Project Blue Print – State Wide Coastal Public Safety Risk Assessment Program

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Abstract

New South Wales (NSW) accounts for almost 50% of the national coastal drowning toll. There have been 262 coastal drowning deaths in NSW between July 2004 and July 2011. The majority of these can be attributed to swimming/rip-currents and rock-fishing, with almost all occurring at unpatrolled locations or outside of patrol operational times, where no expert assistance is immediately available.

Accidental drowning deaths in the coastal aquatic environment can be accounted for through a number of causal factors known as the 'drowning chain'.

These are:

- Lack of knowledge, disregard or misjudgement of the hazard.
- Uninformed, unprotected or unrestricted access to the hazard.
- Lack of supervision or surveillance.
- An inability to cope once in difficulty.

Australian CoastSafe is undertaking an ambitious project after funding approval was granted under the NSW Water Safety Black Spot Fund to conduct 'Project Blue Print', a coastal public safety risk assessment for every beach and rock platform in NSW. This project will be fundamental in addressing the coastal drowning issue in NSW in the short, mid and long term.

The project will do this by providing a long-term, sustainable and effective drowning prevention strategy based upon clear evidence and data, engagement of all relevant stakeholders and the application of effective risk mitigation and drowning prevention initiatives where and when they are required.

Further to this, the assessment of all coastal water access-ways and locations in NSW will provide a suite of assigned individual access/location numbers (emergency marker system) which can be added to existing or future signage. SLSNSW will work with key emergency service stakeholders to align this information into the various (000) CAD systems - to improve emergency response.

This paper will provide details on the scope of the project, the risk management methodologies applied to guide the recommendation of drowning prevention strategies and the tools developed to deliver this project.

Introduction

Over 85% of Australians live near the coast (ABS, 2001) and our tourist beaches alone receive an estimated 110 million visitations (Surf Safety & Rips Study, October 2009) every year. The vast coastline of Australia covers more than 35,877kms and when all islands are included the length increases to 59,736kms (Source: Geoscience Australia).

Most people living near the coast live in capital cities, as seven of these are situated on the coast. However, there has been rapid growth of coastal areas outside of Australia's capital cities. In 2008, the Australian Bureau of Statistics reported that Australians are still heading to the coast, with many of Australia's coastal regions experiencing population gains.

Whilst a magnet for living by and visiting, coastal regions come with inherent, and up until now, unpredictable risk. In the past 100 years Surf Life Saving has saved over 500,000 lives at our beaches and continues to rescue more than 12,000 people every year.

Since 1907, when a group of surf life saving clubs on Sydney's beaches first emerged, the network of services protecting our coastline has grown rapidly. Today, volunteer surf lifesavers, SLS and council employed lifeguards, rescue helicopters, rescue power craft, surveillance systems and radio control and coordination centres all work together to ensure that our beaches are the safest in the world. This collaborative approach to coastal safety is essential in preventing drowning along our coastline.

Despite this extensive network of services, coastal drowning deaths are still at unacceptable levels. In 2010-2011, there were 22 coastal drowning deaths (SLSA, 2011) in New South Wales, and while this figure is down on the previous year's 39 coastal drowning deaths and the seven-year average of 35, it still shows that there is significant work ahead of us – every life lost is one life too many.

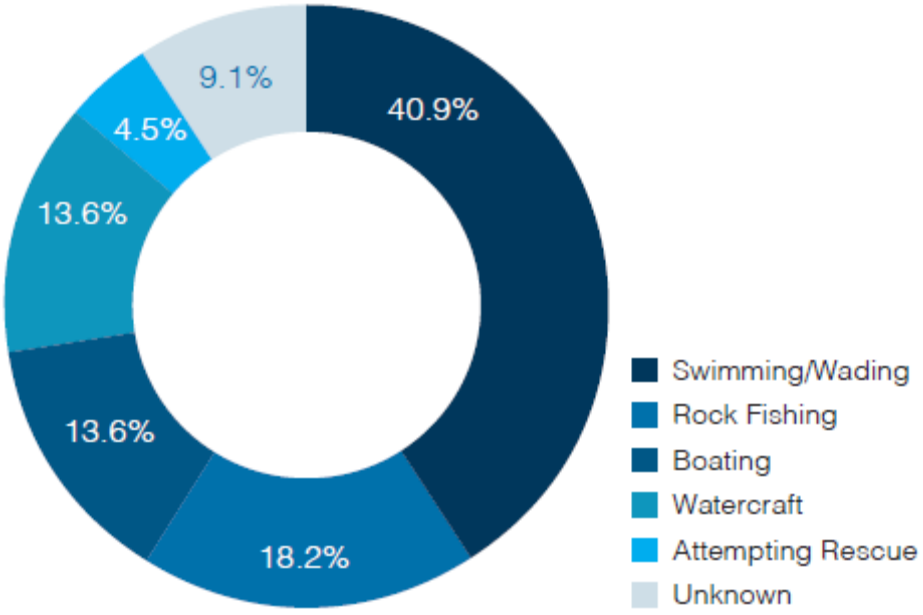

Figure 1: NSW Coastal Fatality Summary (n=22) (SLSA, 2011)

Both the number and rates of coastal drowning deaths have continued to decrease last year. The average rate of coastal drowning deaths from 2004-07 is 0.50, the current three year average rate is 0.47. This is a 6% reduction in the average rate of coastal drowning deaths.

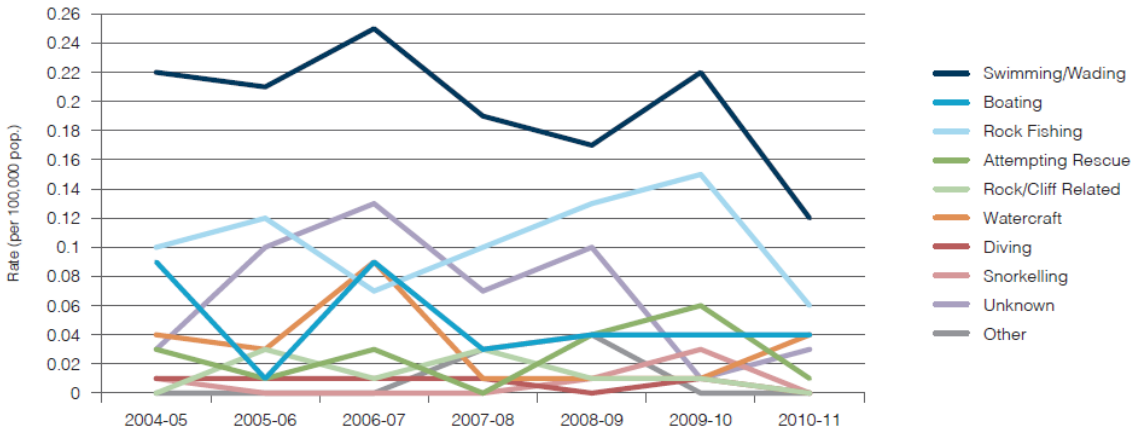

Figure 2: Seven year NSW coastal drowning incidents (SLSA, 2011)

Of the 721 (Short, 2007) beaches now identified by ABSAMP, only approximately 157 or 21.8% have a lifesaving service that is provided by the lifesaving clubs affiliated with SLSA and patrolled by lifeguard services provided by SLSA and local governments across Australia.

Surf Life Saving continues to address the following issues:

- The risk of drowning (fatal and non fatal) on the coast has many contributing factors.
- Risk management concepts of hazard, uncertainty and opportunity based risk collectively provide opportunities for drowning prevention
- Despite ongoing efforts, coastal drowning continues at unacceptable levels.
- SLS has many systems in place to collect, analyse and communicate information.
- Maintaining this information is very resource intensive.

In order to address these issues, Surf Life Saving has developed a suite of low cost, hi-tech, location based tools. These tools are used for a range of applications including, public education, data collection, event risk management and coastal public safety risk assessment.

Background

Aquatic public safety risk assessments have been provided by Surf Life Saving Australia to coastal land managers and developers for more than a decade.

At the 20th NSW Coastal Conference (2011) in a paper titled *Using accessible cost effective technology to save lives*, the development of the technology and tools being used to facilitate this project was explained. These tools, such as the CoastSafe iRisk Assessor iPad application are allowing a small team of qualified assessors to complete this project with accuracy and efficiency.

Figure 3: SLSA's suite of coastal safety risk management tools

Risk Management & Coastal Safety

Surf Life Saving's coastal public safety risk assessment program has its origins in 1986 following a meeting between Andrew May (SLSNSW), Angus Gordon (NSW PWD), Prof. Bruce Thom and Prof. Andrew Short which was initiated by Surf Life Saving New South Wales (SLSNSW) in order to address the problem of how best to compile a database of beaches in NSW and how to assess their safety (Short, 1993). Initially, this resulted in the formation of the NSW Beach Safety Program, a joint venture between the Coastal Studies Unit of the University of Sydney and SLSNSW. The success of this program eventually led to the formation of the Australian Beach Safety and Management Program (ABSAMP) and the expansion and development of a national database containing information on the geomorphology and safety of all Australian coastal beaches (Short, 1993).

The main aims of the program are to:

- Develop a comprehensive, standardised and scientific information base on 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.
- Expand and improve the management and safety services of all Australian beaches, and to assist other countries to develop similar programs.

The ABSAMP database currently contains comprehensive data on over 11,500 beaches around Australia. ABSAMP is based on integration of a scientific understanding of beaches, their hazards and usage, together with the expertise in beach safety management and resources of SLSA, utilising the latest technology for data management and analysis. The program has already had wide application and impact on the management of Australian beach systems, and will play an increasing role in their management into the next century, particularly as growing coastal development, population and tourism all demand accessible, yet safe, beaches for public recreation and tourism.

The resulting database and beach models and classification system (Short, 2006) form the foundation of Surf Life Savings coastal public safety risk management program. Used in conjunction with the international standard for risk management ISO 31000:2009 *Risk Management: Principles and Guidelines* and other relevant industry compliance standards and guidelines the program provides Surf Life Saving an internationally recognized scientific core system for the management and understanding of risks to public safety and the management of these risks around the Australian coast.

Project Blue Print

Surf Life Saving NSW received funding through the NSW Ministry of Police and Emergency Services through its Water Safety Black Spot Fund to conduct a coastal public safety risk assessment for every beach and rock platform in NSW, which will be fundamental in addressing the coastal drowning issue in NSW in the short, mid and long term.

The project will do this by providing a long-term, sustainable and effective drowning prevention strategy with clear evidence/data, engagement of all relevant stakeholders and the application of effective risk mitigation and drowning prevention initiatives where and when they are required.

This project will provide a 'Blue-Print' for NSW from which an effective drowning prevention strategy can be developed to meet the National/State goal to reduce drowning deaths by 50% by 2020.

Methodology

The SLSA coastal public safety risk management program is endorsed by International Life Saving Federation and is aligned to International and Australian standards for risk management. The core of the program is the ABSAMP database, beach classification models and hazard rating system. The coastal public safety risk assessment process involves the following:

1. Determine the minimum acceptable level of risks and potential injuries through completion of a risk assessment in accordance with recognised guidelines, standards and best practice;
2. Provide economically sustainable risk mitigation options;
3. Provide recommended staging plans considering the environmental conditions, forecast settlement areas, beach access and usage;
4. Review the status of aquatic safety and signage management;
5. Evaluate the level of compliance or noncompliance with relevant regulations and standards.
6. The assessment will include reference to:
    a) The Australian Beach Safety and Management Program (ABSAMP)
    b) The Australian Coastal Public Safety Guidelines;
    c) Beaches of Australian coast – A guide to their nature, characteristics, surf and safety
    d) The National Aquatic and Recreation Signage Style manual;
    e) Relevant standards including AS 2416 – 2010 Water Safety Signs and Beach Safety Flags and A/NZS ISO 31000:2009 Risk Management – Principles and Guidelines
7. Consult with relevant community stakeholders including volunteer surf life saving services, beach safety liaison committees and other community organisations involved in or impacted by beach safety.

The diagram below shows the steps involved for the project. These steps will be repeated for each assessment area.

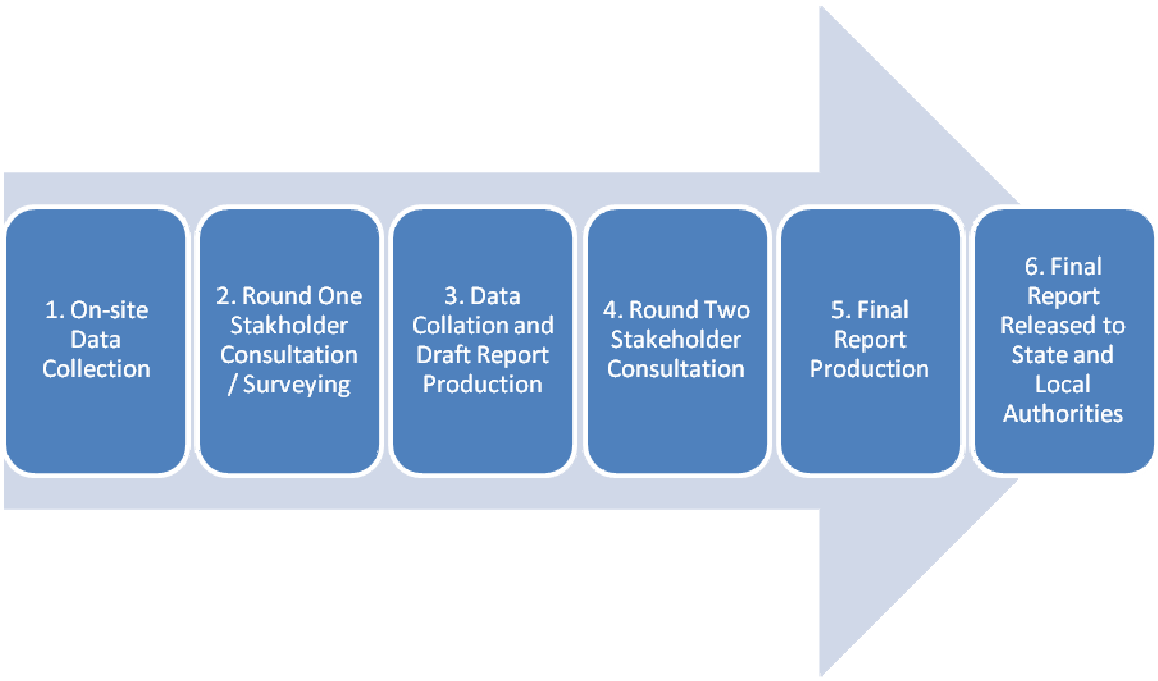

Figure 4: The steps involved throughout the assessment process of Project Blue Print

Whilst on the coast, qualified CoastSafe Assessors use cutting edge tools, developed by Surf Life Saving Australia to collect and assess data on an unprecedented scale. All collected data is geocoded and can be analysed using Geographic Information Systems (GIS) and incorporated into mapping systems of land managers.

Using advanced mobile technology CoastSafe Assessors audit and assess numerous aspects of the NSW coastline which have been identified as factors which contribute to the usage, hazardousness and risk. These include:

- **Hazards** – such as rips, dangerous currents, sand banks, rocks, reefs, manmade structures, litter and debris, erosion, predatory wildlife, etc.
- **Access** – identification of all methods of accessing the assessed location, both formal and informal
- **Existing Signage** – audit and recording of all signage laying within the assessed area, and where appropriate the level of compliance of existing signage with relevant Australian Standards and Guidelines
- **Recommended Signage** – positioning and placement of any recommended signage, including the removal or consolidation of existing signage
- **Facilities** – audit and recording of all facilities and structures in place within the assessment area that attract visitors and encourage use of a location
- **Existing Rescue Equipment** – audit and recording of all existing public and emergency rescue equipment within the assessment area
- **Recommended Rescue Equipment** - positioning and placement of any recommended public rescue equipment
- **Supporting Services** – audit and recording of external supporting emergency services and their ability to respond to emergency incidents at the assessed location

Project Blueprint utilises the SLSA CoastSafe Aquatic Public Safety Risk Assessment methodology, which is conducted to the following standards:

- A/NZS ISO 31000:2009 Risk management – Principles and Guidelines

- AS2416:2010 Water Safety Signs and Beach Safety Flags
- AS 2899:1986 Public Information Symbols Part 1 and 2
- AS2342: 1992 Development, Testing and Implementing of Information and Safety Symbols and Symbolic Signs
- ISO9001:2000 Quality Management Systems

All SLSA CoastSafe Assessors have attained the SLSA Certificate in Coastal Public Safety Risk Assessment. This qualification includes the following units of competency from the Diploma of Quality Auditing:

- BSBOHS509A – Ensure a Safe Workplace
- BSBOHS505B – Manage Hazards in the Workplace
- BSBRSK501A – Manage Risk
- BSBCOM501B – Identify and interpret compliance requirements

Risk Mitigation Strategies

Any risk treatment options provided through the assessment process are presented for the consideration of the land manager; although they are not binding they are made with supporting evidence and alignment to appropriate standards. Council/Land-Managers are provided the opportunity to review and provide feedback on the draft documents before they are finalised. Example risk treatment options include, but are not limited to, the following:

- Compliant water safety signage content: Options for change, or validation of existing signage content,
- Compliant water safety signage positioning: Options for change, or validation of existing signage placement,
- Coastal Access: Options for formalisation/elimination/validation of existing access-ways
- Public Rescue Equipment (e.g. Angel-rings): Identification of existing PRE, options for change or validation of existing
- Public Education: Identification of existing initiatives/validation/options for change. Examples such as Coastal Accommodation water-safety collateral, multi-lingual options, alignment of key safety messages/information portals, public access to information, targeted ethnic/activity education workshops (most of which are available through existing SLS and other organisation programs)
- Silent Sentries/Emergency Beacons: Identification of existing/validation/options for extension or reduction
- Lifesaving Services: Identification of existing service provision/validation/options for extension or reduction/options for changes to service integration & joint response

Progress to date

Project Blueprint officially commenced in June, 2012.

To date, Australian CoastSafe has covered a total of 204.3 kilometres of coastline. This represents 50% of the total coastline scheduled for assessment in year one of Project Blue Print. Although this is an ambitious project, Australian CoastSafe is pleased to report this project is on track to deliver the proposed outputs for year one.

This includes the coasts of the following regions:

- Tweed
- Byron Bay

- Ballina
- Lake Munmorah State Conservation Area
- Randwick

Assessment reports for the areas where data has been collected are currently in production or going through a consultation process with key stakeholders.

Data & Results

The table below shows a summary of the data collection phase for the regions where data collection has been completed. It is worth noting that whilst in the field, CoastSafe Assessors are recording a spatially referenced point of data every 1 minute and 39 seconds.

Table 1: A summary of the areas which have had data collected as part of year one of Project Blue Print.

Region	Coastline Length (KM)	Data Collection Duration (HR)	Total Data Collected (Points)	Average time per point
Tweed	38.56	52.5	2048	1 min 32 sec
Lake Munmorah State Conservation Area	16.50	30	572	3 min 9 sec
Byron	38.50	45	1834	1 min 28 sec
Ballina	34.33	30	1309	1 min 23 sec
Randwick	25	46.8	1907	1 min 28 sec
Total	**152.89**	**204.3**	**7670**	**1 min 36 sec**

The following section present detailed results and data which have been collected during the on-sits assessments conducted to date as part of Project Blue Print. The information included in this paper is raw data and is yet to be assessed and interpreted. The data, specifically the number of hazards identified at any given location, is not intended to be an indication of the overall hazardousness of a location. It is, however, an indication of the amount of data which has been collected and will be used to form the basis of strategies to reduce drowning along the NSW coast.

Tweed Shire

Data collection for the Tweed Shire took place between 2nd July and the 7th July, 2012. During this period a total of 38.56 kilometers of coastline was assessed and audited. A total of 2048 individual data points and associated metadata were collected at an average collection time of 1 minute and 32 seconds per point of data. The tables below shows a summary of the individual points of spatial data collected during the assessment.

Table 2: A summary of the data collected for the Tweed Shire.

Beach	Hazard	Access	Signage	Facility	Rescue Equipment	Service	Totals
Duranbah	25	12	34	32	1	2	**106**
Fingal	89	43	42	25	1	2	**202**
Kingscliff	125	59	114	112	0	3	**413**
Cabarita	179	61	180	170	3	2	**595**
Norries Head	16	3	9	18	0	0	**46**

South Bogangar	54	17	35	9	0	0	**115**
Hastings Point Inlet	20	7	24	1	0	1	**53**
Hastings point	73	31	55	40	1	0	**200**
Pottsville	56	20	43	20	1	1	**141**
Wooyung	96	21	47	12	0	1	**177**
Total	733	274	583	439	7	12	**2048**

Munmorah State Conservation Area

Data collection for the Munmorah State Conservation Area took place between 23rd July and the 26th July, 2012. During this period a total of 16.5 kilometers of coastline was assessed and audited. A total of 572 individual data points and associated metadata were collected at an average collection time of 3 minute and 9 seconds per point of data. The tables below shows a summary of the individual points of spatial data collected during the assessment.

Table 3: A summary of the data collected for the Munmorah State Conservation Area.

Location	Hazards	Access	Signage	Facility	Rescue Equipment	Service	Totals
Birdie Beach	30	10	38	39	0	0	**117**
Catherine Hill Bay Rock platform	8	2	0	0	0	0	**10**
Moonee Rock Platform	23	7	4	0	7	0	**41**
Moonee Beach	30	6	4	2	0	0	**42**
Flat Island	32	4	3	1	2	0	**42**
Little	23	2	1	0	0	0	**26**
Timber Beach	7	2	0	0	0	0	**9**
Bongon Head	16	5	1	1	2	0	**25**
Bongon Beach	5	2	1	0	1	0	**9**
Frazer Beach	28	8	19	26	3	1	**85**
Deadmans Beach	16	0	0	0	1	0	**17**
Wybung Head	36	3	4	3	1	0	**47**
Little Birdie	12	1	1	0	1	0	**15**
Red Ochre Rock Platform	14	1	1	0	6	0	**22**
Birdie / Budgewoi / Lakes	11	8	7	0	0	0	**26**
Snapper Point	19	7	5	6	2	0	**39**
Totals	**310**	**68**	**89**	**78**	**26**	**1**	**572**

Byron Bay Shire

Data collection for the Byron Bay Shire took place between 1st August and the 5th August, 2012. During this period a total of 38.5 kilometers of coastline was assessed and audited. A total of 1834 individual data points and associated metadata were collected at an average collection time

of 1 minute and 28 seconds per point of data. The tables below shows a summary of the individual points of spatial data collected during the assessment.

Table 4: A summary of the data collected for the Byron Shire.

Beach	Hazard	Access	Signage	Facility	Rescue Equipment	Service	Totals
South Golden	62	16	39	32	0	0	**149**
Tyagarah	65	16	45	4	0	0	**130**
New Brighton	80	31	74	31	1	0	**217**
Brunswick Heads	45	14	47	1	2	0	**109**
Belongil	70	26	55	26	0	0	**177**
Main (Byron Bay)	35	10	41	79	0	2	**167**
The Pass	11	3	15	27	0	0	**56**
Clarks	39	13	43	50	0	0	**145**
Wategos	17	9	15	19	0	0	**60**
Little Wategos	20	3	14	10	2	0	**49**
Tallow's	69	20	44	10	2	0	**145**
Suffolk Park	45	18	52	34	0	0	**149**
Broken Head	41	14	29	31	0	0	**115**
Kings 1	11	2	2	1	0	0	**16**
Kings 2	11	4	8	2	0	0	**25**
Brays	14	5	10	1	0	0	**30**
Whites	12	4	4	1	0	0	**21**
Seven Mile Beach	49	8	15	2	0	0	**74**
Total	**696**	**216**	**552**	**361**	**7**	**2**	**1834**

Ballina Shire

Data collection for the Ballina Shire took place between 21st August and the 23rd August, 2012. During this period a total of 34.33 kilometers of coastline was assessed and audited. A total of 1309 individual data points and associated metadata were collected at an average collection time of 1 minute and 23 seconds per point of data. The tables below shows a summary of the individual points of spatial data collected during the assessment.

Table 5: A summary of the data collected for the Ballina Shire.

Location	Hazards	Access	Signage	Facility	Rescue Equipment	Service	Totals
Seven Mile Beach/ Lennox Head	216	61	114	100	1	2	**494**
Boulder Beach	17	8	5	0	0	0	**30**
South Boulder/Iron Peg	28	4	3	3	2	0	**40**
Skennars Head	45	9	5	1	3	0	**63**
Sharpes	30	8	10	3	0	1	**52**
Flat Rocks	26	2	11	8	0	0	**47**

Angels North	17	4	4	4	0	0	**29**
Angels South	39	13	24	14	0	0	**90**
Black Head	15	3	1	2	0	0	**21**
Shelly	52	14	16	25	0	2	**109**
Ballina Head	8	1	2	10	0	0	**21**
Lighthouse	50	13	16	15	1	2	**97**
South Ballina	49	8	43	4	1	1	**106**
Beswicks	22	9	4	1	0	0	**36**
Robins	8	1	1	0	0	0	**10**
Patches	34	11	15	4	0	0	**64**
Totals	**656**	**169**	**274**	**194**	**8**	**8**	**1309**

Randwick

Data collection for the Randwick area took place between 3rd October and the 11th October, 2012. During this period a total of 25 kilometers of coastline was assessed and audited. A total of 1907 individual data points and associated metadata were collected at an average collection time of 1 minute and 28 seconds per point of data. The tables below shows a summary of the individual points of spatial data collected during the assessment.

Table 6: A summary of the data collected for the Randwick area.

Location	Hazards	Access	Signage	Facility	Rescue Equipment	Service	Totals
Clovelly	24	26	43	75	5	0	**173**
Shark Point	27	8	18	18	1	0	**72**
Clovelly Pool Car park	14	2	1	0	1	0	**18**
Gordon's Bay	18	23	25	9	0	1	**76**
Dunningham Reserve Rock Platform	24	5	12	3	0	0	**44**
Dolphn Point	11	3	12	1	1	0	**28**
Coogee	21	12	48	98	6	3	**188**
Maroubra	24	9	30	62	3	2	**130**
Grant Reserve Rock Platform	22	12	21	51	4	0	**110**
Trenerry Reserve Rock Platform	22	9	20	19	0	0	**70**
South Coogee Rock Platforms	17	6	11	17	1	0	**52**
Mahon Pool Rock Platform	23	6	31	29	1	0	**90**
The Stake Rock Platform	19	6	5	3	1	0	**34**
South Maroubra	28	9	66	29	2	0	**134**
Lurline Bay	27	6	13	4	3	0	**53**
Little Greenie	32	5	4	5	1	0	**47**
Shooting Range Rock Platform	8	1	1	0	0	0	**10**
Yellow Rock	32	2	8	5	2	0	**49**

Malabar / Long Bay	54	16	58	45	0	2	**175**
Julieann Rocks	39	5	4	1	1	0	**50**
Little Bay 1	9	4	0	0	0	0	**13**
Little Bay 2	10	3	8	6	0	1	**28**
Cape Banks - East	18	2	0	0	1	0	**21**
Cape Banks - North	16	1	3	1	2	0	**23**
Jolong Rocks	16	11	10	1	1	1	**40**
The Gutter	16	2	1	2	1	0	**22**
The Trap	29	7	0	0	2	0	**38**
Cape Banks - West	8	1	0	0	0	0	**9**
Cruwe Cove	20	3	0	0	1	0	**24**
Congwong Bay 1	10	4	11	0	0	0	**25**
Bare Island	32	5	7	17	0	0	**61**
Totals	**670**	**214**	**471**	**501**	**41**	**10**	**1907**

The results displayed above are included as an indication of the data being collected through the process of assessing beaches for Project Blue Print. This information will be used as evidence to support proposed risk mitigation strategies for coastal public safety within each of these regions.

Next Steps

Still to be have data collected as part of the assessment process in year one of Project Blue Print are the following areas:

- Wollongong*
- Coffs Harbour
- Sutherland
- Waverly
- Gosford

The table below shows the expected on-site assessment dates for these areas.

Table 7: Regions yet to have data collected for and the scheduled assessment dates.

Region	Coastline Length (KM)	Data Collection/Consultation	
Wyong	25	22/10/2012	2/11/2012
Wollongong*	50	3/12/2012	14/12/2012
Coffs Harbour	75	4/02/2013	15/02/2013
Sutherland	50	4/03/2013	15/03/2013
Waverley	10	8/04/2013	19/04/2013
Gosford	35	6/05/2013	17/05/2013

** The Wollongong / Illawarra region has recently completed the assessment of ten unpatrolled locations. This assessment and results will be utilized during the assessment of the wider Illawarra region for Project Blue Print.*

The project is expected to take four years to complete its objective of detailed coastal public safety risk assessments of every beach and rock platform along the coast of NSW.

Also being completed as part of the first year of this project is the design and implementation of a state-wide emergency marker program.

Conclusion

Drowning deaths continue along the NSW coast at an unacceptable level. NSW accounts for almost 50% of the national coastal drowning toll. There have been 262 coastal drowning deaths in NSW between July 2004 and July 2011. The majority of these can be attributed to swimming/rip-currents and rock-fishing, with almost all occurring at unpatrolled locations/times, where no expert assistance is immediately available.

Surf Life Saving NSW has received funding from the NSW Water Safety Black Spot Fund to conduct a Coastal Public Safety Risk Assessment for every beach and rock platform in NSW. This project will be fundamental in addressing the coastal drowning issue in NSW both in the short, mid and long term.

The SLSA coastal public safety risk management program is endorsed by International Life Saving Federation and is aligned to International and Australian standards for risk management. The core of the program is the ABSAMP database, beach classification models and hazard rating system.

This project will utilise the detailed on-site data collected, evidence and stakeholder consultation to provide a 'blue-print' for NSW from which an effective drowning prevention strategy can be developed to meet the National/State goal to reduce drowning deaths by 50% by 2020.

Acknowledgements

Project Blue Print has been funded through the NSW Ministry for Police and Emergency Services Water Safety Black Spot Fund.

References

Australian Bureau of Statistics, 2001, Regional Population Growth, Australia and New Zealand, 2001-02

A/NZS ISO 31000:2009 Risk management – Principles and Guidelines

AS2416:2010 Water Safety Signs and Beach Safety Flags (Parts 1, 2 and 3)

AS 2899:1986 Public Information Symbols (Part 1 and 2)

AS2342: 1992 Development, Testing and Implementing of Information and Safety Symbols and Symbolic Signs

ISO9001:2008 Quality management systems – Requirements

Short, A.D., 1993, Beaches of the New South Wales Coast, Australian Beach Safety and Management Project, Sydney

Short, A.D., 2006, Australian Beach Systems – Nature and Distribution, Journal of Coastal Research, 22(1), 11-27. West Palm Beach (Florida).

Surf Life Saving Australia, 2011. National Coastal Safety Report 2011, Sydney.

Surf Safety & Rips Study, NewsPoll Survey Data, October 2009.

Weir, A, 2011, *Using accessible cost effective technology to save lives,* 20th NSW Coastal Conference