

# PREPLANNING WATER FOR PUBLIC SAFETY DIVING

By Larry L Pierson Jr

It's not a new concept. We plan for firefighting with building drawings and detailed information. Agencies may preplan confined spaces, trails for land search & rescue or swiftwater rescue points along rivers but what do we really know about the bodies of water which our public safety divers will operate in?

The following is a collection of ideas, tools and safety issues that can help bring about successful and safer dive operations through preplanning.

## How do we document all the information?

Simple spreadsheets, forms, underwater slates, camera and/or application of a database will be needed. A combination of a field gathering system, storage and retrieval. Whatever method you use, focus heavily on information being readily available for review by personnel and quickly accessible during operations. Plan for the planning sessions.

## What bodies of water are applicable?

Do you really know all the potential dive sites in your district? There may be commonly known sites and everyone is familiar with the lake or pond name. Driving around the district or viewing aerial imagery may find manmade ponds or other bodies of water that were not previously known or have just recently been constructed. If the site does not have a commonly known name come up with one or at least assign some type of ID. Any body of water which divers may enter should be included.

## Aerial Imagery

Aerial images (*Fig.1*) may be available from a county or municipal GIS system, Google Earth, NC One Map and several other online resources. Not only do such images provide an excellent overview but may also be used with overlays or edited for use during training sessions and table top scenarios. The aerial image can also be used with an overlay and markers to conduct effective dive briefings & debriefings.

## Expected water conditions

Visibility, depth, temperatures (*various thermoclines*), currents, biology and expected contaminants should all be included in the site's profile.



**Figure 1** - - Example of an aerial image which can be used for training or scene briefings.

## Visibility

The difference between 0' and 50' visibility will already let you know search techniques will change. The site's bottom composition may change a high visibility body of water to zero viz after the first diver operates or after a car enters the water. Silt, mud and other easily stirred up material can change conditions quickly. Document current and expected conditions.

## Depth

Using a depth sounder, sonar or information from lake maps can provide a good overview. You need a clear profile of the ENTIRE body of water. While 95% of the site may be 50' deep, a channel or hole may go to 65'. This could cause serious issues regarding dive table profiles or place a diver in a depth that is beyond their training or against the department's SOG.

Depths of most lakes or ponds remain fairly consistent while rivers and some lakes may change 20'- 30'. On the coast and some inland waterways depth will change with the tides. When depths are lower, other areas of the site may now be accessible and fit into the department's capability. When planning, use the site's "normal" or "full pool" level and you can adapt from that during varying conditions.

## Temperature

Temperatures vary dramatically during seasons due to ambient temps, dam release schedules, power plant production (*cooling systems*), drought and lowered or raised levels from any source.

Thermoclines are layers of different temperature. There may be 20°F or more difference between varying depths and these levels will change throughout the year. If a team makes a risk/benefit analysis using 70°F as the line for "cold water drowning" survivability, could the temperature now be 78°F? It will be quite useful to take some water temperature readings throughout the year.

## Currents

Currents are generally expected in rivers and creeks but they may also exist in lakes or ponds. Currents over ½ knot (.58mph) require special considerations and training. A current of 1½ knots becomes incredibly dangerous for diving. If a dive site consistently has such currents you already know the dive site may be a "no-go."

You can use simple formulas to determine current speed. If a floating object moves 22' in 15 seconds, the speed is 1mph or .87 knots. The current may be faster underwater than at the surface so make sure you are assessing the entire area. A diver may begin operating in conditions under ½ knot then enter an area over the max stated in your SOG.

Having prior knowledge of even mild currents in a lake will help determine possible movement of evidence or be taken into consideration when searching an area based on a witness interview.

## Biology & Hazardous Materials

Each body of water, whether fresh or saltwater, can be a unique ecosystem and may contain a potentially hazardous environment. Harmful bacteria or other organisms won't be visible to the naked eye but indicators may provide clues to a potential problem. What once seemed like a "clean" dive site may now have exponential bacteria growth due to higher water temperatures. Periodically recheck each site.

If you really want to know what is in the water, it must be tested. Some of your dive sites may already be monitored by a state's Department of Natural Resources agency, the EPA or other special aquatic study organization. Call these agencies for advice and direction. The three websites listed below will provide some information and links to other resources.

<http://h2o.enr.state.nc.us/>

<http://www.dnr.sc.gov/water.html>

<http://www.epa.gov/ebtpages/water.html>

Hazardous materials may be in the water even before a stereotypical "tanker truck went into the water" scenario. If contaminants are found, is your drysuit's material, Full Face Mask and other equipment capable of protecting the diver in such an environment? Decontamination procedures and exposure documentation can already be expected and planned for.

## Marine life hazards

Some dangers will be well known by team members. Although the type of water, region, temperature and other factors dictate the type of marine life, you may respond to other jurisdictions with marine life you are not accustomed to. Snapping turtles and certain poisonous snakes are found in some regions, alligators and sharks are found in others.



**Figure 2** - Snapping turtle - although it will often move away, it is not a pleasant encounter if it doesn't.

Make sure that newer team members and responding agencies are aware of these instead of assuming. I have even encountered aggressive Smallmouth Bass who do not particularly care for you searching near their spawning beds. On one occasion, after approaching a spawning bed, a large sized Smallmouth Bass circled around and rammed the back of my head quite hard while wearing a full face mask. Quite a surprise, but a reminder that we are in their environment.

### Boat launch & access

Some dive sites may require a hike and for all gear to be carried in by members or ATVs. Other sites may have so much vegetation, debris, steep embankments or other factors that won't allow typical trailer launching of a boat. The boat may have to be hand launched or not used at all. If we know these issues ahead of time it will make initial response and efforts more effectively directed. Use of boats during the preplan can be extremely valuable to gather depth & bottom profile, take temperature readings and other factors.

Part of the preplanning process should include contact and coordination with land owners or site managers. Coordination may allow clearing of an area to improve boat launching and you may gain valuable knowledge concerning other areas of the plan as well as a chance for public relations for the dive team.

### Shore issues

The vegetation, debris and other factors will also cause some problems with some search patterns. While an Arc search pattern (*and others*) look effective in a simple layout drawing, some areas of shoreline may cause it to be totally ineffective and maybe even hazardous.

How hard will it be for divers to enter/exit the water or to bring a victim out? Some shores may be steep above and below the water line or thick mud can extend for several

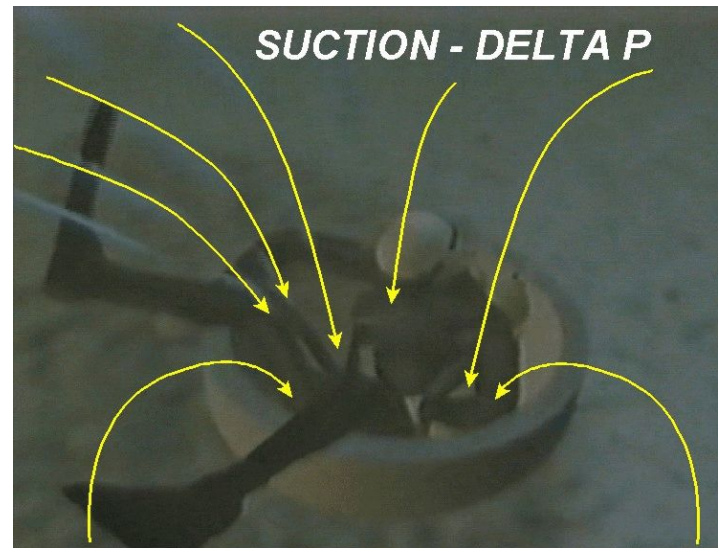


**Figure 3** - As an example from a recreational rescue diver course, these type conditions create difficult entry & exit points and may exhaust Public Safety Divers with thick mud.

feet. Evens with fins off, divers or shore personnel will have an incredibly difficult time when their feet sink 1-2' in the mud (*Fig. 3*). If you can't choose another exit point or use a boat, preplanning will let you know a plastic litter basket (*flotation one of there is any depth*) should be ready with a rope attached to help pull the load (*victim or evidence*) through the muddy area. The tethered line with the diver's harness will help assist their own balance and difficulty.

### Delta P

Delta P or "Differential Pressure" can be a deadly situation for divers and is commonly referred to among commercial divers working around pipes and tanks. It simply means two different pressures, that if given the opportunity, will want to equalize. When the pressure from source "A" is higher than source "B", water will flow towards "B". If a diver gets near the pathway in which the water is trying to equalize, he or she can be "sucked in" or their body can create a seal on the opening.



**Figure 4** - Suction created by "Differential Pressure" can trap and kill a diver. Such potential hazards should be noted.

Intakes for water supply, drain pipes leading from one lake to another, sluice gates at dams or leaks in dams or water containers can all present a Delta P situation. Mapping of the dive site should contain any locations and information about potential problems.

For more information on Delta P, visit the Association of Diving Contractors website to order a 16 minute video. <http://www.adc-int.org>. This video will help a team understand reasons why conducting "public service" events are not "public safety" events. Cleaning drains and other certain tasks move into the realm of commercial diving and therefore the team would not be exempt under OSHA standards. Reference - 29 CFR Part 1910, Subpart T - Commercial Diving Operations Appendix C.

## Resource & Scene Management

Your preplanning should note potential staging areas for boats, POVs and apparatus. Forethought can also discover difficult scene security issues such as dive sites with high activity recreation areas. Remote sites accessed by a trail will be much easier to control. What other logistical support can function at the dive site? If the incident becomes extended, where will people eat, where can witnesses be interviewed more in depth and where will divers rehab?

## Elevation issues

Diving at altitude (*any dive over 1,000' elevation*) takes special considerations with dive tables and decompression theory. Atmospheric pressures change at different elevations and will have an effect on potential for “the bends” and nitrogen “off-gassing.” The elevation at full pool should be noted on the map.

The route to get to the dive site may also cause a problem. If the team leaves from their dive mission at 1,000', over a mountain that reaches 4,000' , back to the station which is also at 1,000', all dives may have to be calculated for diving at 4,000'. After arriving back at the station is not the time to realize the altitude corrections, it must be before any dives are conducted. Divers may also have to stay at the dive site for several hours before climbing to a higher elevation. If you are not familiar with the concept, take an “Altitude Specialty” course. Plan routes for the team and mutual aid resources.

## What is the dive site normally used for?

The site’s purpose may be for public water supply with strict security, water supply for industrial applications, recreational fishing, boating or diving. Heavy boat traffic will dictate some safety precautions that may be helped by Wildlife Law Enforcement or other agencies. Recreational dive sites can cause some concerns for evidence preservation.... others divers may have already entered the area, will enter the search area during their dive or you may have a crowd of untrained, unassociated recreational divers offering assistance.

Preplanning priorities should go to “high probability” areas such as those with recreation use or those sites which present higher hazards. Some dive sites may have a higher than normal potential for a vehicle entering the water. Take that into consideration for what resources may be needed such as including information about the local wrecker company and if winch operations from apparatus are possible.

## Making the dive site map

Your aerial photograph will come in handy for applying lines, symbols and any other important information. A 2 dimensional map/diagram can be used and can be augmented by other software that produces 3D images or .vrml files (virtual reality/walkthroughs). Just be creative.

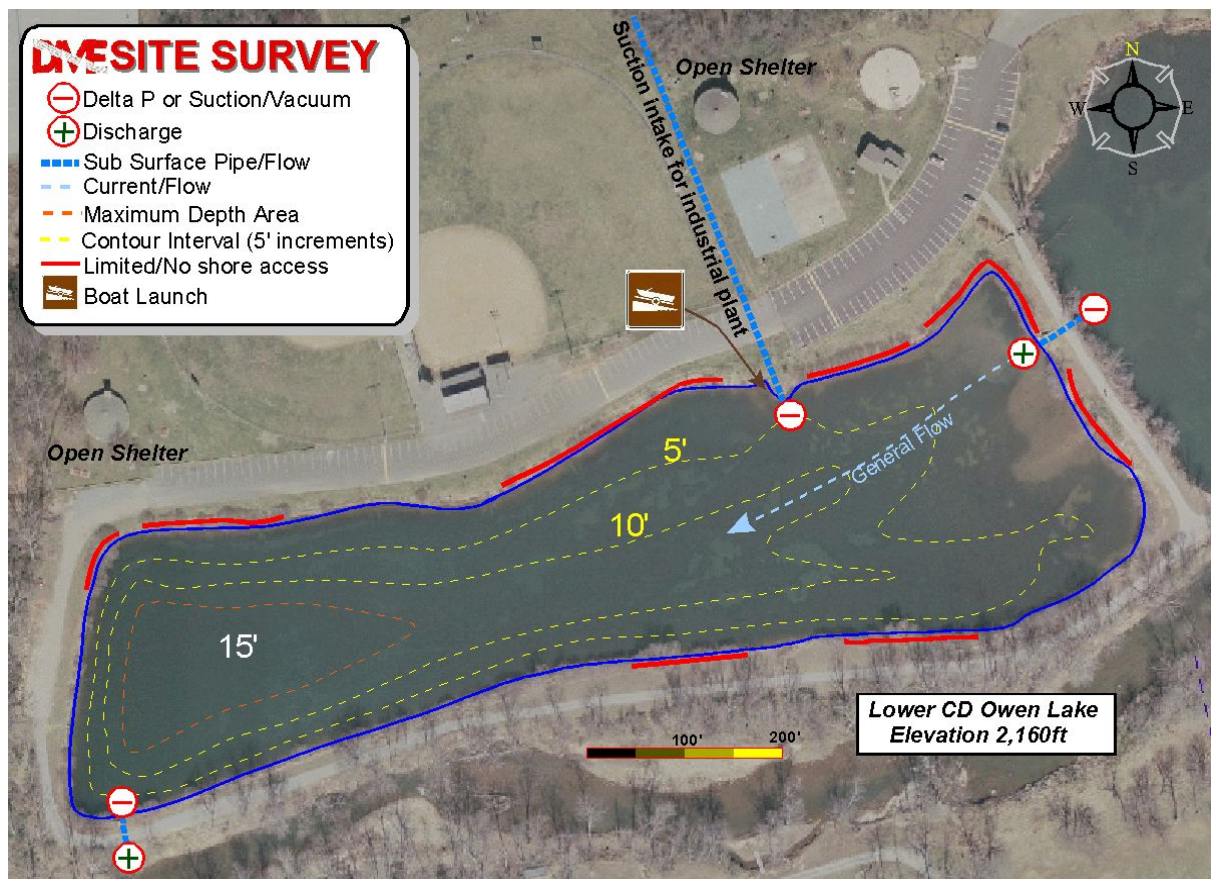


Figure 5 - Aerial image used to indicate contours and other useful information.

## Dive the Site

Actually conducting dive operations in the body of water will produce a lot of useful information and familiarize your team just like a firefighter's tour through a commercial facility. Gather as much information from other categories as possible before diving and conduct a thorough briefing. Dive training sessions should be treated as if they were actual PSD missions. Primary & Backup Diver, Line Tender, Incident Commander or DPIC (*Designated Person In Charge which is OSHA terminology*), and any other positions appropriate for the dive should be set into place.

Underwater video or photos (*if there is any visibility*), slates, marker buoys, UW comm equipment can all be used to document information and provide detail to your map. Divers should be thoroughly trained for the environment, tasks to be carried out and any equipment used.

It will be quite valuable for each diver to gain confidence for real missions by knowing they have been in a particular dive site before. Practical applications can discover that vegetation growth on the bottom or thick algae forming during summer may hamper effectiveness unless tactics are adapted.

## Other resources to help

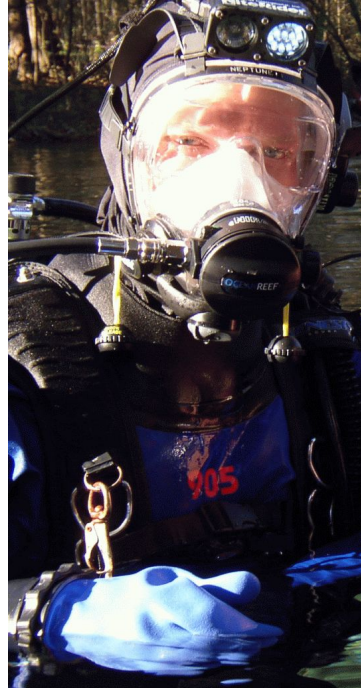
If your team has not done so, purchase the book "Public Safety Diving" by Walt "Butch" Hendrick and Andrea Zaferes ISBN 0-912212-94-2 (softcover) or visit their website [www.teamlgs.com](http://www.teamlgs.com). This book will give you a solid base for operations & planning concepts.

Advanced mapping and visual construction of dive sites can be overwhelming at first. One resource that may help is Tom Brooks of [stingraydiversusa.com](http://stingraydiversusa.com) who is a NAUI instructor and retired NC State Trooper specializing in fatality reconstruction. Intricacies and detailed mapping are part of his curriculum for underwater crime scene investigation taught at the NC Justice Academy .

If you have other questions or would like to participate in dive training events, e-mail [larry@svfd.net](mailto:larry@svfd.net). A software program may be completed before the end of 2007 that will assist in your planning mission. Keep an eye on our website for information.

## Summary

Planning is everything for emergency services. We have only addressed some issues about dive sites but more detail can certainly be added. Team equipment, training, funding, SOGs and several other issues need to be addressed to make the outcome the best it can be. Even if the situation ends up different from the plan, you have to have something to base your decisions from. Don't "shoot from the hip". Any piece of information learned, documented and distributed is better than none. If time is an issue compared to other functions and duties carried out by your agency, do as much as possible. Good luck, be safe, go diving!



### **Larry L. Pierson Jr**

*Deputy Chief,  
Swannanoa Fire Department  
PADI Master Scuba Diver Trainer  
[www.svfd.net](http://www.svfd.net)*