case study

esri Australia

Predictive mapping hedges against flood risks

Inner West Council

Inner West Council maps flooding for its catchment area to protect its community, keep emergency services informed and plan for better stormwater infrastructure investments.

Project overview

Floods cost NSW an estimated $200 million a year – a steep expense that can be mitigated. In an effort to minimise the impact of floods, local councils have conducted studies to better understand the nature of flooding and the associated flood risks in their catchment areas, develop flood management and mitigation strategies and support emergency management planning efforts.

Understanding flood risks allows local councils to make informed decisions on the location of new developments and to direct funding towards stormwater infrastructures to alleviate the impact of flood water on properties and roads.

Leichhardt Municipal Council (now part of Inner West Council) commissioned Cardno to conduct a Flood Study and a Flood Risk Management Study and develop a Flood Risk Management Plan. An interactive web map was developed as part of the Leichhardt Flood Risk Management Study to allow the community to investigate and better understand the nature of flooding in their area. The community are able to investigate the flood extent, flood depth, flood hazard and flood velocity for the one per cent Average Exceedance Probability (one per cent AEP – otherwise referred to as the one in 100 year Average Recurrence Interval) and Probable Maximum Flood (PMF) events throughout the area.

Leichhardt in focus:

The former Leichhardt Local Government Area includes the suburbs of Annandale, Balmain, Balmain East, Birchgrove, Leichhardt, Lilyfield and Rozelle. The Leichhardt Council was amalgamated with Ashfield Municipal Council and Marrickville Municipal Council in 2016 to form the Inner West Council.

The former Leichhardt LGA is a predominantly urban residential, medium density housing area with some industrial, commercial and special purpose land use areas. The 10.7 square kilometre catchment has seen major flood events – in January 1991, a total daily rainfall of 54mm was recorded, February 1993 recorded total daily rainfall of 99.5mm and in April 1998, rainfall recorded over two days resulted in 109mm of rainfall on April 9 and 185mm on April 10.

The Leichhardt LGA is surrounded by the Sydney Harbour to the north, Parramatta Road to the south, Johnstons Creek to the east and Hawthorne Canal to the west, with Whites Creek running through Annandale. Its drainage systems are either tributaries of these main creeks or drain directly into the Sydney Harbour.

> "The former Leichhardt LGA has experienced a number of major flood events in the past which have cost a considerable amount in damages – money that could be better spent elsewhere."
>
> **Amy Steiger,** GIS Manager, Cardno

The challenge:

The former Leichhardt LGA can become inundated by mainstream flooding – overflow of creeks and overland flooding – where the stormwater drainage system cannot handle the volume of rain resulting in excess water flowing over land.

In some locations, developments have been built near or over natural flow paths, depressions and low points leading to overland flow across properties. Additionally, the density of development in the area, such as town houses and terrace housing, has resulted in complete obstruction of the overland flow, leaving the only overland flow-path available directly through actual dwellings.

Prior to the Leichhardt Flood Study, Council and the community were uninformed of the full potential extent of damage and threat to personal safety that could be caused in significant flood events. This limits the ability for Council and Emergency Services to set up effective response procedures to minimise damage and potential loss of life, including the formal identification of flood evacuation routes.

One of the significant community engagement priorities for the NSW State Emergency Services (NSW SES) is to increase awareness of the risks associated with walking, riding or driving through floodwaters, and thus prevent fatalities.

The solution:

To enhance the resilience of the Leichhardt community and allow its members to make informed decisions with regard to flood response, Council commissioned The Leichhardt Floodplain Risk Management Study and Plan (FRMS&P), which considered actions to better inform the community of the risks associated with flooding and provide the community with information on how to protect themselves and their property from the impact of flooding.

One of the outcomes of the Flood Risk Management Plan was the development of a customised, interactive web map using ArcGIS Online historical data and calibrating flood predictions based on annual recurrence intervals –100-year, 50-year, 20-year, 10-year and 5-year – and the Probable Maximum Flood (PMF) including depth, velocity and flow rates.

The map provides members of the community with access to clear and accurate flood information, allowing them to better engage with the floodplain risk management process, prepare for catastrophic events and plan their evacuation routes. The data was displayed on an interactive web map using ArcGIS Online and is made available to the public via Council's web page. The map can be interrogated to zoom in to a particular property or zoom out to show the flood characteristics of an area, suburb or the entire LGA in one picture.

The innovations:

This project is a cutting-edge example of how interactive maps are increasing community engagement. The ability to pictorially understand predicted flood levels and paths of varying recurrence intervals gives Council, the community and the NSW SES the ability to enhance its emergency management by helping those most at risk during a flood. It also allows for the identification of at-risk communities, evacuation routes, and the locating of emergency refuge centres.

Finally, the mapping gives visibility as to where investments in stormwater infrastructure and flood hazard management are most needed and allows urban planners to make better informed decisions on proposed developments. Understanding the flood map enables engineers to devise structural flood modification measures such as stormwater upgrades and construction of additional underground pipelines, detention basins and levees, all of which are aimed at changing the behaviour of the flood.

> "Armed with insight into the flood plains and paths, Council's urban planners and engineers can reduce or minimise flood damage to properties by supporting flood-compatible development in flood prone areas and directing investments towards structural flood modification measures."
>
> **Amy Steiger,** GIS Manager, Cardno

The outcomes:

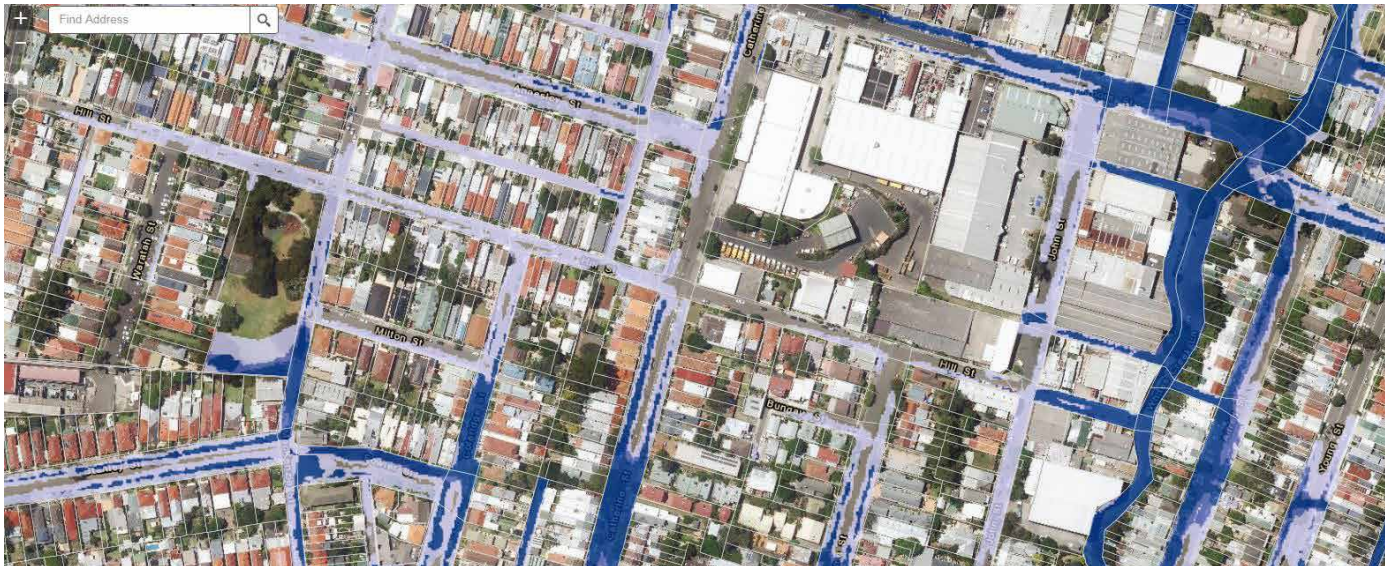
The interactive flood map shows predicted flooding patterns for different predicted storms, giving the community, policy makers and emergency services insight into what to expect during a flood event, allowing them to prepare for and react appropriately in the event of a flood. The key outcomes from the platform include:

- Increased community awareness and resilience in the event of a flood.
- Identification of safe evacuation routes depending on the flood incident.
- Insight into effective flood management investments.

Solution mix:

- ArcGIS platform
- ArcGIS Desktop
- ArcGIS Enterprise

> "Web mapping has become more mainstream, with users expecting to be able to interactively view their information – mostly likely on a map."
>
> **Amy Steiger,** GIS Manager, Cardno



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