



SWIFT WATER RESCUE

Operations and Technician Level

May 2022



Course Outline

- **Swift Water Rescues in Mohave County**
- Standards
- Philosophy and Priorities
- Safety
- River Hydrology
- Terminology
- Equipment
- Read the Water
- Strategies and Tactics



Water Rescue Types

NFPA defines water rescues as:

SURFACE – DIVE – ICE – SURF – FLOOD – SWIFT WATER

- Mohave County has only two streams that may have year-round flow other than the Colorado River:
 - Virgin River on the Arizona Strip
 - Burro Creek at the southeast corner of Mohave County
- Mohave County does not have the Mountain Streams usually associated with year-round swift water rescues.



Swift Water Rescues (2014)

Most common Callout are for vehicles washed away in a flash flood – “Dirty rescues in chocolate water”.





Dolan Springs (2014)

Tour bus washed $\frac{1}{4}$ mile down Archibald Wash off of Pierce Ferry Road (on way to Skywalk), 35 Chinese tourists, all code 4.





Dolan Springs (2014)





Golden Valley (2014)

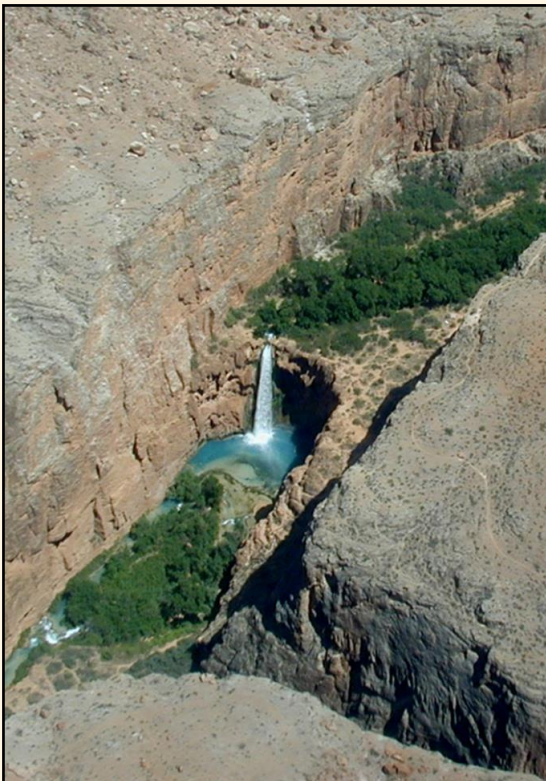
Can expect to do a lot of towing of vehicles out of flooded washes





Havasupai Falls (2008)

We have also been called for major evacuations; when a normally beautiful scene turned into a monster. Evacuated over 250 tourists and residents. Called for SW rescues with Ranger.





Types of Flash Floods

- In Mohave County, flash floods are typically:
 - Of short duration – as a result of a cloud burst in a mountain basin, from 15 minutes to several hours.
 - Can be sunny outside and suddenly appear.
 - Can surge with intermittent high-low flooding during the same event.
 - Usually occurs on the lower slopes in washes that are known for flooding.
 - May carry a lot of debris, making water-based rescues extremely dangerous.
 - Can be anticipated.



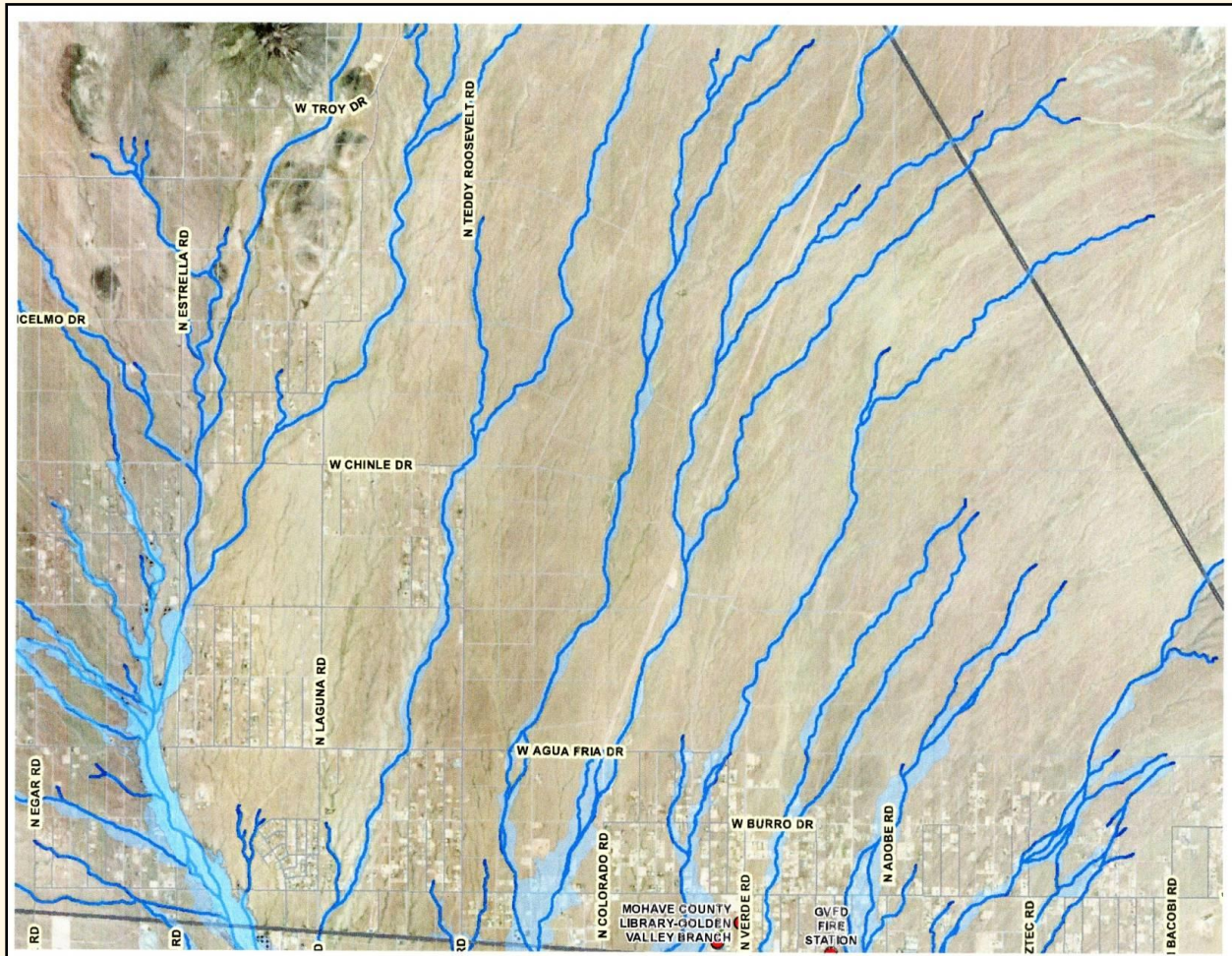
Expect Heavy Debris in Washes





Golden Valley Flood Plain

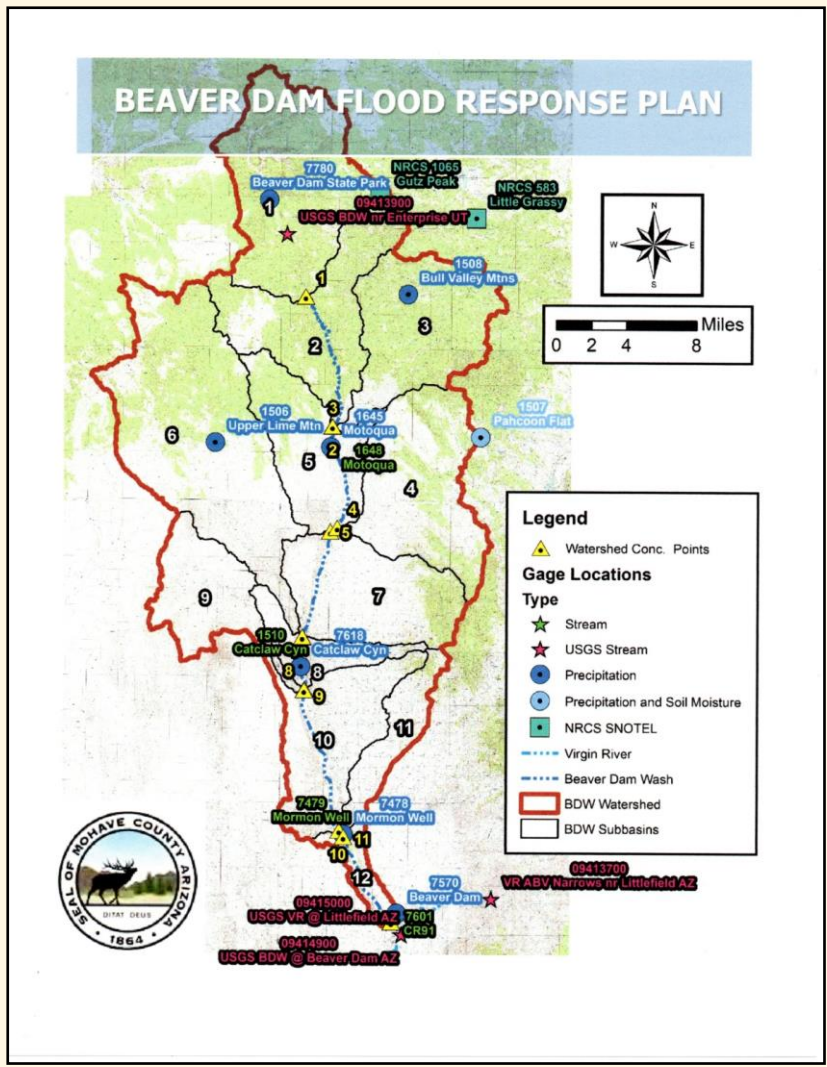
These washes are part of a storm weather monitoring program





Beaver Dam Flood Response

Beaver Dam (Arizona Strip) flood response plan is based on flooding that occurred in 2010.





County Weather Cameras

<https://mohave.onerain.com/dashboard/>

Images automatically update every 60 seconds



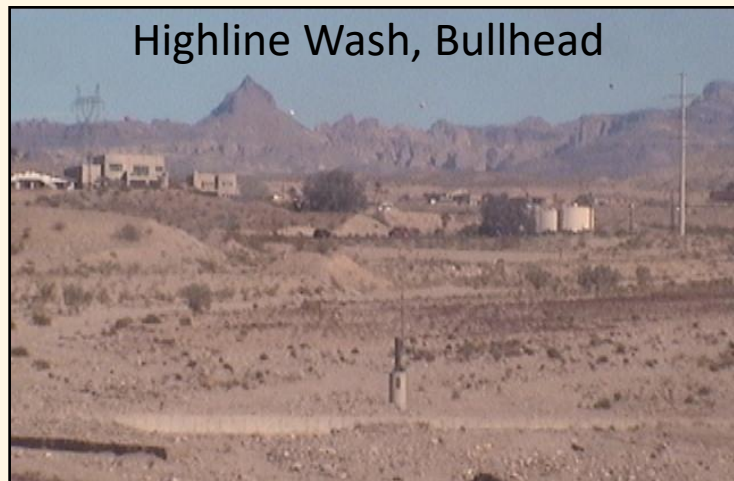
Sacramento Wash, Golden Valley



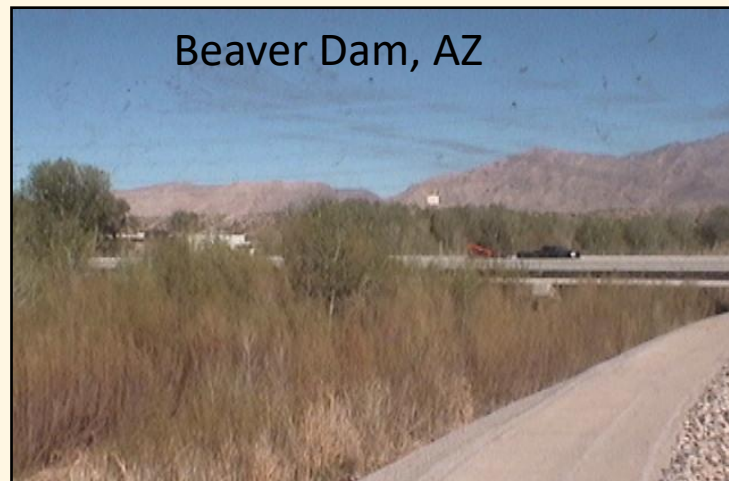
Sacramento Wash, Topock



County Weather Cameras



Highline Wash, Bullhead



Beaver Dam, AZ



Archibald Wash at Pierce Ferry Rd



Horizon 6, LHC



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Swift Water Training: Why?

Arizona Revised Statutes 11-441a-e

Mandates Sheriff shall conduct or coordinate search and rescue operations

Rescue – the render aid to people whose life or health is threatened by circumstances beyond their control and return them to place of safety.



Standards

- This is an in-house class. You will receive a certificate for completing the class from Mohave County Sheriff's Office, the Agency Having Jurisdiction, for
- **Operational Level or Technician Level.**
- It may not be accepted at other jurisdictions.
- This training is intended to prepare SAR volunteers for the most common types of rescues in Mohave County and use NFPA and OSHA regulations as guidelines.



Current Standards

NFPA 1670, 2017, Ch 17.3 – Swift Water Awareness
Level:

- Must meet Swift Water Awareness (Ch 17.2) Requirements (All MCSO SAR Members)
- Shall assist shore base operations
 1. Provide assistance to Operational & Technical Level
 2. Perform look out and observation
 3. Perform search operations for missing Subject which don't require the rescuer to be near the water



Current Standards

NFPA 1670, 2017, Ch 17.3 – Swift Water Operational Level:

- Must meet Swift Water Awareness (Ch 17.2) and Operational (Ch 17.3) Level Requirements
- Must meet requirements listed in Ch 17.3.1 – 17.3.4
- Shall conduct shore base operations
 1. Provide assistance to Technical Level
 2. Using throw Bag and related retrieval equipment
 3. Intervention and self rescue methods
 4. Using Packaging devices for subjects
 5. Perform search operations which don't require the rescuer to enter the water



Current Standards

NFPA 1670, 2017, Ch 17.4 – Swift Water Technician Level:

- Must meet Swift Water Awareness (Ch 17.2) and Operational (Ch 17.3) Level Requirements
- Must meet requirements listed in Ch 17.4.1 – 17.4.4
- Shall also have the capabilities (Ch 17.4.5):
 1. Constructing and operating rope rescue system anchors and mechanical advantage systems as specified by the Agency Having Jurisdiction (AHJ).
 2. Constructing a tension diagonal rope system.
 3. Constructing a highline system over water.
 4. Constructing and operating rope systems that position and move a boat controlled by rope.



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Force of Moving Water

Swift water is different than other water environments

- The force of moving water is relentless
- A 6 mph current pushes on a person's body with the force of 134 pounds
- A 12 mph current pushes on a person's body with the force of 538 pounds
- Safety gear and certain other equipment can do **MORE HARM** than good in swift water rescues



Priorities

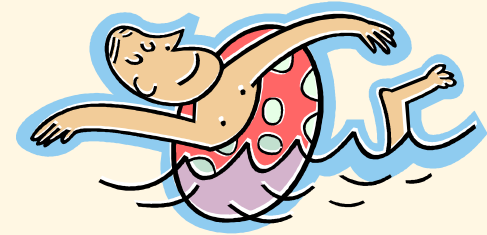
In all swift water rescue scenarios, the priority for safety and welfare is:

1. Me (each individual rescuer)
2. Fellow rescuers
3. The public
4. The subject



Philosophy

- Swift water training begins with the knowledge of:
 1. Our own capabilities
 2. The swift water or river
 3. Swift water rescue techniques



- Rules of thumb:
 1. Keep an open mind
 2. Emphasize training over equipment
 3. Make rescues as simple as possible
 4. Minimize the risk



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Recognizing Hazards

- Am I safe where I am?
 - Am I in the flood plain?
 - Is it still raining and will I get trapped between two washes or rising water?
- Are other people safe or will the water continue to rise and trap them?
- Is there danger of lightning?



Anticipate

- Subject may be combative or panicked – so be prepared to fight off, if needed.
- Do not expect the subjects to help in their rescue.
- Have several plans, because something will always change.
- Use the right equipment.





Necessary Resources

- Identify resources needed to respond to a water incident:
 - Is special equipment needed to affect the rescue – such as boats, helicopter, road grader, etc?
 - Can both sides of the wash be accessed?
 - Are additional site control measures needed?





Absolute Rules

1. All rescuers within 10 feet of the water **MUST** wear a personal flotation device (PFD).
 - Similar to the line of death in rope rescues
2. Priority List (me 1st, other rescuers 2nd, public 3rd and subject last).
 - Same as in rope
3. Never tie a rope around rescuers, subject or **ANYONE**.
4. Have several plans in mind – if plan A doesn't work, what is plan B, plan C... ?
5. Always have downstream backup plans – what if the rescue plan does not work and subjects are washed downstream?



Absolute Rules Cont'd

6. Have multiple upstream spotters, both sides if possible.
7. Have multiple downstream throw-bags.
8. Never put your feet down if swimming or swept away.
9. Never tension a line at right angles to the river – unless doing a highline.
10. Once the subject is contacted, never lose him.
11. Always be proactive.

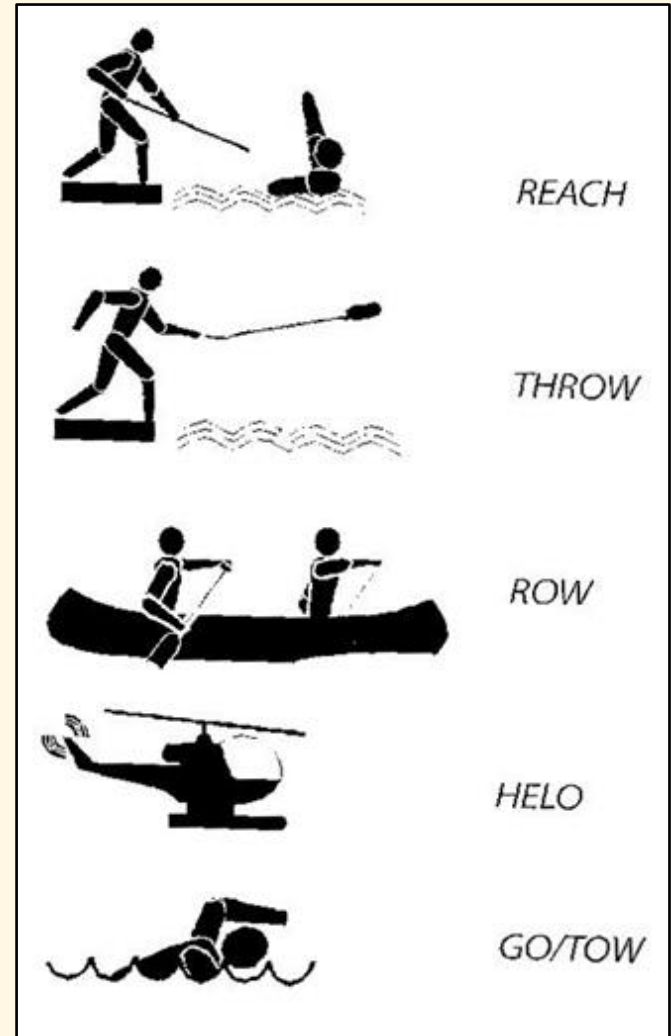


Risk Options

Use the lowest risk option consistent with the situation

RETHROHELGO

1. Reach
2. Throw
3. Row
4. Helo
5. Go /Tow





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River Hydrology

- Swift water is:
 - Relentless
 - Powerful
 - PREDICTABLE



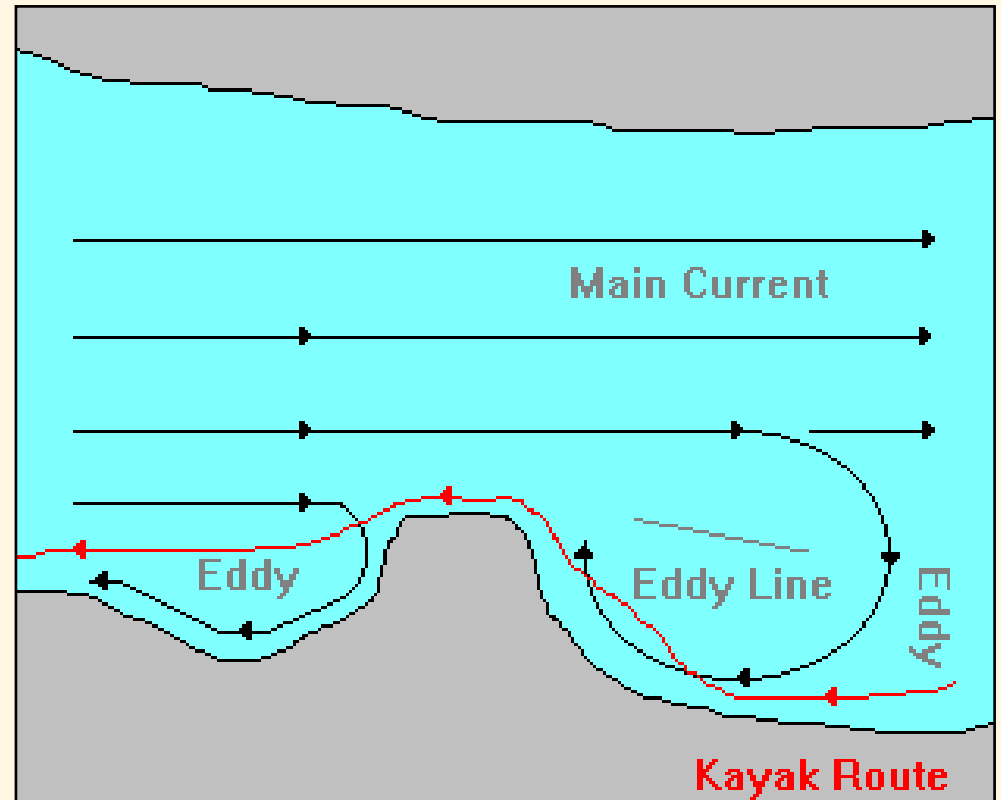


River Characteristics

Current: movement of water

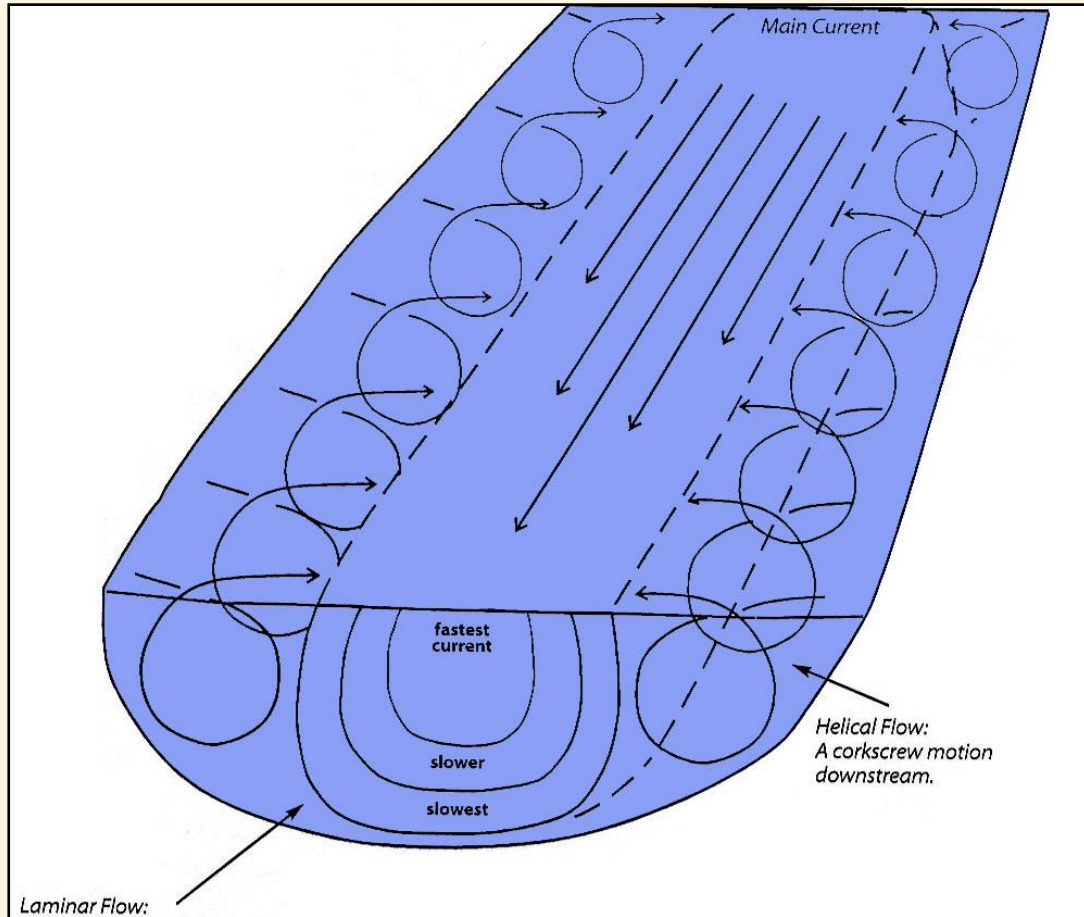
Eddy: water moving up-stream

Eddy-line: the line between up-stream and down-stream currents





River Flow



River flow is turbulent with helical flow at the sides and laminar flow in the center of the current.



River Characteristics

Pillow: water piling up against an object such as a rock or abutment

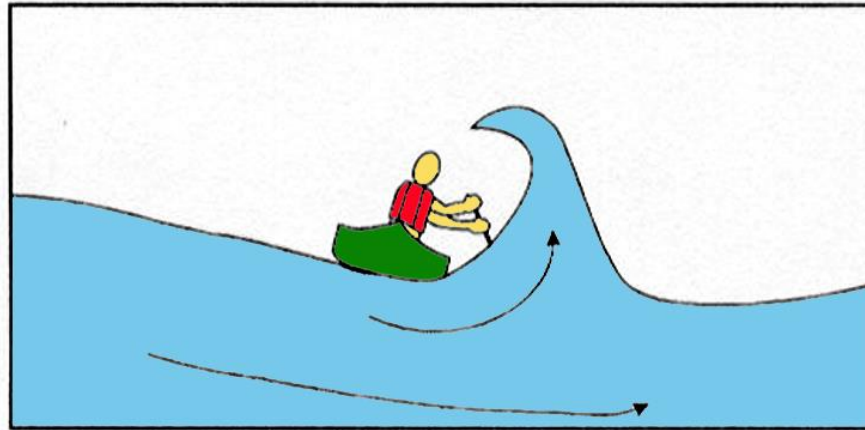
Hydraulic: water flowing over an obstacle causing a recirculating current

Hole: formed by a standing wave breaking upstream

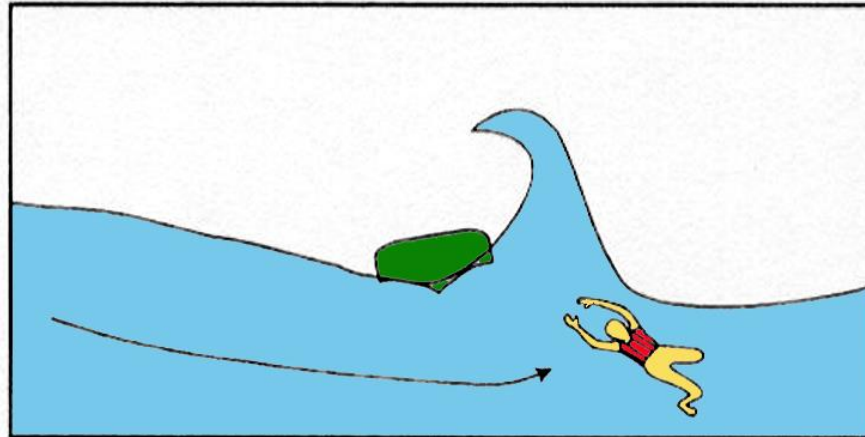
Boil line: boiling bubbling area downstream of a hydraulic



Hole or Standing Wave



A large wave hole breaking back upstream can hold a buoyant object for an extended period, however ...

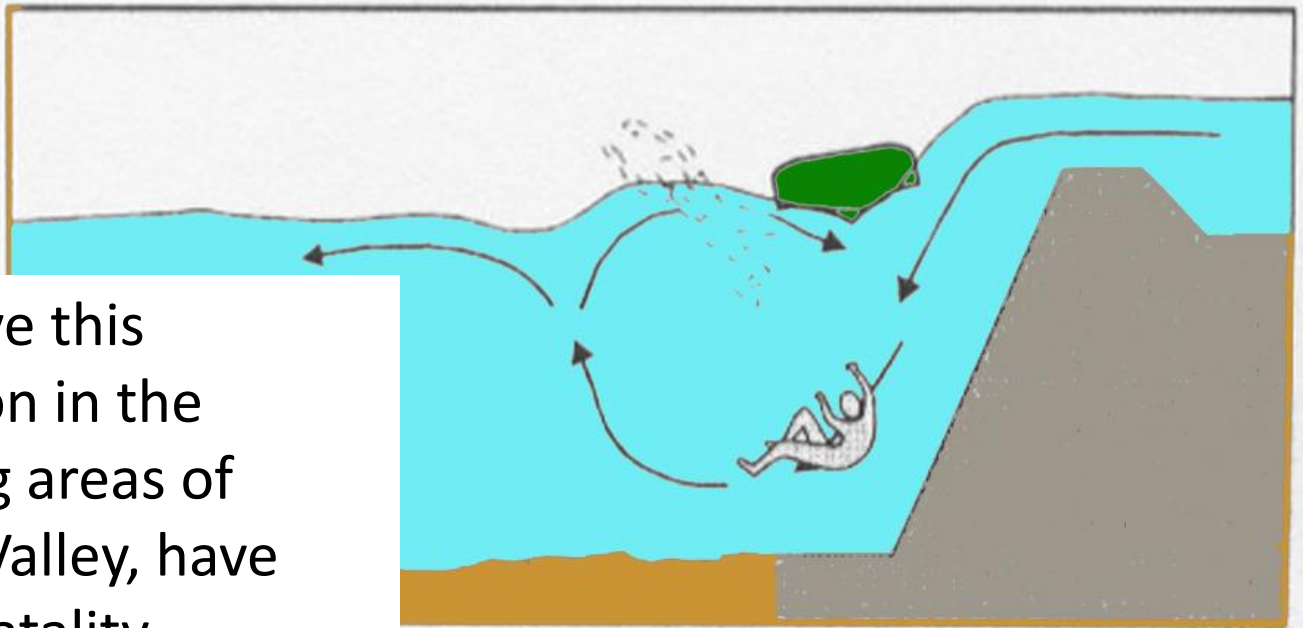


... a submerged object will quickly be swept downstream.



Hydraulic

Water flowing over a dam or rock forms a circulating current that can trap a floating OR a submerged object



We have this situation in the farming areas of Virgin Valley, have had 1 fatality.



Hydraulic





River Characteristics

Strainer: anything that allows water but not solid objects like people- fence across a stream, tree, roots, rocks

Flush drowning: automatic inhalation reflex due to a body entering cold water- reaction is to take a deep breath when you hit the cold water

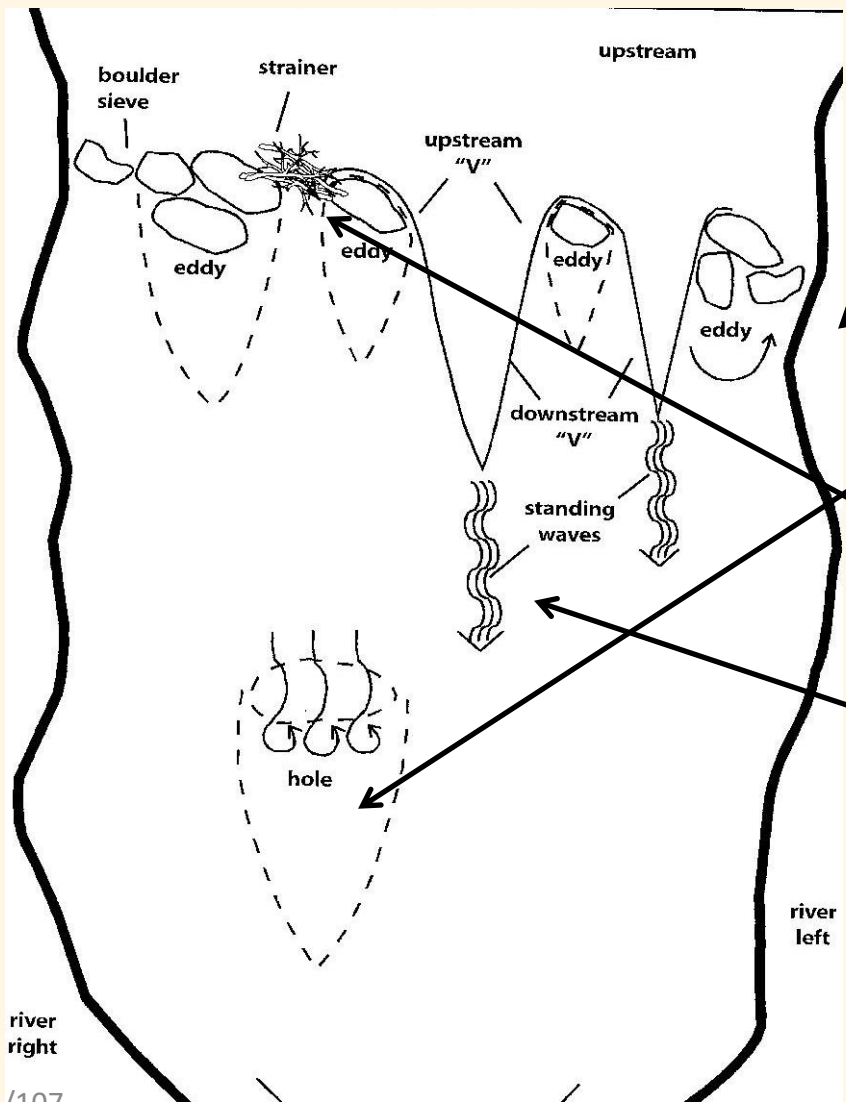
Foot entrapment: a foot being caught by subsurface obstacle because a swimmer tried to stand up in fast moving current

“Vs” : formed by water flowing between obstacles forming a tongue shaped like a V

Standing waves: formed where fast water hits slower water



Reading a River



Eddy- where water flows up stream

Hole- caused by breaking wave

Strainer- allows water to go through but not people

Standing waves- where fast water hits slower water



Can you Safely Cross?

There are people needing rescue at the next wash down the road. Can you cross this wash safely?





How Deep is the Water?





Shoulder Traps

This is why you don't want to drift when crossing a flooded wash. Water flowing over the road scours the sand on the downstream side. If you drift and go off the side, you'll be trapped.





Shoulder Traps

Was this truck pushed off the road by water?



Probably not.

Vehicles that are pushed off by moving water are usually rotated, moving the lighter side downstream.





Forces of Water

According to FEMA:

- Six inches of water will reach the bottom of most passenger cars, causing loss of control and potential stalling.
- A foot of water will float many vehicles.
- Two feet of rushing water will carry away most vehicles, including SUVs and pickups.

If you don't have experience reading water, don't attempt to cross a flooded wash.



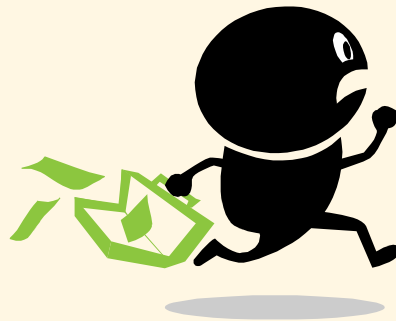
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River Directions

SW has its own nomenclature. Knowing the terms will help maintain communications.

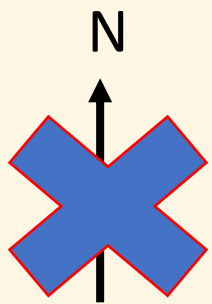


Don't swim over there, there are "what-cha-ma-call-its" in the water.

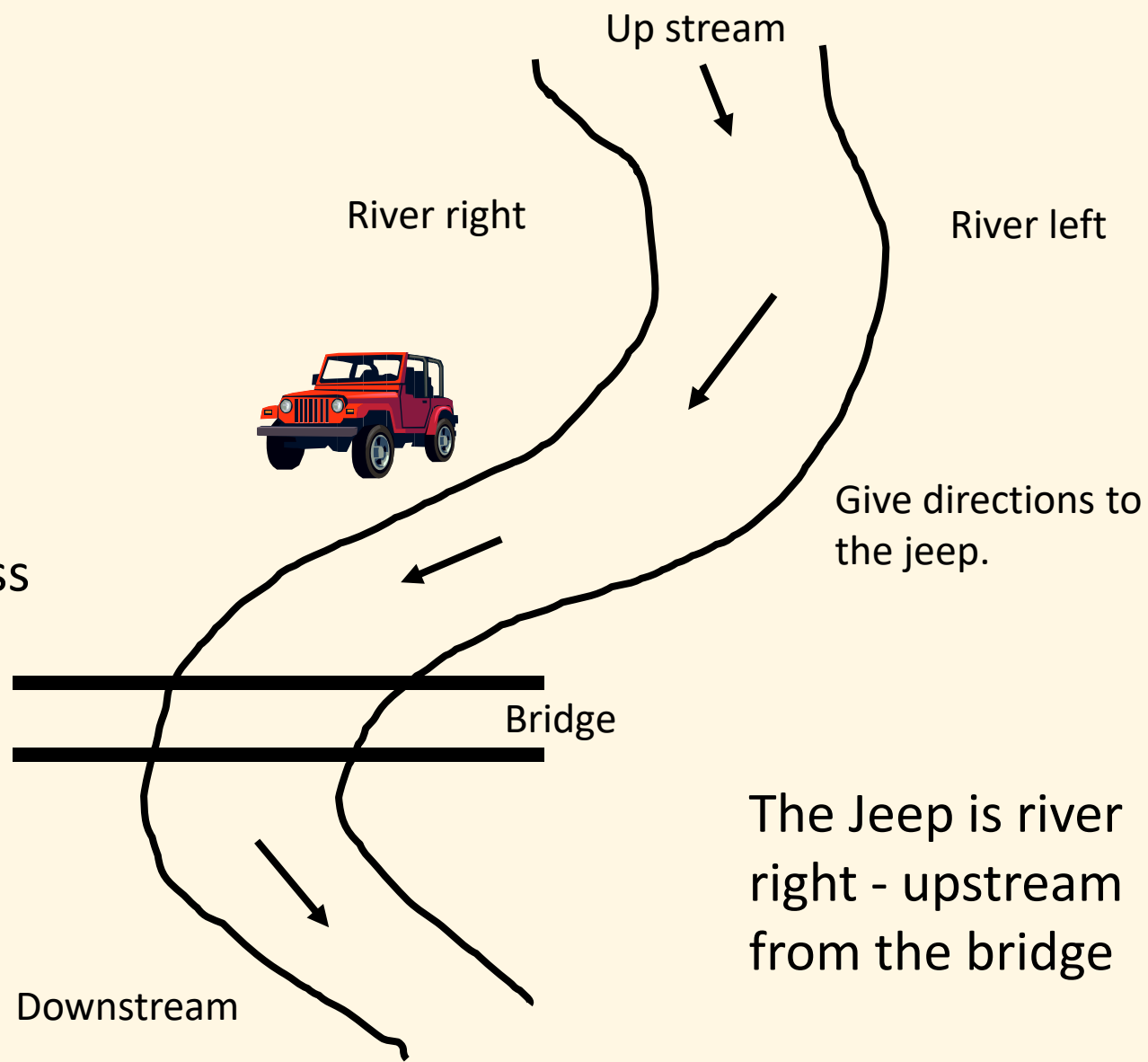




Directions are given in relation to the river



Not compass directions





Communications

- It is very loud when working along rivers and washes.
- Communications can easily prove to be difficult.
- The use of hand signals and whistle signal are often used.
- Knowledge of how to use these skills is critical.



Hand Signals

- 1 hand extended above head – Distress, need assistance
- 1 hand on head (patting head)– OK or question, are you OK?
- 2 hands extended above head then point – Move, swim, move boat that direction
- 2 hands extended above head then wave arms and point – eddy out that direction
- Both arms crossed in front of chest – need medical kit and help



Whistle Signals

- 1 blast - Stop or Attention
- 2 blasts- Attention Upstream or pull boat upstream
- 3 blasts – Attention downstream or pull boat downstream
- 3 long blasts and repeated- Emergency or Rescue!



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Swift Water Equipment

Swift water rescues use some specialized equipment and standard rope equipment

PFDs- Personal Flotation Device- Class 5 for technicians.



PFD should have narrow shoulders so that it doesn't interfere with swimming and a quick release belt.

Used for tethered swimming.

Class 5



Class 3 PFD

Class 3



Shore support (Operational) can use a Class 3 PFD. These PFDs are only for someone that will not go in the water on purpose and will DEFINITELY not be tied to a rope.

Ski PFDs do not have sufficient flotation. Use only the ones issued by SAR.



Helmets

SW Helmet



Rope Helmet



Helmets can be SW or Rope helmets. The best are the SW helmets because they protect the ears from objects.



Knives and Whistles



Knife should be easy to grip when wet, have a blunt tip and a plastic case that will hold the knife tight.
Don't want to stab things like an air-filled rubber boat – it's only to cut rope.



Special whistle that works even when soaked in water (Fox 40)



Gloves and Boots



Gloves should fit tight or have a strap to hold on wrist and go in water, no leather. Mechanic - type gloves work but don't last. Good for short rescue scenarios or training.



Water boots are best but cost +/- \$100. Can get by with high top tennis shoes. (need the high tops with socks to keep sand and pebbles from getting in shoes)



Wet / Dry Suits



Front zipping wet suits of 5mm thickness are best. Cost from \$120 to \$300.



Dry suits are very expensive, +/- \$1,000 and are very hot. Made more for Alpine rivers or very cold conditions, not suitable for flash flood rescues in hot desert environment- you'll cook.



Fins and Throw Bags



Rescue fins are shorter and heavier than regular fins. Made so you can walk easier on land. Seldom used in Flash Flood rescues.

Throw bag should have 75' of floating polypropylene rope.





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Reading the Water





Everyone should become proficient at “reading the water”. Could be the difference between a rescue or a recovery- between reaching a flooded car or waiting on the road for the water to stop flowing at another wash.





Water flowing over road is a good indicator of depth. Small ripples indicate shallow water. The size of the disturbance indicates the size of the rocks and the depth of the water.





Rocks and Boulders

Medium sized rocks with medium sized disturbances indicate deeper water.



Boulders causing major disturbances, DEEP water.





Depth of water can be overestimated when vehicle is on downstream side of road. Downstream is scoured and vehicles appear to be in very deep water.





Vehicle washed off road, note that it was rotated with heavier, engine side, pointing up stream





Vehicle drifted off road to down stream side, was not rotated but starting to rotate when it went off road, slight rotation.





While responding to a SW incident, we arrive at flooded wash. Can it be crossed safely?

May have to check the water depth by doing shallow water crossing.





What information would be helpful before reaching incident?

1. What direction was vehicle going?
Why ?
2. Which way is the storm going?
Why ?
3. Are there reports of other washes flooding?
Why ?
4. How many victims in vehicle?

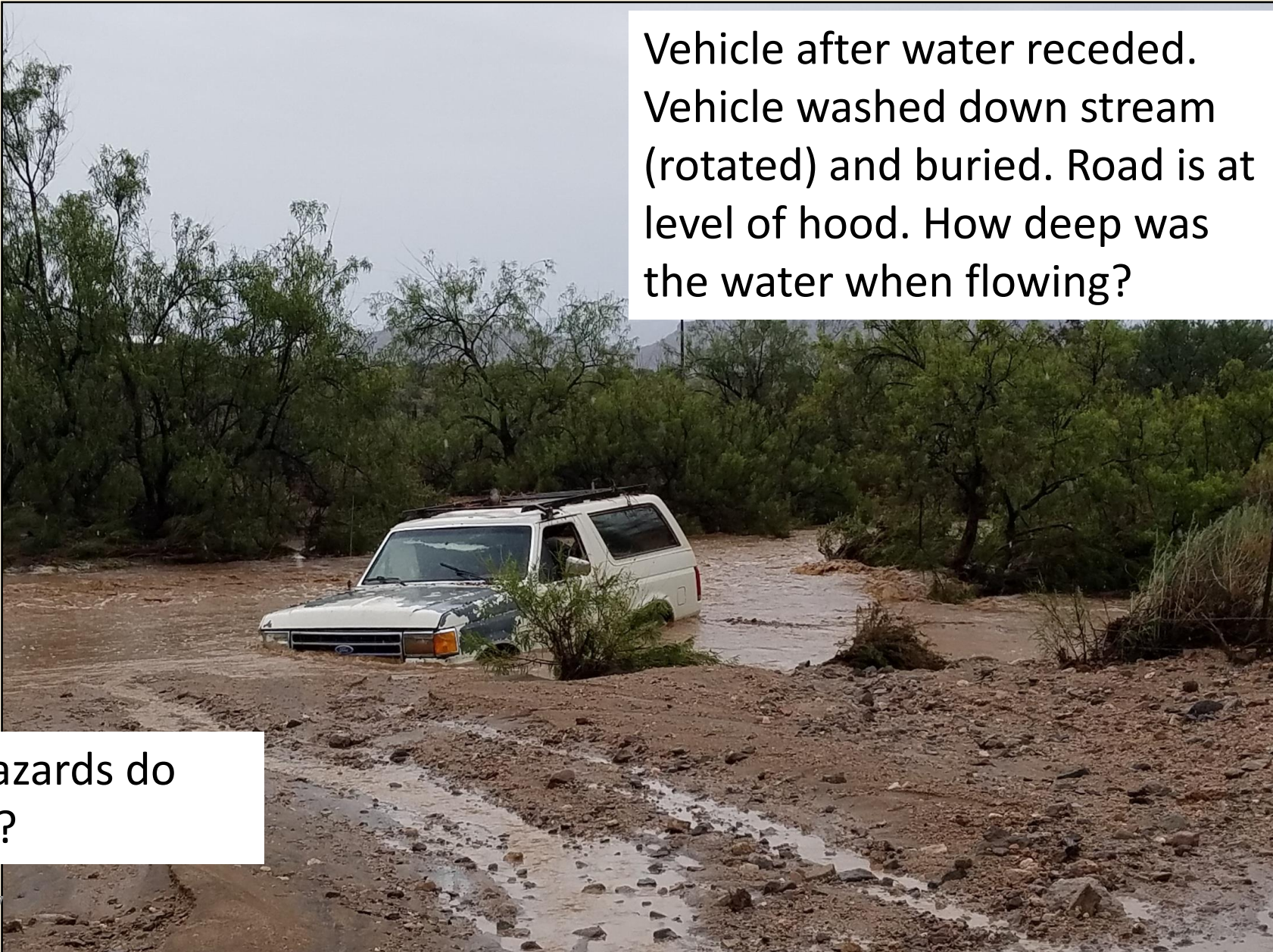


Brown Drilling rescue, 2017.
Can you tell how deep the water was?





Vehicle after water receded.
Vehicle washed down stream
(rotated) and buried. Road is at
level of hood. How deep was
the water when flowing?



What hazards do
you see?



What types of rescues could be attempted?





In mountain streams, holes caused by standing waves indicate a large boulder, etc. In normally dry washes, holes indicate a dangerous situation





Surging Wash (Stockton Hill Rd)







Cause of standing wave in previous slide





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Strategies and Tactics

- When and how to use these skills
- Have multiple plans and backup plans





There is a van in the water with a female inside.
What do you do?
What is plan "A", what is plan "B" ?





Rain events can be anticipated (weather reports). Whether we have a SW incident depends on:

- Strength of storm
- Location of storm
- Time of day storm hits

Strong storm hits northern Golden Valley at 1600:

- Everyone wants to get home from work
- Have to cross flooded roads to get home
- Expect a SW incident

Before bridges built across Mohave Wash in Kingman (~2000), we would stage at Bank and Northern for rescues.



As a SW Operations Trained SAR member, What Should You Do At A SW Scene?

1. Assess hazards- are you in a safe place, are others in a safe place?
2. If other rescuers or road crews haven't already done so, take over scene control.
3. Accurately report to command what you see. Is it a rescue or a recovery?
4. Don't try to affect a rescue.
5. Don't let others that aren't SW trained attempt a rescue.



Respond as soon as possible BUT consider:

- SW incidents usually have a short time duration- most SW callouts will either be resolved before you get there or will develop into a body recovery.
- Need to anticipate an incident by:
 - Staging (such as the Maverick station in GV)
 - Stand-by (available on short lead time)
 - Establishing a multi-agency CP in anticipation of a major storm
- Drawback – who pays for fuel if an incident does not develop and consideration of searcher's time.



Have SW Response Pre-Plans for storms in certain areas:

- Respond to both sides of the wash- ex: Hwy 66 and Sacramento Wash- Kingman needs to coordinate with BHC so we can respond to both sides (no way to get to west side of wash from Kingman).
- Are there washes that flood between your response route and the subject- anticipate alternative roads (Archibald Wash and Pierce Ferry Road, hwy to Skywalk) Need half of unit to go up Hwy 93, then Pierce Ferry- other half go up Stockton Hill Rd.



Once on Scene

Start with scene size-up:

1. Facts – What is happening?
2. Probabilities – What is going to happen if nothing is done?
3. Own situation – What options are available with existing resources?
4. Decisions – Choose an option.
5. Plan of operation – How do we implement the option?



ASAP deploy upstream spotters and downstream throw baggers

- Plan "A" - let the water recede unless there is a **compelling reason** to act (vehicle unstable, panicked subject ready to jump out, etc.) – remember, the usual Mohave County SW event is fast moving.
- Plan "B" – a shallow water crossing to vehicle
- Plan "C" – a helicopter extraction
- Plan "D" - a tensioned diagonal



Flooded Wash



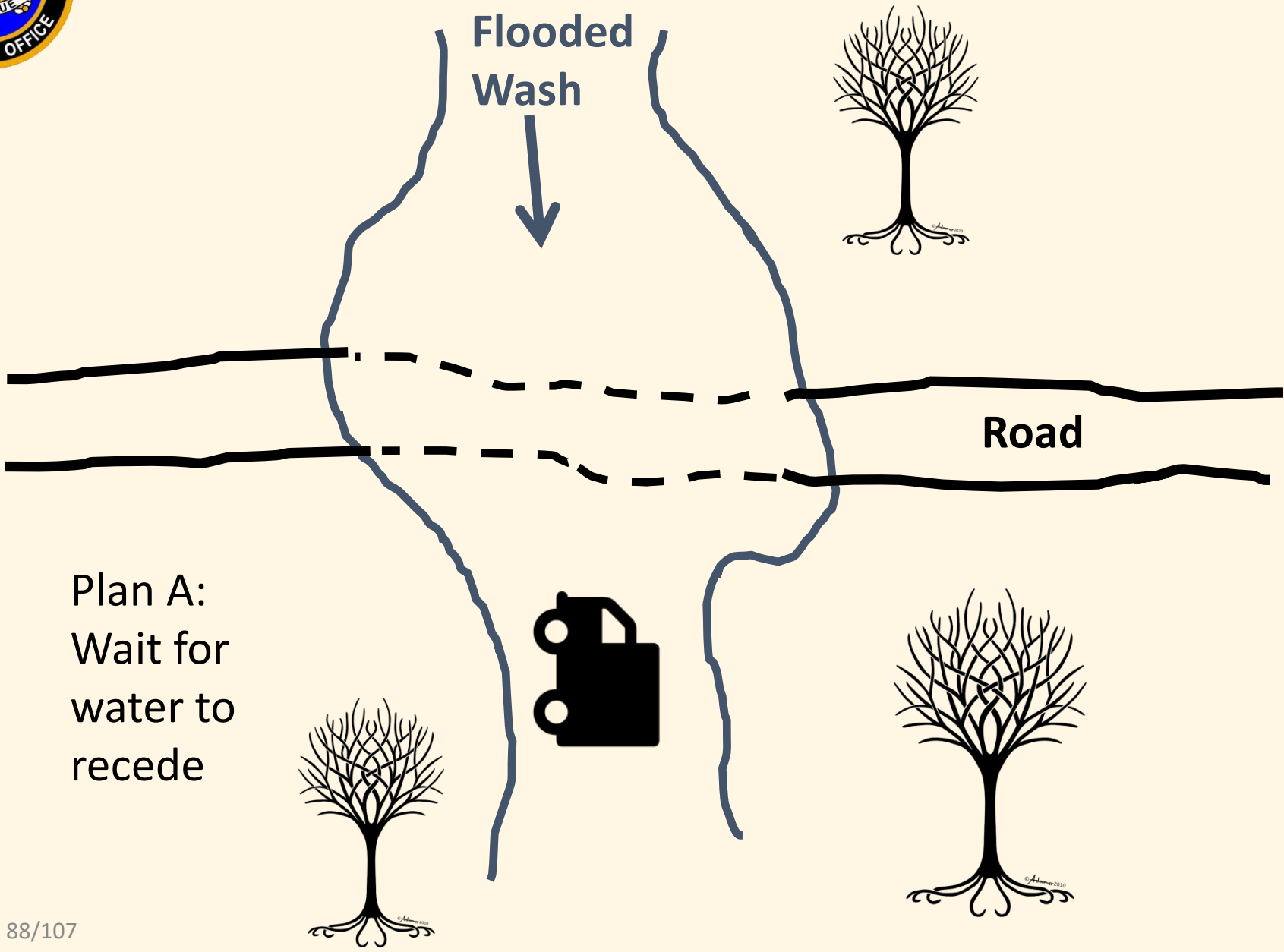
Road

Anticipate:

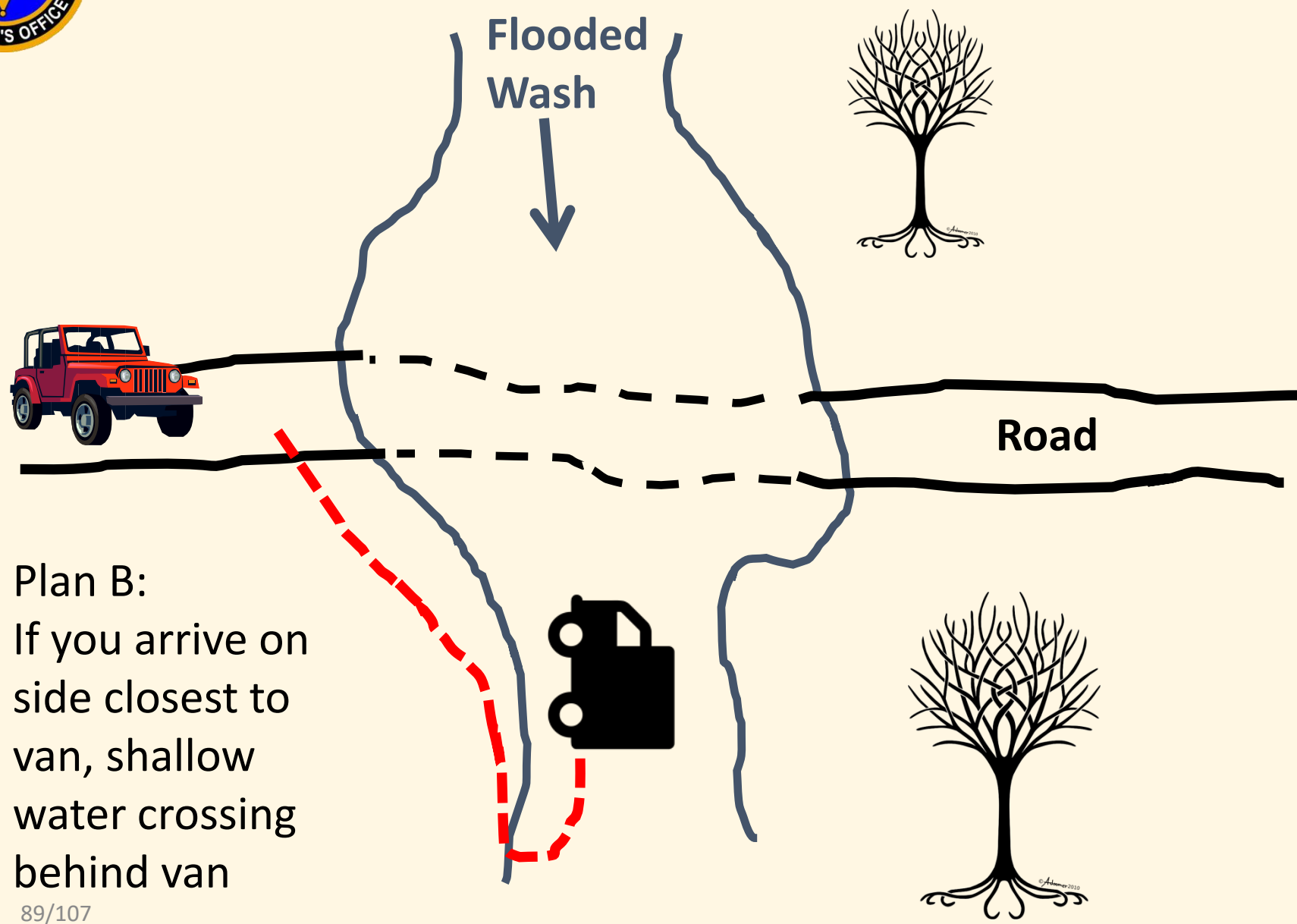
1. Drop off on downstream side of road
2. Depth of water may not be as deep as it looks; **read the water**



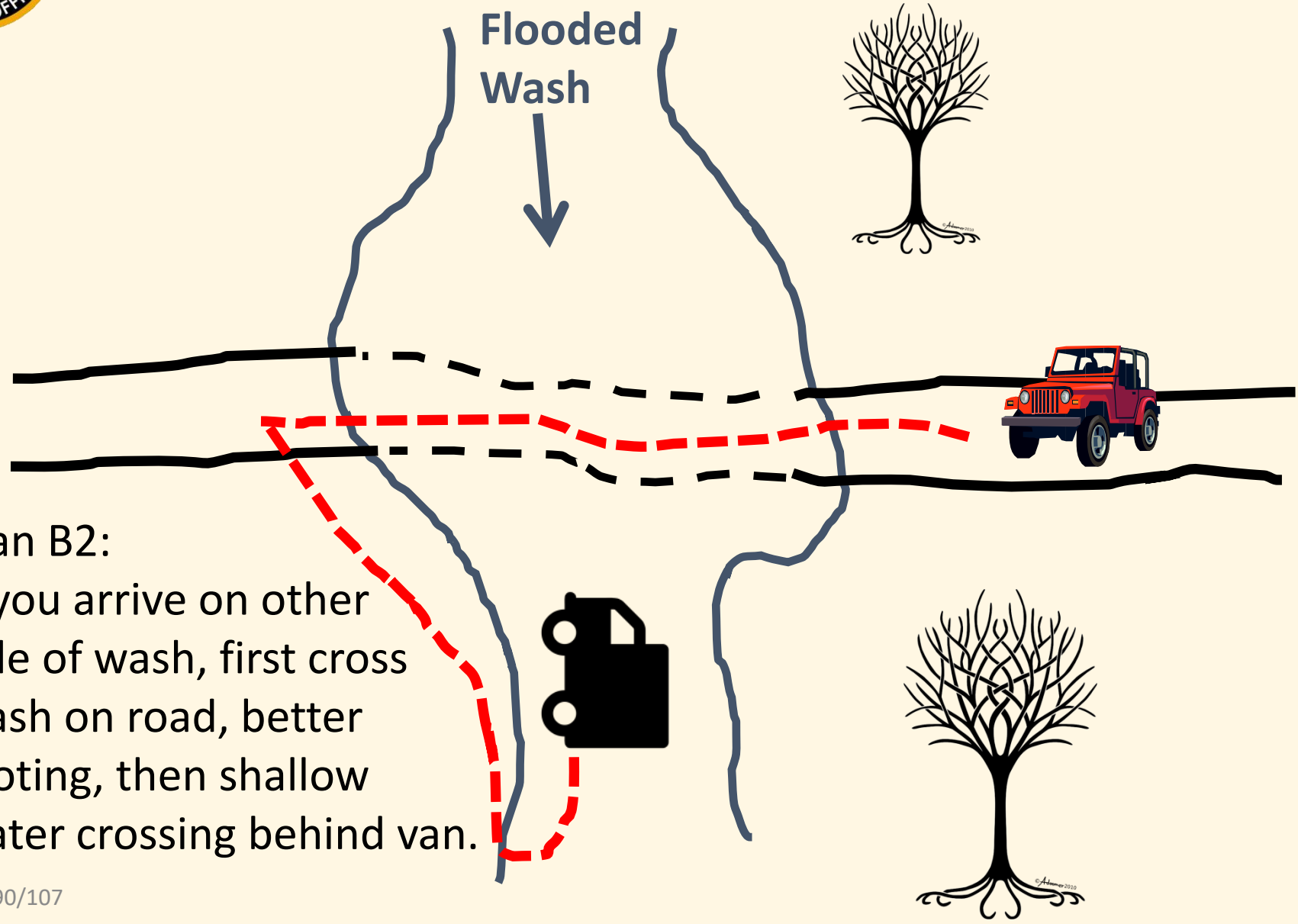
3. Is vehicle closer to one side? Approach from that side, behind vehicle if possible. Vehicle creates eddy



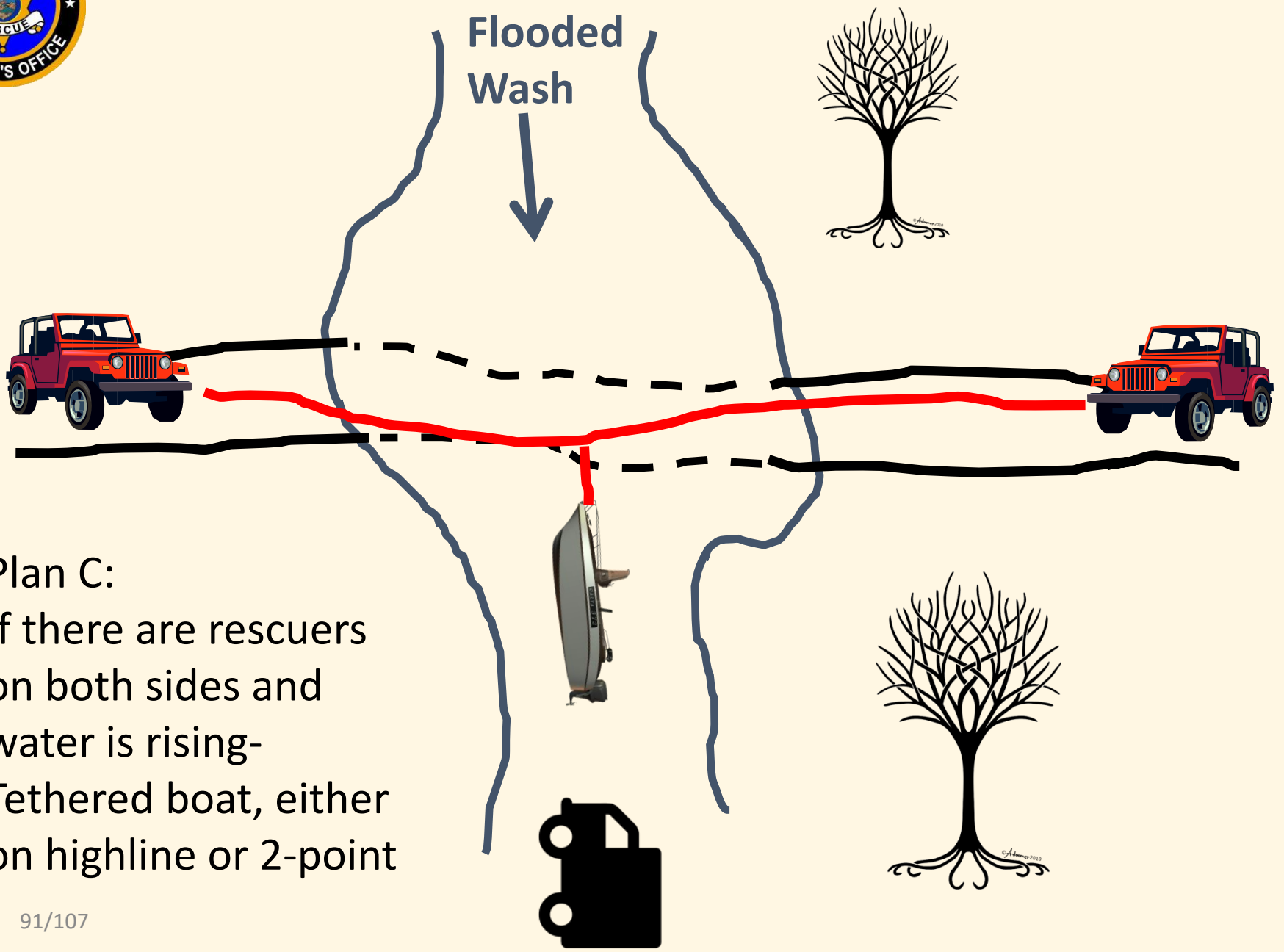
Plan A:
Wait for
water to
recede



Plan B:
If you arrive on
side closest to
van, shallow
water crossing
behind van



Plan B2:
If you arrive on other side of wash, first cross wash on road, better footing, then shallow water crossing behind van.



Plan C:
If there are rescuers
on both sides and
water is rising-
Tethered boat, either
on highline or 2-point



Dramatic rescue unfolds on Internet Swift-water team saves motorists trapped in Sacramento Wash . Sept. 10, 2013



According to newspaper story, GS FD response took more than 1 hour because of flooded washes in Golden Shores, had to go around through Needles.

Deputies did not call for BHC SAR. Need to respond to both sides of wash.





Anatomy of a Mohave County SW Incident: 8/3/2014

A total of 13 SW rescues were completed by SAR, GV Fire, and KFD.

SAR responded to northern GV first, completed rescues, then to the incident at Secret Pass Wash (next to Sacramento Wash) and Hwy 66 in southern Golden Valley.

Subject self reported near sundown in Secret Pass Wash (Hwy 66). SAR responded followed by KFD.

Panicked subject reported water in cab above waist.



Subject was attempting to drive from Oatman to Kingman. Did not see the water because of darkness and speed. Van washed 100' downstream with female inside.



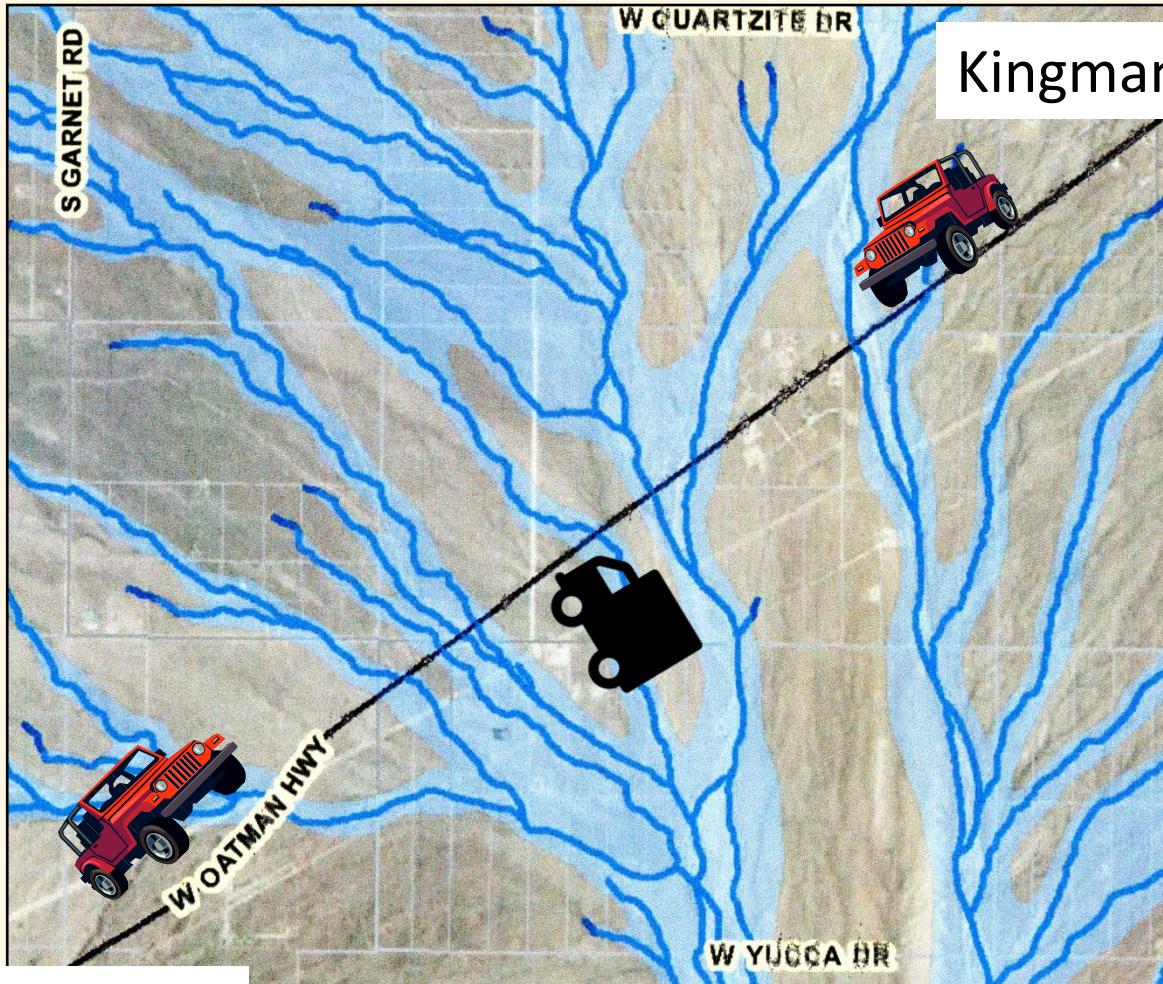


Subject was attempting to drive from Oatman to Kingman. Did not see the water because of darkness and speed. Van washed 100' downstream with female inside.





How do we respond?



1. Can we get to the scene-are there flooded washes to cross?
2. Can you read the water in the flooded washes to cross safely?
3. Do we need to call responders from the other side - BHC in this case?



Once on scene assign up-stream spotters and downstream baggers



What is Plan "A"?
Plan "B"?

Plan "A", wait for the water to recede.

-IF the vehicle is stable

-IF the water doesn't rise

If vehicle not stable, Plan "B", shoot a rope across the vehicle, tie to anchors , stabilize and wait

Plan "C", if boat available- tethered boat

Plan "D", set a tensioned diagonal to slide rescuer to van



Found out it's difficult to shoot line very far once line gets wet and have wrong line and spool (we have correct line and spool now)



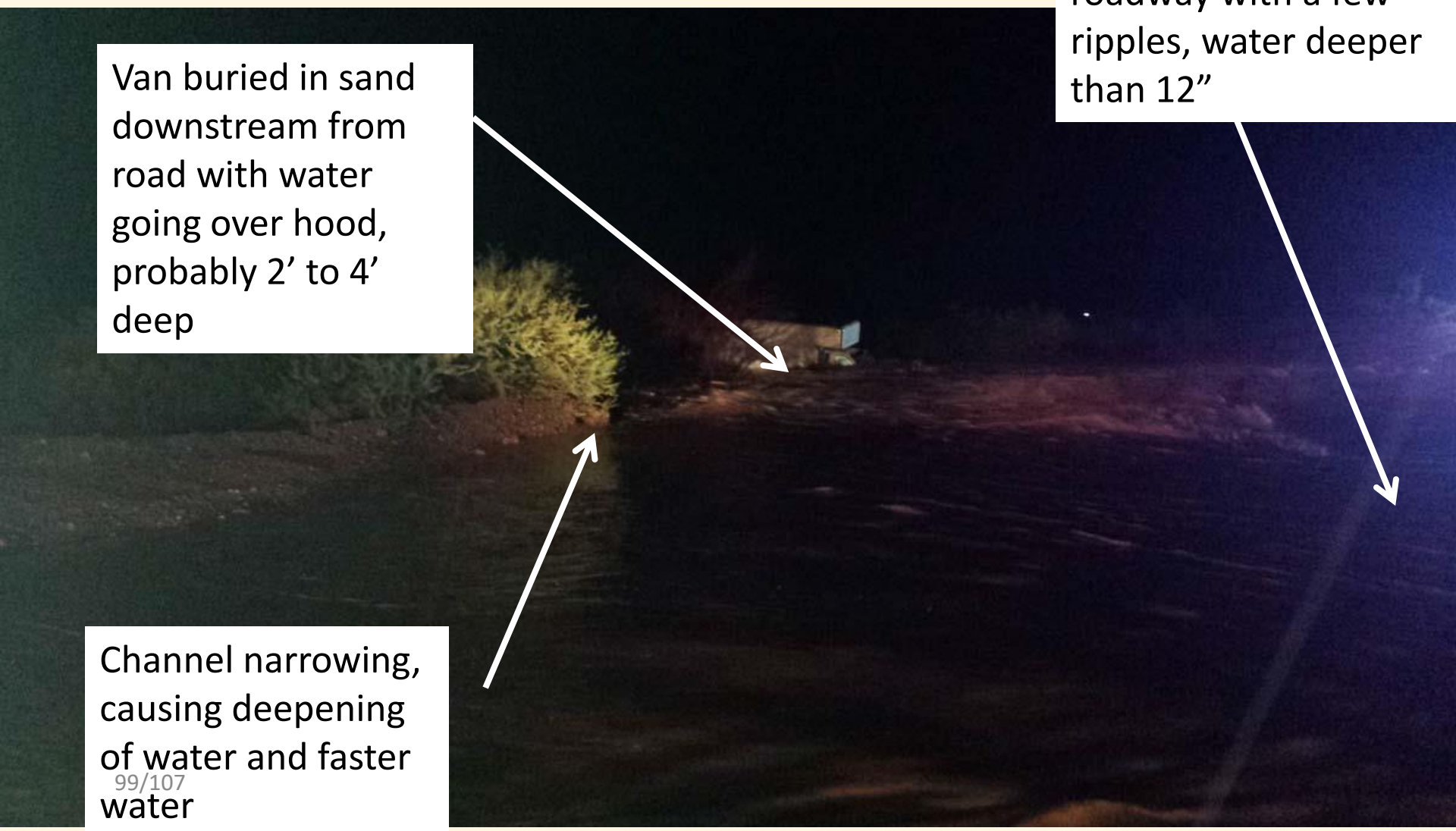


What can you read from the water?

Smooth water on roadway with a few ripples, water deeper than 12"

Van buried in sand downstream from road with water going over hood, probably 2' to 4' deep

Channel narrowing, causing deepening of water and faster water





90 minutes later

Water starting to go down, van stable, wait it out

Note standing waves at downstream edge of road

Water on roadway showing more ripples, getting shallower



If subject is panicking, shallow water crossing on road to get to other side of van



90 Minutes Later...





Shallow water crossing on road then approach van from behind, extract subject and form line to escort her to road





During & After pictures of van from Hwy 66 and Secret Pass Wash



How deep was the water when it was flowing?

Could we have done a shallow water crossing during main flow?





Rescue vs Body Recovery

Rescue

Time is critical

Make it simple

Only trained
rescuers should
attempt

Recovery

Time is not critical

Use the safest and
simplest method

Don't make a bad
situation worse



Archibald Wash, Pierce Ferry





Video of Actual Rescue in Kingman

What can you identify right / wrong?





Swift Water Rescues

Questions??