

BUILDING COMMUNITY AWARENESS OF FLOOD RISK IN SOUTH AUSTRALIA

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The Government of South Australia has developed a website for the community to view floodplain mapping and encourage people to be more self-resilient by understanding their risk of flooding. The website is a key initiative for South Australia in meeting the National Strategy for Disaster Resilience strategic priority 'understanding risk' for flood hazard. The website went live in September 2014.

Developing a single website for the community to view flood maps has presented many challenges and has been a lengthy and highly consultative process between the Department of Environment, Water and Natural Resources (DEWNR) and councils, the Local Government Association of South Australia, a range of organisations that have undertaken flood studies and emergency management agencies. Issues that arose during this process included: liability and insurance concerns for councils, designing an appropriate web interface for presentation of the information, dealing with inconsistencies in spatial data between studies, agreeing on data sharing conditions and managing community and government expectations for sharing of information.

For many organisations in South Australia, particularly councils, the concept of freely sharing flood risk information on a public website to promote community awareness and self-resilience is a significant shift away from how flood risk information has previously been managed and communicated. DEWNR has identified several strategies to streamline the process of collecting and sharing future flood studies, including linking data sharing agreements to funding agreements, and implementing standard briefs for flood studies to ensure that future outputs are consistent.

Introduction

The South Australian Department of Environment, Water and Natural Resources (DEWNR) is the Flood Hazard Leader under South Australia's emergency management arrangements. As Flood Hazard Leader, DEWNR has a leadership and coordination role for prevention, preparedness, response and recovery activities relating to flood.

In South Australia, responsibilities for flood management are shared across local, state and commonwealth agencies. The majority of floodplain mapping has been undertaken by local government authorities (councils). Councils have responsibility for the provision of stormwater infrastructure which—under various schemes—has been subsidised by the State Government on a dollar for dollar basis since 1967 (Lipp 2001). The current scheme is administered by the Stormwater Management Authority and provides matched funding for councils to prepare stormwater management plans for stormwater systems in urban areas which can include underground conduits, natural watercourses and open channels. With the increased availability and affordability of coupled one-dimensional and two-dimensional modelling platforms, many councils have undertaken detailed floodplain mapping of urban areas as part of the development of their stormwater management plans. Responsibilities for floodplain mapping on a regional scale are less clear. Regional scale studies have historically been undertaken by a state government agency, a regional subsidiary under the *Local*

Government Act 1999, or a collaboration between multiple councils or councils and state agencies.

In 2011 the Council of Australia Governments released the National Strategy for Disaster Resilience which aims to increase the resilience of communities when faced with natural disasters (COAG 2011). Understanding risk is a critical component of resilience; hence the strategy contains a strong emphasis on educating individuals and communities. Under the National Strategy for Disaster Resilience, Australian governments at all levels are committed to improving the quality and availability of flood risk information. This builds on the ongoing program of co-ordinated effort under the auspices of the Law, Crime and Community Safety Council (formerly the Standing Council on Police and Emergency Management) and the Australia-New Zealand Emergency Management Committee on promoting best practice in flood risk management.

In 2012 DEWNR received project funding through the National Disaster Resilience Grant Scheme to develop a flood awareness website displaying floodplain maps in an interactive interface and related educational material about flood risk. Consistent with direction at the national level, the project objectives were to make flood risk information more accessible and thus improve the community's understanding of and resilience to flood risk. A second stage of the project will establish a single repository for floodplain mapping information under the custodianship of the Flood Hazard Leader. This repository will make reports and spatial data consistently available across state government agencies, since this information has historically been collected and stored in an ad-hoc manner.

This paper describes the process undertaken by DEWNR on behalf of the Government of South Australia to publish flood risk information drawn from a range of organisations on a public website, the main challenges encountered and how these were managed, and future strategies to improve flood data acquisition and storage and improve community resilience to flooding.

Existing publication of flood risk information in South Australia

DEWNR estimates that—across South Australia—approximately 50 studies have been undertaken that have produced floodplain mapping suitable for publication on its flood awareness website. Other flood and drainage studies that have produced outputs in the form of flood backwater curves or capacity of drainage lines were considered to be difficult to interpret by the community and no attempt has been made to include this type of data on the website (although these studies are still being collected for state government use). It is difficult to provide an exact number of studies and floodplain maps in existence, since several have been undertaken in a staged approach and then consolidated at a later date, while other studies have mapped multiple towns in separate catchments under the guise of a single study. It is estimated that approximately 40 studies have been commissioned by 30 councils either individually or in collaboration, while the remainder have been commissioned by other organisations such as state government agencies or natural resource management boards (but may still have councils as collaborating parties). There are no existing requirements for organisations in South Australia to provide flood risk information to the state government, even when state and/or commonwealth governments have contributed to the funding of the study.

In 2009, the South Australian Department of Water, Land and Biodiversity Conservation (now largely merged into DEWNR), in its role as Flood Hazard Leader, commenced a project to collect floodplain mapping data from councils and publish the 2015 Floodplain Management Association National Conference

data online. Drivers for the project included a desire to make flood risk information readily accessible to the community and government agencies and establishing a consistent data repository to inform flood risk assessments being undertaken by state government using the National Emergency Risk Assessment Guidelines (NERAG). A pilot website was developed but not progressed due to a range of concerns by the South Australian government including liability and licensing.

Approximately half of the South Australia's floodplain mapping can be located online, although largely this is limited to only the 1% Annual Exceedance Probability (AEP) or 100 year Average Recurrence Interval (ARI) event. One council has developed a dynamic mapping interface, but mostly the information exists as downloadable floodplain maps in Portable Document Format (PDF) or within technical reports, also in PDF. Two of the larger, higher populated metropolitan councils, who arguably also have some of the greatest flood risks, have not yet published their flood mapping online.

The South Australian Department for Water (DFW) (now DEWNR) successfully published floodplain maps online for the River Murray in South Australia in early 2011. The hydraulic modelling and mapping was undertaken by DFW in late 2010 in advance of forecast high river flows in the River Murray in South Australia following flooding in New South Wales and Victoria. Due to the extended drought preceding the high flow event, there was potential for the community to have lost a great deal of its local knowledge of flood impacts which could lead to them under- or over-estimating the severity of the event. There was concern that media coverage of flooding in the upstream states may have led South Australians to believe it would be a major event here. Conversely, River Murray shack communities needed to be made aware that their properties and access could be affected and they needed to make preparations, particularly given possible changes in property ownership since the last high river or flood event.

The floodplain mapping was well accepted by the community and valued by state and local government including emergency services. The mapping website received over 33,000 unique visits over a three month period while the River Murray flood watch was current. An indicator of the success of the floodplain mapping was that no requests for assistance were received by the South Australian State Emergency Service despite approximately 400 shacks being inundated.

Approach

While the collection and publication of floodplain mapping to improve community resilience to flooding was a key driver for the project, DEWNR identified that this also presented a valuable opportunity to establish a single state government repository for flood hazard data and resolve issues such as custodianship, sharing and permission to use the data by various parties.

Historically, state government agencies held flood hazard data-sets in an ad-hoc manner, with no oversight of how up-to-date and complete these datasets were, and often without data sharing agreements. State government agencies frequently obtained flood hazard data for individual projects and were restricted from using or sharing the data with other agencies for other purposes. Emergency services did not have access to all the state's flood risk information to use for response planning purposes. The establishment of single state government repository for flood hazard data (encompassing floodplain mapping, technical reports and other associated information) was therefore considered critical for ongoing strategic flood hazard planning.

Despite policy and direction at the national level (including the National Strategy for Disaster Resilience and resolutions of the Standing Council on Police and Emergency Management) to make floodplain mapping transparent, inclusive and openly available, there were still a number of impediments at the state and local level that had to be overcome and which are still being worked through by DEWNR.

DEWNR commenced consultation with councils and the Local Government Association of South Australia (LGASA) regarding the project in mid-2013. From the outset, the LGASA involved their insurer Local Government Risk Services (LGRS) as a key stakeholder in the project consultation. All councils in South Australia participate in self-insurance schemes managed by LGRS. Of these schemes, the LGA Mutual Liability Scheme provides councils with risk, claims and legal services for civil liabilities (Jardine Lloyd Thompson Pty Limited 2015).

On 30 August 2013, the Government of South Australia and the LGASA entered into a non-legally binding agreement in relation to storm water management and flooding. Under clause 8.3(f) of that agreement it was agreed that South Australian councils would, “in accordance with the recommendations of the National Disaster Insurance Review ... communicate floodplain mapping and associated risk information to the community, and allow the State and Australian Government full and free access to also disseminate the floodplain mapping to improve community resilience to flood hazard.” (Government of South Australian and Local Government Association, 2013).

DEWNR wrote to the LGASA in October 2013 seeking their support for requesting flood studies and floodplain mapping from councils, and wrote to all South Australian councils individually in April 2014. DEWNR also met council representatives one-on-one and discussed the project at forums including State Emergency Service (SES) FloodSafe meetings.

On 15 May 2014 the LGASA Board resolved to support in principle the release of council flood studies and mapping data, and requested that the LGASA and LGRS work with DEWNR to establish suitable parameters upon which the data may be released (Local Government Association of South Australia 2014).

Throughout the project, DEWNR sought advice from the Crown Solicitor’s Office regarding legislation, terms of agreements, liability and risk. Consideration was given to whether floodplain mapping could be requested under any existing state or commonwealth legislation or whether state or commonwealth funding for the studies which produced the floodplain mapping implied a degree of ownership by the state. Ultimately, DEWNR decided not to pursue any of these avenues in favour of a collaborative and mutually beneficial approach with councils so that councils are active and willing participants in the process and productive relationships are maintained between state and local government.

Initially DEWNR requested that floodplain mapping and associated reports and data be provided under a ‘Creative Commons By Attribution’ licence to be consistent with the Government of South Australia’s Declaration of Open Data (Weatherill 2013). A Creative Commons By Attribution licence allows users to distribute and build upon work, including using it commercially, as long as the original data owners are credited. However, the terms of that license were unacceptable to the majority of councils, even those councils that were very supportive of the project. Henceforth DEWNR, in collaboration with LGASA and LGARS, sought to develop terms for data sharing which were mutually acceptable to all parties.

Key concerns

Issues and concerns that were raised by a range of parties (including State Government, councils, LGASA and LGRS) relating to the publication, sharing and use of floodplain mapping and associated flood risk data included:

- The publication of floodplain mapping on a website may adversely impact property values and insurance premiums. Although information on flood risk is typically already available from councils, the publication on a website makes it more accessible to a wider range of people, including potential property buyers and insurance agencies.
- The publication of floodplain mapping which shows that properties are flood-prone may result in the community having a negative perception of a council and create an unreasonable expectation to eliminate the risk.
- Floodplain maps that were developed for other purposes (for example, stormwater infrastructure design and development planning) may not be fit-for-purpose for communicating flood risk to the community.
- Catchment changes may have occurred since the floodplain maps were produced (for example, increased urban development, changes to watercourses) which may render the floodplain maps out-of-date.
- Floodplain maps may contain scenarios and assumptions that aren't relevant to current risk (for example, future projections of sea level rise and urban development) which could misrepresent current flood risk.
- The public may have difficulty in understanding and interpreting floodplain maps and may not understand the underlying assumptions, range of uncertainty and concepts such as average recurrence interval or annual exceedance probability.
- If a person or business relied upon the information from the website and they suffered a loss due to flooding, disclaimers may not provide sufficient cover to the council.
- Property owners may attempt to hold council liable for flood damage incurred in locations where published floodplain maps include proposed future upgrades to drainage infrastructure that haven't been constructed yet. A claim could be pursued on the grounds that council has failed to provide adequate infrastructure.
- Property owners may rely on the floodplain mapping to inform their decision on whether to purchase flood insurance. If a floodplain map is later superseded (such as by a new development altering flow behaviour) and an uninsured property owner is flooded, they may attempt to hold the council liable for misleading information.
- A public website where the state's floodplain mapping is shown in one location may highlight areas where mapping has not been undertaken or is of lesser quality. This may create an expectation for councils to undertake this work or ensure the integrity of existing floodplain mapping which they don't have the statutory obligation to do and could be cost prohibitive.
- There may be additional obligations on councils to maintain flood risk data consistent with state government requirements which would have resource implications.
- Councils may not be kept informed of how data which they have produced and is attributed to them is being used and for what purpose.
- Contractors or consultants engaged by the State may retain and use the data for clients and purposes outside the terms of the original agreement.
- Councils may be perceived as liable or subject to public scrutiny for allowing development to occur in areas that were later shown to be flood-prone.
- People may mistakenly believe that the floodplain maps represent a prediction of inundation extent for a real and impending flood event.
- High traffic to the DEWNR website during impending flood events may cause the website to crash since it hasn't been designed for high traffic volumes.

- If floodplain maps were able to be downloaded or freely shared, users could distribute, remix, tweak or build upon the work and present it as valid data or use it commercially.
- If floodplain maps were able to be downloaded or freely shared, they could be used for purposes contrary to which they were intended, or used without heeding the relevant limitations or assumptions.
- Floodplain mapping may be misinterpreted as showing flood extent according to definitions used by insurance agencies when they are intended to represent stormwater inundation scenarios.
- If flood study reports were able to be downloaded, they could be used to demonstrate liability by a council.
- Councils want to remain the first point of contact for the community regarding studies they have undertaken rather than state government.
- People may mistakenly believe their property is not at risk of flooding or is flood proof because their property isn't shown as being inundated by the floodplain mapping. Instead this could mean that floodplain mapping hasn't been undertaken in that location or a larger event than that modelled might cause their property to be flooded.

Whilst it was recognised that councils could not reasonably be held liable for some of the above concerns, councils still expressed concern for the costs that could be incurred while defending their position.

Response to concerns

In order to gain the support of the LGASA, LGRS and individual councils for the provision of floodplain mapping, DEWNR attempted to address the range of concerns raised during consultation for the project. A focus for DEWNR was to engage with the LGASA and LGRS to develop mutually agreeable "suitable parameters" according to the resolution by the LGASA Board.

Development of suitable parameters for data sharing

Based on discussion with representatives of LGASA and LGRS suitable parameters were understood to be described by:

- The Terms and Conditions page which users must accept before accessing the flood awareness website, and
- A template for a Data Sharing Agreement between the Government of South Australia and individual councils.

In general, the website terms and conditions state that councils and the Government of South Australia assume no legal liability or responsibility for the accuracy and completeness of floodplain maps, and that users' reliance on the information is at their own risk.

DEWNR negotiated a template Data Sharing Agreement with LGASA and LGARS which sets out mutually acceptable terms regarding licensing, use and distribution of floodplain mapping data and associated information by the State Government. Key points of the template Data Sharing Agreement include:

- Floodplain mapping may be published on DEWNR's website, but not be downloadable.
- State government agencies may use the data for purposes relating to stormwater, flooding, emergency management, community resilience, education and awareness.

- State government cannot sell or commercialise the data.

There is no obligation upon councils to accept the terms set out in the template Data Sharing Agreement and they can propose modifications to the terms. Importantly, they can have confidence that these terms are acceptable to LGRS.

Negotiations with the LGASA and LGRS regarding the Data Sharing Agreement spanned six months, and during that time DEWNR also sought advice from the Crown Solicitors Office and SAICORP who provide insurance services for the Government of South Australia. At the time of writing, DEWNR had re-contacted councils with the template Data Sharing Agreement. Several councils have agreed to sign while others are still considering the agreement. No councils have yet indicated that they are unwilling to sign or want to amend the conditions, although this may occur in future.

Other features

DEWNR have committed to working with councils to ensure that all appropriate conditions, assumptions and caveats of flood mapping are retained and communicated (such as in the metadata of GIS layers) and are displayed on the DEWNR website where floodplain mapping is published.

The website includes language emphasising the intent for the floodplain mapping to be used for awareness purposes only and includes additional disclaimers and information regarding the limitations of the data. “Frequently asked questions” pages have been developed with topics including “Flood maps – what are they?”, “How is the likelihood of a flood occurring estimated?” and “What do I do before, during and after a flood?”.

On the website, modelled events from flood studies are referred to using the terminology “chance” rather than ARI or AEP to reinforce in layman’s language that modelled events relate to a probability, not that the event that occurs regularly every 100 years, for example.

A brief information box is provided for each study which includes a contact point for further information (usually the council), full study name, the year it was produced, a brief summary of the study and provision to include other brief statements if required. For some studies, information has been included to flag that additional studies or mitigation works are being progressed. DEWNR has invited councils to review and provide input on the information that is included for each study.

Challenges for website development

Development of the mapping interface of the website occurred concurrently to negotiations with LGASA and councils. The presentation of floodplain mapping from a range of sources presented a range of challenges in order to be able to display the information consistently. Key challenges are described below.

Differences in spatial layers

The spatial layers have been provided to DEWNR by councils in the format that they have been received from engineering consultants. There is considerable variability in the datasets received so far. For example, for several studies the spatial data provided to council have been converted and compressed into polygons of depth ranges to give the appearance of flood depth contours. However, the supplied spatial layers and

compression process has varied between studies and consultants. One engineering consultant has transformed flood depth data with 0.25 metre intervals (for example, 0 to 0.25 metres depth, 0.25 to 0.5 metre depth and so on), while another has used a similar approach but adopted 0.2 metre depth intervals instead. It was considered important to show depth data where available, however, this presented significant challenges when trying to adopt a consistent data presentation for the website, including accommodating data sets which had no depth data available. At this stage, DEWNR have elected not to attempt to resource uncompressed modelling outputs due to the time and expense involved. Consequently, it was not possible to have a consistent depth colour legend and instead a depth range is displayed when each layer is clicked on.

Inconsistent events modelled by studies

Many of the studies have modelled different events. Almost all have modelled the 1% AEP or 100 year ARI event, however the remaining events vary between studies. This means that there needs to be individual selection of layers for each study. It is not possible to show all 2% AEP events, for example.

Representing the absence of a flood study

The coverage of floodplain mapping is incomplete, and studies haven't been undertaken for all watercourses and flood-prone developments in South Australia. Website developers considered ways of representing 'no studies undertaken in this area', however, this couldn't accommodate the situation where areas may be subject to flooding from multiple sources, for example, flooding from a major river as well as localised creek flooding, or inter-basin transfers. There is potential that an area may have been mapped for one flooding source and not for others which would be too complex to represent. Ultimately it was chosen to include information emphasising that the lack of mapping did not indicate that a location was flood-free, rather it might be because mapping had not been undertaken in that location yet.

Overlapping flood maps

DEWNR initially sought to be able to view multiple maps so that all flood-prone areas could be viewed at once, for example, all areas at risk from the 1% AEP or 2% AEP event. Problems encountered were that some maps overlapped, for example, flooding from separate studies of major rivers and minor streams overlapped (making it impossible to see different depth shading). A compromise solution was to have the layers individually turned on with a feature enabling the user to view all relevant layers in that location.

Future directions

Empowering individuals and communities to be more disaster resilient involves more than just providing them with information. It requires the availability and accessibility of transparent, accurate and trusted sources of information in various forms and the provision of tools to help communities understand and act on the material provided. DEWNR recognises that its flood awareness website is only one tool which contributes to the engagement and understanding of flood risk by the community and that it needs

2015 Floodplain Management Association National Conference

to be part of a broader approach. It is further recognised that the web-based approach may not appeal to all kinds of user. DEWNR is currently considering how the website can be better integrated with SES FloodSafe activities.

To facilitate the acquisition of floodplain mapping and associated data from future studies, DEWNR is liaising with the LGASA and the Stormwater Management Authority on introducing requirements into funding agreements for studies funded by the state government that requires data be made available at the conclusion of the study. Amendments to the current Stormwater Management Authority guidelines are also being considered to introduce consistent data formats, modelled events and metadata, including assessing if the national generic brief for flood investigations (National Flood Risk Advisory Group 2014) can be adapted for South Australian use.

Further work is being undertaken to establish a data repository to store floodplain mapping and other flood risk information to enable it to be shared seamlessly within South Australian government agencies while ensuring that key issues such as data ownership and limitations on its use are retained. This will be aligned with the National Flood Risk Information Program (Geoscience Australia 2015) as far as practical.

Currently, the agreements between the Government of South Australia and councils do not enable DEWNR to provide data to the Australian Flood Risk Information Program. DEWNR plan to undertake further negotiations during 2015 to achieve this. However, it is anticipated that many councils, at least in the short term, will be resistant to having their floodplain mapping and studies able to be downloaded.

The DEWNR flood awareness website went live in September 2014 with a limited number of floodplain maps sourced from predominantly non-local government organisations (Government of South Australia 2015). Floodplain maps are being progressively added as agreements are made with individual councils. A public launch will be made when the majority of studies are included.

Conclusions

The Government of South Australia via DEWNR has taken important steps towards building a resource for improving awareness of flood risk in South Australia and developing a single consolidated information resource to support a range of state government activities including planning for flood risk and supporting public safety programs. Given the shared responsibilities for managing flood risk, leadership, consultation and engagement are important factors for gaining support for sharing of risk information.

The concept of public communication of flood risk material is gaining wider support amongst government at all levels and the community. However, there remains negative perceptions within government organisations and the community regarding impacts and liabilities. Furthermore, there remains strong opposition to full and free sharing of floodplain mapping. High level commitments for open data do not necessarily resolve legitimate issues at the grass roots level. This will require cultural change which may some time to achieve.

It will be difficult to gauge how well the flood awareness website is received and understood by the community until after its public launch. Ultimately it is recognised that it is only one tool in building community resilience to flooding and that further complementary strategies will need to be developed to effect behavioural change by the community.

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