RESEARCH IN LIFESAVING - DEVELOPING THE PLAN

DEVELOPING A BEACH RISK ASSESSMENT MODEL
FOR PRACTICAL APPLICATION IN THE UK

Peter Dawes[†] RNLI, Poole, UK

Abstract

Context
The World Health Organization offers the following advice in relation to the assessment of hazard and risk in its *Guidelines for safe recreational water environments* (coastal and fresh waters) [1]:

'Assessment of hazard and risk inform the development of policies for controlling and managing risks to health and well-being in water recreation.

'The assessment of a beach or water should take into account several key considerations including:
- the presence and nature of natural or artificial hazards
- the severity of the hazard as related to health outcomes
- the availability and applicability of remedial actions
- the frequency and density of use
- the level of development.'

Several of these considerations are being taken into account in the development of the Royal National Lifeboat Institution's (RNLI) risk assessment model for use on UK beaches.

Project/Partners
One of the most highly accepted science-based models for assessing beaches is the Australian Beach Safety and Management Program (ABSAMP). The RNLI is working with the University of Plymouth to modify the programme for use on UK beaches. Alongside this, the RNLI is working with the Marine Conservation Society (MCS) to create a database of all UK beaches on which to record baseline information to assist the risk assessment process.

Results and discussion
The RNLI's programme considers the implementation of beach risk assessments/safety audits through a three-step process that takes advantage of established scientific principles, established best practice and benchmarking against available standards and guides.

Appropriate best practice models already exist from a number of organisations, both for generic risk assessments and for beach risk assessments. The intention is to incorporate these best practice models into the programme.

As part of forming any recommendation, reference to the available standards and guides ensures appropriate benchmarks are conformed with.

Learning outcomes
1. To understand the principles of risk assessments.
2. To understand the scope of hazards in the beach and coastal environment.
3. To understand what the RNLI, University of Plymouth and partnering organisations are implementing in the UK to reduce drownings through the development of a risk assessment programme.

[†]Corresponding author: Peter Dawes
RNLI, West Quay Road, Poole, UK, BH15 1HZ
E-mail: pdawes@rnli.org.uk, Tel: +44 (0) 1202 663531, Fax: +44 (0) 1202 663550

E-mail of co-author: Timothy Scott, timothy.scott@plymouth.ac.uk

RESEARCH IN LIFESAVING - DEVELOPING THE PLAN

**DEVELOPING A BEACH RISK ASSESSMENT MODEL
FOR PRACTICAL APPLICATION IN THE UK**

Peter Dawes[†] RNLI, Poole, UK

Context

The RNLI is undertaking a programme that considers the implementation of beach risk assessments/safety audits through a three-step process taking advantage of established scientific principles, established best practice and benchmarking against available standards and guides.

One of the most highly accepted science-based models for assessing beaches is the Australian Beach Safety and Management Program (ABSAMP). The RNLI, with the University of Plymouth, is modifying the programme and developing a risk assessment model for practical application on UK beaches. The RNLI is also working with the Marine Conservation Society (MCS) to create a database of all UK beaches on which to record baseline information to assist the risk assessment process.

Appropriate best practice models already exist from a number of organisations, both for generic risk assessments and for beach risk assessments. The intention is to incorporate these best practice models into the RNLI's programme.

As part of forming any recommendation, reference to the available standards and guides ensures appropriate benchmarks are conformed with.

Partners

The Australian Beach Management and Safety Program (ABSAMP) is a comprehensive study of every beach in Australia. In the Australian programme, detailed information about every beach has been amassed to develop a wide-ranging, standardised and scientific information base of all Australian beaches with regard to their location, physical characteristics, access, facilities, usage, rescues, physical and biological hazards, and level of public risk under various wave, tide and weather conditions. Surf Life Saving Australia (SLSA) and Surf Life Saving Great Britain (SLSGB) shared the programme.

The RNLI is now working with the University of Plymouth to modify ABSAMP for the UK coastline and the baseline information about UK beaches is being recorded onto a shared database created with the Marine Conservation Society (MCS). To assist with the risk assessment process, SLSGB and the Royal Society for the Prevention of Accidents (RoSPA) provide continuing advice and liaison to develop practicable models for beach safety risk assessments. The RNLI also engages with a number of key stakeholders through a range of memorandum of understandings and service agreements, including the Maritime and Coastguard Agency (MCA), local authorities, police and ambulance services.

Project

In its *Guidelines for safe recreational water environments* [1] the World Health Organization states: 'Assessment of hazard and risk inform the development of policies for controlling and managing risks to health and well-being in water recreation. … The assessment of a beach or water should take into account several key considerations including:

- the presence and nature of natural or artificial hazards
- the severity of the hazard as related to health outcomes
- the availability and applicability of remedial actions
- the frequency and density of use
- the level of development.'

Several of these considerations are being taken into account in the development of the RNLI's risk assessment model for use on UK beaches. The beach mapping system is still under development but research from this programme is being used to better inform the risk assessment process.

Best practice

In developing a proactive approach to managing risks at beaches, the starting point is to establish a safety management system based on acknowledged good practice. After reviewing a number of potential models, the RNLI identified, for the purpose of the development of beach safety risk assessment, that best practice in risk management was represented by the Australian/New Zealand Standard® *Risk Management* AS/NZS 4360:2004 [2].

The objective of AS/NZS 4360:2004 is to provide guidance to enable public, private or community enterprises, groups and individuals to achieve:

- a more confident and rigorous basis for decision-making and planning
- better identification of opportunities and threats
- gaining value from uncertainty and variability
- proactive rather than reactive management
- more effective allocation and use of resources
- improved incident management and reduction in loss and the cost of risk, including commercial insurance premiums
- improved stakeholder confidence and trust
- improved compliance with relevant legislation
- better corporate governance.

This provides a generic framework and the main elements of the risk management process identified within the Standard are:

- communicate and consult
- establish the context
- identify risks
- analyse risks
- evaluate risks
- treat risks
- monitor and review.

Figure 1: Risk management process – an overview
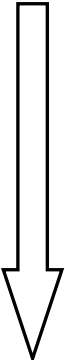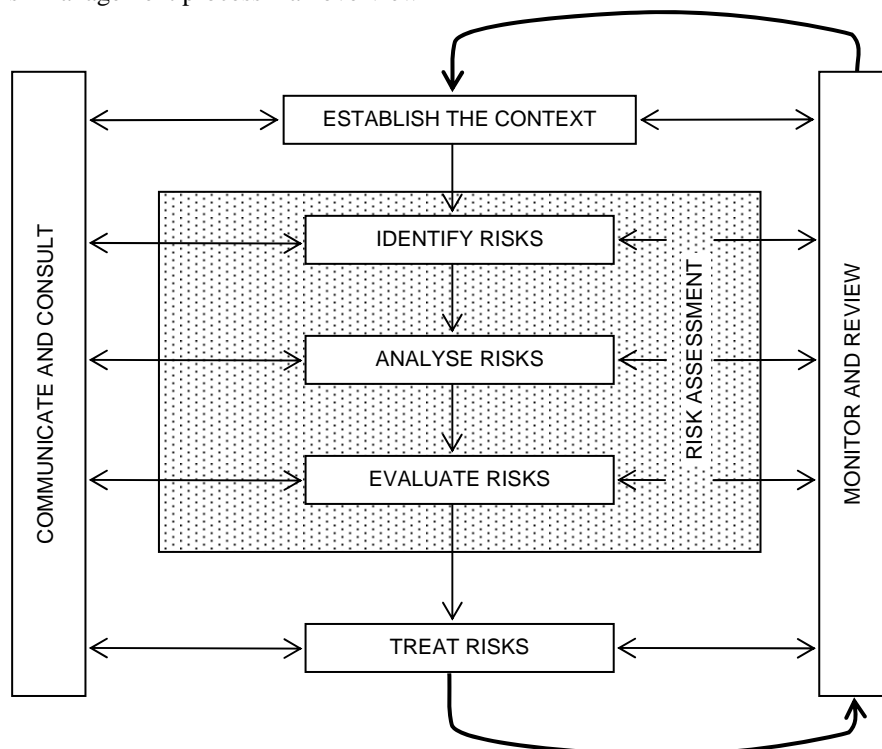
Establishing the context

Establishing the context requires an assessment of the internal and external drivers to conduct a risk assessment and a clear understanding of what the organisation wishes to achieve during the risk assessment process.

Determining a duty of care

In the UK, the Health and Safety at Work Act 1974 places a duty on employers to ensure, as far as is reasonably practicable, that in the course of their undertaking members of the public are not put at risk. The duty to carry out risk assessments extends to visitors as well as employers. A further statutory duty towards visitors arises under the Occupiers Liability Act 1957. An occupier of premises (the premises can include the beach and equipment upon it, like staging and diving boards) has a duty of care to any visitor using the premises for the purposes for which he/she is permitted or invited to be there.

Determining the level of duty of care has been a challenge for land managers and there is no simple answer. However, as a general guide, the more a land manager encourages or promotes activities and provides facilities the greater the duty of care.

Table 1: Determining the level of duty of care

Type of facility provision	Typical built environment	Type of activity promoted	Duty of care
No definable access	Remote rural	Scenic views and walks	Lower
Informal access points	Rural coast	Beach and coast walks	
Formal access points		Family activities on beaches ('bucket and spade')	
Specific car parking for beach users, good access to public transport			
Changing rooms, shower points, coastal promenades	Coastal resort	Swimming and in-water activities, organised groups and events	
Off-beach commercial activity related to beach usage (kiosks, surf hire outlets and others)	Resort beach		
On-beach commercial activity related to beach usage (surf schools, beach kiosks and others)			Higher

A history of incidents would also increase the level of duty of care. While any single incident would not necessarily be a true indicator of risk, a series of incidents or near misses would represent evidence of a trend. A lack of incidents, however, would not mean there was no risk potential.

Results

Conducting the risk assessment

The Health and Safety Executive (HSE) has provided some limited guidance on practical risk assessments and also sets out a simple five-step guide to conducting a risk assessment [3]:

1. Identify hazards.
2. Decide who might be harmed and how.
3. Evaluate the risks and decide on precautions.
4. Record your findings and implement them.
5. Review your assessment or establish a review process and update if necessary.

A beach risk assessment follows a similar process.

A hazard is anything with the potential to cause harm (HSE). However, the range of hazards in beach and coastal environments is often poorly understood. This is especially the case if the person assessing the environment has limited experience or training in coastal hazards and the risks they present. In this situation beach owners should consider the need for taking on formal advice if they feel they lack the expertise to conduct a risk assessment that meets the specific needs of the beach and coastal environment.

Hazards on beaches fall into two broad categories:

> Environmental
> Human

While there are two distinct categories of hazards, it is the interplay between them (that is the interaction between people and their environment) that creates risk.

Table 2: Beach and coastal hazards

Hazard grouping	Hazard	Adverse outcomes
Beach front	Steep cliffs	Fall from heights
	Unstable cliffs/rock falls/mud slides	Fall from heights, impact injures
	Unstable and/or eroded dunes	Sand collapse
	Unsafe beach access	Trips and falls
	Unsafe walkways and lookouts	Trips and falls
	Partially buried or undermined fencing	Trips and falls
	Unsafe buildings and structures	Fall from heights, trips and falls
Beach profile	Vertical drop/sudden drop-off/steep slope	Drowning, near drowning
	Shallow sand banks	Diving injuries
	Rock shelves/reefs	Diving injuries
	Submerged rocks/objects/debris	Diving injuries
	River mouth	Drowning, near drowning
	Headland	Fall from heights
	Mud/quicksand/loose shingle	Caught in mud/sand, loss of footing
Man-made (coastal) structures	Utilities infrastructure	Trips and falls, impact injuries in surf zone
	Groynes	Impact injuries in surf zone
	Jetties/piers	Diving injuries
	Rock swimming and paddling pools	Diving injuries
	Buoys and lines	Entanglement
Water quality and waterborne hazards	Storm-water outlet	Illness
	Sewage outlet	Illness
	Biological hazards/animal excrement/agricultural runoff	Illness
	Pollution/litter	Illness, injury from objects
Surf conditions	Tidal currents	Drowning, near drowning
	Surf zone currents/rips	Drowning, near drowning
	High surf	Impact injuries
	Dumping waves	Impact injuries
	Extensive tide range	Tidal cut off
Weather	Strong winds	Inflatable blown out to sea
	Storms/hail/heavy rain	Loss of visibility
	Fog/mist	Loss of visibility
	Lightning	Electrocution
	UV radiation (Sun)	Sunburn, skin damage, skin cancers
Dangerous animals and marine life	Dogs/other (uncontrolled) domestic animals	Bites
	Large dangerous marine life	Shark attack
	Stinging fish (weaver fish), rays	Stings

Hazard grouping	Hazard	Adverse outcomes
	Common marine stingers (jellyfish)	Stings
	Other dangerous marine life	Various
General hazards	Fire safety	Burns
	Electrical safety	Electrocution
	Hazardous or explosive substances	Various
	Dangerous litter (glass, disposable barbeques, and others)	Cuts and burns
	Natural/man-made disasters	Various

The identification of beach usage patterns helps to identify hazards as low, medium or high risk (see table 3).

Table 3: Activity hazards

Location	Activity	Risk potential
Beach and dune areas	Sunbathing[1] Picnicking Sightseeing Walking Dog walking Beachcombing Beach fishing	Lower
	Beach games Small kite flying Jogging Cycling Rock walking Rock fishing Vehicle parking	Medium
	Contact sports Large kite flying Climbing/bouldering/coasteering Horse-riding Wind-powered vehicles 4WD vehicles Quad/dirt bikes	Higher
Swash and surf zone	Paddling Wading	Lower
	Swimming Inflatable users Bodysurfing Bodyboarding	Medium
	Wave dodging Cliff, rock or pier jumping Surfing Windsurfing Kitesurfing Personal watercraft	Higher
Beyond surf zone	Rowing (oar or paddle)	Lower
	Sailing Snorkelling/Scuba	Medium
	Powered craft Skiing	Higher

[1] While the immediate risk associated with sunbathing is low there are long-term health concerns from any excessive exposure to the Sun's UV rays, ranging from skin damage to increased risk of skin cancer.

Identifying the types of people most at risk enables beach visitors to be categorised according to low-, medium- or high-risk groups.

The very young (0–4 years) are the highest risk group for drowning in still-water environments. This group is vulnerable without constant adult supervision. Statistics consistently indicate that males account for a disproportionate number of drownings; risk-taking behaviour through bravado, adventurousness, alcohol and misjudgement is a contributing factor and the risk-taking behaviour is often increased when there are groups involved. Drowning statistics also indicate a high number of victims suffer medical emergencies, often from pre-existing medical conditions. People unfamiliar with a beach environment, such as overseas and inland visitors, are less aware of coastal hazards and therefore tend to be highly represented in drowning figures. Severe environmental hazards, such as steep cliff faces, rips or currents, pose a danger to all visitor groups.

Treat the risk

Countering the drowning chain

The drowning chain is the sequence of events that leads to a drowning or potential drowning. The implementation of control measures is a matter of taking reasonable and practicable steps to intervene and break the sequence that may lead to a drowning (see table 4).

Table 4: Control measures and applications required to countermeasure the sequence of events leading to potential drowning

The sequence	Countermeasure	Control measures	Applications
Ignorance, disregard or mismanagement of danger	Education and information	Pre-arrival education	▪ Electronic and digital media ▪ Leaflets/brochures/posters ▪ Awareness programmes
		Arrival information	▪ Information signage
		Safe beach access	▪ Formal access points ▪ Disabled access
		On-site education	▪ Public address systems ▪ Face-to-face messages
Uninformed or unrestricted access to the hazard	Denial of access and/or provision of warnings	Barriers	▪ Fencing and/or access barriers ▪ Booms ▪ Buoys and buoy lines
		Signage	▪ Information signage ▪ Warning signage ▪ Prohibition signage ▪ Flags
		Byelaw development	▪ Formal regulatory arrangements ▪ Recognition of lifesaving services
Lack of supervision	Provision of supervision	Trained observers	▪ Trained activity supervisors ▪ Coaches and instructors
		First aid facilities	▪ Portable first aid kits ▪ Permanent/fixed facilities
		Lifeguard services	▪ Intermittent (roving) ▪ Surveillance ▪ Full service (between the flags or open beach) ▪ Emergency response and after hours call out
		Activity management	▪ Self-regulation programmes ▪ Club/group registration ▪ Permit systems

The sequence	Countermeasure	Control measures	Applications
		Activity restrictions	▪ Zoning ▪ Beach/water closure
Inability to cope once in difficulty	Acquisition of survival skills	Community training	▪ Survival skills (including learn to swim) ▪ Self-rescue skills ▪ Rescue skills
		Emergency communications	▪ Public telephone ▪ Outpost alarms ▪ Dedicated emergency telephone ▪ Radio
		Public rescue equipment (PRE)	▪ Life rings ▪ Throw lines ▪ Other extraction equipment and fixtures

Determining the need for a lifeguard service

One of the challenges for auditors/coastal managers/beach operators is establishing the need for a lifeguard service. This need can have the tendency to become an emotive issue and also to bring with it a considerable cost consideration.

The RNLI has developed a simplified calculator (see table 5) for providing an initial indicator that a lifeguard service may be appropriate.

Table 5: Simplified risk calculator for beaches

	Energy		Population	
Rating	**Tides**	**Average wave height**	**Population (in-water)***	**Conflicting activities****
1	Normal tidal range	0–0.25m	1–25	Isolated incidents
2	Extensive Tidal Range	> 0.25–0.5m	> 25–50	Regular
3	Potential for tidal cut off	> 0.5–0.75m	> 50–75	Persistent
4	Extensive tidal range with potential for cut off	> 0.75–1.0m	> 75–100	Persistent and dangerous
5		> 1.0–1.5m	> 100–150	
6		> 1.5–2.0m	> 150–200	
7		> 2.0m	> 200	
* For calculating the in-water population to include surf craft, a novice surfer = 0.5 and an experienced surfer or bodyborder = 0.25 ** Conflicting activities are defined as those activities where there is a danger created from non-compatible activities such as swimming and surf craft or swimming/surfing and powered craft.				

To calculate the risk rating for any given beach:
Risk = Energy (tides + wave) + Population (in-water population + conflicting activity)

Example:
Using the table above, a beach with:
- Normal tidal range   =   1
- Average wave height of 1.25m =   5
- In-water population of 175   =   6
- Conflicting activities – regular =   2

The total risk rating for this beach would be:
- Risk = Energy (tides + wave) + Population (in-water population + conflicting activity)
- Risk = (1+5) + (6+2)
- Risk = 6 + 8 = 14

The total risk would be 14, which is a medium–high risk potential (see table 6).

Table 6: Risk levels and risk potential

Risk	Risk potential
15+	Higher
12-15	Medium–higher
8-12	Medium
5-7	Lower–medium
0-4	Lower

When the risk potential has been determined it is then possible to establish the appropriate control measures and whether a lifeguard service may be appropriate (see table 7).

Table 7: Suggested control measures

Risk level	Suggested controls – provided as a general indicator only
Higher	• Lifeguards may regularly close the beach to aquatic activities • Lifeguards will require additional support (increased personnel or equipment levels)
Medium–higher	• Lifeguards may occasionally close the beach to aquatic activities • Lifeguards may require additional support (increased personnel or equipment levels)
Medium	• Lifeguards normally recommended
Lower–medium	• Lifeguards should be considered • PRE should be considered • Signage strongly recommended
Lower	• Signage should be considered • PRE may be considered • Pre-arrival education

Monitor and review

Once the appropriate control measures and lifeguard service have been established it is then important to monitor and review this at regular intervals. To assist in the process of monitoring and reviewing the effectiveness of the risk management process, the RNLI is developing a uniform system for recording incidents reported by lifeguards known as Beach Related Emergencies (BEAREM). The RNLI is working with key stakeholders in the National Water Safety Forum (NWSF) to agree a common reporting system for coastal and sea-related fatalities.

Benchmarks

The RNLI has been investing considerable effort into the development of a series of guidelines that can be used as benchmarks for different aspects of the risk assessment. These guidelines and standards include:

- o *A guide to beach safety signs, flags and symbols*
- o *A guide to coastal public rescue equipment*
- o Medical and fitness standards for lifeguards
- o *A lifeguard's guide to beach safety education*

Discussion

The risk assessment model under development by the RNLI allows beach managers to gain positive benefits from conducting a risk assessment process. Managing risk in the coastal environment requires the systematic application of management policies, procedures and practices to the tasks of identifying, analysing, treating and monitoring risk. Risk assessment must take a holistic approach when determining the most effective actions and control measures to implement.

The rationale behind carrying out a risk assessment is that it:

- provides the basis for a risk management plan
- improves safety and reduces the risk of death or injury at the site
- ensures the best use of resources and encourages effective management and cost effective operations
- reduces the potential for litigation stemming from accident and management practices
- provides guidance for the development of policies, procedures and practices.

The mapping of all UK beaches by the RNLI is still under development. However, the implementation of the risk assessment model by the RNLI and partnering organisations for implementation on UK beaches will go a long way towards enabling beach managers to undertake the World Health Organization's advice to 'inform the development of policies for controlling and managing risks to health and well-being in water recreation'.

Learning outcomes
1. To understand the principles of risk assessments.
2. To understand the scope of hazards in the beach and coastal environment.
3. To understand what the RNLI, University of Plymouth and partnering organisations are implementing in the UK to reduce drownings through the development of a risk assessment programme.

References:

[1] World Health Organization, 2003, *Guidelines for safe recreational waters Volume 1 - Coastal and fresh waters*

[2] Australian/New Zealand Standard® AS/NSZ 4360:2004, *Risk Management*

[3] Health and Safety Executive, revised 06/06, INDG163 (rev2), *Five steps to risk assessment*

[†]Corresponding author: Peter Dawes
RNLI, West Quay Road, Poole, UK, BH15 1HZ
E-mail: pdawes@rnli.org.uk, Tel: +44 1202 663531, Fax: +44 1202 663550

E-mails of co-authors: Timothy Scott, timothy.scott@plymouth.ac.uk