SIS-10 Bushwalking
Level 2

Aquatic Awareness

`

Table of Contents

Chapter 1. The Aquatic Environment

1.1 General

Water can be defined under two basic headings:
(1) Still Water
(2) Moving Water

1.2 Still Water

Examples of Still Water are:

- Swimming Pools
- Ponds
- Lakes
- Reservoirs
- Urban/Rural Floodwater

1.3 Moving Water

Examples of Moving Water are:

- Canals
- Rivers
- Urban/Rural Floodwater
- Causeways
- Coastal Waters: Sea Cliffs
  Surf
  Beaches

1.4 Common Incidents

Below is a list of the most common type of water related incidents that New South Wales Emergency Services have been called to involving persons working in, on, or near water:

- Pier, Quay fires
- Bridge, Trestle, Overhead elevated structure fire
- Water Vessel fire
- Water Search
- Drowning / Near Drowning
- Ice Rescue
- Swiftwater Rescue
- Surf Rescue
- Flood
- Car in Water
- Animal Rescue
- Floodwater operations
- Hazmat in water courses

1.5 Associated Aquatic Hazards

Scouts, as part of their outdoor adventurous programs may be involved in activities that have them working in, on, or near water.
Some of the hazards faced by Scouts attending these aquatic incidents may include:

- Drowning
- Force of the water
- Temperature of the Water
- Depth of the Water
- Clarity of the water
- Contaminates in the water
- Currents
- Flow
- Undertows
- Whirlpools
- Strainers
- Entrapment by Debris
- Panic of a Drowning person
- Riverbank Conditions (Slip, Trips and Falls)
- Surface Vessel Movement
- Water Borne Debris
- Fatigue
- Muscular /Skeletal injuries from over reaching, pulling, lifting
- Equipment falling in to the water
- Electrical Hazards
- Inadequate lighting
- Helicopter noise and downwash

This list is not conclusive, it is indicative of the types of risks that Scouts may encounter at an aquatic incident.

NOTE

A “scoutsafe” risk assessment must be completed prior to any adventurous activity.

Chapter 2. The Dynamics of Aquatic Environments

2.1 The Dynamics of Aquatic Environments

To plan effectively for activities around an Aquatic Environment Scouts must have an understanding of what the water source is doing.

This knowledge will keep you safe whilst participating in adventurous outdoor activities.

All water sources, still or moving will follow specific laws of nature 24 hours a day, 365 days of the year.

As such, Scouts should be aware that Gravity has the greatest overall effect on all water sources.

All water sources will move / flow until they have met “equilibrium” (when they are flat and level).

If this equilibrium is broken then the water will again commence to flow, or move.

2.2 The Dynamics of Still Water

2.2.1 General

This topic looks specifically at the underpinning knowledge required to work safely in, on, or near still water sources.

These “still water sources” include:

- Lakes
- Dams
- Irrigation channels
- Tanks
- Creeks
- Pools
- Ponds
- Reservoirs

It is a sad fact that most drowning deaths in Australia occur in natural water environments.

Scouts must not be fooled by the innocuous looking water, as most seemingly tranquil waterways can present ever-present hazards.

2.2.2 Hazards Encountered in "Still Water"

2.2.3 Currents

In a single body of water the direction and speed of currents can change from one area to another. These changes can be caused by varying topography; wind speed and strength; rainfall; increased water supply; and escaping water.

Strong currents are often present where rivers enter lakes and dams.

2.2.4 Banks

A crumbling river bank can lead to an accidental fall in the water, by victim and rescuer alike. Rescuers may need to avoid these soft zones by maintaining a safe distance or by bridging with suitable materials.

Creek with soft clay banks.

Rural dam with soft clay banks.

2.2.5 River Beds

A river bed may be uneven, unstable, or slippery making the seemingly easy task of entry and exit from the water source almost impossible.

Beware of natural river beds.

Poor water clarity can obscure underwater obstacles.

2.2.6 Underwater Obstacles

Scouts must be wary of items that may be below the surface. Rocks; Branches; Debris and Rubbish can all cause injury or even death to the careless.

2.2.7 Rainfall

Rainfall will cause rising water levels. Extremely heavy rainfall may cause rapid increases in water levels to the extent they it may cause flash flooding.

It should be noted that these changes to water levels may be as a consequence of rainfall many kilometres away.

As such weather forecasts should be sort by rescuers at their earliest convenience.

2.2.8 Crossings

Scouts need to be wary of vehicular cross-overs (causeways) as they may have been washed away below the visible surface level. It should also be noted that deep water is enough to stall a car during crossing, and if the water is flowing, actually wash the car from the crossing.

Beware of submerged crossings.

Depth Indicator.

2.2.9 Water Temperature

Cold water will quickly cause the victim or rescuer to become incapacitated, to the extent that they will not be able to assist in their own rescue. This is known as Hypothermic Induced Debility.

2.2.10 Depth of Water

As many inland waterways will have poor water visibility and varying depths, spinal injuries are a real hazard in shallow water, conversely deep water increases the risk of drowning.

2.2.11 Pumps

In dams and reservoirs, stay clear of pump inlets which may pin you to the intake.

Pump intakes are not always what you would expect them to be.

Typical rural pumphouse.

2.2.12 Grills and Spillways

In dams, stay clear of grills and spillways as victims and rescuers may become pinned against them and be held there until the flow decreases.

A typical rural spillway.

Layers of snow on ice are inherently dangerous.

It is difficult to judge the thickness of ice from above.

The ice was actually 20mm thick.

2.2.13 Frozen Water Sources

Areas where water sources may freeze over in winter, particularly in our alpine regions, need to be considered as dangerous to work on.

As a general rule “white ice” (i.e. ice that has layers of snow in it) are considered dangerous to work on.

“Old ice” is also considered to be dangerous as it may break up unexpectedly.

“New Ice” is best, if it is necessary to work on it. The following chart gives a good rule of thumb to go by:

Working on Ice.

Thickness of Ice	Advice
70mm	Stay Off!
100mm	Ice fishing / walking; bridge the Ice for rescue work.
125mm	Will support a snow mobile.
200-300mm	Will support small car.
300-375mm	Will support light truck.

2.2.14 Urban/Rural Floodwaters

Scouts must be aware of the following hazards that may be present during times of flooding:

- Sharp objects hidden by flood water
- Open man-hole covers hidden by the flood waters
- Electrocution from submerged power lines and other electrical systems
- Water contamination from fuel oils and sewerage systems
- Fertilizers and other chemical contaminants
- Animals, reptiles and spiders looking for high/dry ground will cause potential health risk to rescuers and victims alike if they are bitten
- Liquid Petroleum Gas cylinders damaged by water flow may cause an explosive atmosphere as heavier than air vapour pools in low lying areas or voids
- Mud may trap rescuers, victims and animals
- Trees may fall as saturated soil can no longer support the weight of the tree
- Building collapse / instability caused by the failure of footings or the force of flowing water

NOTE

Scouts should avoid walking around in floodwaters unless it is necessary and unavoidable.

2.3 The Dynamics of Moving Water in Rivers and Canals

This topic looks specifically at the underpinning knowledge required to work safely in, on, or near moving water in rivers and canals.

2.3.1 River Orientation

When working on any water course, particularly rivers and canals, all Scouts need to use the same method to orientate themselves and others at the scene.

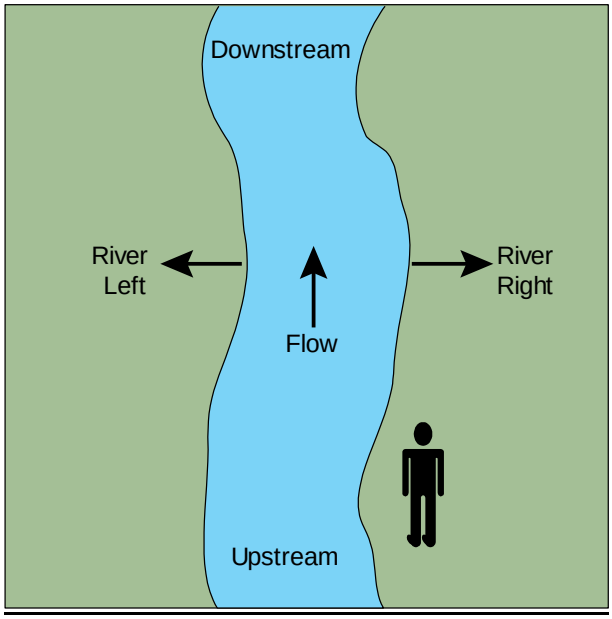
As such directions are always given from the perspective of the rescuer facing downstream.

There are 4 basic directions:

- Upstream
- Downstream
- River Right
- River Left

NOTE

As rivers and Canals will normally wind through the topography in ever changing directions, the use of compass directions will become confusing and ineffective for all involved.



River Orientation

2.3.2 Characteristics of Moving Water

Moving water has 3 basic characteristic: it is **Forceful; Relentless;** and thankfully it is **Predictable** to a trained rescuer.

Forceful

When water moves downhill it is forceful.

As the speed of the current doubles the force against an object is quadrupled.

The chart below highlights the risks faced by any rescuer, or victim, who becomes trapped against an object in moving water.

Velocity of Water	Pressure on legs	Pressure on Body
5 km/ph	7.6 kg	15 kg
10 km/ph	30.5 kg	60.8 kg
20 km/ph	122 kg	244kg

Source: Ohio State Division of River Resources

NOTE

It can be seen from the chart that somebody pinned against on object in water moving at 20 km/hr would have to be able to bench press the equivalent of 244 kg to be able to free themselves.

Relentless
Unlike an ocean wave breaking onto a beach, which breaks, then ebbs, giving the rescuer / victim time to escape, a river current will push against an object (The Victim) relentlessly.

You will be given no reprieve from the force of the water.

Predictable
To a Scout's advantage is the fact that water is predictable as it flows downhill.

It will always try to find its own level.

Variables such as: the amount of water; the speed at which it moves, and the type of river bank and bottom will create the dynamics of the river. Each river / canal is unique.

2.3.3 Water Speed

Water speed will vary dependant on the type of water course involved.
The water course will be either:

- Naturally occurring. (i.e. Rivers)
- Man Made. (i.e. Canals)

Naturally Occurring
The speed at which naturally occurring water courses will run is determined by such variables as friction caused by the composition of the river bottom and banks; the number and size of obstructions within the water course; the width and depth of the river; the volume of water flowing; the fall of the river.

The speed at which the river moves will change as the above variables change.

Noted Austrian engineer, Peter Reithmaier, completed a study of River Speed, and found the fastest running water was on steep run-off swollen alpine rivers. The water was measured to be moving at a maximum of 17.5 km/hr.

Man Made
The speed at which man made canals will run is determined by design.

Engineers will design the canals to carry a notional volume of water from one location to another at a given speed.

Variables will include: fall of the canal; width of canal; shape of the canal (vertical wall / trapezoidal walled channels); Other canals converging; Structure of canal (concrete sides or bottom).

As such, a rescuer can expect to find man made canals that will move (flow) at greater speeds than naturally occurring water courses (> 17.5 km/hr).

2.3.4 Timing of Current Speed

The following Chart gives indicative Current Speeds that will be found in water courses.

It is a useful tool for a rescuer to quickly calculate how far a victim may have travelled from the point that they were last seen.

The calculation is dependant on the rescuer timing a moving object thrown into a current over a 30 metre distance.

Time to Travel 30m in Seconds	Current Speed In metres/ second	Kilometres per Hour
5	6.1	21.9
10	3.1	10.9
15	2.0	7.4
17	1.8	6.4
20	1.5	5.5
23	1.3	4.8
25	1.2	4.4
29	1.1	3.9
37	0.8	2.9
50	0.6	2.3
80	0.4	1.5
110	0.3	1.0

2.4.5 Categories of Swiftwater

Moving water is often referred to as “swiftwater” by many outdoor enthusiasts.

In particular it often refers to rivers with rapids.

As such, white water canoeists have designed a scale of river difficulty, which is a useful tool for Rescuers to determine the risks of the rescue at hand.

International Scale of River Difficulty
Source: American Whitewater Affiliation

Class 1: Easy. Moving water with a few riffles and small waves. Few or no obstructions. Risk to swimmers is slight, self rescue is easy

Class 2: Novice. Easy rapids with waves up to 1 meter high and wide, clear channels that are obvious without scouting. Some manoeuvring is required. Swimmers are seldom injured and group assistance is rarely needed

Class 3: Intermediate. Rapids with high, irregular waves often capable of swamping an open canoe. Narrow passages that often require complex manoeuvring. May require scouting from shore. Strong eddies and powerful currents can be found. Large waves and strainers may be present but are easily avoided. Injuries whilst swimming are rare, self rescue is usually easy, but group assistance may be required to avoid long swims.

Class 4: Advanced. Long, difficult rapids with constricted passages that often require precise manoeuvring in very turbulent waters. Scouting from shore is necessary, and conditions make rescue difficult. Intense, powerful but predictable rapids. Risk of injury to swimmers is moderate to high and water conditions make self rescue difficult. Group assistance for rescue is often essential.

Class 5: Expert. Extremely difficult, long and very violent rapids with highly congested routes, which should always be scouted from shore. Rescue conditions are difficult, and there is a significant hazard to life in the event of a mishap. Swims are dangerous and rescue is difficult, even for experts.

Class 6: Extreme. The difficulties of Class 5 carried to the extreme of navigability. Nearly impossible and very dangerous. Rescue may be impossible.

Changes in water flow will often alter the difficulty of any class of swiftwater. Plan for the worst case scenarios.

2.3.6 River Flow

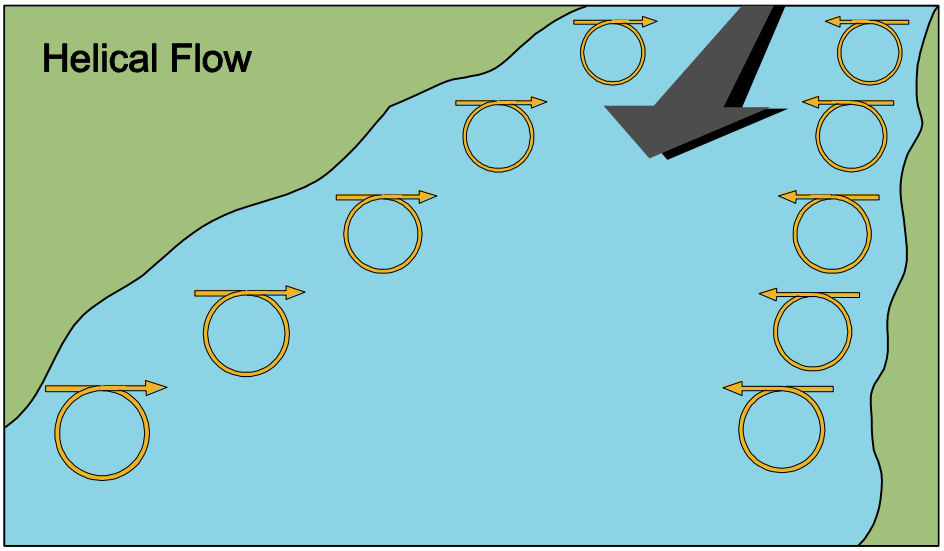
There are two different types of flow created when water moves along on a river or canal
These are:

- Helical Flow
- Laminar Flow

Helical Flow
Helical Flow is created along the river / canal edges, being caused by the friction created as the water flows downstream.

This friction causes water to be slowed and pulled out and down towards the centre of the river / canal. As the current surfaces it moves back towards the area of least resistance, the river bank where it again cycles down and out.

It is important for Scouts to know this, as in practical terms, it means that anyone who falls into this helical flow will be carried into the centre of the river and into the Laminar Flow.



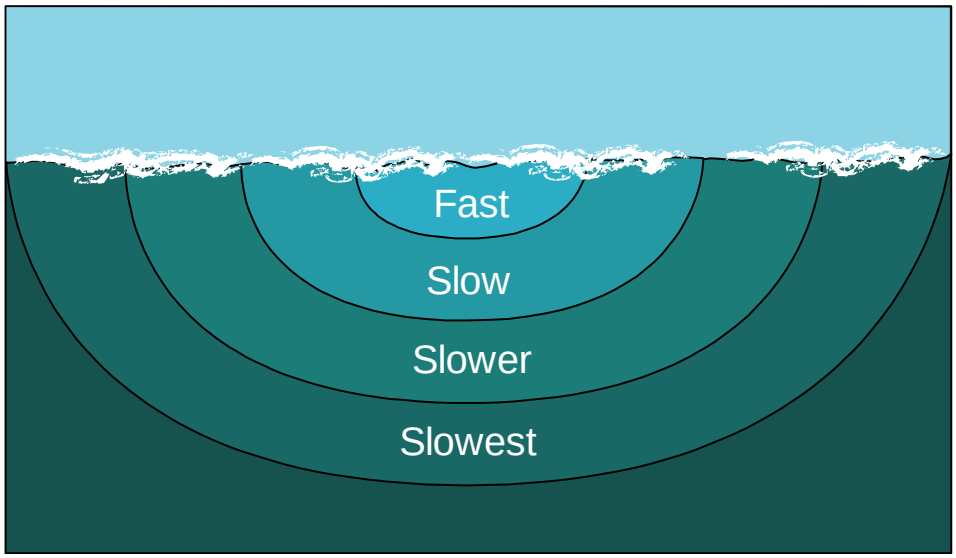
Helical Flow

Laminar Flow
Laminar Flow will usually occur in the centre of the river / canal, in the main current.

Again effected by friction on the river bottom and sides the water will flow at different speeds throughout the depth of the current.

The lower levels and outer sides will be slowed by the river bed, whilst the surface will be slowed by friction with the air and potentially be wind effected.

As such the fastest flowing water is just below the surface, at a depth where the victim would normally float.



Laminar Flow

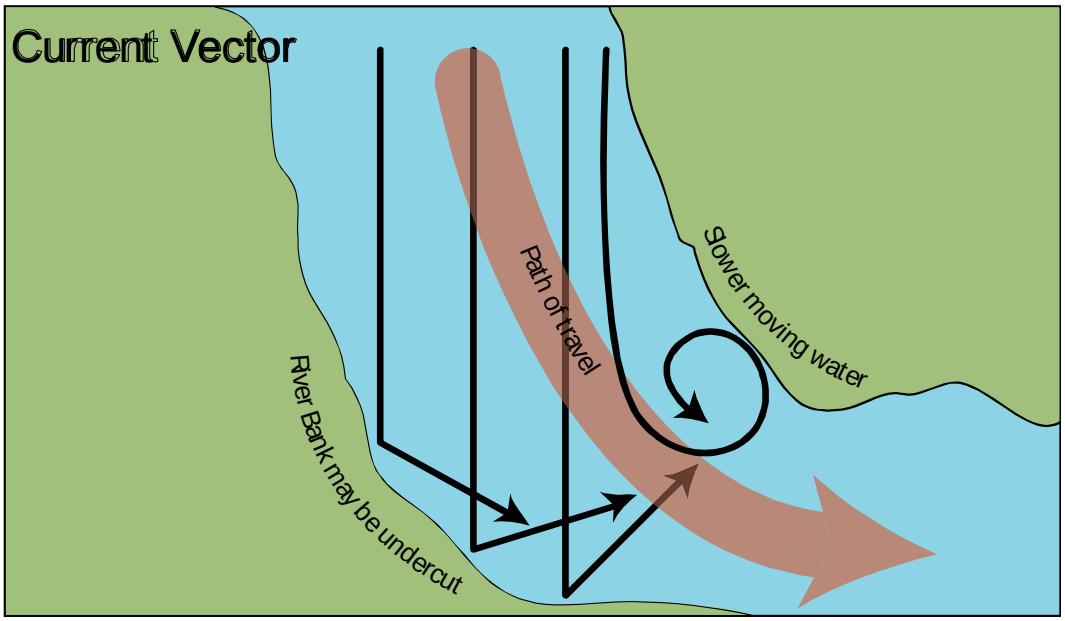
2.3.7 Current Vectors

As the water flows in the water course Current Vectors will form. This is where the water flows along the river or canal following the easiest and quickest path.

As the river / canal winds its way along, the current will bounce from one side of the river to the other causing vectors to form. A good example of these current vectors is shown by the undercutting of a river bank on the outside turn in a river.

By understanding these Current Vectors, rescuers can best anticipate the course that a victim will travel along a particular section of river and position themselves on the correct side of the water course to effect a land based rescue attempt.

Additionally they will be able to make use of the current to ferry themselves through the water, and in particular to the water's edge. (Known as" ferry angles").



2.3.8 River Loads

As a river / canal flows it has the potential to pick up debris along the way.

This is known as the River Load and is broken into 3 types:

- Top Load
- Suspended Load
- Bottom Load

Top Load

The Top Load is usually made up of floating debris, (objects that are positively buoyant) such as wood; drums; rubbish; etc.

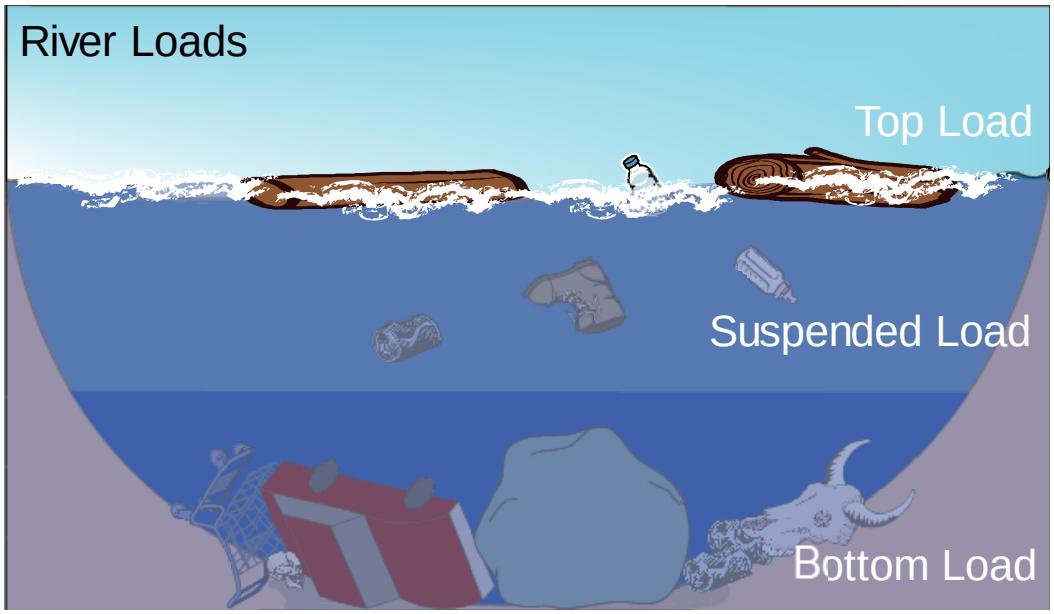
In flash flooding the initial wave of water will carry a large volume of debris in the top load and can be dangerous to anyone in the river / canal as the wall of water moves towards them (this is sometimes referred to as the “Golly Wash”)

Suspended Load

The Suspended Load can be anything in the water course that is neutrally buoyant. It can include fine silt that makes water clarity very poor, to partially submersed car, or bodies.

Bottom Load

The Bottom Load is usually large heavy objects (objects that are negatively buoyant) being pushed along the bottom by the force of the water and assisted by the fall of the water course. The bottom load is extremely dangerous to anyone in the water as they may be crushed or pinned by the objects. Examples include cars and boulders.



River Loads

2.3.9 Hazards Encountered in Moving Water.

One of the biggest hazards to face Scouts as they work in, on, or near moving water, whether they be man made or naturally occurring, will be the seemingly endless hazards that exist in, or under the water source.

2.3.10 Aerated Water

When water is agitated as it runs along the water course it can become aerated. This aerated water becomes a hazard as potentially up to 60% of a person's buoyancy is lost in such water.

As such, a victim will float very low in the water, causing them to experience the feeling that they are being pulled down, this in itself causing the patient to panic. It may also cause ingestion of water as the victim tries to breath.

Even a Rescuer, wearing a Personal Floatation Device, will float low in the water.

2.3.11 Rocky Shallows

Rocky Shallows are typically identified by riffles on the water surface. The rocky bottom may also be visible through the water.

Note: the riffles on the water surface.

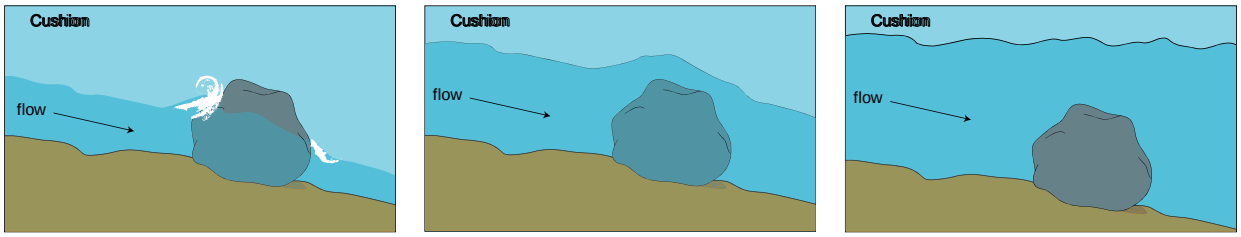
The rocky bottom may be visible.

These types of shallows are usually found in natural rivers and streams, but can occur in some man made canals.

The submerged river rocks or canal bottom may be found to be slippery under foot, particularly whilst attempting a shallow crossing. Hazards in this instance include foot entrapment or slipping and being washed downstream.

NOTE

If a Scout slips and is washed downstream, they should not attempt to stand up, this is to minimise the chance of foot entrapment.
They should immediately assume a “Defensive Swimming Position” (refer Chapter 3).



The hydraulic effect created by the obstacle will vary dependent upon depth of water and flow rate

2.3.12 Cushions, (Pillows)

Cushions are identified by bulges on the surface of the water in the river or canal. They are the result of water being directed up and over an obstacle in the water. This submerged object will usually be found just downstream of the cushion. It should be avoided wherever possible by swimming laterally around it. If this is not possible, then flatten out on the water surface and ride over the top of it in the defensive position. (see Chapter 3).

2.3.13 Holes (Standing Waves)

A “Hole” may be found:

- As water volume increases over the top of a mid stream obstruction
- At a constriction in the water course
- At a step down in the water course

As the water passes through the constriction or over the obstruction, the water tries to find its own level causing the wave to break back upstream. The wave breaks continuously in the same position.

NOTE If the height of a wave exceeds one seventh of its length then it will begin to break back upon itself.

A “Hole” is a surface phenomenon, and as such is capable of holding surface items on the face of the wave (i.e. Surface debris, rafts and boats).

A person in the water, whose body is below the surface, will be ejected with the current flowing downstream.

Variables include: size of the hole; flow of the water; and the body position of the rescuer / victim.

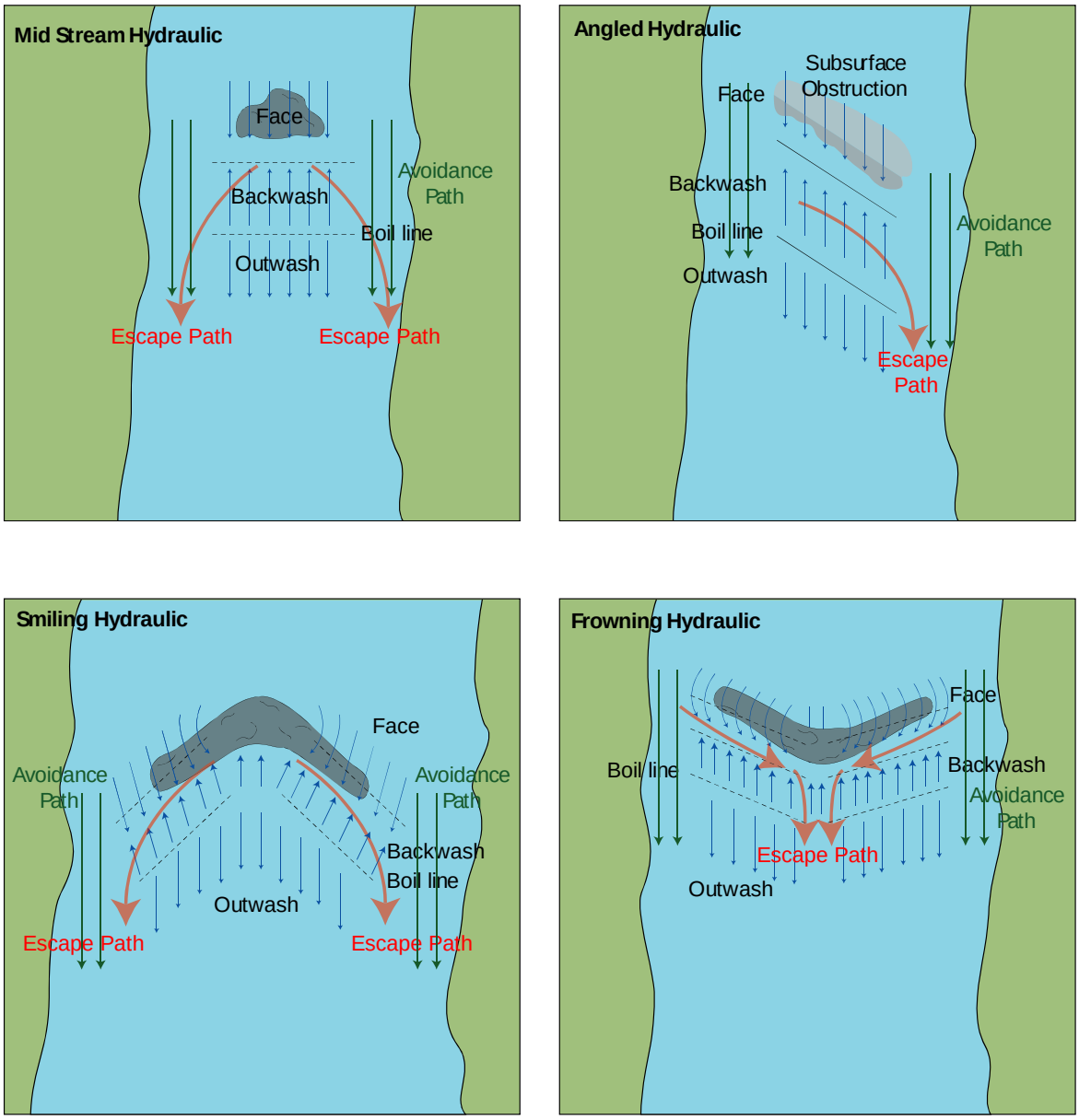
This small hole is indicated by the Standing Wave breaking back upstream.

Is it a hole or a hydraulic?
This will depend on whether it is a partial or full depth recirculating current.

2.3.14 “Smiling Holes” and “Frowning Holes”

These “Holes” can also be referred to as a ‘Smiling’ Hole or a ‘Frowning’ Hole dependent on them forming a ‘V’ pattern in the water course, usually created by a ‘step down’ or ledge.

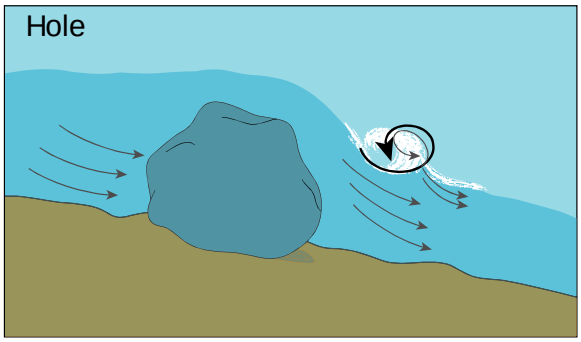
A ‘Smiling’ Hole offers a chance to escape its effect by swimming along its length and exiting downstream to either river left or right. Whereas a ‘Frowning’ hole will carry the rescuer / victim to the centre and hold them there, dependent on whether the current is partial or full depth, changing the feature from a ‘hole’ to a ‘hydraulic’.



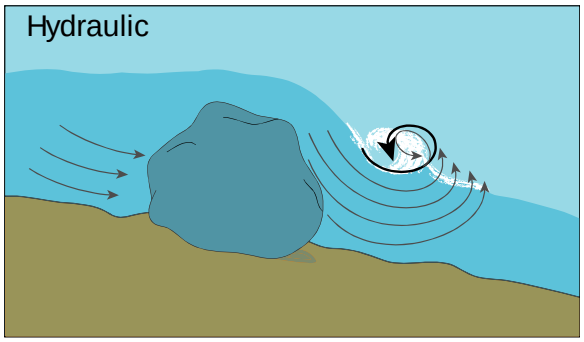
Note the various escape paths for each of these hydraulics

2.3.15 Hydraulics (Stoppers and Keepers)

A ‘Hydraulic’ is similar to a hole, varying in the fact that it is a full depth recirculating current that may keep an object or person in its hold for an extended period.



The partial depth recirculating current may hold objects near the surface only



The full depth recirculating current may hold a person indefinitely

NOTE Scouts must avoid swimming into a ‘hydraulic’ for fear of being held there and drowned.

2.3.16 Low Head Dams

Low Head Dams, more commonly called “Weirs" in Australia, are also called “Drowning Machines.”

Low Head Dam engineered to control water flow.

Engineered to drown the unwary.

Low head Dams are in effect a “Stopper”, or a “Hole”.

The Dams are usually an engineered solution to controlling the flow rate of man made water courses. However, it should be noted that they can occur in natural water courses as well.

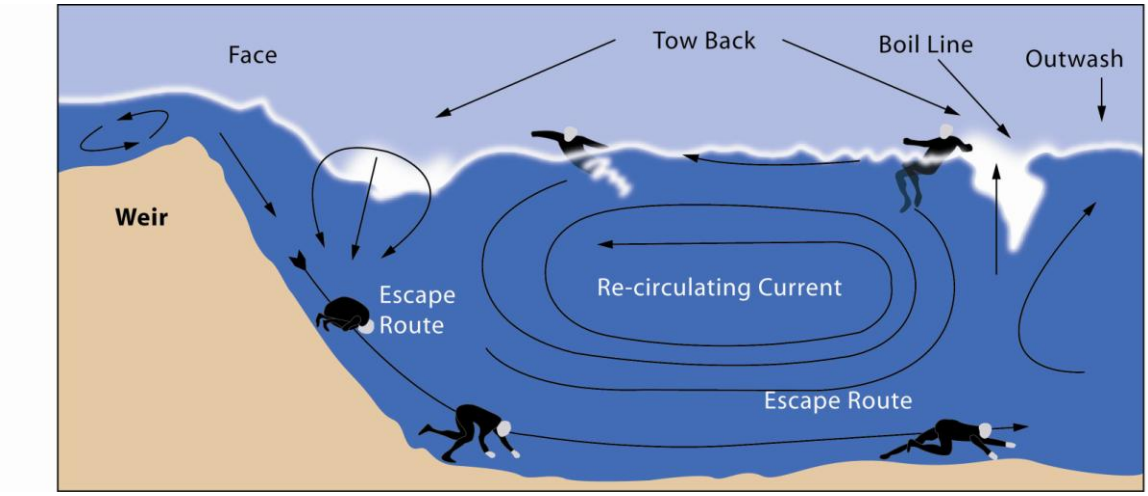
These Drowning machines are so dangerous because:

- The water recirculates vertically upstream as well as running downstream. If you are caught in the upstream current you will recirculate, being drawn to the river/canal bottom time and time again until you drown, or escape by pushing off the bottom towards downstream.
- The weir will normally run full width of the water course, allowing no reprieve.
- The water course will usually have vertical walled or trapezoidal walled channels, making exiting extremely difficult, without assistance.

Many rescuers and victims alike have died in low head dams.

NOTE

Under no circumstances should you allow yourself to be washed into a low head dam, normally indicated by an “unknown horizon” as you travel downstream.



The typical hydraulic effect in a “Hole”.

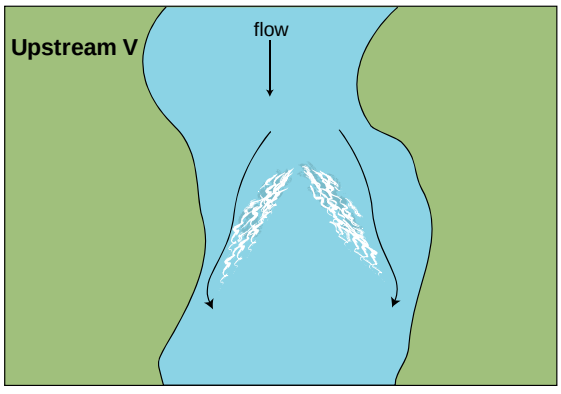
2.3.17 Downstream V’s and Upstream V’s.

As water flows downstream, over and around various obstacles it can cause a “V” pattern in the water course.

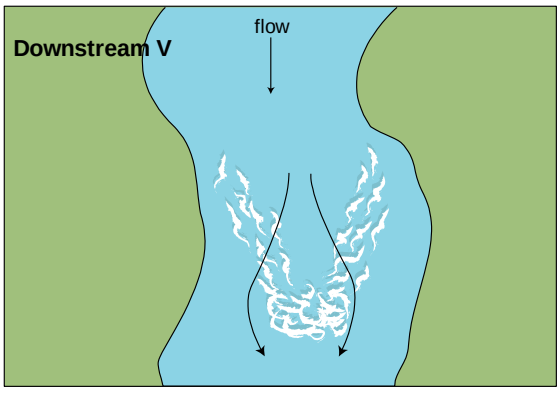
These types of features are referred to as either Upstream V’s or Downstream V’s dependant on what direction they face.

An “Upstream V” will cause the water to fan out around an obstacle. A Rescuer should ride past on the “Green water” to either side of the “V”.

A “Downstream V” on the other hand, has the water funnelling into the point of the “V”. The Rescuer should ride the “Green Water” punching through the white-water.



Preferred paths of travel



Preferred paths of travel

2.3.18 Unknown Horizons

When a river or canal drops away downstream, out of your vision, it is known as an unknown horizon.

If on land, make every attempt find out what is in fact, downstream, prior to any rescue attempt.

If in the water, get out as quickly as possible. The Unknown Horizon, or what is below, could kill you.

Horizons are evidence of a radical elevation change, and can indicate dangerous rapids; a low head dam; or even a waterfall.

An unknown horizon can be extremely dangerous. "Get out and scout!".

This "Strainer" could potentially drown you.

2.3.19 Strainers

Strainers are any fixed, or solid, objects in the water course that allows only water to pass over, under, around or through it.

The most common strainers are fallen trees, rock groins; farm fencing and even traffic guard rails.

A victim or rescuer may be held against a strainer and drowned.

NOTE

Always avoid a strainer, by manoeuvring around it, or over it.
Do not attempt to go under it in any circumstance, as you may be pinned and drowned.

2.3.20 Cold Water

The importance of water temperature can not be emphasized enough.

In New South Wales water temperatures can vary from 25^0c in summer on the coast, down to 0^0C in the Alpine regions.

Hypothermia Induced Debility (HID) will rob even the strongest swimmer of their ability to survive in a hostile aquatic environment.

NOTE A strong swimmer becomes exhausted in only 12 minutes in 10^0C water.

The longer a victim is in the water the less likely they are going to be able to assist in their own rescue.

2.3.21 Eddies

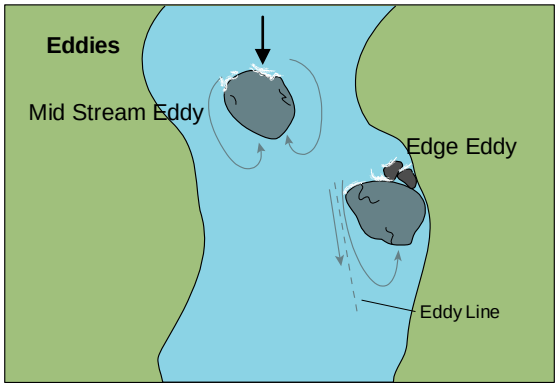
An Eddy is formed behind an obstacle in the current. As the water flowing downstream pushes past the obstacle an area of low pressure is created behind it. This causes the water to run into this area, even though it may be against the flow of the main channel.

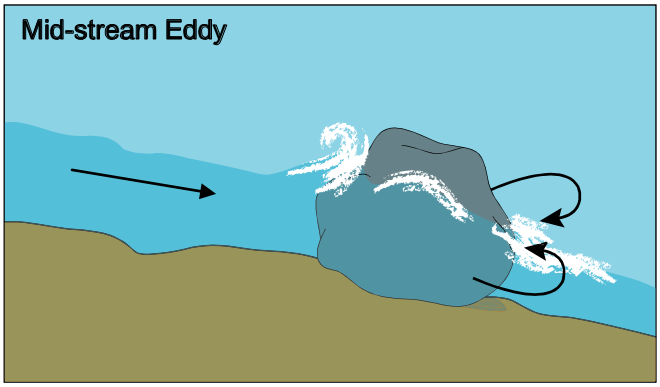
The harder and faster the downstream flow, the harder and faster the eddy will flow upstream or recirculate behind the obstacle.

A clearly visible line may be seen between the two currents. This is known as the "Eddy Line".

This important hydraulic feature can allow a rescuer or victim to escape the main channel, making it over to the water's edge, or even to navigate back upstream against the current. It can also be used to find a safe haven mid-stream.

It should also be noted that whilst it is a useful feature to navigate the water course by, on "Big Flow" rivers these eddies can also contain turbulence and even whirlpools that are a threat to rescuers and victims alike. As such rescuers must be constantly monitoring the river conditions for the task at hand.





A mid-stream eddy is clearly visible behind the boulder.

Note the swirling action in this edge eddy.

2.3.22 Man Made Canals

Man made canals are designed to carry water over a specific course and at a specific rate. Designed features within the canals also create hazards for any person in the canal.
These features include:

- Low Head Dams: as previously explained.
- Vertical walled channels, where due to the channel wall height it becomes impossible for a rescuer or victim to climb out of the canal even if they can get to the edge. It also hampers land based rescue attempts as specific equipment and techniques need to be implemented.
- Trapezoidal walled channels, particularly when moss covered, also make extrication from the canal difficult.
- Bridge Abutments, being supporting columns for bridges crossing the water course, can act as a strainer, that is, an object that a victim or rescuer can get pinned to by the force of the water. As such you should avoid coming into contact with these abutments wherever possible.
- Breakers will sometimes be found at the base of a low head dam or even at the convergence of two water courses. The breakers are usually found as vertical concrete columns, which assist in breaking up debris in the water course. The danger to anybody who strikes one would include drowning or severe physical injury.

2.3.23 Causeways

A Causeway, by design, is a road that crosses a water course in a low lying area. They may be dry most of the time, but when water levels rise in the water course; water will surge over the road surface of the causeway.

As a consequence, these types of crossings become more dangerous as flow across the road rises in level and speed. Scouts should be aware that it takes only 150mm of fast flowing water to carry a car off the causeway.

It should also be noted that not all causeways are made of concrete or bitumen, some are made of compacted earth which may wash away if the current is fast enough or if the causeway was in poor condition prior to exposure.

As such Scouts should not assume that the causeway is still safe to cross or that it is safe to be used in any rescue attempt of a motorist trapped in a car on the causeway. A visual inspection must be made prior to its use. Water flow and rising water levels must also be considered.

NOTE

Poor water clarity will hamper visual inspection of the Causeway.

2.4 The Dynamics of Moving Water in Coastal Waters

This topic looks specifically at the underpinning knowledge required to work safely in, on, or near moving water in coastal environments.

2.4.1 Waves

Waves are formed by the wind blowing across the surface of the ocean.

The size of the waves is determined by three factors

- The intensity of the wind
- The length of time that the wind blows
- The distance the wind blows

(Source: Surf Lifesaving Australia)

2.4.2 Wave Sets

As the wind blows, the waves begin to travel in distinct lines, known as sets.

These sets of waves can travel over great distances maintaining most of their energy. However they will become smaller if travelling into a head-wind.

These sets of waves, will hit the coast, having the same number of waves per set, and the same lull between sets. Scouts can make use of this knowledge by timing their entry and exit through the surf zone.

2.4.3 Wave Types

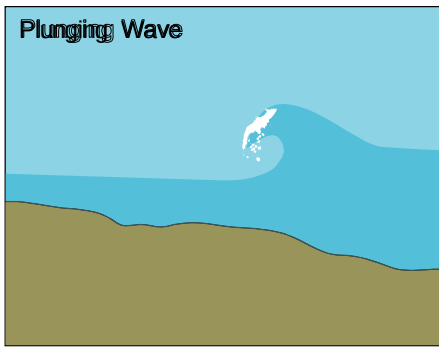
There are three types of Waves:

- Plunging Waves
- Spilling Waves
- Surging Waves

Plunging Waves (“Dumpers”)

A Plunging wave will occur where the incoming swell runs onto a shallow bottom, causing the wave to stand up and violently fall forward, crashing onto the shallow ocean floor.

This type of wave is synonymous with spinal injuries.



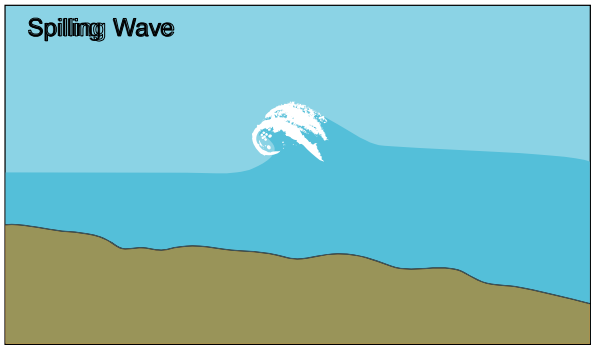
Plunging waves indicate a shallow ocean floor

Wave lifting

Wave plunging

Spilling Waves ("Rollers")

This wave stands up as it approaches the shallow water, with the crest of the wave spilling forward, sometimes forming a tube.



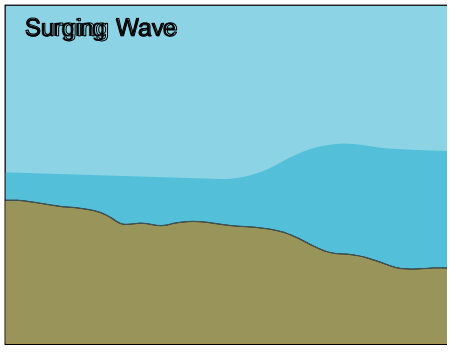
A Spilling Wave is a safe wave.

This type of wave is the safest for surfing.

Surging Waves

This type of wave never actually breaks, as it approaches the coast. This is due to there being deep water below it. The wave loses neither speed or gains height.

It surges forward onto the beach, or rock platform, and drags victims back into the ocean.



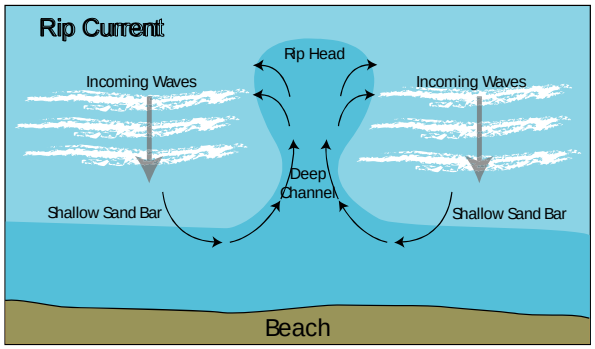
Surging waves are silent in their approach

Before the surge

After the surge

2.4.4 Rip Currents

A Rip Current is formed by the water forming its own level. As sets of waves break onto a beach, large volumes of water start to build up inside the surf zone. As the water, effected by gravity starts to flatten out, a channel of water will start to run out through the surf.



Large volumes of water arriving on the incoming waves must make their way back out to sea

The larger the surf, the stronger the rip.

It is this outward running current that puts swimmers at risk of being pulled out to sea.

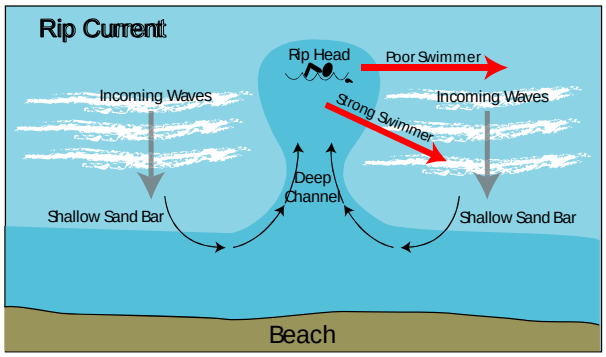
Whilst rips are dangerous to the unwary, they are conversely, a quick and easy way for a Rescuer to negotiate a path across the Surf Zone.

2.4.5 Identifying Rip Currents

Common signs of rip currents are:

- Discoloured brown water, due to sand which has been stirred of the bottom
- Foam on the surface extending beyond the break
- Waves breaking further out on both sides of the rip
- Debris floating seaward
- A rippled appearance where the surrounding water is generally calm.

Source: Surf Lifesaving, Australia.



To escape from a rip current, simply wait until the strength of the current wains, then swim to the side and raise your arms for assistance

2.4.6 Types of Rip Currents

There are four types of Rip Currents:

- Permanent
- Fixed
- Flash
- Travelling

Permanent Rips:
A permanent rip will remain in the same area for months or even years. These types of rips exist because of the permanent nature of the ocean floor and prevailing conditions.

Fixed Rips:
A fixed rip is accompanied by a gully in the sandy ocean floor. It will remain in place dependant on the movement of the sand.

It can last from hours to many months.

Flash Rips:
A flash rip is caused by a large influx of waves over a short period. The large influx of water will find the quickest means of finding its own level.

As such flash rips appear suddenly, normally without warning.

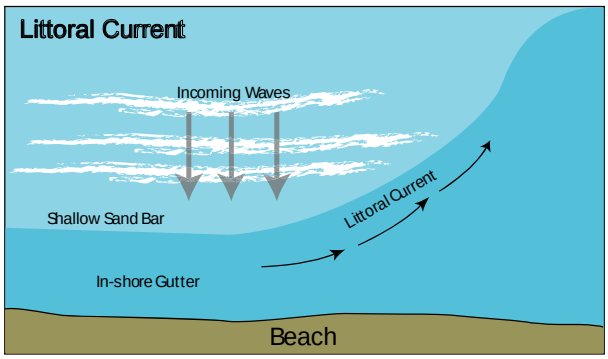
The outflow of water will be strong, but relatively short lived.

This type of rip will catch the unwary swimmer and quickly pull them out to sea.

Travelling Rip:
A travelling rip current is as the name suggests a rip that travels along the beach front. It is driven by littoral currents.

2.4.7 Littoral Currents

Littoral currents are also referred to as “side sweeps” or “drifts”.
These in shore currents move parallel to the shore. They can be barely noticeable through to fast flowing, dependant on the size of the surf.



This Littoral Current running to the right is indicated by the sand-bars running at 90 degrees to the surf.

These currents will inevitably feed into a rip current and carry a swimmer out to sea.

NOTE

Escaping from a Rip Current

If caught in a rip:

- Do not panic.
- Ride the current out to sea where the current will dissipate.
- Raise your arm for assistance and wait for help.
- If a strong swimmer, swim across the rip at an angle, and return to shore outside the rip channel.

2.4.8 Tides

Tides should not be confused with currents.

The tide is caused by the rise and fall of the ocean level as a result of changes in the gravitational attraction between the Sun, Moon and Earth.

Whereas ocean currents are the horizontal movement of water with tides being a contributing factor to this movement of water.

Changes in tide levels will occur in Bays, Beaches and up rivers as far the tidal influence reaches.

Generally tides reach their highest levels twice a day. An average interval between two tides will be 12 hours, 25 minutes. However this can vary greatly during a given week.

The height of the tide will also vary dependant on gravitation forces; wind; storm surge and the like.

A changing tide is important for Scouts to consider as it may either assist or hamper in the conduct of your activity.

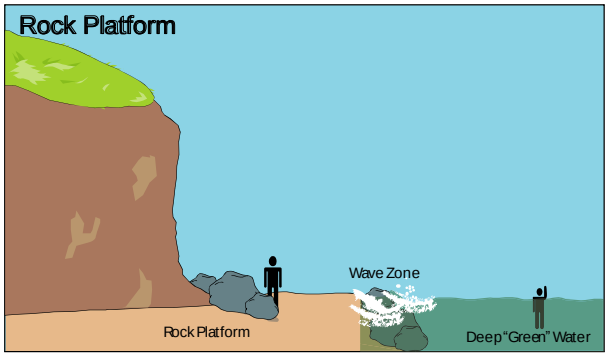
NOTE

Tidal Information can be gained through Bureau of Meteorology or on various web sites. Consider the tides for entry and exit from a location.

2.4.9 Rock Platforms

Rock Platforms are a typical geological formation on all New South Wales coastal waterways.

Steep headlands, remnants of ongoing coastal erosion, with rock platforms below are found along our entire coastline.



Rock platforms can be a dangerous area to work

Many rescues are effected from these rock platforms, with this type of environment having a number of inherent dangers:

- Falling rocks – be wary of falling rocks from eroding cliff face and also from Rescuers working above
- Moss – be wary of moss on rocks (both green and brown in colour), which can cause serious injury, if the Rescuer slips
- Honeycombing – weathered rock, particularly sandstone will make walking difficult, is likely to cause falls resulting in injured ankles and/or knees
- Moving rocks – loose and moving rocks on the rock platform will also cause serious falls and injuries
- Rising tides – will potentially cause equipment, patients and even Rescuers to be washed away. Be aware as to whether the tide is rising or falling. Make all haste to effect rescue or move patient to higher ground as a matter of urgency
- Waves – with a rising tide and increasing winds and swell comes the added risk of waves washing over the rock platform. Keep a constant watch of the surf.

NOTE

If Scouts are washed into the water, they should swim away from the rocks to deep water, outside the wave zone, and await further assistance.

Chapter 3: River Crossings

Crossing a River, or any other water course, can be a dangerous undertaking, particularly if it has not been well thought-out prior to entering the water course.

3.1 Pre-Departure Planning:

Scouts should consider the route of the hike that they are undertaking prior to leaving home for the activity. Will it require them to cross any water courses? If the answer is yes then they must consider:

- Accessing relevant sources to interpret weather and other environmental information prior to departure. The Bureau of Meteorology has extensive information available on its web site (www.bom.gov.au) Information about river levels; expected flood conditions; as well as weather forecasts are all available. Further information can be gained from National Parks web sites as well as many sites that provide field notes for the hike that you are doing.
- Are there alternate routes or tracks to take if your planned route is blocked or otherwise impassable? Scouts should pre plan an exit strategy.
- Will the crossing require any special equipment to safely negotiate the water course? (i.e. Ropes, poles, canyon bags, garbage bags, swim wear, wetsuits, foot wear to wear in the water, etc.)

Scouts should complete an initial risk assessment (Scout Safe Risk Assessment form) at the earliest stage of planning, addressing the expected risks and hazards to be encountered.
It should be noted that the document should be reviewed along the hike to ensure any new hazards and risks are identified along the way and dealt with. This "Dynamic Risk Assessment" will ensure your safety, particularly when it comes to crossing a water course.

NOTE If you fail to plan…You plan to fail!

3.2 Planning a River Crossing:

3.2.1 Selecting a River Crossing Location:

Choose a river crossing:

- Where there is an easy entry point on your bank.
- Where there is an easy exit point on the far bank.
- Where the river is shallowest.
- Where there is safe footing underwater.
- Where there is a safe exit point downstream should you slip and fall in.

3.2.2 Don't cross a river:

- When it is in flood.
- When the river is moving a "heavy bottom load" or there is a large volume of surface debris running down the river.

- When the water is so discoloured that you cannot see the bottom.
- When the water is flowing faster then you can walk.
- When there is no safe exit point downstream.
- When there are waterfalls, canyons or low head dams downstream.
- When you feel uncomfortable about crossing.

3.2.3 Safety considerations when crossing the river:

- Cross the river on a slight angle so as to ease the pressure of the water on your legs.
- Take short steps.
- Wear footwear in the water.
- Don't Rush.
- Take of heavy clothing. It will drag you to the bottom if you fall in.
- Waterproof your pack. Float your pack across if appropriate or use ropes to pull it across once you have a scout on the other side. If you are going to wear it on your back, have all waist and chest straps undone so that you can easily remove the pack if necessary.
- Beware of "Foot Entrapments", whereby your foot may become stuck between rocks on the river bottom. If your foot went into the hole, it will usually come out the same way. Don't panic, initially attempt to manoeuvre your foot back out. Others may assist if necessary. If the water flow is strong and pushing you downstream you may need another person to support your weigh against the flow of the water until you can manipulate your foot free.

3.2.4 Crossing the River:

Once you have determined that it is safe to cross the river at the selected location you should put a "**river crossing plan"** in place.
In its simplest form Scouts should assign from their patrol:

- An "Upstream Lookout": This Scout will assume a position upstream to keep watch for any danger such as rising water levels or large items of surface debris such as large floating tree branches that may knock a person over whilst attempting to cross.
- A "Downstream Safety": This Scout will assume a position downstream to attempt to recover any scout who should slip over and get washed downstream. This person should attempt a "Reach Rescue" utilising a stick or pole for the person to grab onto. Alternatively they may attempt a "Throw Rescue", where a rope is thrown to the person from the river bank. The "Downstream Safety" never enters the water. All rescue attempts are made from the safety of land.
- A "Team Leader" who coordinates all activities pertaining to the river crossings.
- The "Scout Crossing" should take their time and adopt the river crossing method as determined by the Team Leader. If they should fall over and be washed downstream they should expect the downstream safety to be standing by to assist them. If these attempts fail the scout should adopt the "defensive swim position", adopt the appropriate "ferry angle" and attempt to make it to the safest, nearest river bank.

Team positions will change during the crossing process, by both person and location, as eventually all scouts must end up on the other side of the river.

3.3 River Crossing Methods:

Scouts must be aware of the various methods available to them to cross a river, or water course safely:
These river crossing methods are:

- “Individual, without aid.” The scout may simply cross the river at the selected river crossing point. The Scout simply walks, taking short steps (or sliding the feet across the river bottom). This should be done whilst facing upstream against the flow of the river. This technique would only be used on a slow flow crossing.
- “Individual with a pole”. The Scout faces upstream, leaning onto the pole which is in front of him, creating three points of contact with the river bottom. By moving the pole and each alternate leg, one at a time towards the other side of the river, a minimum of two point of contact will be maintained throughout the entire crossing process, making for a very stable crossing technique.
- “Mutual Support Techniques” such as the “line astern technique” whereby additional persons stand behind the “individual with the pole” to create a conga line, one behind the other. Each person holds the shoulders of the person in front and bears down on them to create positive downwards pressure on the river floor. This is a very good technique for quickly moving a large group across the river. Other similar techniques to this can be used such as forming a circle with the group, so there are many points of contact as the group moves across the river, with each person supporting the other.



These three photos show: Crossing with an aid; line astern; and the circle method of crossing

- Other options such as building a span line (Flying Fox) across the river or swimming across the river either with or without you back pack are also methods that can be used.

3.4 Swimming Techniques in Moving Water:

Scouts must be aware of, and be able to demonstrate, swimming techniques that are to be used should they get washed away during the river crossing process.
The two techniques are:

- Defensive Swimming
- Offensive Swimming

Defensive Swimming Position

Offensive Swimming Position

3.4.1 Defensive Swimming.

The **"defensive swimming position"** is where you assume a seated position in the water. Head above water, feet pointed downstream, with knees slightly bent.
The reason for this position is that it allows you to easily breath; visually scan the river; and fend off obstructions and avoid strainers.
In this position you can set a **"ferry angle"** which will allow you to make use of the flow of the river so as to make your way to the river bank. A ferry angle is set by pointing your feet away from the river bank you wish to go to.
The force of the water will then force you to the side of the river bank that you wish to exit from. You can use your hands to paddle to assist in this process.

3.4.2 Offensive Swimming.

The **"Offensive Swimming Position"** is where you roll over from the defensive position into a normal swimming position, but with your face out of the water so you can see downstream.
This position allows for you to aggressively and forcefully swim away from any dangerous hydraulic river features that you wish to avoid. Offensive swimming uses a lot of your energy, so it is usual practice to switch between the two styles.

NOTE Offensive swimming uses a lot of your energy, so it is usual practice to switch between the two styles.

3.5 Waterproofing your Back pack:

It is imperative that the food and equipment contained in your back pack remains dry, particularly when you are in a remote location and have no easy way out.
Whilst most back packs are water resistant, particularly to rain, they are not designed to be immersed in water.

As such scouts must consider how they will keep the contents of their pack dry if they should have to float their pack across the river, or if the pack is inadvertently dropped into the river whilst crossing it.
Pre planning for a river crossing is essential. The most effective way to waterproof the contents of your back pack is to pack them into a canyon bag or waterproof pack liner that is designed for this purpose. These items are now readily available from camping stores nationwide.
Simply place the liner into your back pack and load your food and personal items into it and then seal it off before closing your pack. If you do not own a liner a heavy duty garbage bag can be used.
If you are required to float your pack across the river it can be loaded into a large heavy duty garbage bag and tied off with air in it to aid with the floating process. This will only be effective if the plastic bag is carefully handled so as not to tear any holes in the bag which will cause for the pack to sink and be lost, or at a minimum cause your equipment to get wet.

A canyon bag or large heavy duty garbage bag can be used to put your backpack in, filled with air and then sealed to float your pack across the river