate equipment & training for the situation
- Inadequate planning and a back-up rescue team
- Inadequate use of a risk assessment to determine benefit vs. risk

## *Specialized Water Rescue Disciplines*

There are many different water rescue disciplines including;

- Swift-water / Flood Rescue
- Ice/cold water Rescue
- Dive Rescue
- Surf/marine Rescue


Each discipline has its own knowledge, skills, equipment, and procedures. What is considered safe in one discipline maybe dangerous in another environment. Slim Ray, a pioneer in water rescue, once said "What may be a standard operating procedure in one water rescue discipline may quickly kill you in another."

An example of this are the tethers used in dive & ice rescue. If used in a swift-water scenario the force of the moving water will trap the rescuer at the end of the rope and drown them. Informal estimates in the US, based on the number of firefighter deaths in fires per thousand working fire calls, compared to the number of firefighter deaths per thousand water calls, would seem to indicate that the chances of an American firefighter drowning on duty are 400% higher than those of dying in a working fire!" Jim Segerstrom

# ***Water Rescue Response Planning***

An important first step in preparing for water rescue response is planning. While every agency does not need to have a full water rescue team, all agencies need to have a response plan to deal safely with water emergencies when they occur. NFPA 1670 sets forth planning standards for agencies responding to technical rescue incidents.

Components of response planning

- Hazard Assessment
- Incident Preplanning
- Determine Agency Response Level
- Resource Identification
- Policy & Procedures
- Personnel & Equipment

## *Hazard Assessment*

A hazard assessment should be conducted to determine technical rescue needs. A hazard assessment should look at probability, vulnerability, and consequences of a technical rescue incident to help to determine the need for a technical rescue response capability.

The probability of an incident can be estimated by evaluating past history of incidents, physical hazards, exposure to the hazards, event likelihood and time hazards are present.

Vulnerability can be determined by assessing the risks for injury or death, community disruption, infrastructure damage, mass casualties, and the area affected.

The consequences of an incident can be considered by assessing risk to responders, resources needed, duration of incident and how time critical the response will be.

## *Site Hazard Survey*

While the hazard assessment looks at the needs for a response capability, a site hazard survey looks at the physical hazards to gather information for development of an incident response plan.

- Survey & mapping projects can identify local swiftwater hazards, site access & egress, river features, and flood zones.

- Often rivers features are best evaluated from the river by a boat survey at favorable water levels.

- Evaluation of use/users: how much public exposure is there to the hazards, what type of users are accessing the site, are they adequately prepared, and where are they likely to have accidents?

- Flow Data: how high can the water get, how fast will it rise/recede, and how fast will the current be at high flows…?

## *Determine Agency Response Level*

Department response levels for swift-water/flood rescue should be determined by the local authority having jurisdiction (AHJ). The department should provide the necessary training and equipment for that level of response. Plans should be made for responses beyond the department capability. NFPA 1670 sets standards for department operations at technical rescues incidents and includes the following response levels:

- Awareness Level: basic safety knowledge only
- Operations Level: basic self-rescue & shore based techniques
- Technician Level: fully trained & equipped for performing rescues

## *Resource Directory*

A resource list of local water rescue resources can also be a great help in identifying where assistance can be found and what capabilities are available. Directory should include:

- List of swiftwater rescue resources
- Include resource type, capability, dispatch information, & estimated response times.
- Personnel rosters & Equipment inventories
- Mutual aid arrangements

**Water Rescue Resources**

- Mutual aid from local water rescue teams
- Vermont State – Urban/Technical Search & Rescue
- NYS OFPC- Urban/Technical Search & Rescue NYTF-2
- Statewide Mutual Aid System
- Vermont National Guard
- New York State DEC Forest Rangers
- US Coast Guard - Helicopter Rescue NJ & Cape Cod

Since technical rescues often require a large number of highly trained and experienced personnel, it is often difficult for a small department to adequately staff water rescue teams. Mutual aid agreements and regional technical rescue teams make sense.

## *Developing swiftwater rescue policy & procedures*

Each jurisdiction needs to establish its own policy and procedures for water rescue based on local conditions and resources. NFPA 1006 and 1670 are good resources for creating local SOP's. Incident response plans should be clear & concise, providing direction on basic operations, but still allowing for flexibility.

- Developed by local AHJ (IE: Fire chief, team leaders…..)
- Use NFPA 1670 as a guideline
- Keep it simple – don't write a book- one page is best
- If you write it down, be sure you can always follow the procedure

## *NFPA Standards*

The National Fire Protection Association (NFPA) standards are a national consensus standard. They are not laws or regulations unless adapted by an AHJ as such. They are professional standards that are developed to provide professional guidance for the fire service and fire protection industries. While they do not carry the weight of law or regulation, they have legal standing in that courts may weigh our actions (or inaction) against these standards in civil or criminal cases. The following NFPA standards apply to Fire departments operating at technical rescue incidents

- NFPA 1670 – standard on operations & training for technical rescue
- NFPA 1006 - standard for technical rescuer professional qualifications
- NFPA 1952 -standard on surface water operations protective clothing and equipment
- NFPA 1983- standard on life safety rope & equipment

**Personnel Qualifications**

Rescue personnel need to be qualified to preform technical rescue or the risks of death or injury increase. Determining personnel qualifications is the responsibility of the local AHJ (i.e.: Fire chief, team leaders…..). This is not as simple as having a swiftwater rescue training certificate. While obtaining a certificate of training may be used as part of the qualification process, other factors need to be considered such as; fitness levels, other training & experience, personal competence, skill maintenance, and the ability to work within the ICS structure. NFPA 1006, the standard for professional qualifications for technical rescue provides a good resource for developing rescuer qualifications for your team.

**Equipment needs**

It is the responsibility of the AHJ to provide adequate personal protective equipment for the specific hazards personnel will be exposed to at the level of response the department will operate at for a given technical rescue incident. For swiftwater and flood rescue responses these hazards are moving water, physical environment, cold environments, contamination (flood waters), and bodily fluids. The AHJ should also provide adequate rescue equipment to affect a rescue and protect victims.

# Dynamics of Moving Water

In order to understand the hazards involved in water rescue, an understanding of how water flows and the hazards it presents is essential. This lesson will describe some of the more common hazards and the mechanics behind these hazards.

### Water Hazards

Fast Moving Water- Less than 2 feet of fast moving water can sweep people & even vehicles away. Attempting to stand in moving water can cause foot entrapments. While with proper technique successful wading can be accomplished but many people attempting to cross flooded roads are swept away each year. People trying to cross such waters are also subject to foot entrapments and being swept into strainers. Force of water on rescuer tied to rope or stuck on a strainer can be deadly and nearly impossible to escape from.

# Force of moving water

| Current Velocity | Force on a body | Force on a Boat |
|---|---|---|
| 3 MPH | 33 LB. /FT | 168 LB. /FT |
| 6 MPH | 134 LB. /FT | 672 LB. /FT |
| 9 MPH | 302 LB. /FT | 1512 LB. /FT |
| 12 MPH | 538 lbs. /FT | 2688 lbs. /FT |

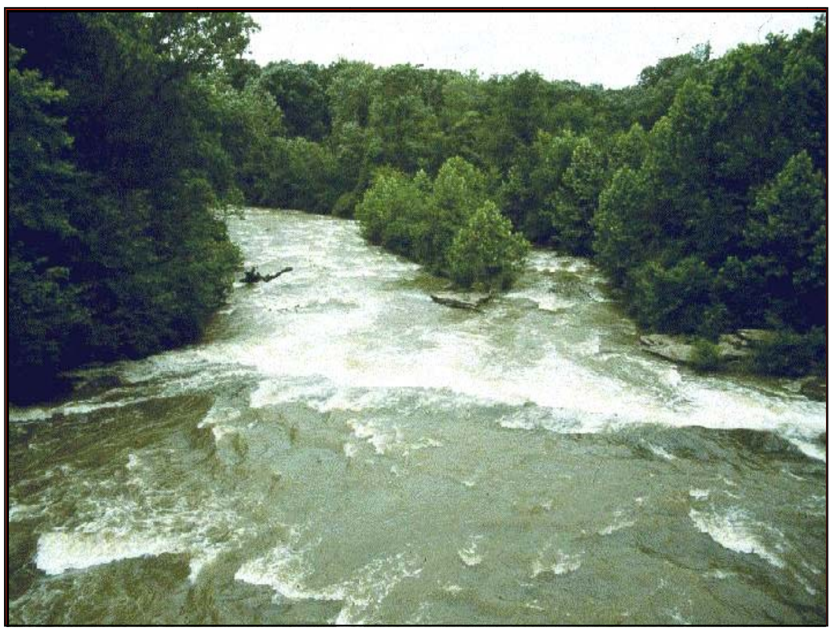
Speed of the current can be calculated by timing an object moving between points of known distance – see chart for speed computations. Force generated by water is a product of velocity (speed) and Volume. This is referred to as flow. Flow to usually measure in Cubic Feet per Second (CFS), this refers to the amount (cubic feet) of water that passes a certain point over a time period (one second)

## Speed of water

| Current Velocity | 6000ft | 100 ft | 10 ft |
|---|---|---|---|
| 1 knot (1.15 MPH) | 1 hr | 1 min | 6 sec |
| 3 knots (3.45 MPH) | 20 min | 20 sec | 2 sec |
| 6 knots(6.9 MPH) | 10 min | 10 sec | 1 sec |

## *River Orientation*

Orientation to the river is important to both the river runner and the rescuer.
In the rescue service we have adopted some common river orientation terminology from kayakers and rafters such as: river right and river left which refer to the right bank and left bank when facing downstream. Understanding the features of moving water and some basic river terminology is important part of preparing for water rescue operations. The ability to "read the river" is developed through experience and gaining knowledge of river features. White water rafting trips provide an excellent means to gain river reading skills.

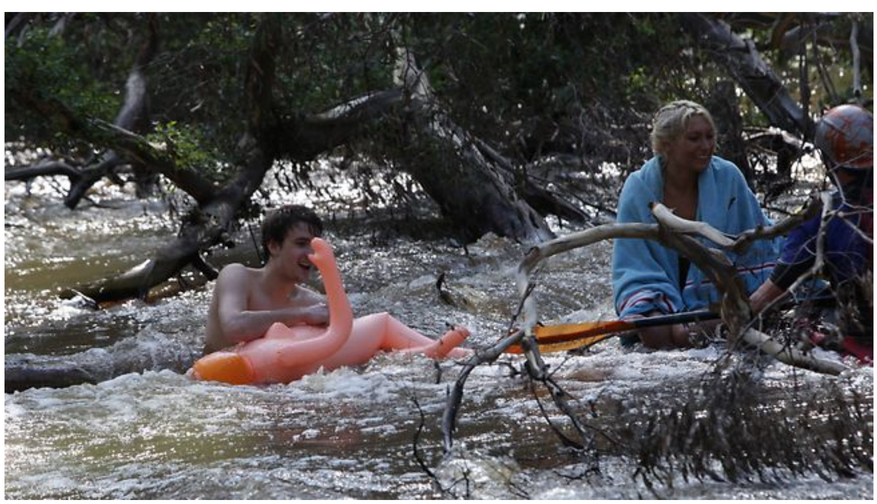


## *Eddies*

Eddies form behind rocks and other obstructions in the current. Eddies are like rest areas on highways. In eddies the current is very slow or even moving back upstream


## *Strainers*

Strainers are one of the most hazardous features on a river. The force of the water can trap a person or a boat with unbelievable power. Can be formed by trees, fences, debris, guardrails…..Water passes through but solid objects become trapped. Down trees, log jams, fences, debris, low bridges and other stationary objects allow water to move through them but will trap and hold a swimmer of a boat. Rocks can also present entrapment dangers like strainers do under cut rocks and rock sieves can entrap boaters as well.



## *River Waves/Standing waves*

As water flows over rocks and other obstructions in the river it forms waves. Water cannot be compressed so it gets pushed up on the surface and forms a wave that can look like a breaking wave at the ocean, however unlike an ocean wave the river wave is stationary. The wave may rise and fall due to fluctuations on flow and speed of the water, but it will remain at the same spot on the river. Large standing waves may appear to be hydraulic and can flip boats but will not hold the boat or a swimmer like a hydraulic will.

## *Hydraulic/Hole*

Water pouring over obstacles forms a reversal current which recirculates
A hydraulic or hole is a reversal due to water pouring over the top of a rock or other obstruction. The current is reversed and forms a washing machine type of current which can trap objects such as boats or swimmers. Hydraulics can trap boats or swimmers. Some holes are fairly safe and easy to exit via the downstream currents at the ends of the hole. Kayakers often enter these holes to “surf the wave”. However some holes are known as keepers which trap boat or swimmers and don’t have easy exits.  Large holes can have extremely turbulent waters that can flip large rafts and power boats.

## *Water Falls*

Waterfalls and dams often are nearly invisible when approached from upstream.
Often the only warning is a horizon line across the river once you are close enough to see and hear the falls. Often it is too late to do anything to avoid being swept over the falls.

It is always good to know what is downstream of your operations. The appearance of a horizon line on the river is an ominous sign, usually indicating a drop like a falls or dam. Experienced whitewater boaters will immediately exit the river and scout what is beyond the horizon line.

Rescues of persons trapped at the brink of the falls are extremely challenging and usually require high angle rope rescue operations.

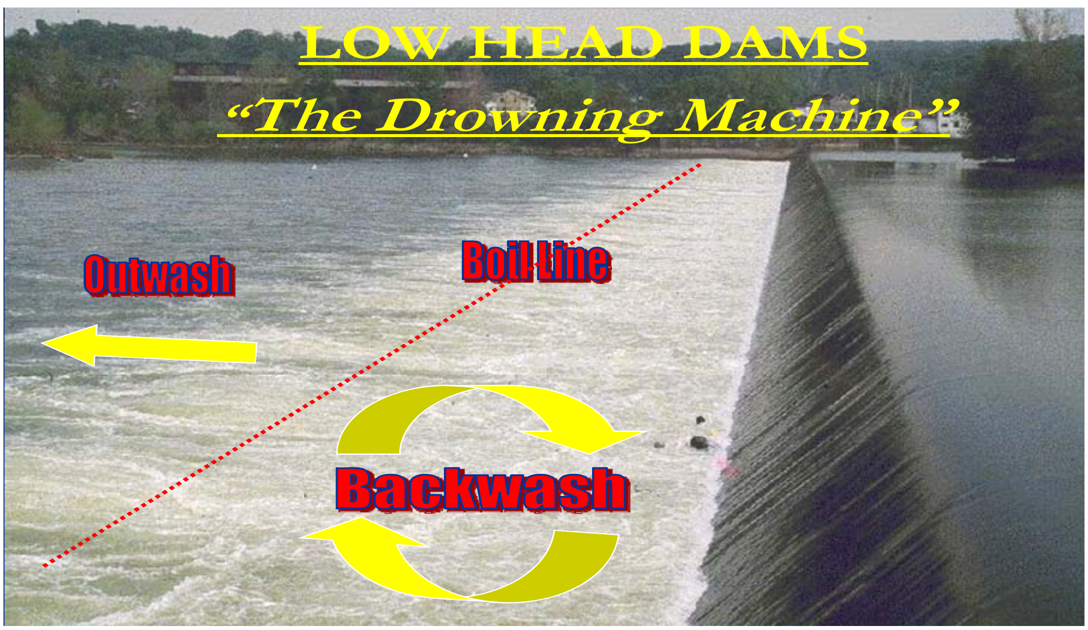
### *Low Head Dams*

Form a perfect hydraulic – almost impossible to escape

Unlike natural hydraulics these dams have no exit currents at the surface

The backwash recirculates continuously without breaks across the entire dam face.

The ends of the dam are often concrete walls. These are common sites for fatalities as most people who end up it these dams do not survive the experience. Rescue is very difficult. Several methods have been developed such as the inflated fire hose rescue technique which allows firefighters to execute a rescue without entering the backwash.




### *Flood Control Channels/Washes*

- Steep concrete sides
- Limited access
- Rapid flow - up to 30 mph
- No eddies/slow currents
- Obstructions – Bridges
- Debris & Contamination
- Extremely hazardous to rescuers entering the water

# ***Medical Considerations for Water Rescue***

In Technical rescue incidents the goal is to rescue the victim. The medical concerns of the patient need to be addressed during and after the rescue phase. A perfectly executed rescue ends in failure when the patient expires due to his injuries.

## *Drowning*

What is drowning?

- Drowning is suffocation by water.
- Types of Drowning
- Dry – no water in lungs
- Dry drowning are those events in which the patient becomes submerged in water.

When the patient inhales water the larynx spasms, preventing water & air from entering the lungs. The patient losses conscience and then cardiac arrest will follow.

If rescued and successfully resuscitated these patients have fewer complications during recovery.

## *Wet – lungs fill w/H2O*

Wet drowning happen when for whatever reason the water does enter the lungs.
These patients may suffer further complications after resuscitation such as blood chemistry imbalances and infections.
There is not however a need to make attempts to clear the water from the lungs.
Techniques that have been advocated in the past such as the Heimlich maneuver are not beneficial to the patient and delay CPR which is the most effective means of resuscitation.

## *Flush – no submersion*

Flush drowning happens when a person in rough water is constantly pushed under then back to the surface. Can get a quick breath but inhales some water each time. The victim's airway becomes compromised. Panic sets in and swimming becomes less effective. Larynx spasm occurs and the victim may lose consciousness. A rafter, with a PFD, that falls out of a boat in heavy whitewater, is not rescued quickly and takes a long swim, may end up flush drowning like this.

## *Near Drowning/Secondary Drowning*

Near drowning victims may have aspirated some water and should always be assessed by medical personal.

## *Care for Drowning Victims*

Remove from water

- Ensure CAB's and initiate CPR as required
- Prevent further heat loss
- Handle gently
- Administer high flow oxygen
- Follow local protocol
- Transport to nearest medical facility

## *Hypothermia*

A condition in which the body's core temperature has been lowered below 95 degrees. Almost all water rescue incidents happen in water that is significantly cooler than normal body temperature. The average water temperature even in the summer in Vermont is at least 30 degrees cooler than normal body temperature. This combined with waters ability to transfer heat away rapidly means there is no other environment which puts both victims and rescuers alike at such great risk of becoming hypothermic.

**Signs and symptoms of hypothermia**

All rescuers should know the signs and symptoms of hypothermia and how to identify it early in victims, other rescuers, and themselves. Hypothermia is easily treated early but can become life threatening quickly

Signs and symptoms include:

Mild

- Shivering
- Impairment of fine motor skills
- The Umbels: mumbles, fumbles, & stumbles
- Loss of judgment/Reasoning ability

Moderate to Severe

- Apathy, confusion & disorientation
- Slowing respirations and pulse
- Shivering stops
- Respirations and pulse slow
- Coma & death

Treatment for hypothermia

- Removal from the cold environment;
- Prevent further heat loss;
- Basic BLS care
- Transfer to nearest medical facility ASAP

## *Resuscitation efforts*

There have been several cases of hypothermia & drowning victims being successfully resuscitated after being underwater for up to an hour.
All efforts to resuscitate these patients should be made.

## *Spinal Cord Injuries*

All trauma victims need to be immobilized in the water to protect the c-spine. These skills will be practiced during the pool session.

# Swiftwater Rescue PPE & Self-Rescue

All rescuers should be prepared to go into the water. Rescue scenes are dynamic events, unexpected things can happen, all rescuers should be prepared to go into the water at any time. Always have your PPE on and ready before approaching the scene. Practice Self Rescue swimming skills often. Swiftwater PPE equipment and self-rescue skills are essential to rescuer safety.

## *Responder Well-Being*

In order to prevent hypothermia and to be able to function well in extremely poor environments such a cold swiftwater rescue or search, responders must take care of themselves well. Being prepared with the right PPE and Clothing, eating right, and keeping hydrated are all essential to rescuer safety.

- Water Rescue PPE/Equipment
- Standard Swiftwater rescue PPE should include:
- Personal Flotation Device – PFD
- Thermal protection
- Helmet
- Throw-Bag
- Whistle
- Knife
- Light
- Gloves

**Personal Floatation Devices**

All personnel within 10 ft. of the water should be equipped with a PFD.

NFPA 1952 set standards for water Rescue PPE including PFDs. Requires 22 lbs. floatation for a rescuer PFD. This is more than USCG PFD requirement due to the possible need to provide floatation for a victim as well as the rescuer in extreme conditions.

The US Coast Guard rates PFD's for specific uses; for rescue type 3 and type 5 are the best. Type 1 and type 2 should not be used for rescue work due to being bulky and hard to don. Types 4 are throw able devices only. Type 3 and 5 PFD's vary in both function and style. The best PFD for your use will be one designed for the specific type of water environment you deal with such as: Whitewater vests for swift-water Work/utility vests for marine boat crews and; Type 5 swift-water PFD's for in water swift-water rescues.


## *PFD's for Rescue*

PFDs for rescue work should:

- Be a Type 3 or 5.
- Properly sized & adjusted
- Have high floatation >20lbs
- Be easily adjusted
- Be highly visible.
- Have pockets to stow survival and safety gear are a good idea.
- Have a whistle, a knife, and some type of light for night use attached.

### *Type V - Swift-water Rescue Technician PFD*

The type 5 swift-water rescue technician PDF consists of: a whitewater recreational PFD with high floatation (over 22 lbs.) with a built-in quick release harness for safety line attachments. These SRT vests also feature extra pockets for gear, reflective materials, and attachment points for tethers and a rescue knife.

## Thermal Protection

### *Wet Suits*

Designed to trap a layer of water between the skin and the neoprene material.
The body warms this layer of trapped water which provides insulation
Wetsuits provide good thermal protection and some abrasion protection too.

## *Dry Suit*

Dry suits provide the best overall protection from cold water They are designed to keep water away from body. Insulation clothing worn under suit can be changed to meet the needs of the environment. This is the suit of choice for most swift-water and flood rescue teams because it provides best protection from the cold water and protection for contaminated flood waters. Suits can range from $250 to over $1000 depending on construction and features. Built in socks give better cold and contamination protection. When using a Dry suit insulating clothing is needed under the suit as the suit does not provide any insulation. A fleece Jump suit works very well as does any synthetic long underwear. For extreme cold thicker layers are needed, for warmer temperatures less is needed.


## *Donning and removing dry suits*

It is best to have assistance donning dry suits

Use extreme care with seals; don't force hands, ankles or head through. Make sure seals lay flat & directly on skin. If seals a rolled or on top of under garments they will leak.

Lubricate zipper with wax before use to assure zipper seals properly & checked that zipper is fully seated against stop.
Burp air from suit before entering the water and check for good seal

When removing suit have assistance, unzip fully, and use care with seals. Have a clean surface to stand on when removing suit to avoid getting dirt and sand into seals and zipper
Wash suit with clean warm water, Inspect for damage, lubricate zipper and hang to dry fully before returning to service.

## *Ice Rescue Suits*

For quick entry into surface ice/cold water. Not designed for rescues in swift or moving water. Ice rescue suits are bulky and difficult to swim in effectively. The harness does not have a quick release and can lead to rescuer entrapment in moving water. Never allow any rescuers to enter swift-water tethered with these non-release-able harnesses. The seal at the head is not as effective as the seals on a dry suit and suit may fill with water if submerged. While these suits provide floatation they are not designed or approved as PFD's and should not be used as one. A PFD must be used if these suits are used in boats. Teams that respond to swift-water Rescue incidents in these suits most likely do not have appropriate training for moving water rescues and should be placed into shore based assignments.

### *Helmets*

Helmets are a good idea for all rescue personnel.

Avoid the use of fire helmets as the pressure of water on the extended rim can cause injuries.

Water Rescue Helmet should provide head protection to the: Front, Back, & Sides. A water rescue helmet should be equipped with holes that permit the passage of water

## *Hands and feet protection*

Hand and feet must also be protected from cold. Neoprene gloves and boots are best in water. Boots should be sturdy enough for walking on rocky shorelines but not so inflexible to cause entrapment problems. Glove should have reinforced palms for rope handling. Neoprene hat or hoods are also good additions for protecting the head from the cold.

## *Other PPE and personal equipment*

- Whistle
- Knife or cutting tool
- Headlamp
- Throw bag


## SELF RESCUE

Self-Rescue is the ability to help yourself if you get into trouble.

The first task of self-rescue is to be prepared, donning full swiftwater rescue PPE is very important to rescuer ability to self-rescue.

## Moving Water Self Rescue

Should you find yourself in moving water the first thing to do is get into the self-rescue position:

- Turn unto your back with your feet pointed down stream
- Keep your head up and toes up near surface
- Do not panic.
- Control your position in the water by a back ferry, backstroking toward the shore with your head pointed toward the upstream shore.
- Breathe when your head is out of the water, timing the waves and troughs

Do not attempt to stand in fast moving water (1 foot or less) - Risk of foot entrapment

Aggressive Swimming – Modified Crawl Stroke Ok if water is deep. Use to reach a safe area such as an eddy or to avoid obstacles such as strainers

## *Strainers*

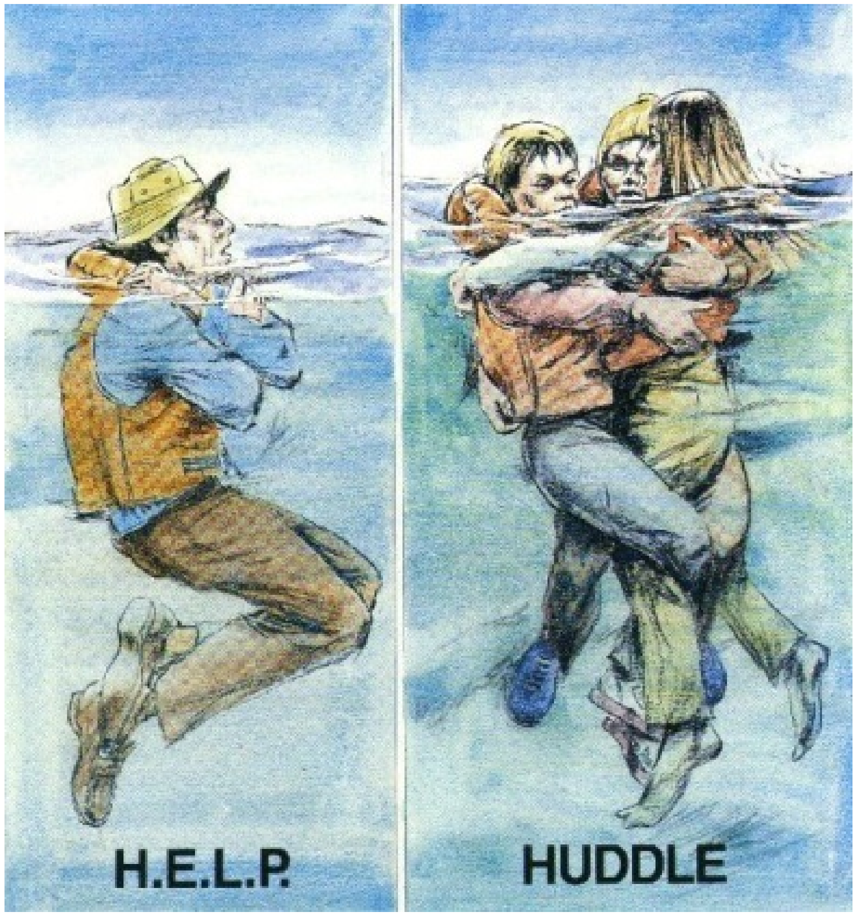
Avoid at all costs – these are deadly to swimmers
If you can avoid go over the top – keep body at the surface swim hard and get on top of strainer avoid legs getting washed under by kicking hard on surface.

## *Drops/ledges*

If you go over a large drop ball up to avoid foot pins at the base of the drop

## *Help & Huddle Positions – Open water survival*

These survival positions can help slow the onset of hypothermia when forced to survive long periods in the water- not for swiftwater situations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# Basic Swiftwater Rescue Techniques

The basic swiftwater rescue techniques are the skills identified in NFPA 1006 as level I swiftwater skills. Most rescues can be made using these basic level skills and forestalling use of more risky level II skills when possible. The Preach, Reach, Throw, Row, and Go Sequence is used to select the least risky method of rescue that is appropriate for the situation. All swiftwater rescuers should master the level I skills and practice these skills often to retain a high level of competence.

## *Rescue Sequence*

Follow the rescue sequence by using the lowest level of rescue appropriate for your level of training and the given situation.

**<u>Preach</u>** - Talk victim through a self-rescue
Make contact with the victim as soon as possible. Give directions and reassure victim that help is coming. Keep talking to the victim and maintain visual contact throughout the rescue.

**Reach** – Extend a reach device to the victim

Pike Pole, ladder …..

Inflated fire hose works well in low head dams

**Throw** – throw a rope or floatation to the victim

Throw bags work the best; 60 to 75 feet of polypropylene rope stuffed into a nylon bag.

**<u>Row -</u>** Boat based rescues

Use raft or other boat to rescue victim. Rescuers must have PPE and Self-rescue skills. PFD's should be given to victims.

**<u>Go -</u>** Swimming rescues

Rescue swimmers may be needed if victim is unable to assist in their rescue – in water rescues are highest risk for rescuers- training and skill are needed.

Avoid entering the water without hands-on training and proper PPE equipment

All personnel in or near the water must wear a PFD

## Basic swiftwater Rescue Equipment

Basic swiftwater rescue equipment will be used for most swiftwater rescues. Most of the basic equipment is inexpensive and has multiple uses.

Basic Swiftwater equipment includes:

- Swiftwater PPE
- Water Rescue Throw bags
- Inflatable fire hose Kit
- Inflatable Boat
- Paddles
- Rescue Hardware: Carabineers, pulleys ….

## Water Rescue Rope

One of the best and fastest water rescue devices is the water rescue throw bag consisting of 50 -75 feet of floating rope stuffed into a small bag.

## Inflatable Hose Device

An inflated fire hose can be used effectively for both ice rescue and low head dam rescues from shore.

This takes minimal training but is best practiced before use.

Inflatable Boat

An inflatable boat such as and RDC, zodiac IRB, or a whitewater Raft can be a great asset to a swiftwater rescue team. Inflatable boats have the advantage of being very stable in rough water and are very forgiving for inexperienced operators. Avoid cheap toy type boats sold in sporting goods stores, purchase boats designed for rescue operations such as the RDC or whitewater rafts intended for outfitter use. Inflatable boats should have multiple inflation chambers.

# Basic Swiftwater Rescue Techniques

## *Throw bag use*

It can be quickly deployed to a victim with little training. The use of a throw bag requires practice for the best accuracy. One must be careful in swift-water not to be pulled into the water by the force of the current on the victim, so a belay stance is needed to control the rope. In moving water the force of the current causes the victim to pendulum into the shore downstream.

## *Wading Skills*

While we stress not trying to stand up while in moving water, with training and practice teams can effectively wade in moving water up to about 4 ft. deep by using each other for support.

These skills allow a fast way to get rescuers across a river or out to an accident site safely. Group wading can be used to get to a victim and assist them back to shore. Anytime we assist a victim we should provide a PFD and helmet if they do not have them on already.

- Single person wade – w/paddle
- Triad wade – two or three person
- Pyramid wade – large group

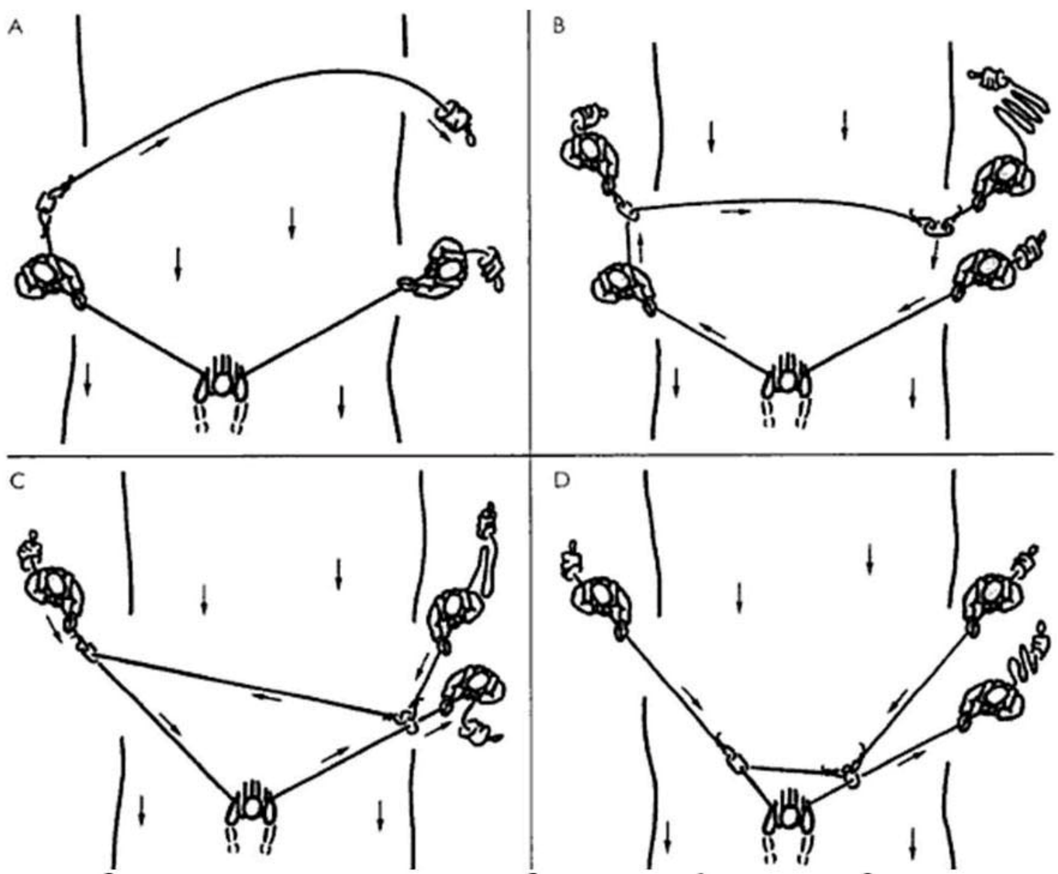
## *Line Rescue Systems- Snag & Tag Lines*

Cross current rope systems can be used effectively use to stabilize an entrapped victim and then to free the victim from the entrapment in a controlled way. Use throw bag ropes to span river to support and free entrapped victims

- Limited to narrow streams less than 75 feet wide
- Takes practice & coordination to set up quickly
- Stabilization line should be established first to help support victim above water.
- Snag line can be weighted to sink line to free entrapments

### *Cinch line*

In desperate situations when other means fail to release an entrapped victim, a cinch may be needed to get a haul line attached directly to a victim. This is a technique which will cause harm to the victim and should not be used unless absolutely necessary. This will be a last ditch effort to free a submerged victim from an entrapment at all costs. In most cases this will likely be a body recovery at this stage



### *Floating Tag line*

Another cross river line system that is effective for stranded victims trapped mid-stream on a rock or vehicle is the floating tag line. Floating tag line provides the victim with floatation to assist in keeping the victim on the surface while being retrieve. Floatation may be a ring buoy, a foam water rescue sling or a PFD tied to the ropes.

## *4- Line Tethered Boat Rescues*

- Boat belayed from both shores
- Works best with RDC or self-bailing raft
- In Faster water tree wraps can be used
- Can be either 2 or 4 point for lowering
- A rescuer may be placed into boat

## *Shower Curtain system*

The shower curtain system uses a tensioned diagonal line to suspend a hanging loop just above the water where a victim can grab it and be pulled to shore. This system works well on flood control channels and other sites where throw rescues do not work well. Once the system is established it allows multiple victims to be rescued. It works well as a downstream safety at events like water rescue training, kayak races and other events with multiple people in the water.

# Swiftwater Rescue Communications

Communication at river rescues is often very difficult due to distances and river noise. There will be times when it will be difficult to communicate with other personnel because of the tremendous sound of moving water. It is vital to have backup communications established.

Personnel should be familiar with hand & whistle signals used to direct a rescue. Everyone must understand what these signals are beforehand. Use hand & whistle signals routinely during training and incidents to be proficient when needed.

Most fire ground Radios don’t like to get wet and are expensive to replace. Some other options are available:
Marine band portable radios are an inexpensive and waterproof solution for water rescue operations

Waterproof radio bags work well also

## *Hand/Whistle Signals*

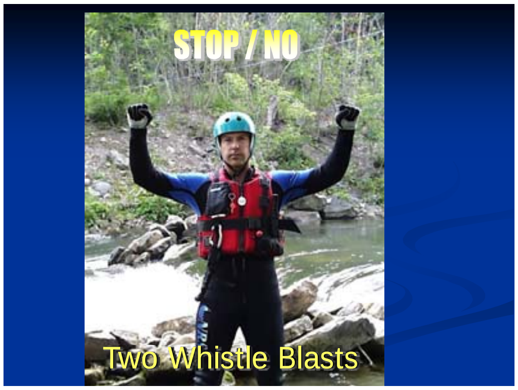
Ok/Attention – pat top of head with hand/one whistle blast

Question: Are You Ok?

Response: I Am OK.


Stop/No – Fist held at head level/2 whistle blasts

Either stop action or a negative reply

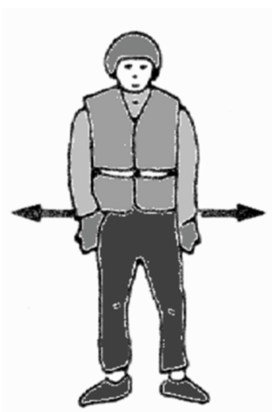



Help/Emergency - Waving Hands above Head – 3 whistle blasts repeated
Help needed for an emergency at my location –

## *Hand /paddle Signals*

Direction    Point with hand/paddle
Point in the direction you want the subjects to go – never point toward a hazard

Lengthen Line – move hands outward from body at hips & back

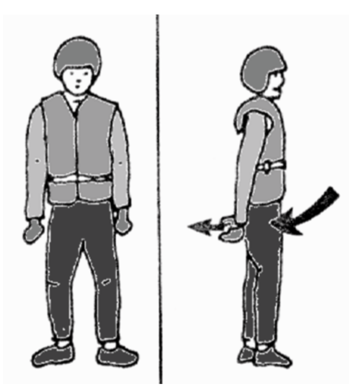


Shorten Line - move hands in an up and down motion
Take up slack in rope –

Wrap up- operation complete- regroup at staging area

Victim recovered – hands crossed on chest

Near shore – hands at hips move toward rear of body



Far shore – hands over head move forward

## Incident Management

Incident management of swiftwater rescue incidents is very important to assure safety of rescuer and the victims. It provides a framework on which to conduct rescue operations. The steps of incident management are:

- Scene Size-up
- Initiate the Incident Response Plan
- Establish Scene Control & Initiate ICS
- Initiate Risk assessment
- Establish safety backup & lookouts
- Initiate Rescue operations

### Size-up

A scene size up should be initiated as soon as possible and should include the following areas:

- Number of victims
- Victim's location or Point Last Seen (PLS)

- Head-Up or Head-Down incident?
- What are hazards?
- Call for additional resources
- Develop Incident Action Plan

**Incident Response Plan**

Keep it simple, one page is best. Everyone should know plan basics. Should Address:

- Basic incident info
- Initial Response
- Mutual Aide requests
- Assignments
- Safety Zones & PPE requirements
- Basic plan of action

**Scene Control**

Establishing scene control early in the incident is very important in swiftwater incidents. Often these are very confusing and chaotic scenes, and establishing the ICS command system will help to bring order to the scene. Accountability at such scenes is essential to rescuer safety. A safety officer must be appointed by command to assure a safe rescue operation. Steps for scene control are:

- Establish Command & Take Control of scene
- Establish Rescuer Accountability & Safety
- Secure & Interview witnesses/bystanders
- Remove untrained personnel to a safe area
- Establish up stream lookout
- Establish downstream safety backup

**Follow the Rescue Sequence**

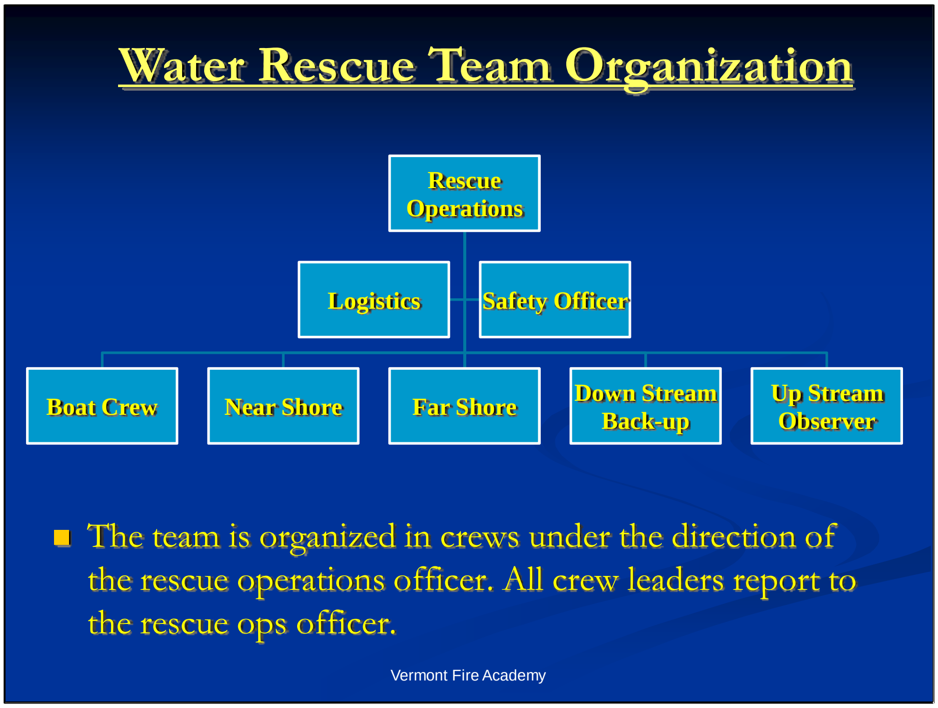
Utilizing the least risk rescue method before engaging the higher risk options is good risk management; the rescue sequence is a simple way to articulate this. The steps to the swiftwater Rescue Sequence are:

- Preach – establish communications with the victim.
- Reach – extend a reach devise such as a pole or inflated fire hose to the victim.
- Throw – Use a water rescue throw-bag to throw a rope to the victim
- Row – Use a boat to rescue the victim
- Go - a rescue swimmer makes a contact rescue
- Helo – Helicopter rescues are the highest risk in swiftwater

**Incident Command System structure for swiftwater Rescue**

Basic ICS Structure

Swiftwater rescue team ICS structure



## Risk Management

Risk management is the process of assessing the risks presented by the incident and the rescue response and taking steps to mitigate the risks, for the safety of both the rescuers and the victims.

**Principles of Risk Management**

- All personnel are responsible for risk management
- Do not accept high risk for low gain
- Use a systematic approach to risk management
- Risk Management is an ongoing process

***Who is Responsible for Risk Management? Everyone!***

**Risk Management Process**

- Identify Mission Tasks
- Identify Hazards
- Assess Risks
- Mitigate Risks
- Evaluate Risk vs. Benefits
- Execute mission
- Monitor Situation

**Risk Assessment System:**

In order to make a reliable evaluation of the risks of a mission, a system should be used to evaluate the risks. The GAR system consists of the following elements:

- Planning: Are there written SOPs, Pre-plan, or Incident Response plan for this type of incident. Have all team members been briefed on the mission?

- Event Complexity: is the incident simple or complex in nature: single victim vs. multiple victims, multiple locations or large area

- Crew Readiness: is crew fully trained for this type of mission. Are they well rested & fit. Is there clear leadership for the team?

- Equipment: is the PPE and rescue equipment fully mission capable?

- Communications: are the communications systems adequate for the mission, are all team members able to communicate with command and other team members

- Environment: what type of environment is the mission taking place in: poor weather, nighttime, extreme cold /heat, difficult terrain…?

**Risk Mitigation**

- Warn/prepare – Brief personnel on the mission, hazards & mitigations. A fully briefed crew is safer than one that gets limited mission information.

- Protect: personnel from hazards. Assure all personnel have proper PPE for the environment. Establish back-up rescue capability

- Reduce – Reduce or limit risk exposure. Minimize the time rescuers are exposed to the risks. Use a lower risk rescue method
- Transfer – Request better-suited assets be assigned to the incident IE: Request a type II swiftwater rescue team if the local response is a type III swiftwater rescue team.

- Avoid – Circumvent hazard: Wait for risk to subside. Wait for daylight or for river levels to drop.

- Accept – In some cases, the benefits justify the Risks.

**Risk vs. Benefit comparison:**

Evaluate the level of risk the mission has to the level of benefit of completing the mission.

## GAR Risk Assessment Tool

The GAR is a tool for evaluating risk in technical rescue operations. The tool rates the 6 elements of risk with a system. It also has mitigation steps and a risk vs. benefit comparison.

### Technical Rescue - GAR Risk Assessment Tool

**Step #1 Risk Assessment:**
Review the questions and rate the risk level for each of the below category's. Total the values and plot on line graph at bottom of page. See step 2.

**Pre-Planning:** Incident Pre-Planning, Site plan, written SOP's/IAP, Crews briefed. Well defined mission.

| Adequate | | Minimal | | None |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Event:** Refers to incident complexity. Multiple victims, large area, difficult access/terrain

| Simple rescue | | | | Complex rescue |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Crew**: Selection of appropriate resource. Factors that affect risk: Experience level, unfamiliar with rescue site, fatigue, response time, adequate supervision

| Crew Excellent | | Adequate | | Marginal |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Equipment:** Proper response vehicle/craft, equipment available (Hardware, ropes, etc.)

| Fully mission capable | | | Partially mission capable | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Communications**: Ability to maintain comms with all parties throughout the incident.

| Adequate | | Marginal | | None |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Environment:** External condition surrounding event: weather, time of day/night, water conditions, water temp, air temp, visibility.

| Benign | | | | Marginal | | | | Hazardous | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**Step #2 Risk Management**
Risk Management are the steps taken to control or reduce hazards. Below are *Control Options* used to mitigate the risks. Implement the options, and then reassess the risks as appropriate.

**Warn/Prepare:** make personnel aware of hazards & mitigations available. Fully brief crews.

**Protect:** provide correct PPE/Equipment to protect personnel from hazards

**Disperse/Transfer** –Disperse the risk by increasing the time between events, using additional assets, or transfer incident to a better-suited asset

**Reduce/Avoid** – limit risk exposure by reducing numbers of personnel exposed or time exposed. Circumvent hazard: Wait for risks to subside

**Accept** – In some cases, the benefits might justify the assumption of the risks. In these cases, a decision to accept risk may be made.

Reassess the values for each risk category & compare to 1st assessment

**Step #3 Define Mission Benefits**

**L**ow Gain – Situation with low or intangible benefits. Examples include: Body recovery, flood area searches, & saving property.

**M**edium Gain – Situation that provides tangible benefits. Examples include evacuating victims, searches, and protecting public safety.

**H**igh Gain – Situation that provides immediate, tangible benefits that if ignored could result in loss of life. Examples: Live victim rescues.

Given the mission description above, what is the "Gains" for this mission? How do they compare to the risks?

**L/M/H Risk vs. Gain L/M/H**

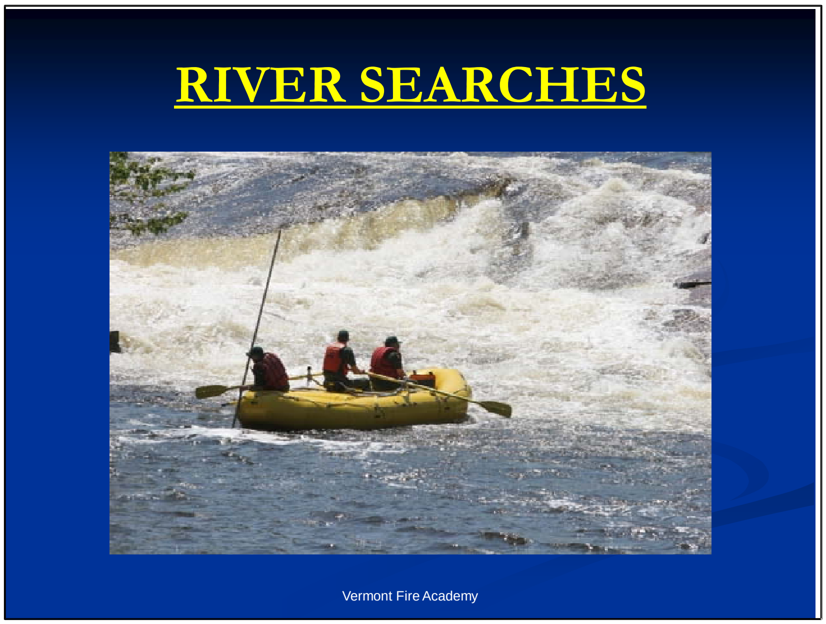
**GREEN** | **AMBER** | **RED**
**1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35**
**Mission Status: GO | Caution | No Go**

**Always remember that a routine mission does not equal a low risk mission**

## Advanced Swiftwater Rescue Situations

Some situations in swiftwater rescue are more complex and require advance skills and techniques.

# River Search




Often incidents on rivers become searches for missing persons. These searches may become long term operations.

**Search is an emergency**

A person missing on the water must be assumed to be in danger or distress and in need of assistance. An immediate response is needed.

**Search Types:**

- Search Size-up
- Confinement Search
- Hasty Search
- Bastard Search
- Thorough Search

**Size –Up**

Size-up is a search for information. Basic information must be obtained before a search can begin, then as the search gets under way start to gather more in depth information. Basic steps are:

- Secure & interview Witnesses
- Determine PLS (point Last Seen)
- Number of victims
- Water conditions (speed, temperature, hazards….)
- Victim Information
- Define search Area

**Confinement search**

The goal of the confinement search is to limit the search area & to detect a subject that is leaving the search area. These posts can be manned by non-trained personnel if they are not to be within fifteen feet of the water. (Bridge watchers)

- Bridges: Spotters on bridges
- Road Patrols: patrol roads adjacent to the river
- Choke Points: spotters at natural chock points

**Hasty Search**

A fast moving search meant to detect live victims & recon search area

- Boat Search: Raft, Kayak, RDC…… two boats if possible for safety
- Bank search: Teams of at least two searchers w/ PPE
- Secondary crews: on water & shore, cover spots missed by 1st crew

**Hasty Search objectives:**

- Deploy quickly
- Cover the search area quickly

- Detect any live victims
- Interview any witnesses found in the search area
- Recon the search area
- Identify hazards
- Report findings back to command

**Thorough/Grid Search:**

A methodical search of the entire area.

- Grid search of river
- Bank Grid search
- Underwater search
- Probe
- K-9 searches
- Helicopter/Aircraft

**Bastard Search**

A bastard search is to determine if the subject is no longer in the search area, may not have ever been in the search area, or even not lost at all.

- Check local bars, motels, taxi, bus stations……
- Interview Family/friends for information
- Law enforcement is helpful for investigations

## Night Operations

Night Operations on swiftwater are extremely hazardous and only critical life safety missions should be considered at night. All personnel should be equipped with headlamps or other lights as many incidents occur late in the day and rescuers may find themselves benighted during a mission.

**Night-time Difficulties**

- Inadequate light
- Very High Risk
- Finding the victims
- Communication
- Evaluating conditions
- Accountability of rescuers

**Risk management for night operations**

- Risk Assessment
- Only Critical Life safety missions should be considered
- ICS & rescuer accountability is critical
- Train for night missions

**Equipment**

- Reflective Tape on PPE
- Headlamps (waterproof)
- Scene Lighting
- Chemical light sticks
- Strobes for emergencies

# High Angle Rope rescue

Many incidents occur in river gorges with steep walls access by rope may be the only good option and extracting the victim may require a full rope rescue evolution. While some rope skills are needed by swiftwater rescue personnel there are often critical differences in the techniques used in swiftwater rope work and high angle rescue techniques.

- High angle techniques may be needed to extract victim.
- Use a trained high angle rope rescue team and equipment
- Keep lifeline rope & equipment separate from water rescue rope & equipment.

Swiftwater rescue operations may subject rope and hardware to higher and unknown type loads.

**Highline Rope systems**

When extreme conditions prevent putting rescuer in the water such as class 5 -6 conditions or a low head dam it may be possible to use a high line system to suspend a rescuer just above the water to search or perform a rescue. Highline systems require a very high level of rope rescue knowledge and skill.

- Use to position a rescuer directly above an accident site
- Use traditional rope rescue techniques
- Rescuers should also have water rescue PPE

## Helicopter Rescue Operations

Helicopter rescue operations in swiftwater conditions carry a very high risk to both the crews and the victims; still there are situations where helicopter rescue is the best and safest option. Floods often increase the need for helicopter operations. It is essential that the helicopter crews are trained for swiftwater/flood rescue situations.

- Hoist Operations
- Hoist equipped ship
- Trained crew
- Good conditions
- Short Haul Operations

- Trained crew
- Proper equipment
- Rescue Swimmer Deployments
- Transport/Logistic Support

# Flood Response Operations

Floods are one of the most common natural disasters to affect the State of Vermont. Nationally floods claim more lives annually than any other type of disaster. Most disaster response planning for floods is focused on Major River flooding however; flash flooding is much more dangerous to both the citizens who are victims of a flood and rescuers who attempt to assist them.

**Types of floods:**

- Flash Floods: Flash floods are fast developing floods that produce a rapid rise in streams. Flash floods can turn a normally insignificant waterway into a raging torrent in a very short time. Flash floods are normally associated with thunderstorms or tropical storms, but also can result from rapid snow melt or dam breaks.

- Major River floods: Major river floods are usually predicable and occur over a matter of days. While they can do great damage to property there is usually enough notice for people to evacuate the flood zones. However there are those who refuse to leave and have to be rescued from flooded homes.

- Ice Jams: Ice jams can have properties of both flash flooding and major river floods. In addition the ice blocks carried by the flood can do tremendous damage to structures far beyond what the water alone would do. Rescue operations in ice jam floods are extremely hazardous due to cold water and the ice flowing with the water.

- Coastal Flooding: Coastal flooding like major river floods is fairly predictable. It can be caused by extreme tides or storms. One type of coastal flooding that can be more abrupt and unpredictable, are earthquake or landside generated waves called tsunamis. These large ocean waves can travel thousands of miles before coming ashore. They can be very deadly and destructive.

## Stages of a flood

- Pre-Flood/ High Water Phase: Sometimes extended periods of rain can cause watersheds to become saturated over time. Streams and rivers are at capacity and any additional rain will cause flooding. In addition with the rivers running high it becomes more dangerous (and possibly more attractive) for recreational activities.

- Flash-Flood/ Swiftwater Phase: When a watershed exceeds its point of saturation, run off occurs and causes rapid rise in water levels. Smaller streams and rivers are most likely to have flash flooding, but sometimes roadways and dry drainages can also fill to beyond capacity and flood. Flash floods are the most deadly because they often catch people off guard. These events often cause multiple incidents in very short time overwhelming even the most prepared departments.

- Riparian /Major River Floods: Once the smaller streams and rivers start to dump their loads into the major river systems widespread river flooding may occur. This phase is usually predicated at least 24 hour in advance, however because it may now affect more urbanized areas people often become trapped in buildings and many rescues will be needed. Most will be of a non-technical nature but other problems can also occur such as building collapse and fires.

- Receding/Recovery phase: once the waters start to recede, much of the focus now shifts to damage assessment and clean up. However as the water recedes; dangers from damaged structures, gas leaks, snakes, bio/chemical contamination…. may become a problem.

## Flood Prediction

With most disasters we do not get advanced warning, but with most floods some warning can be made. While great strides have been made in this area it is also important to remember that these predictions are dynamic in nature and subject to change as the situation develops. It is important to monitor the weather situation before and during the flood response.

**Web sites for flood information:**

- National Weather Service NWS Web Site – General watches & warnings for severe weather and flood watches designed for general public.
- NWS Northeast River self- briefing page : http://www.erh.noaa.gov/nerfc/self_brief.shtml
  A more detailed one stop shopping flood prediction site. Has a great deal of information including river gauges, rainfall, predicted rainfall, Radar, snowpack, river levels and predicted levels……
- NWS River Level web site – River levels & crest predictions
- NWS gauge information has different info than the USGS river gauge site has including predicted crest levels

**River Level Monitoring**

USGS Real time river level site: http://waterdata.usgs.gov/ny/nwis/rt

This site provides raw data on current stream levels including:

- Real time river gauges
- Raw data – no interpretation
- River height in feet
- Volume in CFS (Cubic Feet per Second)
- May include other info
- Does not make predictions
- Historic gauges readings

**Special Flood Concerns**

Multiple Incidents: Flash floods often cause so many incidents in a very short time that even well prepared rescue organizations become overwhelmed by the number of incidents. In large flash flood incidents we see every available resource tasked to rescuing civilians; fire, EMS, police and public works are all called on to assist in rescues most without any training or equipment. Calls go out to the state and federal governments for assistance but usually this takes hours or days to mobilize, the flash flood rescues are all over by the time the state and federal resource can deploy.

- Train local agencies to at least awareness level & equip with PFDs and throw bags – so they can handle minor incidents safely.
- State and federal flood rescue resources should be pre-deployed for major storms so they can support local efforts during the flash flood phase.
- Develop strong local swiftwater /flood rescue resources to deal with the more technical rescues.
- Develop a dispatch triage system for flood rescue incidents

**Swiftwater/flood Incident Triage system**

- Priority 1 – Very High – Immediate Response
    - People in immediate danger of being swept away by swiftwater
    - People trapped in vehicles & Structures being swept away
    - People in water / Active drowning victims
- Priority 2 – High -
    - People trapped in slow moving but rapidly rising water
    - Persons known to be in flood area that may be in distress
    - Searches for Missing Persons in the water
- Priority 3 - Low
    - Evacuations from flooded/isolated structures in non-rising water
    - Searches of structures/Welfare checks in flooded areas
    - Animal rescue/evacuations
- Priority 4 - Very Low
    - Body Recovery
    - Known Fatalities

**Flood Disaster Rescue Response**

- Multiple Agencies/Resources: once the state and federal response gets into high gear expect large numbers of responders and resources. While efforts are being made to type flood response resources expect a great variety in the capabilities, training, and equipment of the responders.

- Control & Coordination: Often with multiple agencies and resources control and coordination becomes an overwhelming task. A resource tracking system should be put into place to assure accountability and safety of all resources.

- Communications: with multiple agencies and resources operating in the area it will be important to have good communications. Developing a communications plan with each unit at check-in is critical. Have multiple communications options and back-up plans.

- Resource Capabilities: The state is undertaking a major resource typing project to type all rescue resources to be deployed to disasters throughout the state. This will follow the NIMMS/FEMA Resource typing guidelines. This will help to assure that resources assigned to disaster response meet the needs of the locality ordering resources.

**Base of Operations –logistics:**

Often the success of these missions is determined by the logistics operations: equipment, lodging, feeding, staging, and finance are all very important to the operation of a large response.

**Floods Effect Response Capability**

Due to disruption of the road system it may be difficult to move resources where they are needed during and after floods. Roads and bridges may wash out, flood waters block highways, and infrastructure is flooded or destroyed. Be extremely careful traversing flooded roadways in vehicles. Many flood deaths are people being swept away in vehicles.

**Storm Drains& Culverts**

In flood condition storm drains can become lethal traps. The suction created by water moving through pipes and culvert can trap people with tremendous force. Open manholes can present the same hazard

**Strainers, Debris, and Obstructions**

Floods create very hazardous conditions with swiftwater flowing through urban and suburban areas everyday things like fences guardrails and signs become dangerous strainers that can trap and kill swimmers. Debris floating in the water also becomes very dangerous to rescuers these moving strainers can entrap rescuers and damage watercraft.

**Contamination / Decon**

- Flood water can contain all types of chemical & biological contaminates.
- Exposure to contaminates by rescuers & victims must be assumed
- All personnel coming out of flood areas should go through decontamination.

# Team Management

Team management is essential for the day to day functioning of swiftwater rescue teams. Selection and training of well qualified personnel for technical rescue helps to provide for the safety of all team members. Equipment, funding, and team typing should also be considered.

**Personnel Qualifications**

Qualifications should include training, experience, job specific medical clearance, a good fitness level, and personal competence. Team members should be selected and assigned according to their skill and experience levels. An annual review of skills and abilities should be conducted.

Qualification Task-books provide a means of tracking individual member qualifications, training, and skill maintenance. These should be based on skills and knowledge need for the role the member takes on the team: team leader, rescue swimmer, rigger, shore rescuer, logistics…

**In-house training Program**

In order to maintain skills an in house training program should be established to provide a means to practice skills in a safe environment.

- Maintain personnel skill levels as per accepted standards
- Scenario based practice sessions
- Annual qualification/training task book
- Leadership practice for senior team members
- Train with mutual aid resources
- Written lesson plans – don't try to wing this stuff

**Team Equipment**

- Personal Protective Equipment –PPE: if possible each team members should be issued their own set of Personal Protective Equipment including: PFD, dry suit, boots, helmet, gloves, knife, whistle, throw bag. Having gear pre-sized and ready for use will save time when incidents happen.

- Rescue Equipment:  The team should have equipment that reflects the team's level of operation and local needs. Resource typing has specific equipment requirements for each response level. Checklists are included in the student workbooks.

- Boats: a boat is a rescue platform that can get rescuers and equipment to the location of the incident.

- Vehicles: Trailers can be used to transport boats and equipment. A rescue vehicle for transportation of personnel and can also function as a dressing area for donning PPE.

**Team Funding**

- Grants: A wide variety of grants are available to the fire service for preparedness for disaster operations. Some federal grants Such as Fire Act grants give special preference for programs that promote interagency response capabilities.

- Donations: often donations can be sought for developing specific programs such as swiftwater rescue teams. Corporations often have programs to donate goods, services, or funding to Local community benefit organizations.

- Fund Raising Events: organizing a fund raising campaign with a specific target (such as a new rescue boat) often succeed when more general fund raising schemes may not.

- Tax/fees: taxed based fire services may get line items put in to Department budgets if there is political support for the resource. User fees may also be a possibility if the rescues are meeting a need created by a specific activity such a whitewater rafting operation on the local river.

**Technical Rescue Resource Typing Program**

- Type I /II Swiftwater/Flood Rescue Team
  - 14 – rescue technicians
  - Fully equipped
  - Logistical support
  - 72 Hour self-sufficient
  - 2 – IRBs w/Motors
  - High Angle Rope Capability
  - Type I team has Helicopter Rescue Capability

- Type III Swiftwater/Flood Rescue Team
  - 5 Rescue Technicians
  - PPE & Rescue Gear
  - Fast & Light
  - Line systems
  - IRB - Boat w/Motor
  - Rescue swimmer
  - Vehicle for personnel & equipment transport

- Type IV Swiftwater/Flood Rescue Team
  - 5 Personnel
  - Boat – Type varies
  - Flood evacuations
  - Vehicle for personnel & equipment transport

**Statewide Mutual Aide System Responses**

- Requests & orders sent via CFC -Do not self-deploy
- Bring only equipment & personnel requested
- Be prepared to be self-reliant for 72 hours
- Check-in at staging as soon as you arrive
- Do not leave without checking out
- Disaster response can be challenging and frustrating.

# Boat, Line Systems & Rescue Swimmer Skills

**Tensioned Line Systems:**

There are many types of rescue systems based on a tensioned line across the river; Telfer boat lowers. Boat ferry systems, zip lines, & shower curtains all require a tensioned line system to operate.

**Establishing a rope across the river**

Often the hardest part of establishing a tensioned line system is getting the first rope across the river. This is especially true on wide fast moving rivers. Good teamwork and planning are essential. Some methods are:

- Throwing: using throw bags will work on narrow rivers. Use of a throw bag on one side and a line capture device like the Reach on the other shore is very effective.

- Wading & Swimming crossings: a strong swimmer or a wading operation may work if the current is not to strong and there a no significant downstream hazards.

- Big shot: a large slingshot device that is from arborist tool kits can work to span up to about 250 feet with a pilot cord that can then pull a larger rope across the river.

- Line Guns: Like the big shot line guns shoot a pilot line across the river but are powered by either compressed air or a rifle shell and can be effective up to 800 feet.

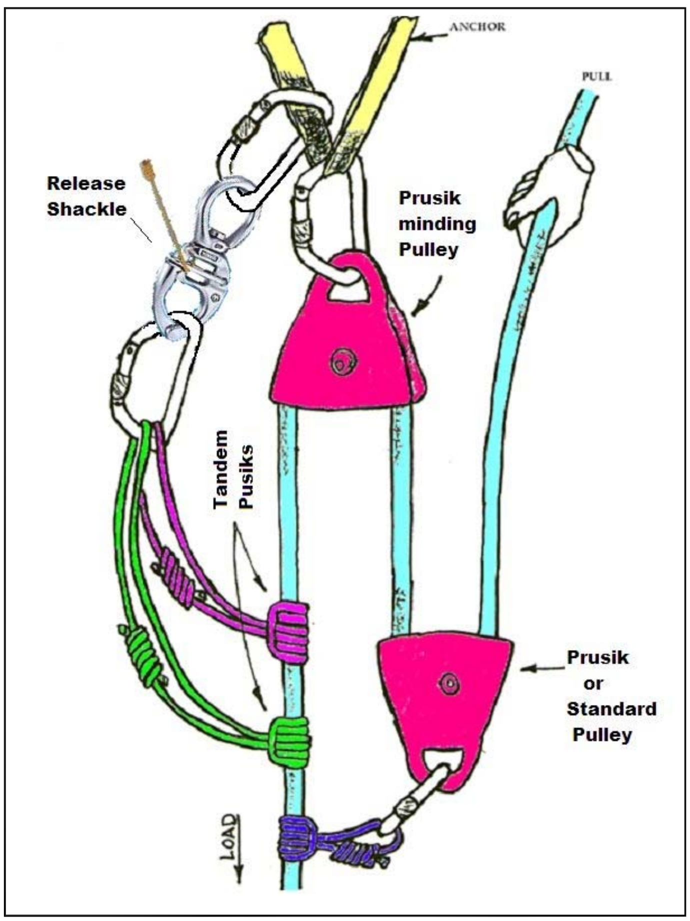
- Boat ferry: a boat can be used to ferry the line across a wide river. Use a small diameter cord at first to reduce drag the pull the larger lines across.

**Setting up the tensioned highline:**

Once the line is established across the river, the next task is to establish the anchors for the highline system. The high line should be at least four feet above the water. This is to allow for passage of boats or debris under the high line, it can be higher, but should not more than ten feet high. An A-frame may be needed to raise the highline to the desired height.

**Tensioning System:**

A 3 to 1 mechanical advantage system is used to tension the highline; this is commonly known as a Z –rig.  It requires two pulleys and two prussiks. The prussiks are short loops of 8 mm cord tried to the rope with a triple wrapped prussick hitch; this acts as a rope grab that will hold about 1200-1800 lbs. force on the rope.



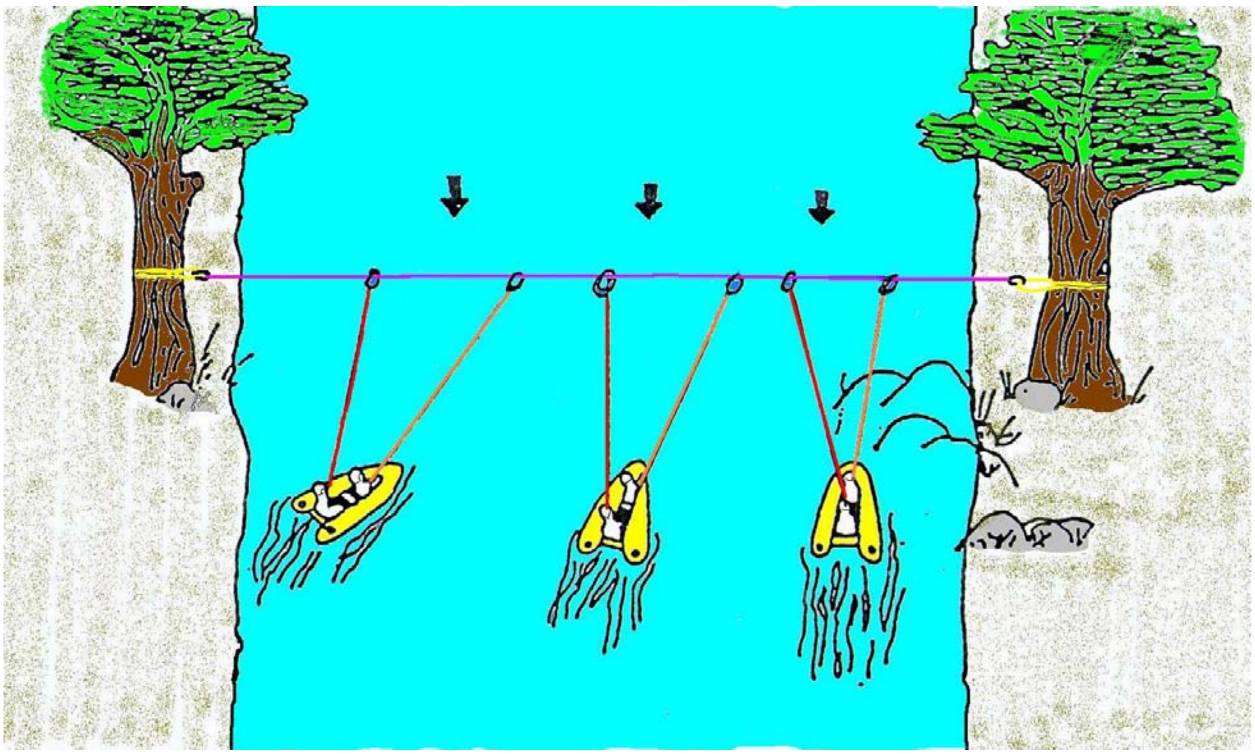

If overloaded the prussick will slip preventing rope damage. A mechanical rope grab will damage the rope if overloaded.  Tensioning the system is done by having three people pull the rope through the 3 to 1 system this will tension the system to just under 1000 lbs.  The highline should be level and perpendicular to the main current. Diagonal highline run at 30 to 45 degree angle to the current.

**Artificial High Point / A-frame**

An artificial high point may be needed to keep the highline at least 4 feet above the water and l

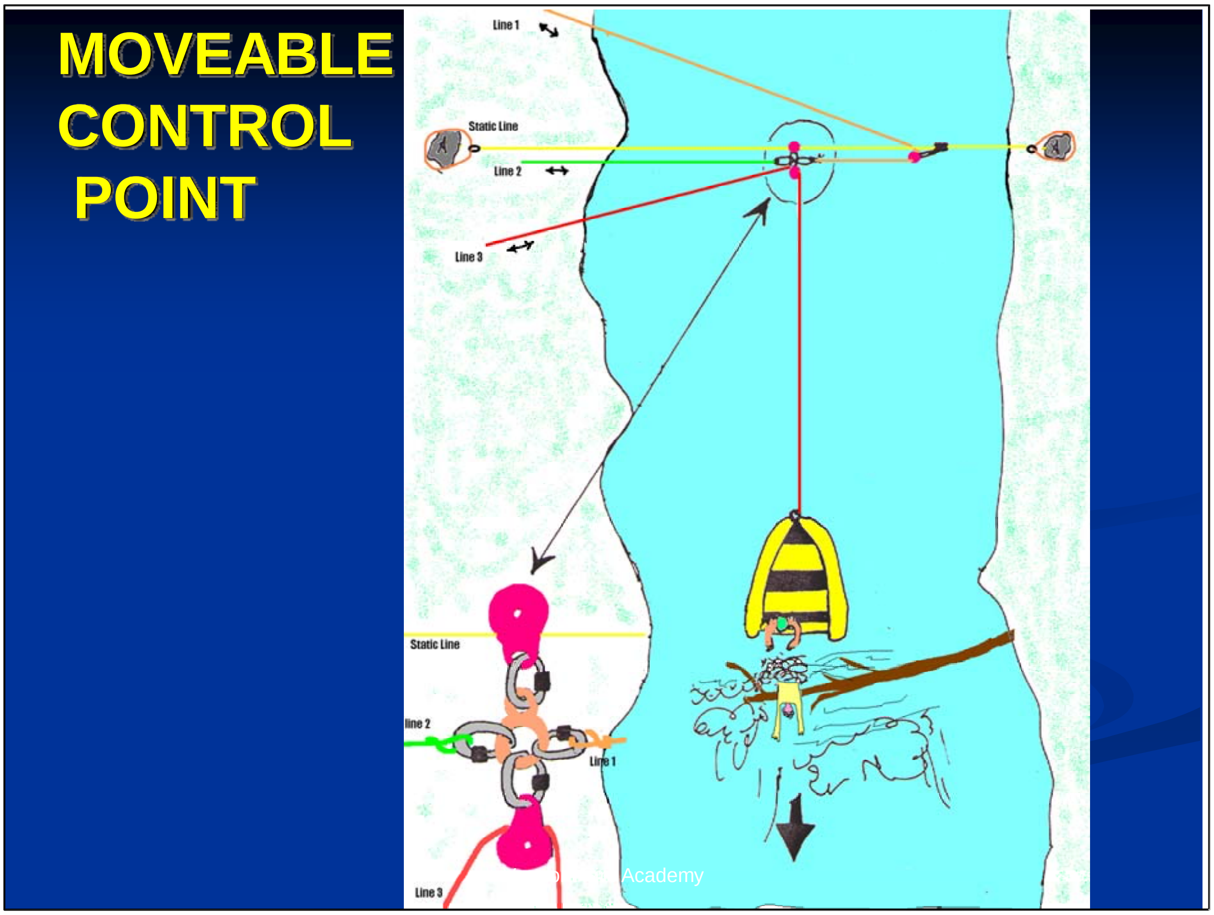
## Dynamic boat ferry

By using ropes attached to the highline by pulleys and anchored to a boat so the boat runs at angle to the current a dynamic ferry can be made across the river using the highline. This system allows multiple trips to be made back and forth across the river. This is a good system to conduct evacuations of a large number of people across the river.



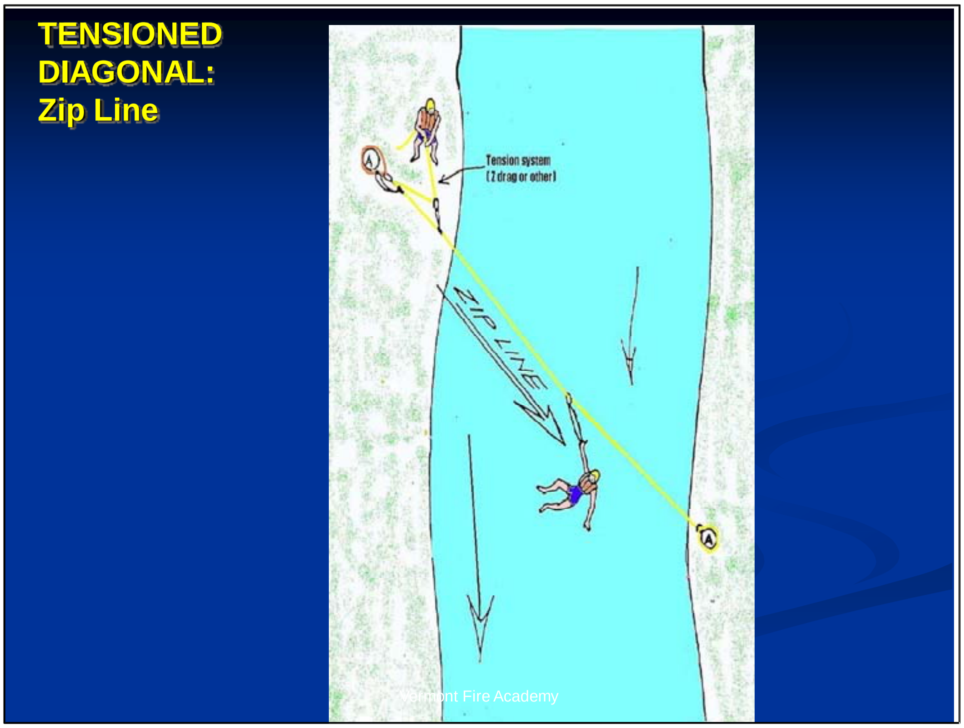
## Movable control point Telfer lowers

For a controlled lowering of a boat downstream, the movable control point system is used. This system allows rescuers to be moved across and down the river and then back to the starting point.  The movable control point Telfer lower requires team good work; it takes at least 5 personnel to operate the system. It is a good way to place the rescue platform at an exact point in the river.




**Tensioned Diagonal/ Zip Line Systems**

Tension Diagonal systems also employ a tensioned Highline, however in this case it is set at an angle to the current. A common application for a tension diagonal is a zip line. The zip line is used to quickly move a number of rescuers across the river by using the current to push them across the river. The highline must be under enough tension and at a steep enough angles to the current to prevent the line from forming a V that will trap the swimmer mid-stream. A rescuer can ride the zip line to quickly get to the other side without having to swim against the current.




**Rescue Swimmer Skills**

With the use of the quick release tether on the Type 5 SRT PFD rescuers have a means of conducting swimming rescues in swiftwater while having a safety tether to shore. Without a quick release system for the tether entering swiftwater tied to a rope can be very dangerous. Rescuers tied to a rope in moving water can be pushed under and trapped by the force of the current. It is essential to practice releasing the harness on the type 5 under controlled conditions. Also remember that if the rescuer fails to release the belayer must release or cut the rope.

**V-Lower Rescue**

- Used to position a rescuer at a stationary point in the river
- Works well for entrapment situations
- Must use a Type V PFD w/ a quick release harness
- Rescuer can wade or float to victim

**Tethered Swimmer Rescue**

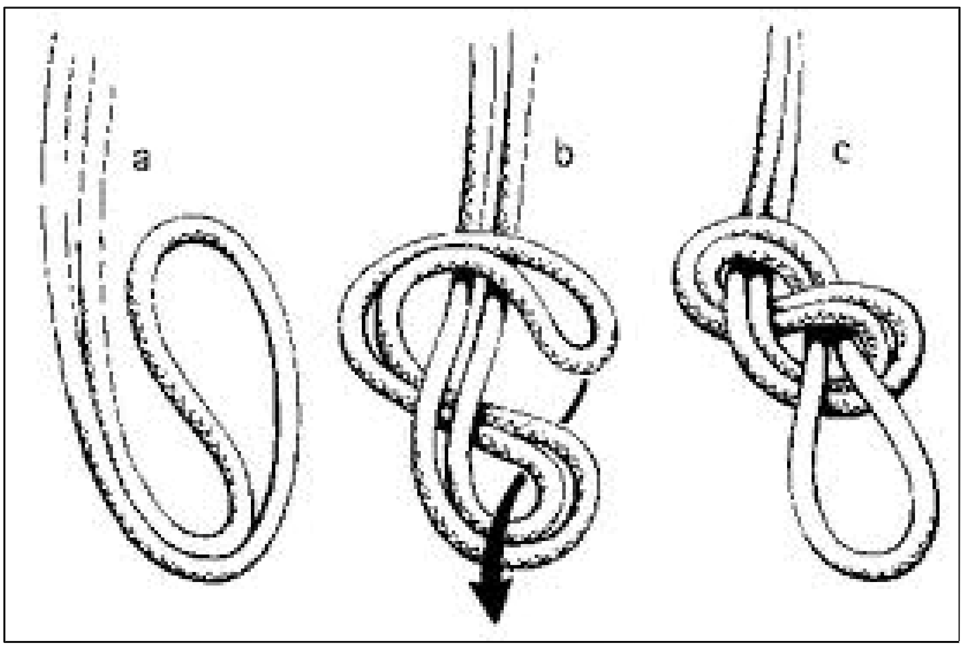
- Used to rescue a moving victim
- Rescuer must be a strong swimmer
- Approach victim from back
- Must use a Type V PFD w/ a quick release harness

# Knots & anchors

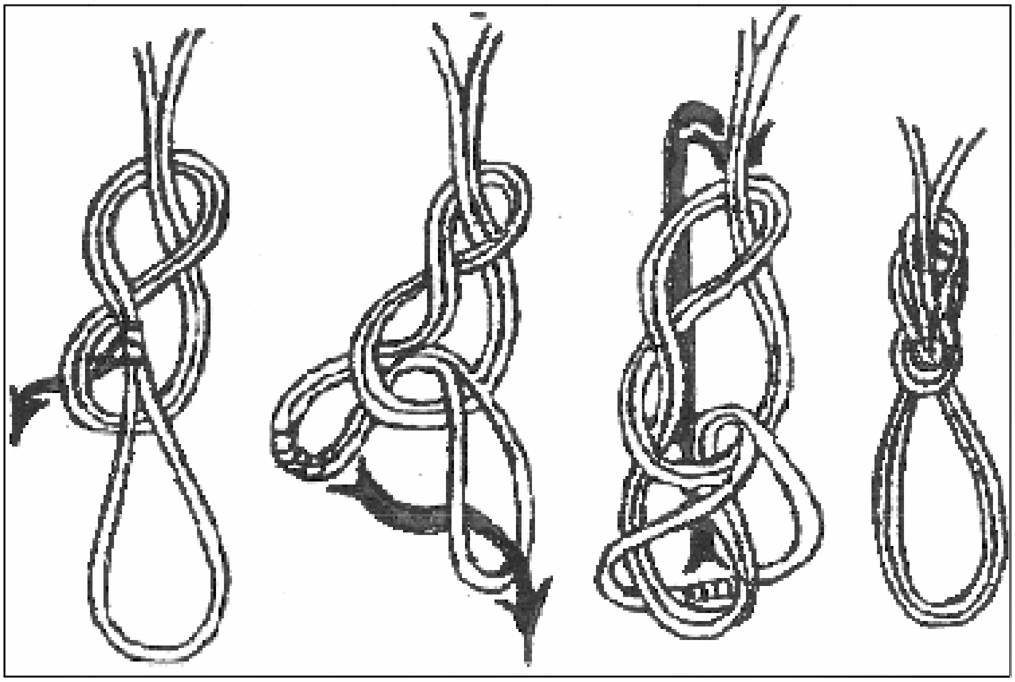
Knots are needed for building line systems in swiftwater rescue. The correct knots for each application must be used to assure the system operated properly and is safe. While these knots and anchors are the same as used in rope rescue, it should be remembered that the consequences of a system failure are not the same in swiftwater as in life safety rope operations. In rope rescue operations the backup system for a system failure is the belay, in swiftwater rescue the backups may include self-rescue and downstream rescuers.

**Swiftwater Rescue Knots**

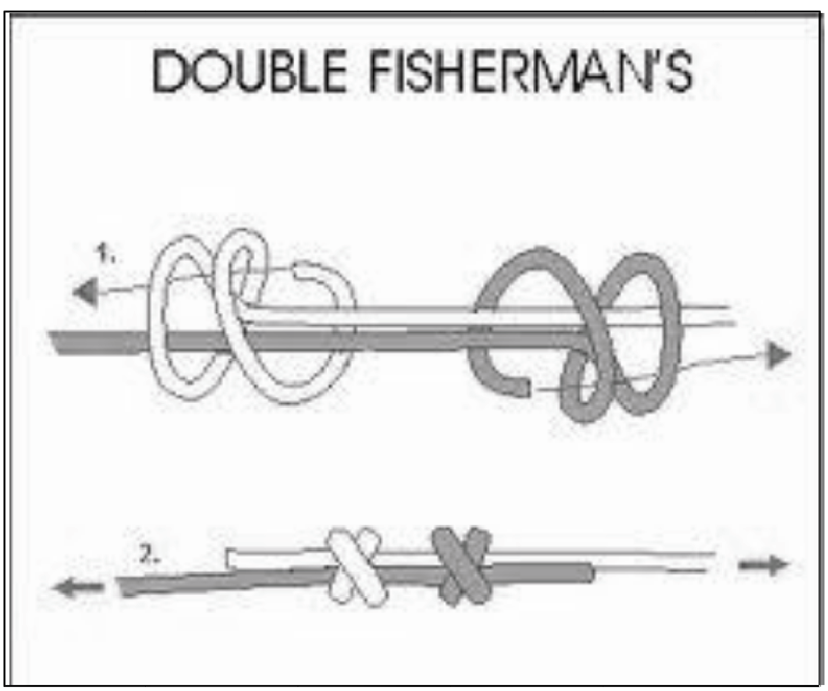
Fig 8 Loop: used to secure the end of the rope to an anchor, object such as a boat, or to a rescuer.



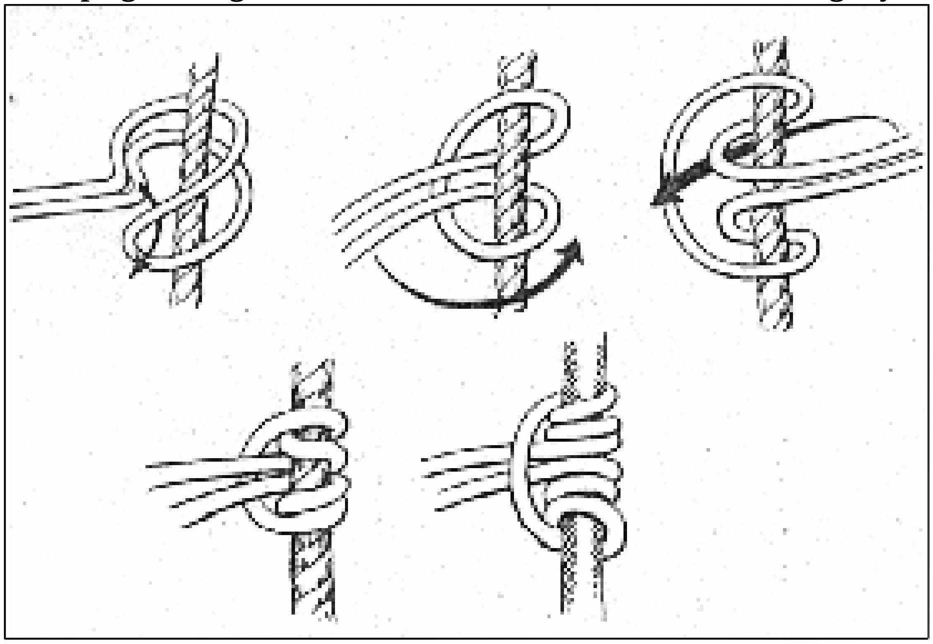
Double loop Fig 8: same as the fig 8 loop but with two loops – can be used for a two point anchor system



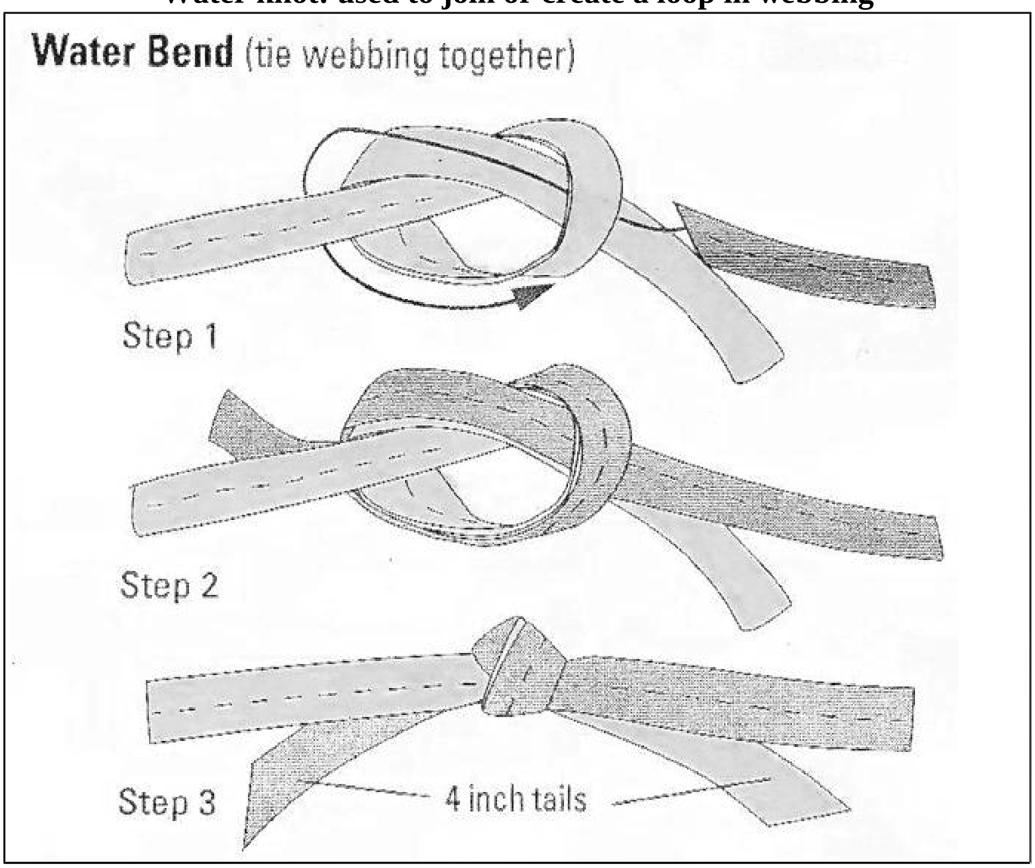
**Double fishermen:**
Used to join two ropes for high strength or to form the prussick loop in cord



**Prussick Hitch: a rope grabbing hitch is used to create mechanical advantage systems**



**Water knot: used to join or create a loop in webbing**



# ANCHORS

## Tensionless Hitch

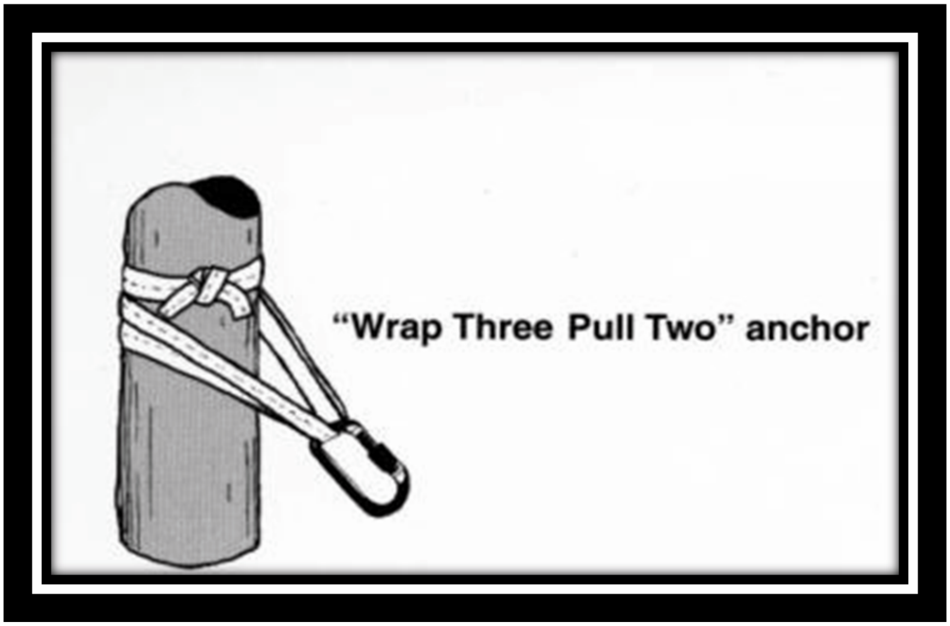
Used to secure the end of a rope with on an anchor like a tree without having a knot under load. Preserves the full strength of the rope.


## Single point – BFR-Looped webbing

A simple anchor made with looped webbing slings on a bomb proof anchor – Large tree

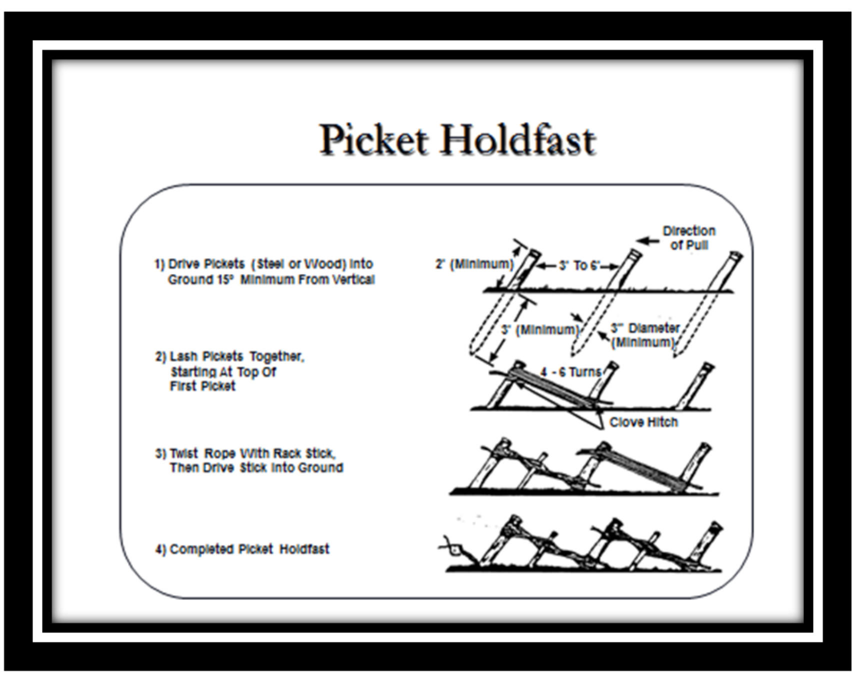
## Wrap Three –Pull Two

A stronger version of the single point anchor – this method has almost full strength of the webbing slings as there is little force on the water knot.




## Picket Holdfast

An anchor constructed with large steel stakes called pickets. This anchor allows rescuers to create an anchor where it is needed. In good soil the picket anchor will hold about a 2000 lbs. load



# Appendix

Swift-water Accident Reports

*Complied from the American Whitewater Accident database, FF close calls, and other sources*

This is an excellent resource for information on swift-water incidents. Its main objective is to share information to prevent kayak and canoe accidents. It has over 800 whitewater incident reports listed by both state and year or occurrence.

Full database is available for viewing or reporting swift water accidents at:
www.americanwhitewater.org/accidents/

OPEN CANOEIST TRAPPED IN SINKING CANOE

Norman's Kill River near Guilderland, NY
Date: March 17, 1990
Volume: High
Classification: II

DESCRIPTION: The Norman's Kill is a local class II run, which on that day was badly swollen due to recent rains and snowmelt. The victim, Dr. George Lesher, 64, was a scientist who had done considerable research on heart drugs. He was a trained, but still inexperienced paddler, running tandem in an inexpensive touring canoe with low-hung plastic molded seats with an inner tube for center flotation. The boat apparently tipped and swamped in fast-moving flat water. His partner bailed out, but Lesher stayed with the canoe. At this point the inner tube popped free, and Lesher found that he could not extricate his foot. He was washed into a strainer, where his friends tried so hard to rescue him that they stripped some of his clothing from his body. The rescue was made by Officers Mark Jones and Dan McNalley, experienced paddlers and police paramedics. With shore support from local firefighters they were able to release the victim. CPR was begun at once, and Dr. Lesher was flown to Albany Medical Center where he was pronounced dead.

Accident Database: Accident #723

River: Slippery Rock

The next two accidents involved novice paddlers who encounter strainers while running moderate white water. Slippery Rock Creek, a popular destination for intermediate kayakers in Western Pennsylvania, was the scene of a tragic triple fatality on April 8th. The Pittsburgh Post-Gazette reported that Neil Balcer, 23, met his death while running the Class II lower stretch of Slippery Rock below Eckart Bridge. Balcer, a novice paddler, spotted a downed tree just above the Harris Bridge takeout. He flipped while taking evasive action and made several roll attempts before washing into the strainer. He became solidly pinned about 20 feet from shore. His PFD and helmet washed off and were recovered in an eddy below. Boaters in the vicinity rushed to the scene, but there was nothing they could do. When firefighters arrived, paddlers told them that Balcer had been underwater for 45 minutes and was clearly dead. They suggested that they use a chain saw to cut the downed tree loose from shore. But the dive team from the Unionville Volunteer Fire Department had another plan. They elected to have two men approach the strainer from upstream. Lines from shore were tied to static harnesses (which have no quick release), a procedure which has resulted in many firefighter deaths nationwide. In addition, the two men were connected by an additional line which created a serious snag hazard. Minutes later something went terribly wrong. It's not clear if the pair lost their footing or something became snagged, but the ropes pulled Anthony Murdick 25, and Scott Wilson, 25, under water. Both men, married with young children, were killed. A few minutes later the ropes were ordered cut, but by then it was too late. The pair were dead when they washed ashore below Harris Bridge. The next day firefighters cut the downed tree at the shoreline, allowing Balcer and his kayak to wash free. This incident teaches us the importance of swift-water rescue training, and that we shouldn't take unnecessary risks to recover a person who is already dead.

Accident Database: Accident #182

River: Kaaterskill Creek

Section: High Falls to Catskill South of Albany, NY

Date: March 31, 1993

DESCRIPTION: On March 31, 1993 Catskill Creek, a popular early-season Class III run, was running bank-full due to recent and snowmelt. Temperatures were in the 60°'s, but the banks were snow covered. Six high school kids in three canoes attempted the run. They wore no wetsuits or drysuits;

clothing consisted of foul weather gear and work books. PFD's were worn, but no flotation was used in the canoes. About a half mile from the put-in a canoe wrapped around a tree about 5 feet from the bank, trapping one of the boys. The state police were called; the officers took considerable time making the rescue and hassled boaters who were in the area and trying to help. They also refused to start CPR on one boy, who was not breathing but could possibly have survived because of the cold water. A second boy was hospitalized for hypothermia.

Ohio Firemen Bring ‘em Back Alive:

River: Great Miami

Location, Dayton, Ohio

Date: June 1, 1981

Accident Description: On June 1, 1981, a group of four people, inspired by a rafting trip taken in West Virginia the previous spring, launched a pair of small vinyl rafts into the Great Miami River . The air was warm, but the water was high as a result of recent rains. The group, which was wearing life jackets, proceeded without incident until they went over the first major dam in Dayton, OH . They knew the dam was there, but as they put it “we’d been whitewater rafting and it didn’t look bad”. They soon found that appearances can be deceiving, as all of them became caught in hydraulic below. This incident had all the makings of a real tragedy. But fortunately, this came under the jurisdiction of the Dayton Fire Department, an active participant in the State of Ohio ’s innovative river rescue program. Once the men arrived at the scene, two of the victims were retrieved by an inflated fire hose extended into the hydraulic. This technique, developed in Dayton , has been described in previous issues of the RSTF. The other members of the party were plucked out using an aerial ladder extended horizontally. One victim was badly bruised by huge logs which were also trapped by the current, but the others were unharmed

Ohio Firefighter Dies Rescuing Teens From Water June 25, 2006

At 1:18 pm, on June 22, 2006, the Wellington Fire District responded to a 911 call for a water rescue, in Wellington Township. The department's Dive Rescue members responded to the call, with initial reports of two juveniles, in the water. The initial attempt to save the juveniles, who had attempted to drive their vehicle through the road closed barricades and rushing water, was unsuccessful. During a second attempt to reach the juveniles, Diver Allan "Buz" Anderson, Jr. entered the water, attached to a safety line. Water conditions rapidly deteriorated and he was overcome by the water current. At that point, the diver was extricated by rescue personnel using his attached safety line.

While Anderson was being removed, additional personnel successfully reached the two victims and removed them safely from the water. After Anderson was removed from the water, medical care was initiated by fire and EMS personnel. He was eventually transported by Lifeflight to Cleveland Metro Hospital. Resuscitation efforts at the hospital were unsuccessful.

Al "Buz" Anderson was 47 years old. He served on the Wellington Fire District's Dive Rescue team for four years and was a trained swift water rescue diver with fifteen years experience. Buz was married to his wife Julie for 20 years and had four children.

VT Woman Dies During Boat Rescue

SPRINGFIELD, Vt.— A rescue boat crew made several unsuccessful attempts to free an injured woman as their boat capsized in the Connecticut River, trapping her beneath the overturned boat, where she drowned, authorities said.

Virginia Yates, 64, of Rockingham, was stepping on a dock when she slipped Tuesday, injured her head and fell into the river, said Sgt. Craig Morrocco of the Fish and Game Department. A fire and rescue crew from Cornish brought Yates onto their brand-new, flat-bottomed airboat and strapped her onto a backboard. But as the boat headed to a waiting ambulance at a landing, it started taking on water and capsized, Morrocco said Tuesday.

"She was strapped to the backboard and she was strapped into a gurney," Sullivan County Attorney Marc Hathaway said, a standard precautionary measure. Officials said yesterday that after several attempts to save Yates the boat sank. Crew members were rescued by a passing boat and Yates' body was recovered an hour later. The boat remained stuck in the mud at the bottom of the river yesterday. Divers planned to attempt to dislodge it today. Officials said Yates was conscious when the rescue boat arrived at the dock.

Five people were on board the boat when it sank. Officials say the circumstances surrounding the sinking are under investigation.

Yates' friends said they don't know why she needed to be strapped in.

"Why would you take a 64-year-old lady that's got a little bump on the head and a strained ankle and strap her into a situation where if there was an accident, she couldn't get out?" said her friend, Tracy Snide. Edgar Emerson, of Bellows Falls, said he and Yates were on their way to visit friends when she slipped getting out of his pontoon boat. She had cuts and bruises on her head and arms and might have broken her ankle, so he made sure she was seated on the shore before he boated to Hoyt's Landing to find a cell phone and call 911.

Her flip flops lay where she kicked them off and marked the last steps a young female made before she entered the rain swollen violent Paluxy river to help rescue a friend on Tuesday, May 29 at approximately 5:15 p.m.

Witnesses on the scene of a popular swimming area, located in a low area where County Road 205 once crossed the Paluxy, said that Courtney Butler, 16, of Stephenville, jumped in to help her boyfriend who had fallen into the violently churning water.

The river was running faster and rising quicker than usual because of the large amounts or rain received in the area over several previous days. Both teens became caught in a whirlpool of rolling rapids and debris, and were unable to get out.

The young man, Carlos Manzano, 19, was eventually caught by a swift current and washed downstream where he caught hold of a bush sticking out of the rising waters.

Watching from the bank and unable to reach her, the witnesses said they saw Butler come up once in the forceful waters near where she initially went in, and then did not see her again for what seemed like a very long time. They reported seeing her one final time, being pulled quickly away from the area in the rushing water. They did not see her again.

Valiant efforts from the Somervell County Volunteer Fire Department/EMS and Somervell County Sheriff Deputy Steve Gibson were successful in eventually retrieving Manzano from the tree. The teen was immediately transferred by EMS to the Glen Rose Medical Center.

Rescue personnel continued to search for the missing girl until after dark; returning to begin more aggressive efforts early Wednesday morning.

The search became a rescue mission again soon after resuming, when a flat-bottom boat carrying two Texas Parks and Wildlife Department Game Wardens was suddenly sucked in by the strong waters and overturned. SCFD/EMS crews on the bank, Sheriff Greg Doyle and Deputies Anders Dahl, Shane Tipton and Steve Gibson began attempts to get the two Wardens from the raging water.

Hood County Game Warden Danny Tuggle, 58, was pulled ashore and immediately given medical aide before being carried up the steep embankment to waiting EMS crews. Tuggle was transported to Harris Methodist Hospital in Fort Worth where he was treated for near-drowning injuries

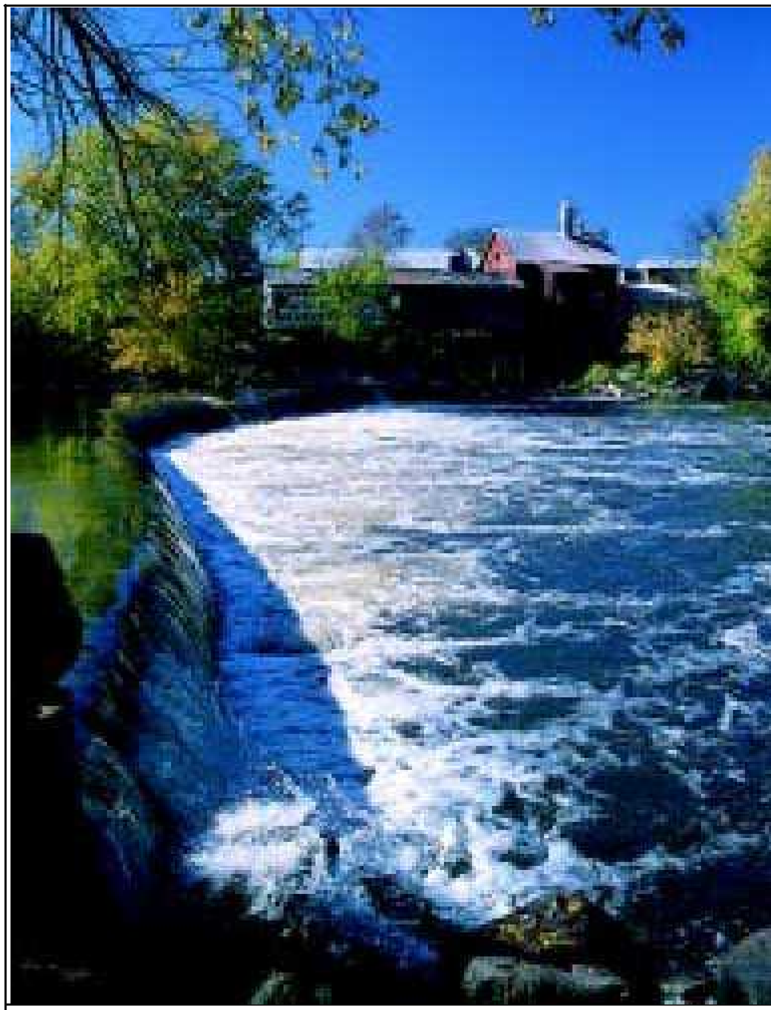
Efforts to retrieve Tuggle's partner, Johnson County Game Warden Teyran "Ty" Patterson, 28, were not so successful, with the strength of the water making it almost impossible to get the capsized boat and the submerged Patterson to shore. The men were finally able to secure and pull the victim from the waters after almost 10 minuets of fighting the current. Vigorous CPR efforts continued on Patterson until he was air lifted to the hospital, but they were unable to revive the fallen officer.

Search efforts continued for the missing Butler, with local rescue personnel, Texas Parks and Wildlife personnel, Department of Public Safety dive teams and helicopter assistance from around Texas working around the clock. Surveillance stations were set up at numerous locations along the Paluxy, including Big Rocks Park, where Butler's body was finally recovered at approximately 2:30 a.m. on Thursday, June 1 by SCVFD/EMS crews.

# Lowhead Dams: The Drowning Machine
## by Kim Elverum and Tim Smalley

In late September 1975, a tragic chain of events in Binghamton, New York, taught river users and rescue teams valuable lessons in dam safety. By the time the episode ended a day later, three people were dead and four had been injured.

An early fall storm had made the Susquehanna River unusually high. One evening, two rafters were swept over the Rock-bottom Dam and trapped in the current below the structure. Witnesses to the accident summoned help, and a rescue boat was launched with three firefighters on board. In the turbulent water, the craft capsized. All three were thrown into the river. One firefighter drowned; the other two, along with the two rafters, were pulled from the water.



The Berning Mill Dam on the Crow River near St. Michael, MN was typical of a lowhead dam. Water flowing over the top creates a recirculating current drawing objects back toward the face of the structure. Even boats with powerful engines have been trapped and capsized by lowhead dams such as this one. The dam has now been removed as part of a state dam safety program.

The next day, on a body recovery operation for the lost firefighter, the fire chief and two firefighters approached the dam from downstream. As their outboard powered boat reached the base of the dam, the current caught it and the boat turned over in the roiling water. Desperate attempts to rescue the trio failed, including a try with the fire department's extension ladder.

Twenty minutes later, a rescue boat carrying two sheriff's deputies arrived on the scene. By this time, two of the firefighters had disappeared, the third was bobbing in the maelstrom.

As if to add horror to horror, this attempt once again ended in tragedy as the third rescue craft overturned in the turbulent water. Luckily, the two deputies and the remaining firefighter were swept clear of the dam and eventually rescued. Why did this tragedy occur? Are these small dams that dangerous? Was this just a freak accident or could it happen in other places, including Minnesota? What can be done to prevent these tragedies?

**DROWNING MACHINE**

Dams come in many sizes and shapes, everything from huge lock-and-dam structures on the Mississippi River to small, "lowhead" dams. Although there are safety problems with larger dams, their size and design do not present the type of threat involved in the seemingly harmless lowhead dams.

Lowhead dams are generally small structures usually no more than 10 feet high, although some are as low as six inches. They have no gates or water control devices; water flows constantly over them. Most were built to provide water for grain mills or early hydroelectric generators, and to control lake levels.

Because of their small size, they do not appear to be dangerous, especially when viewed from a boat or canoe upstream. They can be pleasant places in the summer when water drops over them and gently flows downstream.

In the spring and during other periods of high runoff, however, the dams become very dangerous. Torrents of water pouring over the dam create a churning backwash or current. This "hydraulic," as it is often called, is really a recirculating current. The roiling water takes any object — including a person — to the bottom of the stream, releases it to the surface, sucks it back to the face of the dam, and pushes it back to the bottom. This cycle can continue indefinitely.

In addition to the current, other hazards are inherent in most lowhead dams:

• Both faces of the dam usually consist of a vertical concrete abutment. Even if a victim struggles to the edge of the structure, chances are poor that he or she will have enough strength to climb the wall.

• Branches and other debris trapped in the hydraulic pose an additional hazard to the victim.

• Temperature of the water at times of high runoff is usually cold, which decreases survival time.

• Finally, air bubbles mixing in the water decrease its buoyancy by one-third. The victim has a hard time staying afloat, even with a personal flotation device (life jacket).

In sum, these factors combined with the hydraulic current create a nearly perfect drowning machine.

**OUR LOWHEAD DAMS**

Problems with these dams are not confined to New York. Deaths of victims and rescuers have occurred in nearly every state, including our own. Most of the several hundred lowhead dams in Minnesota were built during the late 1800s and early 1900s. Many have been abandoned or are no longer used.

One such dam which was removed was located on the Crow River, which forms the boundary between Hennepin and Wright counties. In July 1979, events nearly as tragic as the Binghamton incident began with what was alleged to have been a dare.

A 25-year-old man wearing a boat cushion on his back plunged over the Berning Mill Dam on an air mattress. The river was unusually high for the summer and the man was trapped in the hydraulic.

Occupants of two canoes below the dam attempted to rescue him, only to become victims of the current themselves. The first canoe capsized. Fortunately, the canoeist was washed clear of the dam and reached shore safely. The second canoe with two men and a woman was pulled into the spillway. It broke in two throwing all three occupants into the river.

A state trooper arrived on the scene, but was unable to rescue the man wearing the boat cushion trapped below the dam. Instead, the trooper turned his efforts to the woman from the second canoe who had been brought ashore by two fishermen. He and two bystanders managed to keep her breathing until more help arrived. That evening she died at the hospital.

Two days later, the bodies were recovered. The final toll: three deaths.

The MN DNR teaches rescue techniques at a Fast-Water Rescue School. In a drill, a rescue team pulls a float through the boil. A victim caught in the boil could hang onto the float and be pulled free.

As tragic as these deaths were, however, they were not unique. Over the past 10 years, 14 deaths have occurred at dams on Minnesota rivers. The dam which has claimed the most lives is the Red River's Drayton Dam located on the Minnesota-North Dakota border 40 miles north of Grand Forks. Since it was built in 1964 over a dozen people have died in its spillway. Despite warning signs, ordinances, and city and state police officers patrolling the site, fishermen and canoeists continue to press their luck at the base of the dam.

**RESCUE**

In 1980, officials of the Ohio Department of Natural Resources were dismayed to learn that, in two years, nine firefighters and police officers in that state had lost their lives, and others had been injured, in fast-water-rescue attempts. Additional checking revealed the same type of deaths and injuries had occurred in other states.

These accidents involved rescue personnel who were injured or killed in what had been considered routine water emergencies. Typically, the rescue personnel, like adventuring river users, were confident of their equipment, knowledge, and experience.

Only a few fortunate rescuers have survived a trip through the current below a lowhead dam. Dennis Lutz, a Miamisburg, Ohio, firefighter, described his experience attempting to rescue a teenager:

"You can't believe how powerful the current is. As my buddy and I approached the dam, the boat seemed to rise and move rapidly forward. It's like being caught by a monster. It just won't let you go."

The rescue boat filled with water and capsized as the strong current sucked it into the dam. Lutz was dragged down into the hydraulic, battered along the bottom, caught in a submerged tree, wrenched free, and pushed to the surface, only to have the cycle repeated. Lutz was finally rescued, but his companion and the teenager drowned.

In response to these tragedies, the Ohio DNR Division of Watercraft, with the assistance of firefighters, the Red Cross, and canoeists, developed techniques that can help anyone faced with a fast-water rescue problem.

The techniques that Ohio devised have been put into practice across the U.S.

Lowhead dam rescues are either shore- or boat-based. Shore-based rescues are used on dams up to 300 feet wide which have accesses at both ends. If rescue by a throw-line is not possible, a line with a rescue buoy in the center is placed across the river. This can be done with a line gun, or by using a boat downstream from the dam. Rescuers on both sides of the river then work the line up to the victim and pull the victim to shore.

Dams where access to both ends is not possible, or dams that are wider than 300 feet, generally require a boat-based rescue. This method requires two boats which are connected by a safety line.

The first boat approaches the dam from downstream, being careful not to enter the hydraulic. A flotation device on a line is then cast to the trapped person. The second boat remains 100-150 feet downstream. Its purpose is to assist in the rescue and keep the first craft from being pulled into the dam.

Other techniques have also been used successfully, including specialized watercraft and a coupling which allows an ordinary fire hose to be inflated with compressed air and pushed out to the victim.

Rescue techniques must be realistic and simple. Rescue agencies must know the dams in their area, take measures to prevent accidents, and plan and practice rescue methods.

*Kim A. Elverum and Tim Smalley. Photos by Tim Smalley.*

# In the immediate aftermath of Hurricane Irene, New York's normally placid Croton River was transformed into a treacherous beast with Class V rapids. And no shortage of hazards. For a few local rafters, it was too hard to resist.

**by William McGowan**

They'd waited all week for it. And then finally, on the afternoon of Sunday, August 28, as Hurricane Irene began to ebb in the northeastern states it had ravaged, a group of rafters got their chance. Torrential rains had transformed the Croton, a mild river that flows through suburban Westchester County, into the sort of Class V thrill ride they'd fly across the country to paddle. Earlier that week, Dr. Peter Engel, a 53-year-old psychiatrist and addiction specialist who'd done some of the world's most challenging rivers, texted a friend, "Now that it's all going to be flood, it's time to go boating."

That day the river, which runs over the spillway of the massive Croton Dam and continues for three and a half miles into the Hudson, was a hellbroth of logs, tree limbs, stumps, and whole trees that had been uprooted from the saturated banks. Normally, the river flows at 300 cubic feet per second; it was now running at 22,500, the heaviest in 55 years. Its currents had reached nearly 50 miles per hour (faster in more narrow chutes) and churned with colossal wave trains and Class V and even Class V–plus rapids — the kind of muscular surge you'd see in the Niagara River below the falls. Midstream, islands of rocks and trees had been almost completely submerged, creating classic "strainers," which whitewater riders avoid at all costs. "That river can be treacherous on any given day," Croton police detective Paul Camillieri says. "But that day it was a monster. It was Mother Nature at its most fierce and unpredictable."

The trip had been organized by 37-year-old Ken GiaQuinto, the business manager of a pharmacy his family owns in the city of Rye, New York. GiaQuinto had worked for a time as a river guide in Breckenridge, Colorado. The 12-foot blue raft was his. As Irene made her way up the eastern seaboard, GiaQuinto sent text messages to four friends he thought might want to take advantage of the dramatic rainfall. One was Brian Dooley, a third-grade teacher who coached high school lacrosse with GiaQuinto and was celebrating his 33rd birthday that day. Another was Joe Ceglia, also 33, a boyhood pal of Dooley's who'd been a lacrosse All-American at Syracuse University and even played professionally. He was now the athletic director at Rye Neck High. Neither of them had done a lot of whitewater rafting. A third recruit was 37-year-old Michael Wolfert, an avid skier and climbing-school owner with considerable rafting experience. He lived about 100 yards from the Croton Dam Gorge and was familiar with the Croton, at least under normal circumstances. The fourth friend was older and more seasoned than the others. Dr. Peter Engel, who had two adult children, had been running whitewater for more than 30 years. He was the last one to arrive at the river that day, rendezvousing with the other rafters at around 4 pm.

The crew had a hard time finding a safe put-in, so they drove to a county park beneath the massive Croton Dam, inflated their raft, and parked it on a bridge spanning the raging water below. GiaQuinto's and Wolfert's wives snapped pictures of their children in the boat, while the crew assessed the water from the bridge.

There were dozens of people in the park that afternoon, most gaping at the cataract crashing over the dam's massive spillway. "Everyone seemed dumbfounded that anyone would try to do this," said Mark Stevenson, a photographer who shot footage of the group that day. But, he said, the group had an "air of authority" and all the right gear. At one point Stevenson asked GiaQuinto if they had experience with whitewater. "Oh, yeah," GiaQuinto joked. "We looked it up on Google."

Normally, rafters wouldn't put a boat in the water until they'd had a chance to do a safety walk, scanning the river by foot to evaluate various hazards and plot their course. But the water level made a full survey impossible. And the doctor, the most experienced of the group, hadn't had a chance to read the water features at all.

According to the American Whitewater organization, the Croton River can present rafters with a number of hazards: keeper holes, rocks that cause blunt trauma, natural strainers, and low-head dams that create unpredictable hydraulic perils. That day the five-man crew would encounter them all.

They launched late in the afternoon, around 5:30, but with near–50 mph currents, they knew they'd finish the trip well before dark. The first mile or so was fast but flat. They "smoothed" three low-head dams with ease, and then a higher, more difficult dam, in near-perfect form. GiaQuinto was sitting comfortably in the stern, calling out paddling commands. When they came upon a bridge that had 12 feet of clearance on a normal day, the rafters leaned backward in the raft to duck beneath it. A photograph taken from that bridge shows the crew beaming, thrilled at being on such powerful water.

Less than two miles downriver, the group hit a wave train that resembled a giant roller coaster, as well as a set of rapids. Then, not even 10 minutes into the trip, they rounded a bend into Silver Lake, a wide, flat part of the river used as a town swimming hole under usual conditions. At this point the rafters could have paused in an eddy by the riverbank to assess what hazards lay ahead or to consider altering their original course. The trickiest waters were still to come. If they'd wanted to pull out and call it a day, this was their last chance.

But they pressed on, and at the Silver Lake spillway, the boat skewed to the right and plunged into a lurking depression. Immediately, the raft somersaulted, stern over bow. "Somehow we just hit the wrong spot at the wrong angle at the wrong time," Wolfert explained later. Another rafter subsequently told police: "We never thought an accident would happen. There was no notion of danger. All of a sudden, the boat just flipped."

Thrown into the smash and boil of the churning 70-degree water, Ceglia, the rafter with the least experience, knew enough to keep his feet up and his head out of the water as he barreled through a half-mile of powerful rapids and rolling waves in a matter of minutes. He managed to grab onto a tree on the flooded right riverbank and cling to it until a Croton policeman and volunteer firefighters threw him a rope and pulled him to safety. "I'm OK," he told rescuers, "but I've got four friends still out there."

As Ceglia was speeding downstream, GiaQuinto and Wolfert struggled to swim out of the hydraulic backwash created by the underwater dam. GiaQuinto later told a friend it was the hardest swim of his life and that he thought he was going to die as the force of the backwash dragged him and his life jacket under. Somehow, both he and Wolfert made it safely to shore.

Dr. Engel had a more difficult ride downstream. He was found by a Croton police rescue boat at 6:24 pm, facedown in the water about a half-mile from the mouth of the Hudson. He still had on his dark-green helmet, his life jacket, and his dry top. But all of the garments on the lower half of his body — including his baggy Nike swim trunks — had been ripped off by the river or a strainer he might have passed through. According to the medical examiner, he had a laceration on his forehead and an abrasion on the bridge of his nose, as well as contusions, bruises, and scrapes all over the rest of his body. The official causes of death were asphyxia by drowning and hypothermia; his body temperature was 93 degrees at the time of his death.

Now four of the rafters were accounted for — Brian Dooley was still missing. As the sun was setting, dozens of responders fanned out along areas where Dooley — or his body — might be.

As soon as the call went out that a raft had flipped, local rescuers put their boats in and assumed shoreline watch posts. Croton's volunteer fire department and EMTs were joined by counterparts from neighboring communities, county police, and emergency personnel; police helicopter crews came from as far away as New York City. More than a hundred personnel turned out to assist the rescue operation, several of them nearly becoming victims of the river that day, too.

Three volunteer firemen went swimming after launching an 18-foot skiff just above a railroad trestle bridge. Their engine stalled soon after they launched, and they could do nothing as an onlooker cried out, "Bridge! Bridge! Bridge!" The firemen's boat capsized when it slammed against the railroad bridge, and the crew members were swept downriver. One of the three, the department's 44-year-old chaplain, found himself trapped under the boat, his foot snared in a line. He didn't break to the surface until he was more than 200 yards out into the Hudson.

Geoffrey Haynes was at home, listening to his police scanner, when he heard about the missing rafter. The former AP reporter thought he might be able to be "another pair of eyes, if nothing else," in the Dooley search. He and his 23-year-old son grabbed life jackets and binoculars to scan the area where the raft had flipped. On their second sweep of the riverbank, the elder Haynes looked through his binoculars and spotted Dooley's orange jacket and turquoise dry top about 30 yards from the river's far bank at the upper tip of Fireman's Island. He had wedged himself into a sweet spot in the nook of two trees, Haynes said, but the water was still crashing over him, pushing him into one of the trees, forcing him to constantly change his grip. "To get to this guy would have required a Navy SEAL operation," Haynes said. Dooley kept trying to pull himself up higher on the tree, reaching for a small branch above his head. But as the hours passed, his motions got slower as hypothermia set in.

A Westchester County Technical Rescue Team, trained in swift-water operations, put in a rescue swimmer, but he was immediately swept away and pulled from the river by teammates downstream. A helicopter rescue had been considered, but the tree canopy and the continuing high winds made it inadvisable to drop in a crew member on a harness. The only thing a helicopter could do was hold Dooley in its searchlights so rescuers could keep track of him.

Around 8:45 pm, Geoff Haynes picked up his binoculars to check on Dooley, but he was gone. A moment later he heard over the police radio that Dooley was out of the trees.

Croton Detective Sergeant John Nikitopoulos and his two-man dive team had been idling in their Zodiac by the shoreline downstream. When they heard the radio chatter, they hurried out into the river. Using powerful handheld searchlights, they got a visual on Dooley, who was moving downriver at about 1,000 yards in 30 seconds. He flapped his arms weakly to signal them. When they hauled him into the boat, Dooley curled up in the hull, “totally spent,” Croton police lieutenant Russel Harper later said. Dooley, who’d spent close to three hours of his birthday struggling in the water, was shaking and almost unable to speak. He was admitted to the hospital with extreme exposure and hypothermia. He told police he wasn’t sure whether he had lost consciousness or lost his grip. He had no idea how long he’d floated or how he made it without hitting any trees.

The day after the incident was bell-blue and sunny, and a rainbow arced over the Croton River where the rafters had put in, but elsewhere in town, a stormy backlash was brewing. Some townspeople were furious that the rafters had put so many rescuers at risk simply to satisfy what one called “juvenile urgings.” The comments sections of local news sites teemed with ugly remarks. “Score one for Darwin,” somebody posted. Another cracked, “Good riddance. Minus one arrogant, reckless soul in the world.”

Not helping things were certain statements that survivor Michael Wolfert made to the press. “We were not novices,” he told one reporter. And when asked whether they calculated the risks of rafting the swollen river, Wolfert replied, “It’s a risk we assume.” But the risks of their ride were hardly confined to the men in the raft. Three volunteer firemen and a rescue swimmer nearly drowned. Helicopters came and went in dangerous winds, hovering over a heavily treed gorge. Many in the town thought the rafters should have been billed for the rescue, estimated at more than $45,000; others urged criminal prosecution.

Engel’s paddling buddies were left scratching their heads. “Peter was not reckless,” insists lifelong friend Gary Maltz, an internist who’d paddled the Gauley with him. “When he went on a river, he usually knew every nook and cranny. He was very safety-conscious, very smart, very rational.” But the crew had violated some of the cardinal rules of whitewater paddling. They had not done a full safety walk and had shot low-head dams that they might have portaged. Most significantly, they left no margin of error — for being stranded, caught in a strainer, snagged on a tree, or thrown overboard.

Maybe they failed to give a local, suburban river the respect they’d give rivers with bigger names, fiercer reputations. Croton detective Paul Camillieri thinks it was a case of hubris. “They thought they were going for a Sunday ride. That it’d be over quickly, they’d high-five each other and then go for beers. I don’t think they really took it seriously enough.”

Richard Charney, who'd paddled the Colorado and whose house is near where Ceglia was rescued, maintained that the big rivers Engel had done are "known quantities." Their features and hazards are studied and discussed by paddlers who'd done them. "But that experience would not apply to the Croton at that level," he says. "At that level, it is a completely unknown quantity."

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Sgt. Geoff Maurer was the first Princeton Township police officer to arrive at a flooded Rosedale Road in Princeton, just minutes from the University campus. Down the street in front of him, submerged in rushing flood waters, sat a dark colored sedan. It was 4:37 a.m. on Aug. 28, in the middle of Hurricane Irene.

Maurer and three other officers who arrived on the scene tried with flashlights to figure out if anyone was in the car. He then called out to the car using his cruiser's PA system, asking anyone inside to honk the horn or flash the brake lights.

Minutes before rescuers were about to enter the water, police were told that a New York woman reported she had abandoned her gray Volvo earlier in the evening on the same part of Rosedale Road. But officers weren't positive that this was the same car.

Two volunteer rescuers from the Princeton First Aid and Rescue Squad — Michael Kenwood and Peter Simon — were directed to get closer to the car to see if it was occupied. At 5:01 a.m., the rescuers, tied together and wearing life vests, slowly shuffled into the water.

In seconds, the rescue attempt took a tragic turn.

Kenwood and Simon were swept downstream and became stuck in trees. Because of the rain, dark and brush, Simon and other rescuers on shore lost sight of Kenwood. Then, suddenly, officers saw a yellow life vest — which they realized was Kenwood — being sucked downstream.

Maurer's voice crackled over the police radio: "[He's] face down in the water!" Maurer shouted. "Face down in the water!"

Kenwood, 39, was in the water for about five minutes and later died from his injuries. Simon was unharmed. The car was empty.

Two months after the fatal rescue attempt, dozens of pages of police and ambulance records combined with 20 minutes of police dispatch recordings reveal previously unreleased details about what happened that morning.

Most notably, the documents illustrate confusion and uncertainty at the scene — whether the Volvo was occupied, the decision to enter the water, the rescuers' attempts to battle strong currents and the desperate attempts to save Kenwood's life — that soldiers often call the "fog of war."

The documents — including maps, incident logs and firsthand accounts of four police officers and three EMTs who were on the scene — were released on Friday to The Daily Princetonian under the Open Public Records Act.

Kenwood, who officially died due to acute asphyxia due to drowning, according to materials released to the media, was the only rescue worker killed in the United States during the hurricane. He is survived by his wife and three-year-old daughter.

**The abandoned car**

About 10 miles north of Princeton, in Belle Mead, N.J., a couple from New York was visiting their in-laws. Around 3:30 a.m. on Aug. 28, the family decided they had to evacuate the flooding home. Traveling in two separate cars, the couple and their in-laws decided to drive to Lawrenceville. The couple drove a gray Volvo.

Instead of reaching Lawrenceville, the two cars were detoured onto Rosedale Road. There were no barricades on the street, the family later told police, so the drivers decided to continue.

However, the road had been declared flooded and Princeton Township Public Works reported installing barricades to block off the road. Township police Det. Ben Gering later wrote that he found "no evidence that barricades were still in place" when the Volvo drove by, raising the possibility that they had been swept away or removed.

As the New York couple began driving down Rosedale Road, they encountered low standing water. Deeper water was ahead, so they decided to back out. But the car stalled, and the couple was forced to climb out the sunroof.

They traveled in their in-laws' car to the Nassau Inn. They arrived there at around 4:30 a.m. and notified Princeton Borough police officers about the abandoned car.

**'Overtaken by water'**

At 4:31 a.m., a member of the Princeton Sewer Operating Committee who was near Rosedale Road noticed a car — later identified as the gray Volvo — in the water near an overflowing Stony Brook Creek. The man called Princeton Township police dispatch. The call faded in and out, but the caller's message was clear: The car was "overtaken by water," but the caller was unsure if there was anyone inside.

Four police officers responded immediately and were able to get within 275 feet of the car. PFARS rescue units were also dispatched. A fifth officer tried to drive around to the other side of Rosedale Road to get a better vantage point but was stopped by flooded roads.

The tail reverse lights of the car were on, but due to poor lighting and the storm officers couldn't determine if there was anyone inside. The flashing brake lights — possibly caused by a shorting out of the electrical system — only added to the uncertainty.

At 4:47 a.m., Borough police Det. Thomas Lagomarsino notified Borough police dispatch to report the abandoned Volvo after speaking with the owners. The information was immediately passed on to officers on scene.

The dispatcher asked: "OK, what kind of car is it? Because the squad is about to launch a boat to see if anyone is inside it."

Lagomarsino transmitted the license plate. He added, "And the car is empty. Everyone was able to get out of it."

When Township officers on scene were notified about the abandoned Volvo, there was momentary confusion between dispatchers and officers: There were two cars, in addition to the Volvo, on the street, but officers quickly judged that those other two cars were empty and out of danger.

The situation became more complicated when an additional car arrived on the other side of the street. This new car was shining its headlights, and officers didn't know if anyone was inside. They soon learned it was the personal car of a PFARS member.

The only car in question now was the Volvo, and officers sought to determine whether this car was the same one that was abandoned. The PFARS member on the other side of the street said he didn't see anyone inside.

Officers were told that the license plate of the abandoned car was New York EFN2182. Looking through his binoculars, Maurer thought he could see "2182" and the blue stripe of a New York plate. But because the plate was obscured by the water, he wasn't sure, and neither were other emergency personnel.

"It appears that that vehicle is the same vehicle the Borough reported," Lt. Robert Toole told the dispatcher. "We're unable to 100 percent confirm that. The water rescue team is going to go out and try to confirm that."

The next radio transmission, three minutes and four seconds later, reported that the rescuers had been swept off their feet. They were stuck in the trees.

**‘Added risk’**

Kenwood and Simon, already dressed in dry suits and personal floatation devices, arrived on Rosedale Road at 4:55 a.m. along with other PFARS rescuers. The pair immediately prepared an inflatable raft called a “banana boat” and put on their helmets.

Looking out at the vehicle, Simon noticed that the water had risen about a foot, just enough to cover part of the vehicle’s license plate. EMS Capt. Nate Plough, in command of the squad at the time, made the decision that the rescuers should get a closer look.

Kenwood and Simon hooked a retrieval line onto their life vests, with Kenwood at the end and Simon several feet from the end. They were attached with breakaway rings so they could break off the line in case of trouble. They also decided to abandon the banana boat, in favor of wading in themselves.

Kenwood and Simon stood in the center of the roadway and began shuffling slowly toward the car. The water level had risen to the base of the car’s windows, and white water crested over the roof. Police officers, EMTs and firefighters held onto the other end of the rope.

But as the pair got about halfway to the vehicle — roughly 150 feet — Simon decided to call off the mission.

“Although we could proceed further, we would not likely get close enough to the vehicle to complete our task” because the depth and flow of the water was increasing, Simon wrote in an account of the incident.

“The added risk,” he wrote, “was not warranted.”

The pair began to retrace their footsteps, with water settling at just their mid-shin. But about five steps after they started walking back, Kenwood fell. Simon tried to keep walking, but he began being dragged downstream. He tried to brace himself on a curb. Simon then lost his footing too.

Kenwood and Simon were swept along about 30 feet by the water when they became caught in a tree. Simon lost sight of Kenwood, so he called out to him. There was no response.

**‘We need the boat!’**

At this point, officers on shore had lost sight of Kenwood too. Officers tried to pull the rescuers in but were not able to. Simon, concerned that Kenwood had been trapped underwater, pulled out his knife and cut Kenwood free. Simon estimated that two minutes had elapsed since their initial fall. Three more minutes passed before Kenwood was pulled from the water.

Back on shore, officers saw a yellow life vest being swept downstream. The life vest traveled about 175 feet in the water before it was caught on debris. Officers and EMTs ran toward the yellow vest. As officers got closer, they realized it was one of the rescuers. He was about 30 feet away.

Cpl. Marla Montague shouted into the radio, “Face down in the water! We need the boat over here, boat over here!”

Maurer tried to wade into the water, but Toole ordered him back. It was too dangerous. Officers grabbed a rope and tied it to Plough, who swam into the water, grabbing Kenwood. Attaching the rope to a tree, the officers on shore pulled the two to safety.

Officers found that Kenwood was very pale and had no pulse, and they began performing CPR. Kenwood was transferred to an ambulance. That ambulance broke down on the way to the University Medical Center at Princeton after hitting debris. Kenwood was placed in a second ambulance and taken to the hospital. He was initially listed in critical condition. He was transferred to the Intensive Care Unit.

By this time, the Volvo had been washed away by the flood waters.

Meanwhile, Simon was still in the water clinging to a tree. Units on shore were in radio contact trying to devise a plan to rescue him. Rescuers ultimately decided to wait for backup. Trenton Department of Fire and Emergency Services and two other departments couldn’t respond, but finally rescuers from Rocky Hill, N.J., arrived on scene.

In the meantime, firefighters tried to extend the boom on the Princeton Fire Department’s ladder truck to get closer to Simon, but wound up 30 to 40 feet short.

Simon’s rescue proved harrowing. A team of rescuers tried twice to get to Simon, but dangerous waters forced them to turn back.

Meanwhile, Simon realized he was in trouble. He felt that the retrieval line — the line that was supposed to rescue him — was beginning to be pulled downstream and he had to break off of the line.

He eventually was able to stand up by holding onto a tree. The water level, which had begun at mid-shin, had risen to above his knee.

Rescuers from Rocky Hill, anchored to a nearby telephone poll, finally threw Simon a rescue line and he could climb to safety.

Rescued from the water, Simon headed to UMCP. Simon spent that morning at the hospital with Kenwood's family, and was alongside Kenwood when he died that evening.

The next day, on the crackling radio that first dispatched Kenwood to the submerged car on Rosedale Road, a Mercer County 911 dispatcher announced the news: "Michael selflessly gave of himself that early morning so others may live. May Michael rest in peace with the rest of our nation's fallen heroes."

'NEVER BEEN MORE SCARED'

Colonial Beach firefighters recall harrowing life-and-death rescue the night Tropical Storm Lee turned a creek into a raging river.

*Date published:* ***9/18/2011***

By CATHY DYSON

Jim Jett went back to the place where his life could have ended, to the exact spot where he clung to a tree for two hours as floodwaters raged around him.

The water was up to the firefighter's neck that night, after Tropical Storm Lee drenched Colonial Beach and nearby neighborhoods.

Torrents of white water rushed around him, and his body was pulled by the current like a flag stretched out in the breeze.

With one hand Jett clung to a stalk of bamboo, and with the other he held onto a woman who had gotten stranded on Monroe Bay Circle after her car stalled.

But when Jett returned to the scene Thursday, with fellow firefighters who went through the harrowing experience with him, he didn't see the life-and-death images the men still carry in their minds.

He saw a little creek that looked like a nice place to go fishing.

"Nobody would ever believe the water was rushing like it did that night," said Chris Saulnier, a captain with the Colonial Beach Volunteer Fire Department. "The trees that it was picking up and floating across the river, it would blow your mind. I ain't never seen anything like it, never."

THE CALL OF 'MAYDAY'

The men probably won't experience another scenario like Thursday, Sept. 8.

Saulnier had issued the "Mayday" call for the first time in his life. He let everyone know a firefighter was down and in the water, along with the woman, who wasn't identified, and another rescuer who happened upon the scene. That was Nick Roe, a member of the Westmoreland Rescue Squad.

Saulnier was in command, and he had plenty on his mind. He couldn't let any other firefighters put themselves at risk, including Jett's longtime friend Tony Crouse. Saulnier kept shouting for him to stay put.

Meanwhile, the captain was on the radio with the fire chief, who was headed there in a ladder truck.

The chief is Jett's son, Jim Jett III. When he kept asking Saulnier which firefighter was in the water and the captain wouldn't answer, the chief figured out it had to be his dad.

"Nobody could see him, and we couldn't even hear him at that point," Saulnier recalled about the moment Jett plummeted into the water. "We just knew they were all gone."

He shook his head, remembering the despair. From across the room in the fire department, the elder Jett, 49, realized what it must have been like for Saulnier.

"You had more on you than anybody should ever have," Jett said.

'PEOPLE WERE STRANDED'

Volunteers had gathered at the firehouse on Sept. 8 to work on renovations. They were all surprised by how much water the storm dumped in hours, and roads and neighborhoods flooded around them.

"People were stranded everywhere," Saulnier said.

The volunteers helped about two dozen people get out of cars.

By midnight the rain had let up and even more people went out, looking around. That's when the call came in from Monroe Bay Circle, off State Route 205 in Westmoreland County.

When firefighters got there, water was up to the car's door handles. Crouse and the elder Jett came into the road from the back side of the neighborhood, and other firefighters entered from Route 205.

The car stalled on the little bridge over an area that's barely a creek during normal times. But that night, water rose about 4 feet above the road.

Roe, the Westmoreland rescuer, came upon the scene. He has had some swift-water training, so Crouse and Jett threw him a safety rope and Roe reached the woman. As the two were about two-thirds of the way across the water--which was as wide as a football field--the woman slipped, and both went under.

They went over the bridge, which has such a drop-off that it looked as if they plunged into a waterfall. They landed on a sizable piece of tree, the woman face-down.

Jett maneuvered his way to them to help Roe lift the woman out of the water.

The tree snapped.

"It sounded like a shotgun going off," Saulnier said. "We all heard it."

All three plummeted into the darkness.

NEVER MORE SCARED

Jett doesn't know how long he was underwater; he said it felt like a week.

He isn't sure how many times he popped up, gulped more water and went back down again. He was dressed in full turnout gear, which probably added 100 pounds of weight.

Roe was still tied to the safety rope and ended up the farthest downstream, away from the bridge.

The woman and Jett got caught in a small grove of bamboo. Crouse had maneuvered as close as he could to the dangerous water, and when Jett yelled for help, Crouse breathed a sigh of relief. He also kept a spotlight on Jett the whole time.

Jett is hardly a novice in the water. He has fished and crabbed all his life, and he's on a boat almost every day.

His 8-year-old son, Jace, is also an avid crabber and was featured in a Free Lance-Star story in July 2010.

But things were different that night in the water, which was very cold.

"Forget about being macho," Jett said. "I have never been more scared in my life."

IN DIRE STRAITS

Jett was buoyed by the strength he got from seeing Crouse's light and from hearing other firefighters above the roar of the water. When his son got there in the ladder truck--after driver Dana Reed fought his way through floods and washed-out roads--the chief extended the ladder as far as it would go.

He didn't scale it himself, but purposely picked two men to calm the situation.

They were Bill Sanford, the elder Jett's friend since high school and a retired firefighter at the Dahlgren Navy base, and Tommy Feltner, a medic whom Jett had coached in baseball.

They told him to hang on and stay strong, and reassured him that help was on the way. As the men talked with Jett, his son could hear his father's voice growing weaker from the cold water, which brings down a body's temperature 25 percent faster than cold air, according to hypothermia websites.

"It was pretty intense," the chief said.

The Chesterfield Fire and EMS Scuba Rescue Team had been summoned earlier in the night.

"When we showed up, we knew some of their brothers were in dire straits," said Capt. Gerald Pruden, who directed the team.

They assessed the scene and all they saw were trees, fences and "tons of things that can hang you up or trap you there," said Pruden, who graduated from Spotsylvania High School in 1978.

Three men launched an inflatable boat into the water. When the rescuers got close enough, two dived in and helped each person, one at a time, get into the boat. It took them about 10 minutes, the Colonial Beach firefighters said.

"Those guys were bad to the bone," Jett said. "It was like the cavalry coming to the rescue."

Pruden's team included boat operator Gene Ledlie and divers Jake Britt and Bryce Ford.

They had quite an audience that night. By the time the water rescue was over, about 50 firefighters, from all units in Westmoreland, had lined the banks of the creek in a show of support.

'WEAK AS A KITTEN'

The woman refused treatment and left the scene. Roe and Jett were rushed into waiting ambulances. Jett's wife, Marcie, was there, too, and helped medics cut off his wet clothes and cover him with warm blankets.

The three had been in the water for about two hours and were suffering from hypothermia. Other firefighters were worried about their core temperature and how pale they looked, Saulnier said.

Chief Jett had asked for a helicopter, but none could come because of the weather. A Colonial Beach fire truck led the way for the ambulance, through flooded roads, to Mary Washington Hospital. The men stayed for several hours and were released.

Jett, who works with his son in construction, told him they'd get back to work on Monday, but that didn't happen. The elder Jett was "weak as a kitten" after the experience and said he felt as if he had the flu all week.

Like the other firefighters who hung with him, Jett can't stop thinking about the events that night.

Any of the three who went into the water could have been gored by broken bamboo, or squashed if they had washed into a hardwood tree at the speed they were moving. Or they could have been hit by the debris that littered the banks afterward: chunks of concrete blocks, pieces of bricks and panels of corrugated metal.

"It's amazing when you think about what they did to rescue me," Jett said. "I never would have made it without these guys."

# A New Flood Rescue Response Model

*by Slim Ray*

Many of the flood responses in the past few years have fallen into the "too little, too late," category. The scenario is distressingly familiar, especially for flash floods: as the flood hits, residents and local emergency workers struggle to survive and rescue others. Emergency managers struggle under a staggering call load, trying to separate the desperate from the trivial. They call outside resources, but by the time they arrive on scene, the flood is mostly over. This scenario has played itself out many times—in Ft. Collins, Kansas City, the floods of Hurricane Floyd in North Carolina, and elsewhere.

In the aftermath the response is generally justified with "we did all we could" and "there's just no way you can plan for something like this." Yet much of the problems emergency managers have encountered is due to using an antiquated and inadequate response model. In this article we will explore a newer, more responsive model. But first, let's look at some of the characteristics of floods.

Floods generally come in two flavors: river floods and flash floods. Many floods, such as the recent ones in North Carolina in the wake of Hurricane Floyd, have characteristics of both. In general, a river flood is just what the name implies: too much water in a river's watershed. It often affects a wide area, quite often an entire region, and has a slower onset and retreat than a flash flood. This leads to a different time problem than a flash flood, which comes and goes in a hurry. In river floods a major problem is exhaustion of the rescuers over an extended time period.

A flash flood, on the other hand, tends to be an intense but short-term event. The entire incident may last only four to six hours from start to finish, or it may be the start of a long-term river flood. One of the salient characteristics of a flash flood is that there are a very large number of life-threatening incidents in a very short time (more about that later). A flash flood may affect an entire region, or it may be localized to only a few city blocks. Time, always, is the rescuer's enemy, and the major management problem is that there are never enough rescue resources to go around.

All floods, generally speaking, have three phases, which often overlap:

**Swiftwater Phase:** this initial phase is where the most fatalities (and the most rescues) occur. Large numbers of people, including those in rescue agencies, are caught unaware, often in darkness. Many are swept away. Statistically the two largest groups are people killed are 1) those driving through moving water and 2) children playing near flooded creeks and flood channels. The sheer number of incidents overwhelms dispatch and available units.

**Flood Phase:** the situation stabilizes somewhat, but there is standing water everywhere and rivers may continue to rise, further restricting access. Those who are able have rescued themselves, at least gotten to positions of less immediate danger like the roofs of houses or the tops of cars. Because of the flooding, rescue units cannot access many locations. Large numbers of people may have to be evacuated from flooded areas and are displaced to shelters. In a river flood, this phase may be prolonged, sometimes for months.

**Recovery Phase**: the water begins to recede and people return to their homes. The dangers of this stage are more indirect—downed power lines, debris, disease, contaminated water and food, etc. The are major infrastructure problems—washed out roads; loss of power; lack of clean water. Rebuilding begins.

What rescue resources might we expect to use in a flood? The most obvious would be specialized water rescue teams. These, especially any used in the initial phases of the flood, must have swiftwater-specific training. Dive teams or those with only generic water rescue training only put themselves and the victims at risk in fast-moving water. However helpful these specialized teams are, however, there will never be enough of them to go around in flood event. To supplement them, we first need to look close to home.

There are many non-specialized rescuers in any flood zone. These include law enforcement personnel (police, sheriff, etc.), firefighters, rescue squads, and EMS personnel. However, these people need at least minimal training and equipment for simple rescues and to protect themselves. While all these groups will protest that they don't do water rescue, the simple truth is that during a flood, everyone will be doing it. Do not overlook other local resources, like municipal storm water personnel; power crews; and other city/county/state employees whose duties take them into the flood area.

Outside resources include mutual aid from surrounding jurisdictions (who may be having their own problems), and military assistance from the regular military and National Guard, and Coast Guard. Don't overlook qualified volunteers, especially kayakers and raft guides from river companies. These outfits often have a great deal experience in moving water and useful equipment, like rafts and PFDs, also.

Educate your dispatchers on the basics of flood and swiftwater rescue. They can't make decisions on what to send where unless they know how the system works. Any dispatch system needs a ramp-up capability; that is, the ability to expand its capacity from normal call volume to several hundred calls in a short time. In addition, it is critical for any dispatch system to be able to triage incidents; that is, to separate the trivial from the life-threatening. The newly-devised Natural Disaster Information Cards (see sidebar) are a great help in doing this.

> Developed by meteorologist John Weaver at Cooperative Institute for Research in the Atmosphere (CIRA) at Ft. Collins as the result of the flood there in 1997, the Natural Disaster Information Cards are an invaluable tool for helping dispatchers and managers triage incidents and for helping citizens cope with emergencies. They can be downloaded free at http://fcgov.com/oem/ndic.php and modified to suit local needs.

Incident commanders and emergency managers also need a working knowledge of flood and swiftwater rescue, so they will know what works and what doesn't. Agencies need to have common maps and enough command interoperability to at least be able to talk to each other. A good way to do this is to schedule joint exercises. Most emergency managers, used to the routine of daily operations, have had little experience in managing a large incident.

Okay, most of these things so far are common sense, although unfortunately few agencies do them. But let's look at the response model, especially for a large incident. How do we manage a large flood incident to get rescuers where we need them? One thing we've already noticed is the lack of time, especially in flash floods, and the fact that most casualties happen in the first few critical hours.

The traditional response method is often called the "pull" system. In this model, response units remain at their home station until called. Once a disaster occurs, it is sized up and resources are identified to handle the problem. These are then requested through proper channels, alerted and dispatched. With volunteer units, the volunteers must first come to station, don their gear and draw their equipment, then proceed to the incident location. In a large-scale disaster, outside resources are often not notified until local units realize that they can't cope with the situation, causing additional delays.

The advantage of the pull system is that it is a very efficient way to allocate resources. Rescuers are sent only to actual incidents, and then only as many as are needed. For routine situations this works just fine.

The big disadvantage of the pull system, however, is that it is slow. The cycle of size-up, request, approval, selection, alert, and dispatch is called a decision loop, and it takes time. The more people and the more command levels in the loop, the longer it takes to get people on the road. In a flood this often means people get there too late, and when they do get there, they may not be able to reach flooded areas.

This problem also surfaced in the US Army in the early 1980s, especially for battlefield logistics. Military logisticians found that on the fast-moving air-land battlefield, the pull system was just too slow. By the time supplies had been requested up through the chain of command, authorized, loaded, and sent down to the units, the situation had changed radically and the original requests were no longer appropriate.

To deal with this the army came up with the "push" system. Under this system, unit logisticians would monitor the situation and make an estimate of what the units needed, then dispatch it without being asked. It was not as efficient as the pull system, because the requirements were not exactly known, and sometimes the logisticians guessed wrong. But it was much, much, faster and more responsive.

So what has this got to do with floods? Experience has proved two things—things happen in a hurry and large areas are quickly cut off by rising water. This has meant in practice that the people who are on the spot make the rescues, ready or not. There simply is not time to mobilize and deploy after the flood starts, and often impossible to get there.

By adopting a "push" system, managers have a much better chance of getting people where they need to be. As flooding threatens, units are predeployed to known or suspected trouble spots as determined by weather predictions, historical data, pre-incident surveys, and agency preplans before flooding begins. Only in this way will they be where and when they are needed. It also works in reverse, allowing managers to get citizens out of areas sure to flood.

A good example of this is the system used in Los Angeles. When weather conditions are right for flooding, strike teams are dispatched to walk the flood channels, and swiftwater teams are positioned in likely trouble spots. This cuts out the time needed to identify the incident, dispatch, and travel to the incident. This way they can begin rescue immediately.

Obviously this is a much more difficult challenge than reacting to an existing incident. It requires considerable expertise on the part of managers and a close working relationship between weather forecasters and emergency services—much closer than is now generally the case.

**Plans and Preparations**

The Chinese military philosopher Sun Tzu said many years ago that most battles are decided before either army sets foot on the field. So it is with floods, and perhaps the most important arrow in the flood manager's quiver is his preplan. Unlike natural disasters like earthquakes and tornadoes, floods can often be predicted. Furthermore, floods are constrained by geography. It's possible, especially in these days of GIS software packages, to map low areas and watersheds and to compare this with real-time meteorological data.

An agency's preplan needs to be a realistic, worse-case scenario of flooding in an entire region. What areas are at risk? In many cases your best data is historic, since some low areas flood every time there is a heavy rain. Where have rescues and drownings occurred in the past?

Where will the water go? You will need maps of the entire watershed of any rivers and creeks, even if they go out of your jurisdiction. When planning deployments, try to anticipate which roads will be underwater, both so they can be blocked off and so that you won't try to deploy through them. Try to choose pre-deployment spots that won't go under water also.

Good maps are a necessity. Federal agencies like U.S. Geologic Survey can be a great help here in showing you where the flood plains are. Don't neglect the smaller watersheds in your jurisdiction, since creeks will, with enough rain, become rivers. As mentioned before, common maps for all agencies are a necessity.

**Survey your jurisdiction for obvious flood hazards:**

Low bridges: These need to be blocked off. Seven people died in one incident in Kansas City when three cars were swept off a low bridge. Low bridges can also become blocked with flood debris and turn into dams, then send a surge of water downstream if they let go.
Dams: Low-head dams can become "drowning machines" during floods or high water. How would you rescue someone in one?
Flood channels: These present a difficult and dangerous rescue problem, with fast-moving water (up to 30 mph) and smooth banks.
Low water crossings: Very common in many western states, these need to be blocked off or at least monitored during high water.
Creeks and watersheds (watershed maps): Do you know where the water goes? That insignificant creek running through town may become a major river after a storm.
Storm water systems: People and even trucks have been sucked down storm drains.

Remember, though, that your flood problem is never "solved." Like any plan, it has to be periodically re-evaluated. Development, in the form of paving, roads, housing, malls, and other commercial development, can radically change flooding and drainage patterns. So can flood control measures. Often flood controls in one area just move problem somewhere else. Some flood protection measures, like low head dams and flood channels can greatly increase danger to rescuers.

There is one more vital piece of the puzzle—weather prediction. Just as a general must know as much as possible about his opponent, you must know about the weather. Only then will you as a manager be able to accurately allocate resources and make decisions.

New advances in weather forecasting, like Doppler radar and telemetric rain gauges, now make it possible to get real time information about exactly what is happening in the heavens and on the ground. You can now literally watch as storms pass over, filling watersheds and flooding creeks and rivers. For the first time, an incident commander can anticipate a storm’s next move. But to do this, you need to develop a "weather intelligence" program. This means establishing a close relationship with weather forecasters, even to having them sitting at your elbow during the incident. In several incidents, large and small, the operation has come to grief because weather information did not get to where it was needed in a timely fashion.

CIRA meteorologist John Weaver calls this "tactical meteorology." By knowing what the storm is doing and when, incident commanders can greatly reduce the duplication of effort inherent in the push system.

If you’ve done your homework on where flooding is likely to occur, and are able to make a tactical intelligence estimate on where the rain is coming down and where the storm is moving, you can predeploy resources before the roads flood out. You can also warn people in the path of the flood and evacuate them if necessary. One recent innovations is the development of the "reverse emergency calling" systems. These software packages allows EMS to automatically call households in a selected area (which they have determined is going to flood) and play a pre-recorded message warning residents of the danger and perhaps ordering an evacuation. It will never replace knocking on doors, but it does give residents critical advance warning time.

Don’t forget the media. It can be friend or foe, but it is absolutely vital for public education. Insist on a two-way relationship. If they want you to keep them informed, they need to help you keep the public informed. Citizens should be told the basics of flood safety. Probably the most important thing they need to know is not to drive through flooded roads, since the majority of flood fatalities happen in cars. Some states have produced videos to discourage this, and maybe you can get the local TV station to do a spot.

Don’t wait until the flood hits and then try to figure out what to do. This has been tried and it doesn’t work. Modern management techniques make it possible to get ahead of the flood, and that’s where you must be for effective flood incident management. If you don’t, you’re sunk, literally. Once you get behind, you’ll never catch up during those critical opening hours, where you are most likely to lose the most people, both civilians and your own.

**To reiterate the differences between old and new models:**

OLD MODEL:

Reactive
"Pull" system — resources sent only when requested
Incident command designed to deal with serial incidents, copes with multiple simultaneous incidents only with difficulty.
Long response time
Responds to incidents already in progress
Resource deployment hampered or prevented by flooded roads
Efficient use of resources
Mangers trained "on the job" for routine operations only

NEW MODEL:

Proactive
"Push" system — attempts to anticipate needs rather than reacting to them
Extensive preplanning and use of weather intelligence data
Incident command able to deal with multiple simultaneous incidents, has "ramp-up" capability
Short response time
Reacts to predictions of flooding
Resources predeployed when possible
Less efficient use of resources, some duplication unavoidable
Emphasis on multi-agency, multi-jurisdictional operations
Managers trained for large-scale operations

Let's look at some actual examples.
In the floods in Fort Collins, Colorado (1997) and Kansas City (1998) the dispatch system quickly became clogged by the large number of incidents. Emergency managers ran out of local resources in short order. In both cases the response model at the time did not allow expansion of dispatch capability to cover the increased number of incidents, nor was outside help summoned until it was too late. In Kansas City there was no agency preplan or much interagency cooperation, leading to a failure to close access over a low bridge. Seven people in three cars were washed off the bridge and drowned.
The next year North Carolina found its response model was simply inadequate for dealing with a disaster the size of Hurricane Floyd. State policy is to relegate rescue responsibility to the counties, with state emergency managers acting only as resource coordinators. When rains from the hurricane swamped the eastern part of the state, county emergency management was quickly overwhelmed, but state policy prevented mobilizing resources until the counties actually asked for them, virtually guaranteeing that adequate rescue resources would not be available during the first critical night. By the time teams outside the

area were actually dispatched, flooded roads prevented them from getting into many areas. Thirty-seven counties flooded, yet there was no overall state management of the overall crisis, at least in the initial stages. Each county struggled along as best it could, attempting to deal with incidents on a case by case basis. Had it not been for massive intervention by military rescue helicopters, it is likely that the death toll would have been much higher than the fifty-two who actually lost their lives.

Another common failure of the rescue agencies in both Kansas City and North Carolina was the lack of flood rescue training and equipment. National Guardsmen, transportation workers, and others were deployed to the flood zone without any training or PPE. According to a CDC report, ten percent of the fatalities in the Hurricane Floyd flooding were rescue workers.

It is time for us, the rescue community, to recognize that existing response models, both for floods and large-scale disasters, are simply not adequate. No longer should we pretend that they are meeting the needs either of citizens who look to us for rescue, or for keeping our own safe. Our task for the future is to plan, train, and make rescues in the safest and most expedient way possible.

***THE* Weapon of Mass Destruction:**

**<>The Growing Impact of Moving Water and Floods on the International Fire Service.**

***Reprinted from Fire International Magazine, Great Britain, June, 2001***

by Jim Segerstrom

Special Rescue Services, a member company: World Rescue Group

*Bangladesh, Chile, Venezuela, Portugal, Hungary, Ukraine, Mozambique, United Kingdom, Australia, Vietnam, Cambodia, Mexico, Switzerland, Italy, Japan, China, Taiwan, Hong Kong, South Africa, United States, France, Germany, Holland, Canada*…

The list is actually a lot longer–the countries, the states, the provinces that have suffered significant problems from rising rivers, swiftwater, and catastrophic flooding

When I started the Swiftwater Rescue Technician program in 1979 at Rescue 3, the major new interest in rescue circles was “river rescue.” Indeed, a number of public safety personnel had died in those years–making the same mistakes repeatedly, not knowing what they didn’t know. Our delivery emphasized that a lot of moving water emergencies occur *outside* of rivers–in canals, irrigation ditches, flood control channels, storm drains, sewers, flooded city streets, desert arroyos–anywhere that water could get moving down a gradient. We adopted the word “swiftwater” to separate the concept from other existing programs.

In the early years most of our students were law enforcement rescue personnel, park rangers, fisheries personnel and whitewater guides. The fire service was not yet the mission of the fire service it has become today.

The Swiftwater Rescue Technician philosophy–certified since 1984 by the International Rescue Instructors Association in the US– was correct for the time–what can a handful of rescuers, sometimes acting alone, safely do to rescue a finite number of victims in a defined area? The SRT class has now been delivered to nearly 100,000 people in 11 countries.  Today nearly 70% of those taking and teaching the program, and other similar programs, are firefighters.

Indeed the fire service, particularly in the United States, has jumped enthusiastically into the mission of delivering search and rescue services–rope, confined space, earthquake and USAR. . . and water rescue.

However, even if we are generous in our estimates, the number of firefighters trained to a consensus standard for basic water rescue, much less the more hazardous swiftwater environment, is a "spit in the ocean," compared to the growing problem.

As the result, firefighters and rescuers world-wide continue to go in harm's way at an increasing number of moving water and flood calls–attempting to maintain the traditions of personal sacrifice, "improvise, adapt, and overcome;" letting emotion cloud judgment–and paying the ultimate price.

In recent months rescuers have been swept away to their deaths in a number of countries. In many other situations, untrained rescuers have not only nearly died themselves, but failed to rescue those they were attempting to assist. Informal estimates in the US, based on the number of firefighter deaths in fires per thousand working fire calls, compared to the number of firefighter deaths per thousand water calls, would seem to indicate that the chances of an American firefighter drowning on duty are *400% higher* than those of dying in a working fire! Those deaths–most recently in Colorado, Nagoya, Japan, and Manchester, UK–can most readily be attributed to lack of knowledge, lack of equipment, and emotion and urgency.

Meanwhile, the global problem increases in severity. The daunting challenges have been emphasized to me recently as I have visited with government officials in China and Japan–densely populated countries which have suffered recent large flood events.

There is bad news, worse news, and very little good news.

First the bad news:

Global warming is a fact. Poor countries are going to bear the brunt, as the cycle of droughts and floods increase in severity. Glaciers on the equator are disappearing. The ice cap on Kilamenjaro in Africa, millions of years old, will disappear by 2016. The world will warm approximately 10 degrees C in the next 100 years. The oceans will rise nearly a meter. There will be more "freak" weather events. There will be massive population displacements and potentially enormous loss of life. Floods are already the world's number one weather-related killer, and cause more property loss than all other weather-related events *combined.* Ninety-four million people a year are now affected–from minor inconvenience to death–by floods. Property loss from flooding has rise nearly $40 billion each year. The insurance industry is able to replace very little of this loss. The World Bank is now spending over $28 billion each year on disaster packages.

The title of this article, from my friend, US swiftwater expert Slim Ray, encapsulates the problem most aptly. Today public safety agencies are devoting tremendous amounts of time and money preparing for earthquakes and terrorist events–which, combined, kill nearly 21,000 people each year. Meanwhile, each year, 300,000 a year die in monsoons, hurricanes, and floods.

Slim is correct, water is the ultimate "weapon of mass destruction."

Now, the worse problems:

1. Contrary to the opinion of many public safety officials that I have met in my 27 year career, in every country and every location: There is nothing unique, special, or different about floods in *your* jurisdiction. Water moving down a gradient behaves in a predictable fashion, and responding to such emergencies needs to be done in a fashion comparable to what reasonable, prudent, *properly trained and equipped* responders are doing elsewhere. These events no longer occur periodically. There is no such thing as a "100 year flood." This problem is not going away. It is getting worse.

2. Twenty-six percent of US firefighters–paid and volunteer combined–are either weak or non-swimmers! Their supervisors in most cases don't know who those personnel are because swimming has traditionally not been a hiring aptitude or required job skill.

How many of your agency personnel don't know how to swim?

3. In the US there is only one lifejacket/buoyancy aid in service for every 15 emergency personnel. Many of these are old. Even if they have not been used, such equipment loses flotation with age. In recent classes I've demonstrated by having personnel jump into a pool wearing only a bathing suit and their personal flotation devices. In many instances the PFD will not support the wearer's mouth and nose above the surface in flat water!

How many life jackets does your department have? Are you employee's trained in how to wear them properly. Have they been tested for flotation recently? What are the occupational safety legal requirements in your jurisdiction for employees exposed to the chance of drowning? Does your department comply fully with those requirements?

3. Since 1989 nearly 40 US public safety personnel have drowned on duty. Traditional water rescue programs are no longer adequate to deal with the scope and intensity of the problems. Even the title Swiftwater Rescue no longer is no longer an adequate way to describe the discipline.

Now the problem is Swiftwater/Flood Rescue.

Yet, water rescue in many areas remains the “red-headed stepchild” of public safety priorities.

4. The problems in these events are virtually unknown to most emergency supervisors.

The expression “flood disaster management” is, in most places, a contradiction in terms.

Swiftwater and flood events occur in four phases–pre-event; the “rescue” phase; the “evacuation, search, and safety” phase, and the recovery phase. Each has its own long list of concerns. Those concerns should be the available to incident commanders through the use of a Swiftwater/Flood Technical Specialist–to provide safety information and guidance in the planning for such responses.

A Swiftwater/Flood Technical Specialist is intimately acquainted with all aspects of basic to advanced moving water rescue, including shore-based concerns, boat operations, rope rescue applications, helicopter utilization, communications, logistics problems, searching flood habitats, animal rescue in floods, citizen awareness and evacuation procedures, hazardous materials, contaminated conditions, night and inclement weather operations, and a host of other concerns.

There are a handful of such individuals in the US, less in most other locations. And, even in the US, most emergency managers have no idea who they are or how to utilize them.

5. “Disaster Management” is, by definition, reactive in nature. Money, *serious money*, needs to be spent on the pro-active “pre-flood” preparation in most locations. Educate the public on the dangers. Legislate so that those who fail to obey lawful orders to evacuate, or drive around barricades and become stranded in low water crossings, can be punished for public endangerment. Mitigate by condemning property in low-lying areas

that continually flood, relocating businesses and residences to flood resistant areas. Plan the community response. Identify the resources available before the event, by type, training, and equipment. Make basic operational-level moving water equipment and skills available to as many responders as possible. Indeed, like an earthquake, it won't be the high-tech USAR team that makes most of the rescues; but the locals–trained or untrained–who are on-scene as the flooding becomes life threatening.

Many locations have only started on this work. Others have not started. There is no budget for it. Budgets are already tight, and in many places shrinking.

Now, the good news:

1. Credible, consensus-standard, awareness-level training is readily available and inexpensive. It should be provided to ALL personnel.

2. Operations-level training and equipment is also readily available. NFPA 1670 pretty well defines the operational needs for public safety agencies. Such training can generally be accomplished in as little as 16 hours, with qualified instruction.

3. Basic, common practice, equipment is also relatively inexpensive. All personnel operating in the "hot zone," which most swiftwater educators identify as within 15 feet or 4 meters of the edge of the moving water, should be wearing an approved buoyancy aid or personal flotation devices.

4. Systems exist that can be used as models for flood preparation. After a 3 year stint as a member of the California Governor's Office of Emergency Services, Swiftwater/Flood Rescue Committee, under the chair of Captain Jay Bowdler of the Sacramento Fire Department, our Operational Systems Description for swiftwater/flood response was recently released. It is now being used as a response model in several states, and is readily available to those interested.

Summary

The problems are ***immense and growing***: *flash floods; seasonal floods; levee failures; surface debris; night rescues in rivers; vehicle rescues in floods; evacuations in contaminated conditions; mud flows; land slides; deteriorated road surfaces; open manholes; storm drains; fast-moving flood channels; multiple victims; poor communications; poorly trained boat crews; incompatible training; hazardous materials;*

*disabled persons; inadequately trained helicopter crews; no flood maps; poor crowd control; lack of unified command; weirs and dams; inadequately marked and patrolled flooded roadways; lack of search skills; late evacuation; even structure fires!*

All will become more common-place. And the time to prepare is now.

SEGERSTROM'S AXIOMS FOR THOSE GOING ON A FLOOD RESCUE IN A FEW HOURS, AND OTHER TIPS:

1. Never let emotion and urgency drive your decision. "Common sense" has no place at a swiftwater/flood rescue. If you don't know what to do, don't do anything. It is better to be tried by twelve than carried by six. At least you will be breathing while you explain what happened at the inquiry.

2. Rescuers start each new discipline with a pocket full of luck and the other pocket empty of experience. The trick is to fill the second before the first is empty. Take the benefit of others experience and seek competent, standard-of-care, professional rescue training.

3. Personnel within 15 feet of the edge of moving water should be wearing a lifejacket.

4. I promise not to wear my swiftwater wetsuit to your house fire, if you promise not to wear your structural firefighting clothing and helmet to my swiftwater rescue. My rubber suit will melt, and yours will sink.

5. Moving water is deceptive. It is more powerful than you realize, and relentless. If it is moving 12 mph or 20 kph it will push you into that fence downstream with a total force of over 400 lbs, or 220 kg.

6. Water moving half that speed and 1.5 feet or 1/2 m. deep will move a sedan sideways on asphalt. If a vehicle floats away before the drivers escape, the chances of survival are minimal. Fire engines are not acceptable swiftwater rescue vehicles either. I've got lots of videos of immersed fire apparatus if you'd like to see some.

7. Don't tie a rope to a rescuer and attempt to wade out to help someone. Rescuers die each year that way–stuffed under cards or entrapped in debris.

8. Make sure you employ upstream spotters–to spot debris; and downstream protection–in case rescuers and victims are washed away, before initiating a moving water rescue.

9. Try to do an appropriate size-up and hazard assessment. Make sure you have enough trained personnel on-site. Use your incident command system, with a designated “safety,” and good communications, before choosing the plan. Choose the lowest risk options first.

10. Don’t put any personnel in a rescue boat who don’t feel they can get out of the middle of the situation *without* the boat. Boat skills and swimming skills don’t necessarily go hand in hand.

11. Don’t request a helicopter that you have never worked with and can’t communicate with when it arrives.

12. On an swiftwater/flood incident the Incident Commander can start the plan; but *anybody* can stop it! Everybody is “safety,” and should recognize their own personal limitations.

13. After the “rescue” phase, comes the “search and evacuation” phase. Utilize an Incident Action Plan. Make sure that you are prepared for hazardous materials, contaminated flood water; and the potential for fire. Make sure that power is off in the search area. Make work periods brief, and make sure that rest, and food are supplied to personnel, along with gross decontamination for those being relieved.

Fatigue, cold, and bodies immersed in excrement and fuel oil for long periods: a formula for loss of efficiency, illness and injury.

# Swift-Water Rescue Incident Responce Plan

Incident Name ________________________________________ Date/ Time ________________

Location ________________________________________________________________________

Description: ____________________________________________________________________

Incident type: ❑Stranded person ❑Person in water ❑ Entrapment ❑Missing persons

Staging Area location: ___________________________________________________________

## Initial response

❑Command ❑ Rescue Squad ❑Swift-water Rescue Team ❑EMS ❑Police/Fire Police

## Initial Assignments

Incident Command: ____________________________ Safety Officer ____________________________

Rescue Ops Officer____________________________Equipment Coordinator____________________

Near Shore Team :____________________________________________________________________

Away Team : ________________________________________________________________________

Downstream Back-up Team: ____________________________________________________________

Up-stream Safety: ____________________________________________________________________

Boat Crew __________________________________________________________________________

## PPE/Equipment

- ❑ **Hot Zone - In water:** Dry Suit, Rescue PFD, Helmet, whistle, headlamp, knife, & throw bag
- ❑ **Warm Zone - within 15 ft of water:** PFD, Helmet, gloves, & throw-bag
- ❑ **Cold Zone - more then 15 ft from water:** EMS gear or fire gear ok

## General Rescue Plan

- ❑ Establish Command, Size-up, and Scene Control – remove bystanders to safe location
- ❑ Make visual / verbal contact with victims – do not break contact
- ❑ Deploy Downstream Back-up Rescuers and Up-stream Safety/Lookouts
- ❑ Use Reach, Throw, Row, or Go Systems (as determined by available resources & situation)
- ❑ Package victims with PFD & Helmet before moving if possible
- ❑ Transport & transfer victims to EMS

# Technical Rescue - GAR Risk Assessment Tool

## Step #1 Risk Assessment:

Review the questions and rate the risk level for each of the below category's. Total the values and plot on line graph at bottom of page. See step 2.

**Pre-Planning:** Incident Pre-Planning, Site plan, written SOP's/IAP, Crews briefed. Well defined mission.

| Adequate | | Minimal | | None |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Event:** Refers to incident complexity. Multiple victims, large area, difficult access/terrain

| Simple rescue | | | | Complex rescue |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Crew:** Selection of appropriate resource. Factors that affect risk: Experience level, unfamiliar with rescue site, fatigue, response time, adequate supervision

| Crew Excellent | | Adequate | | Marginal |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Equipment:** Proper response vehicle/craft, equipment available (Hardware, ropes, etc.)

| Fully mission capable | | | Partially mission capable | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Communications:** Ability to maintain comms with all parties throughout the incident.

| Adequate | | Marginal | | None |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

**Environment:** External condition surrounding event: weather, time of day/night, water conditions, water temp, air temp, visibility.

| Benign | | | | Marginal | | | | Hazardous | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

## Step #2 Risk Management

Risk Management are the steps taken to control or reduce hazards. Below are *Control Options* used to mitigate the risks. Implement the options, and then reassess the risks as appropriate.

**Warn/Prepare:** make personnel aware of hazards & mitigations available. Fully brief crews.

**Protect:** provide correct PPE/Equipment to protect personnel from hazards

**Disperse/Transfer** –Disperse the risk by increasing the time between events, using additional assets, or transfer incident to a better-suited asset

**Reduce/Avoid** – limit risk exposure by reducing numbers of personnel exposed or time exposed. Circumvent hazard: Wait for risks to subside

**Accept** – In some cases, the benefits might justify the assumption of the risks. In these cases, a decision to accept risk may be made.

Reassess the values for each risk category & compare to 1st assessment

## Step #3 Define Mission Benefits

**L**ow Gain – Situation with low or intangible benefits. Examples include: Body recovery, flood area searches, & saving property.

**M**edium Gain – Situation that provides tangible benefits. Examples include evacuating victims, searches, and protecting public safety.

**H**igh Gain – Situation that provides immediate, tangible benefits that if ignored could result in loss of life. Examples: Live victim rescues.

Given the mission description above, what is the "Gains" for this mission? How do they compare to the risks?

**L/M/H Risk vs. Gain L/M/H**

| GREEN | AMBER | RED |
|---|---|---|
| 1 2 3 4 5 6 7 8 9 10 11 12 | 13 14 15 16 17 18 19 20 21 22 23 | 24 25 26 27 28 29 30 31 32 33 34 35 |
| Mission Status: GO | Caution | No Go |

# Tech Rescue Hazard Analysis

**Agency:__________________________ Incident Type: ________________________________ Date: ________________**

## Probability Hazard Analysis

**Physical Hazards Present**

None — Moderate — High
1 2 3 4 5

**Accessibility to Hazard Area**

Low — Moderate — High
1 2 3 4 5

**Usage by public**

Low — Moderate — High
1 2 3 4 5

**Time Hazard is Present**

Limited — Seasonal — Always
1 2 3 4 5

**Past History of Incidents**

None — Moderate — High
1 2 3 4 5

## Impact Analysis:

**Persons at risk of death**

Few(1-3) — Some (3-9) — Many(10+)
1 2 3 4 5

**Persons at risk of injury**

Few(1-3) — Some (3-9) — Many(10+)
1 2 3 4 5

**Property at Risk**

Light — Moderate — Extreme
1 2 3 4 5

**Economic risks**

Light — Moderate — Extreme
1 2 3 4 5

**Public/Media Profile**

Low — Moderate — High
1 2 3 4 5

## Incident Complexity Analysis

**Risks to Rescuers**

None — Moderate — High
1 2 3 4 5

**Resources Committed**

Few — Some — Many
1 2 3 4 5

**Time needed to Resolve incident**

Short — Moderate — Long
1 2 3 4 5

**Multiple Victims / Incident locations**

Single — Two/three — Multiple
1 2 3 4 5

**Geographic Area Covered by Incident**

Limited — Moderate — Large
1 2 3 4 5

**Probability Score __________ + Impact Score _________ + Complexity Score_________**

**TOTAL SCORE ______________**

**LOW HAZARD 15 to 35 — MODERATE HAZARD 36 to 55 — HIGH HAZARD 56 to 75**