



## **AUSTRALASIAN ALL-HAZARDS SYMBOLOGY PROJECT**

Project Report

Version: Final, May 2007

developed for the  
INTERGOVERNMENTAL COMMITTEE ON SURVEYING & MAPPING (ICSM)

Original Prepared by Spatial Vision Innovations Pty Ltd – ABN 28 092 695 951  
March 2007

## Document Control

Client Name	Intergovernmental Committee on Surveying and Mapping (ICSM) All-Hazards Symbology Working Group
Project Name	Australasian All-Hazards Symbology Project
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Document Type	Project Report
Project Number	SV001606
Version Control	1.0 – April 2007
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Final Edit	ICSM May 2007 Based on discussions and agreements at the EMSINA meeting Hobart, 16 May 2007
Version Control	Final – May 2007

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All-Hazards Symbology Project – Feedback

## Executive Summary

Within Australia, there is currently common national standard for map symbols used to represent features relevant to responders to emergencies, law enforcement or counter terrorism.

Many emergency events, especially large scale incidents, cross jurisdictional and geographic boundaries. Often in these circumstances, personnel from different agencies and jurisdictions are brought together into a single command structure. It is important for these people to be able to absorb information quickly. Maps play a vital role in summarising and describing a situation.

It is well accepted that map products that use a standard set of symbols that are readily understood by all emergency management personnel at all levels of the incident management framework contribute to increased efficiency and safety.

ANZLIC – The Spatial Information Council, in association with the Intergovernmental Committee on Surveying and Mapping (ICSM) want to encourage consistency in how All-Hazards events are depicted on maps and aim to develop a consistent Australasian All-Hazard symbolology set and have it adopted by emergency management agencies across Australia and New Zealand. In the medium term, the symbolology set would be further developed to support agencies leading responses to law enforcement and counter terrorism.

Spatial Vision was commissioned to document the outcomes of an audit of mapping symbols used by emergency management agencies and to recommend a framework for Incident Management System (IMS) and all-hazard symbols and an initial set of symbols to largely satisfy Emergency Management requirements.

In undertaking the project, Spatial Vision widely consulted with key representatives of the emergency management and national security sectors through five workshops held around Australia; a national teleconference including New Zealand; meetings with Federal agencies, and an audit questionnaire sent to 49 agencies of which 26 responded.

The audit results indicated that most agencies (81%) use the Australian Inter-service Incident Management System (AIIMS), as the basis for their IMS. AIIMS was developed in the 1980s and included a limited set of mapping symbols mostly aimed at bushfire response. The AIIMS map symbols are of limited application to many agencies, only 62% used them, mostly bushfire response agencies, and all of these agencies needed to expand the symbol set beyond the limited range.

The audit revealed a high level of consistency within jurisdictions in relation to the symbols used for IMS which reflected a significant level of cooperation between agencies, particularly fire related agencies, at the state level. For example, in South Australia, there is a common symbol set used between the Country Fire Service and the Department of Environment; whilst in Victoria, there is also a high level of consistency between the Department of Sustainability & Environment and the Country Fire Authority, and in NSW between the Rural Fire Service and the Department of Environment & Conservation.

The results of the audit also revealed differences between jurisdictions in relation to both AIIMS and non-AIIMS IMS symbols. Examples of these include symbols for refuge areas, threatened assets and base camps.

In addition to the physical differences in symbolology, the audit process revealed a number of differences in terminology associated with symbols. There were significant variations between agencies such as local government, search and rescue, police, health and environmental agencies on what constitutes features such as a 'staging areas', 'control areas' and 'control points'. These differences in definitions impact the

ability to create usable map based products for use in multi agency incidents. Clearly, there is no comprehensive common approach to symbols in use within Australia.

On the international scene, the most recognised standardised approach to emergency management mapping symbology is provided by the United States Federal Geographic Data Committee (FGDC). The FGDC Homeland Security Working Group (FGDC HSWG) established the Symbology Sub-group which developed a symbology set commonly referred to as either the US Homeland Security symbology library or the FGDC symbology library. The symbology library was designed to be used by the emergency management and first responder communities at all levels of need (i.e. National, State, Local and Incident).

Although the specific symbols within the US Homeland Security symbology library have been designed for use within the US, there are a number of characteristics of the symbology set which are of interest to other jurisdictions. These characteristics include:

- Defined categories that are differentiated by frame shapes. Diamonds, circles and rectangles are used to visually classify the symbols into their respective groups (Incidents, Natural Events, Operations, and Infrastructures)
- Border patterns to provide further information on a symbol level
- Designed for use in digital and paper map products
- Designed to work across a range of (but not all) scales.
- Designed for use both in black and white and colour (eg while a coloured symbol frame can be used, the pattern of this frame also denotes the level of damage or operational status).

At this stage, the scope of the FGDC symbology set is limited to point symbols. However, it is expected to expand at a later date to include lines and polygons. The US Homeland Security symbology library has been formally recognised as an ANSI Standard.

The objective for the Australasian All-Hazards Symbology standard is to define a symbology framework that will support emergency management across jurisdictions, agencies, hazard types and technology platforms. To be successful, the symbology framework must reflect the requirements of the emergency management community and be presented in a form that they can readily adopt.

Consultation undertaken to identify the requirements for an Australasian All-Hazards Symbology standard revealed the strong need for the symbology framework to cater for all levels of practice: Jurisdictional Coordination; Regional Coordination and Event/Incident Coordination.

Level	Example of Use	Role of Mapping
Jurisdiction	State Control Centre	<ul style="list-style-type: none"> <li>• Provide strategic oversight</li> <li>• Typically point based features</li> <li>• Broad scale: 1:500,000 – 1,000,000</li> </ul>
Region	Incident Control Centre	<ul style="list-style-type: none"> <li>• Overview of area of responsibility for number and location of incidents</li> <li>• May be point or polygon or line features</li> <li>• Medium scale: 1:100,000 – 250,000</li> </ul>
Event/ Incident	Incident Management Team	<ul style="list-style-type: none"> <li>• High level resolution, mapping of details covering area of concern</li> <li>• Point, polygon and line features</li> <li>• Detail scale: 1:10,000 – 50,000</li> </ul>

**Table A: Summary of the primary role of mapping at each the three levels.**

In the Australian context, the use of the FGDC symbols would be constrained to the higher

levels (jurisdictional and regional) and severely limit the level of adoption by emergency management agencies. These agencies have a clear need for mapping at the event level to represent features by their geometric characteristics (i.e. point, line or polygon).

The approach recommended for the Australasian All-Hazards Symbology will incorporate features of both AIIMS and FGDC. The symbols will be defined within an extensible framework that will be characterised by:

- Three categories: Incidents, Operations and Assets
- Status of a feature: eg. planned / completed
- Definition for every feature (symbol)

The symbol framework is designed to clearly define type, purpose and application of each feature. Symbols must work in conjunction with contextual or background mapping that is typically presented in the form of a standard topographic map or remotely sensed image. The features may be represented with point, line or polygon symbols depending on their geometry and the scale of the map display. Where practical, symbols will be drawn from existing standards and practices. All symbols will be able to be created digitally, while some operational symbols may be able to be hand drawn. For example, features that need to be identified or verified on the ground (i.e. at event level) will be designed to allow the feature to be drawn by hand onto a topographic map that can be faxed to a command/control centre.

This report includes a description of an initial set of 81 features are based on symbols that are already well defined by agencies, especially wildfire response agencies. The feature list may not satisfy the complete mapping requirements for wildfire response but should cover at least 80% of their needs. This initial set is intended to focus on limited hazard types but provide a base that can be built upon to meet broader emergency management and national security needs in future.

There are significant risks or potential issues that would impair the successful adoption of the Australasian All-Hazards Symbolology standard. A broad range of risks were identified by the project through stakeholder consultation and are documented in a risk management matrix. In summary, the primary risks can be categorised as those related to:

- Limited adoption by agencies due to a lack of acceptance of the standard or low prioritisation by agencies
- Constraints to adoption presented by costs of changes to systems, procedures and training
- Symbols do not meet the needs of the emergency management sector

Broad adoption of a standard Australasian All Hazard Symbolology will require clear and dedicated arrangements to ensure that the catalogue of features is updated where improvements are identified and expanded to incorporate broader incident types and operational practices. The report recommends a governance structure to address this issue.

Over the next twelve months, the key activity required for the implementation of the All-Hazards Symbolology will be to trial the recommended symbols with a few nominated agencies to refine the definitions and quantify the cost and impact of adoption.

The implementation and wholesale adoption of an Australasian consistent approach to all hazards symbols may then follow and will be a very significant achievement. Adoption of new symbols and definitions for terminology will not only impact mapping systems and tools but also operational procedures and training. Fortunately, the project audit of emergency management agencies identified that there was a high level of awareness of the importance and willingness to adopt a consistent approach to mapping symbols.



# 1. Introduction

## 1.1 Background

Within Australia, there is currently no common national standard for map symbols used to represent features relevant to responders to emergencies, law enforcement or counter terrorism. Many events, especially large scale incidents, cross jurisdictional and geographic boundaries. Often in these circumstances, personnel from different agencies and jurisdictions are brought together into a single command structure. It is important for these people to be able to absorb information quickly.

In the emergency management (EM) sphere, there is significant investment being made in the deployment of Geographic Information Systems (GIS), map production tools and purpose built incident management systems that generate map products for use in event management and coordination. The majority of these products are cartographically different in terms of the colour scheme and symbols used to represent the (All-Hazards) features on the maps (both hardcopy and digital).

It is now well understood that increased efficiency and safety will follow from use of standard symbol sets that are readily understood by all emergency management personnel at all levels of the incident management framework.

ANZLIC – The Spatial Information Council, in association with the Emergency Management Spatial Information Network Australia (EMSINA) and the Intergovernmental Committee on Surveying and Mapping (ICSM) wanted to encourage consistency in how All-Hazards events are depicted on maps. To this end, ANZLIC invited multiple stakeholders to attend a workshop in December 2005 to discuss the issues.

The first All-Hazards Symbology workshop took place on Friday 2 December 2005 in Sydney at the NSW Lands Department and was facilitated by ANZLIC. The workshop was attended by 25 people from all jurisdictions (except the NT). Participants at the workshop discussed the requirements, current situation and preferred scenario. The agreed definition of the requirement is as follows:

- The need for a consistent symbol set across Australia and New Zealand that preferably links to international standards. The symbol set needs to be scale dependant as well as hierarchical.
- The symbols need to be part of a broader classification of All-Hazards. The symbols set needs to cover all stages of an event i.e. from mitigation to recovery
- An intuitive, simple and scalable symbol set.
- Agreed governance and custodianship to ensure maintenance of the national symbol set, as it would be dynamic.

A second workshop of the All-Hazards Symbology Working Group was held on 22 February 2006. A project comprising two major tasks was identified by the Working Group.

### Task 1

To conduct an audit of key agencies involved in emergency management and response to compile a nationally consistent Incident Management System (IMS) symbology resource catalogue. An IMS may encompass Incident Command / Control Systems (ICS).

### Task 2

To conduct an audit to define the major categories of symbols for All-Hazards used or required by Emergency Managers and response personnel and develop documentation outlining which categories of symbols are relevant to different types of organisations and events, gaps in existing categories and priority areas for additional work.

This task will lead to a subsequent phase (out of scope) to compile an Australasian All-Hazards project that will develop and submit an Australasian All-Hazards symbology set that takes into account ISO and other relevant international standards.

The project was sponsored by the ICSM and ANZLIC and supported by EMSINA. Spatial Vision was subsequently engaged by the ICSM to undertake the project.

## 1.2 Project Aims

The primary aim for the project sponsors (ICSM and ANZLIC) is to develop a consistent Australasian All-Hazards symbology set and have it adopted by emergency management agencies across Australia and New Zealand. In the medium term the symbology set would be further developed to support agencies leading responses to law enforcement and counter terrorism.

The purpose of this project undertaken by Spatial Vision is to document the outcomes of an audit of symbols used by emergency management agencies and to recommend a catalogue or framework for IMS and all-hazard symbols and provide an initial set of symbols to largely satisfy EM requirements.

The outcomes of this project will be 'beta' tested by project sponsors, and be put forward for endorsement as an Australasian standard.

In this context of this project it is important to define the following terms.

- Emergency management is a range of measures to manage risks to communities and the environment. Comprehensive emergency management concerns strategies for risk assessment, prevention, preparedness, response and recovery (PPRR) (Koob<sup>1</sup> 1998).
- The All-Hazards approach relates to dealing with all types of emergencies or disasters and civil defence using the same set of management arrangements (Koob 1998).

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<sup>1</sup> Koob, P. (1998) Australian Emergency Management Glossary., Emergency Management Australia

- Incident Control System (ICS). A command structure to systematically and logically manage suppression of emergency incidents including wildfires, from small, simple incidents to large, difficult or multiple situations (Koob 1998). Incident Control System is used interchangeably with Incident Command System and Incident Management System (IMS) in this report.
- Australian Inter-Service Incident Management System (AIIMS). Five sub-systems which collectively provide a total systems approach to incident management, modified from the National Interagency Incident Management System (USA) (Koob 1998).

This project report will generally refer to the All-Hazards symbolology to embrace both All-Hazards and IMS features.

The commonly agreed objective of defining a consistent approach map symbols for reporting All-Hazards (adapted from Dymon<sup>2</sup> 2003) are to:

- facilitate exchange of information and data
- promote universal understanding of hazardous and vulnerable locations
- address communication of mission critical information across agencies, jurisdictions, and all levels of public and private sectors
- strengthen coordination and communication between planners
- enhance the ability of emergency managers to better understand information at a glance during crucial decision making moments.

### 1.3 Approach to Consultancy

The project sponsors recognise that the development of standard symbols will need to be done in an iterative approach to address feedback regarding the existing symbols and with ever widening circles of new symbols to meet broader EM, law enforcement and counter terrorism agency requirements. This project has focussed on developing an initial set of symbols to primarily meet the needs of the wildfire and other EM agencies and hazard response types more broadly.

The nature of the work undertaken by EM agencies necessitates that information needs to be readily available in various forms and easily interpretable. Often the on-the-ground work is conducted by large numbers of trained volunteers.

Although there is no existing standard approach to use of mapping symbolology, the EM agencies have well developed operational procedures and made significant investments in training of their workforces.

The project sponsors and Spatial Vision recognise that the recommendations of this project may significantly impact the existing investment of agencies and their workforce skills. With this in mind, the approach to this project has been to identify existing relevant mapping standards and work practices, and where practical to make recommendations that build on them rather than replace them. The project has been undertaken with extensive consultation with the key stakeholders through surveys and workshops and distribution of draft report material.

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<sup>2</sup> Dymon, U.J. (2003) An analysis of emergency map symbolology., Int. J. Emergency Management, Vol. 1, No. 3, pp.227.237.

## 1.4 Report Structure

The following table sets out the structure of this report.

**Table 1: Report Structure**

Section	Purpose
2. Methodology	Describes the methodology used in this project
3. Existing All-Hazards Symbols and Practices	Describe existing relevant standards for All Hazard symbols and the outcomes of an audit of symbols used by emergency management agencies.
4. Recommended Approach to Australasian Standard Symbology	Describe the fundamental elements of the framework for the Australasian All-Hazards Symbology standard
5. Initial Set of Symbols	Describes initial set of 81 features and their symbols and discusses the issues that need to be addressed to support implementation
6. Plan of Action	Sets out a recommended plan of action for the next twelve months.

APPENDICES:	
Appendix A – Symbology Audit – Agencies Consulted	Agencies and personnel consulted during the consultancy
Appendix B - Symbology Audit Results	Summary of existing use of symbols from audit results
Appendix C - Workshop Summaries	Summary of outcomes of each consultative workshop convened by Spatial Vision
Appendix D - All Hazard Features and Symbols	Description of initial 81 recommended All Hazard features and symbols in the recommended framework
Appendix E – Implementation Risks	Potential risks and constraints to implementation of the standard symbol set.
Appendix F – Glossary	Glossary of abbreviations used in this report.
Appendix G – Feedback	Summary of comments on the final draft report April 2007

ATTACHMENTS:	
All-Hazards Symbology Project – Feedback	Full transcript of responses to the final draft report April 2007

## 2. Methodology

This section describes the methodology used by Spatial Vision in this project.

The project was commenced with an inception meeting with ICSM representatives to clarify the project scope, deliverables and approach to consultation.

Spatial Vision undertook the two specified tasks (Task 1 and Task 2) in a combined manner. Spatial Vision, in consultation with the ICSM representative, developed an audit template (survey) that covered the information requirements for Tasks 1 and 2. The audit template was broadly distributed to 49 agencies representing emergency management and law enforcement. Some difficulties were experienced in identifying the appropriate contacts within some agencies and this partially reflects the different levels of mapping and incident control across the broad range of agencies consulted.

Spatial Vision arranged a series of jurisdictional workshops to directly engage stakeholders in the project. The participants for the workshops were identified by the EMSINA representative and Spatial Vision's contacts for the audit.

The consultants were careful to ensure that the draft project outcomes were reviewed by appropriate stakeholders to seek their input and confirmation.

The following table sets out the key project stages and tasks.

**Table 2: Project Stages and Tasks**

Task No	Stage and Task Descriptions:
	<b>Stage 1: Project Inception</b>
1.	Project inception meeting held at Mt Macedon, 3 <sup>rd</sup> May
2.	Development of Consultation Plan: - document agencies and lead contacts to be consulted and the form of consultation
3.	Development of Project Plan: – develop project plan outlining tasks and timing
	<i>Milestone #1: ICSM approve project plan</i>
	<b>Stage 2: Consultation and Audit</b>
4.	Initial research into ICS and symbol models used by NSW EICU, FGDC and NZ Fire Service
5.	Prepare and facilitate workshop as part of M7M to introduce project
6.	Develop audit template for IMS symbology (Task 1 and 2)
7.	Distribute v1 Audit Template to Vic DSE, Vic CFA and Tas Forests as trial
8.	Revise audit template from feedback and distribute v2 Audit Template to agreed agencies (as per consultation plan) - distributed in two rounds to a total of 49 agencies
9.	Collate responses to audit: - 26 agencies responded
10.	Prepare and facilitate consultative workshops 2 to 5: - Melbourne workshop, 13 <sup>th</sup> July, attended by 17 people - Perth workshop, 27 <sup>th</sup> July, attended by 13 people

Task No	Stage and Task Descriptions:
	<ul style="list-style-type: none"> <li>- Brisbane workshop, 25<sup>th</sup> August, attended by 10 people</li> <li>- Sydney workshop, 18<sup>th</sup> September, attended by 17 people</li> </ul>
11.	Follow-up specific agencies to clarify responses to audit in conjunction with workshops:
12.	Additional follow-up of ACT agencies: - consulted with DIGO, DOTARS and AFP 4 <sup>th</sup> October
13.	Prepared material for workshops in SA, Tas and NZ for ICSM representatives to run themselves - workshop outcomes received back from SA
14.	Document outcomes of workshops 2 to 5

	Stage 3: Draft and Final Project Outputs
15.	Prepare outlines of final report and All Hazard Symbol Catalogue for circulation
16.	Convene all states teleconference, 24 <sup>th</sup> October to discuss draft material
17.	Prepare 1 <sup>st</sup> draft of All Hazard Symbol Catalogue and review with key representatives, review and incorporate comments
18.	Prepare 2 <sup>nd</sup> draft of All Hazard Symbol Catalogue and provide to EMSINA for comments, review and incorporate comments
19.	Prepare Final Draft Report (inc All Hazard Symbol Catalogue) for circulation to Working Group for comments
20.	Present Final Draft Report to Working Group in workshop 22 Feb 2007.
21.	Review feedback and complete Final Report and submit to ICSM.
	<i>Milestone #2:</i> <i>ICSM accept Task 1 and 2 complete:</i>

The two major final deliverables of this project were:

1. Recommended All Hazard Symbol Catalogue and associated documentation as per Task 1 (this report).
2. Audit report of existing symbology categories used in the emergency management community, as per Task 2 (this report).

### 3. Existing All-Hazards Symbols and Practices

The purpose of this section is to describe existing relevant standards for All Hazard symbols as well the outcomes of an audit of symbols used by emergency management agencies across Australia and New Zealand.

#### 3.1 Existing Relevant Standards

##### 3.1.1 AIIMS

The Incident Control System (ICS) or Incident Management System (IMS) is a structure of delegation to ensure that all vital management and information functions are adequately performed. IMS is divided into four functional areas; incident control, operations, planning and logistics

The Australian Inter-service Incident Management System ('AIIMS') was developed in the early 1980s by the Australian Association of Rural Fire Authorities (AARFA). AIIMS was derived from the North American National Inter-agency Incident Management System (NIIMS).

AIIMS is designed to promote effective joint operations through the use of common terminology and a structure which provides for appropriate communication between organisations at all levels of the incident, whilst maintaining the integrity of the chains of command and information systems within the participating agencies.

A standard set of symbols has been adopted within the AIIMS framework which covers the key features of interest during an emergency and these symbols are shown in Figure 1. Although AIIMS has been historically associated with fire response, the framework has been partially adopted by non fire agencies in Australia.



## ICS MAP SYMBOLS

Use styles, colours and sizes for symbols, lines and polygons as indicated.

Symbol font is ICS Fire Symbols 1.1 24 point unless otherwise stated. Always use Bold and Halo.

	Control Centre		Burnt Area (Pattern: column 5 row 3; Colour: grey column 2 row 1)
	Control Point		Fire Boundary (Line Style: column 2 row 1; Width: 5 Pixels)
	Assembly Area		Active Fire Edge (Line Style: column 1 last row; Width: 2 Pixels)
	Staging Area		Predicted Fire Edge (Line Style: column 4 row 1; Width: 5 Pixels)
	Refuge Area		Backburn - Proposed (Line Style: column 4 row 10; Width: 2 Pixels)
	Helibase		Control Line - Proposed (Line Style: column 4 last row; Width: 2 Pixels)
	Remote Helipad		Control Line - Completed (Line Style: column 3 last row; Width: 2 Pixels)
	Water Point		Machine Cut Track (Line Style: column 1 row 9; Width: 3 Pixels)
	Water Point - Helicopter		Area Marker (Pattern: column 2 row 4; Colour: grey column 2 row 1)
	Fire Sensitive Asset		
	Machine Sensitive Asset		
	Structure		
	Defendable		
	Potentially Defendable		
	Not Defendable		
	Fire Origin		
	Hot Spot		
	Spot Fire		
	Fire Direction (48 point)		
	Aerial Ignition - Proposed		
	Sector Boundary (48 point)		
	Division Boundary (48 point)		
	Portable Radio Repeater		
	Mobile Weather Station		
	Boat Ramp		
	Point Marker		

Version 3 September 2003

**Figure 1: AIIMS Symbology**

Although AIIMS provides a standard set of symbols, most rural fire agencies in Australia have adapted and extended the base set of symbols to accommodate the representation of features not contained in the original symbol set.



### 3.1.2 FGDC Homeland Security Symbol Set

The United States Federal Geographic Data Committee (FGDC) has been developing symbology standards for emergency management for a number of years. The FGDC Homeland Security Working Group (FGDC HSWG) established the Symbology Subgroup which has developed a symbology set commonly referred to as, both the US Homeland Security symbology library and the FGDC symbology library. The complete FGDC symbol set can be viewed at <http://www.fgdc.gov/HSWG/index.html>. The US Homeland Security symbology library has been designed for use by the emergency management and first responder communities at all levels of need (i.e. National, State, Local and Incident). The symbols, and associated definitions have been defined into four broad categories; Incidents, Natural Events, Operations, and Infrastructures. Although the US homeland security symbology library is comprehensive, it does not cover all emergency management features. The symbology set does however; establish a framework by which agencies can incorporate additional required symbols.

Although the specific symbols within the US Homeland Security symbology library have been designed for use in the US, there are a number of characteristics of the symbology set which are of interest for other jurisdictions. These characteristics include:

- Defined categories that are differentiated by frame shapes. Diamonds, circles, and rectangles are used to visually classify the symbols into their respective groups (Incidents, Natural Events, Operations, and Infrastructures).
- Border patterns to provide further information on a symbol level
- Symbology set designed for use in digital and paper map products
- Designed to work at a range (but not all) scales.
- Designed for use both in black and white and colour. While a coloured symbol frame can be used to denote the level of damage or operational status, the pattern of this frame also denotes the status.

At this stage, the scope of the FGDC symbology set is limited to point symbols. However, it is expected to expand at a later date to include lines and polygons. The US Homeland Security symbology library has been formally recognised as an ANSI Standard (ANSI Standard ICITS/ANSI 415) and may also be put forward for ISO accreditation at some point. Figure 2 outlines the high level structure of the FGDC symbol set.

Symbol Types	Symbol Image	Key Stroke	Symbol Terms and Definitions
1.) Incident (Damage/Operational) No Levels		A	Incident (Damage/Operational) - Not Applicable
2.) Natural Event (Damage/Operational) No Levels		B	Natural Event (Damage/Operational) - Not Applicable
3.) Operation (Damage/Operational) Level 1		C	Operation (Damage/Operational) - Fully operational/open.
4.) Operation (Damage/Operational) Level 2		D	Operation (Damage/Operational) - Operational, but filled to capacity or otherwise closed.
5.) Operation (Damage/Operational) Level 3		E	Operation (Damage/Operational) - Operational, but partially damaged or partially incapacitated.
6.) Operation (Damage/Operational) Level 4		F	Operation (Damage/Operational) - Destroyed or Totally incapacitated.
7.) Infrastructure (Damage/Operational) Level 1		G	Infrastructure (Damage/Operational) - Fully operational/open.
8.) Infrastructure (Damage/Operational) Level 2		H	Infrastructure (Damage/Operational) - Operational, but filled to capacity or otherwise closed.
9.) Infrastructure (Damage/Operational) Level 3		I	Infrastructure (Damage/Operational) - Operational, but partially damaged or partially incapacitated.
10.) Infrastructure (Damage/Operational) Level 4		J	Infrastructure (Damage/Operational) - Destroyed or Totally incapacitated.

**Figure 2: FGDC Structure**

Figure 3 provides an example of the US homeland security symbols for Emergency Incident Command Centres. The frame pattern indicates operational status of the command centre ie Fully operational/open; and Operational, but filled to capacity or otherwise closed.



**Figure 3: FGDC Example**

There are a number of jurisdictions and agencies that are currently looking at adapting the US homeland security symbolology library for other jurisdictions. One such example is the New Zealand Fire Service (NZFS) which is adapting the FGDC symbol set for use across a range of hazard types. For further details about New Zealand's use of mapping symbolology, see Section 3.3. It is expected that the FGDC symbol set will also be adopted for use within a range of hazard mapping systems such as the Asia Pacific Natural Hazards Information Network <http://www.pdc.org/> and the US National Oceanic and Atmospheric Administration's Tsunami Warning system <http://wcatwc.arh.noaa.gov/>.

### 3.1.3 Other Relative Standards and Approaches

There are a number of other Australian and International standards and practices relating to map symbolology that are relevant when considering an Australasian All-Hazards Symbol Set.

The United Nations Military Symbols Handbook (UN DPK 2000) provides a range of map symbols focussed on peace keeping. Although the symbols within this document are mainly focused on military activities, there are a number of symbols which are generic in nature. In particular, the proposed Road Closure / Traffic Control Point symbol has been adapted from this symbol set. Other relevant United Nations symbol sets are contained within the UN Disaster Assessment and Coordination Field handbook (2000) which outlines search and resource symbolology (also covered by INSARAG) and basic command and control symbols.

International meteorological organisations use a set of standard symbols to describe specific aspects of weather, refer to the World Meteorological Organization (WMO).

The International Search and Rescue Advisory Group (INSARAG) is a global network under the United Nations umbrella focussed on urban search and rescue (USAR). INSARAG has established standards for international USAR teams including a set of map symbols. Emergency Management Australia (EMA) have published a set of guidelines based on the INSARAG standard referred to as the Search and Rescue Capability guidelines for Structural Collapse response (EMA, 2004). The proposed symbols outlined in this report related to search and rescue have been adapted from the INSARAG standard.

Another symbol set that is of interest is the US National Wildfire Coordination Group's Geographic Information System (GIS) Standard Operating Procedures (SOPs) on Incidents Project (GSTOP). The GSTOP project is focussed on the GIS needs of wildfire incident management. The GSTOP manual contains a set of symbols designed for use within the wildfire community. There is no consistent symbology standard used in the United Kingdom for incident response.

In addition to existing approaches and standards for mapping, there are also a number of standards related to signage that are also relevant. These include the National Aquatic and Recreational Signage Style Manual (July 2005) and a number of Australian Standards such as AS2786 (Health Care Symbols in Hospitals), AS2899.3 (Public Information symbols signs), AS2293 series (Emergency Signs) and AS1319 (Safety signs for the occupational environment).

### 3.2 Symbology Audit

As part of the scope of work outlined in the project brief, an audit of Incident Command System and all hazard symbols used by emergency managers in the Australasian scene was undertaken.

#### 3.2.1 Audit Process

Spatial Vision approached the audit process by developing a draft set of audit questions and testing these with a number of key stakeholders. Feedback on the draft audit questions was used to further refine the questionnaire. The questionnaire included a series of 12 questions covering different aspects of incident symbology and also requested examples of any existing symbols in use.

The questionnaire was distributed to 49 agencies across all jurisdictions covered by the All-Hazards Symbolism project. The list of organisations was developed from the initial guidelines set out in the project brief and included Australian Fire Control Authorities (AFAC) and Australian Council of State and Territory Emergency Services (ACSES). The project sponsor (ICSM) also provided a list of additional agencies to be included in the audit. Additional agencies were also identified during the audit process and workshops and Spatial Vision's approach was to include any agency which felt that they should be included. Appendix A lists the agencies included in the symbology audit.

Some difficulties were experienced in identifying the appropriate contacts within some agencies and this partially reflects the different levels of mapping and incident control across the broad range of agencies consulted. Out of the 49 agencies included in the audit, 26 provided responses.

### 3.2.2 Results & Analysis

The 26 audit responses returned represented 25 EM agencies. The following table summarises the type of agencies that responded; whether their existing ICS was based on AIIMS, whether their mapping symbols are based on AIIMS and if they are receptive to adopting the proposed Australasian All-Hazards symbology set.

**Table 3: Summary of Audit Responses by Agency Type**

Agency Type	Responses	AIIMS	AIIMS Symbols	Receptive
Fire	9	8	6	9
Combined Emergency Management	3	3	3	2
Land / Environment Management	4	4	4	4
State Emergency Services	3	2	1	3
Health	1	0	0	0
Police	2	2	0	2
Local Government	2	1	1	2
Marine	1	1	1	1
Rail	1	0	0	1
<b>Totals</b>	<b>26</b>	<b>21</b>	<b>16</b>	<b>24</b>
<b>Percentage</b>		<b>81%</b>	<b>62%</b>	<b>92%</b>

Note: In response to a question asking whether the agency would be receptive to adopting an Australasian All-Hazards symbology set, one respondent indicated that they would prefer to adopt an international standard.

The results indicate that most agencies (81%) use AIIMS as the basis for their ICS. However, the AIIMS map symbols are of limited application to many agencies, especially those not involved in wildfire response.

The following table summarises the hazard types that the 26 agencies respond to. One agency may respond to one or more hazard types. For example, many wild fire agencies respond to hazardous material incidents, and search & rescue.

**Table 4: Summary of All Hazard Responses**











Agency Type	Responses
Wild Fire	14
Metro Fire	8
SES (inc storm, flood, auto crash) and Search & Recovery	19
Health or Hazardous Material	12
Law Enforcement or Counter terrorism	3
Other	12

Although the agencies represent a broad range of hazard responses, the symbols provided by these agencies were heavily focussed on wildfire response. There were no symbols provided for law enforcement or counter terrorism.

The responses to the audit, as shown in Appendix B reveal a high level of consistency within jurisdictions in relation to the symbols used and in particular, the non-AIIMS symbols. Using the examples provided during the audit, this is a reflection of the cooperation of agencies, and more particularly, fire related agencies at the state level. For example, in South Australia, there is a common symbol set used between the Country Fire Service and the Department of Environment, whilst in Victoria, there is also a high level of consistency between the Department of Sustainability and Environment and the County Fire Authority. It should be noted that this intra jurisdictional consistency generally applies to fire and fire related agencies (such as departments of environment etc). The limited audit results from other areas such as Police, Animal and Plant Health and Transportation do not allow comparison and conclusions to be drawn in relation to the cross agency consistency within jurisdictions.

The results of the audit also reveal differences between jurisdictions in relation to both AIIMS and non AIIMS symbols. Due to the symbols reported as part of the audit process, this comparison can only be made between fire and fire related agencies. The table below outlines some of these differences.

**Table 5: Examples of symbology differences**

Feature	Symbol	Symbol
Base Camp		
Threatened Asset		
Hot Spot (Fire)		
Road Crash / Vehicle Accident		
Staging Area		

In addition to the physical symbology differences, the audit and workshop process revealed a number of differences in relation to terminology associated with symbols (and therefore, the underlying features). Within fire and fire related agencies, there is a high level of consistency due to the use of AIIMS and as

incident control and management framework. Outside of this area, there were significant variations between agencies such as local government, search and rescue, police, health and environmental agencies on what constitutes features such as a 'staging areas', 'control areas', 'areas of concern', 'declaration areas' and 'control points'. These differences in definitions impact the ability to create usable map based products for use in multi agency incidents.

### 3.3 New Zealand Situation

In 2004, the New Zealand Fire Service (NZFS) together with the Ministry of Civil Defence and Emergency Management (MCDEM) began a proof of concept trial. In this trial either symbols from the FGDC symbol set or where a symbol was not present a symbol using the same characteristics was created, were used in three web applications. These applications were the online incident mapping system (SMART Map), the on line incident query system (SMART Incident) and the online resource and deployment monitoring system (SMART Status).

These online systems are available to 360 fire stations, 36 regional and district offices and are made available via secure internet to over 100 other agencies (MCDEM, National Crisis Management Centre, all Territorial Authorities, NZ Defence Force other emergency responders, etc).

Feedback was very positive and while there were some requests for changes in style the largest request was for a faster rate of implementation.

One unforeseen need was the value of using the symbols outside of a mapping context e.g. in reports and lists as they added valuable visual queues and context. Consequently the incident list was expanded and the trial of infrastructure icons accelerated. NZFS has adopted ANSI Standard ICITS/ANSI 415 where ever possible. Where ever practicable, NZFS have enhanced the set through the use of colour. These are additional symbols to the Standard and are not designed to replace the Standard symbols but to be an alternative.

These systems are now fully operational and the 'proof of concept' has ceased. The current operation is based on ANSI Standard ICITS/ANSI 415 adopting its characteristics of incident, operations, infrastructure and status.

For infrastructure symbology, NZFS/MCDEM have implemented a supporting code list for each symbol based upon the Australian and New Zealand Standard Industrial Classification 2006 ABS Cat No. 1292

#### 3.3.1 NZ Status

- The National Crisis Management Centre is using ANSI Standard ICITS/ANSI 415 plus the NZFS additions/modifications
- The Ministry of Civil Defence and Emergency Management promotes ANSI Standard ICITS/ANSI 415 including the use of status.
- The New Zealand Fire Service has adopted ANSI Standard ICITS/ANSI 415 with some small modification and a series of additions.
- New Zealand's National Rural Fire Authority is trialing a set of symbols based on AIIMS and ANSI Standard ICITS/ANSI 415
- Territorial authorities in the greater Wellington area have or plan to adopt ANSI Standard ICITS/ANSI 415
- One Territorial Authority – Hutt City Council has developed their own set – not in use by any other



## 4. Recommended Approach to Australasian Standard Symbology

The purpose of this section is to describe the fundamental elements of the proposed framework for the Australasian All-Hazards Symbology standard.

### 4.1 Objectives for Standard Symbology

The objective for the Australasian All-Hazards Symbology standard is to define a symbology framework that will support emergency management across jurisdictions, agencies, hazard types and technology platforms. The symbology framework needs to be broad enough to cater for the later inclusion of features to support counter-terrorism. To be successful, the symbology framework must reflect the requirements of the EM community and be presented in a form that they can readily adopt.

The symbology framework needs to cater for all levels of practice or control hierarchy. The hierarchy includes: Jurisdictional Coordination; Regional Coordination and Event/ Incident Coordination. These three levels are defined as:

- **Jurisdiction:** Overall command and responsibility for an incident. Determines policy, overall strategy and the parameters within which the lower levels will operate. Information requirements are broad. Information outputs including tasking, situation awareness to Regional level and meeting public, media and political interests.
- **Region:** Directs the tactics of incident management. Information requirements are more specific, focussing on hazards, vulnerabilities, risks and resources. Information outputs are task specific to support Event level and upward transfer of changing situational information to State level.
- **Event/ Incident:** IMT commanders work within a functional and/or geographical area of responsibility to implement the operational plan. Must have access to information that is critical to its execution on the ground. Information requirements are task orientated. Information outputs are fed upwards to maintain and accurate and relevant Common Operating Picture.

These definitions were adapted from a UK report developed for Category One responders under the Civil Contingency Act 2004. This report listed the three categories as Strategic, Tactical and Operational; it also noted that military terminology may reverse Operational and Tactical levels in the hierarchy<sup>3</sup>. However these terms were changed to scale of area (and command) to reduce confusion with AIIMS defined terminology.

The following table provides a brief summary of the role of mapping to support each tier of the control hierarchy. There may be a fourth (higher) level that caters for the media or the general public but that is considered outside the focus for this project.

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<sup>3</sup> MacFarlane, R (2005). *A Guide to GIS Application in Integrated Emergency Management*, Emergency Planning College, Cabinet Office.

**Table 6. Role of Map Products to Support Control Hierarchy:**

Level	Example	Role of Mapping
Jurisdiction	National or State Control Centre	<ul style="list-style-type: none"> <li>• Provide strategic oversight</li> <li>• Broad overview for interagency, multi-agency, national – state coordination</li> <li>• Aggregated view at state or national level</li> <li>• Depict operational support outside auspices of combat agency</li> <li>• Typically point based features</li> <li>• Easy to understand information for non-technical people</li> <li>• Broad scale: 1:500,000 – 1,000,000</li> </ul>
Region	State, Organisational or Incident Control Centre	<ul style="list-style-type: none"> <li>• Overview of area of responsibility for number and location of incidents</li> <li>• Generalised view or district level map</li> <li>• Combination of symbology determined by level / scale</li> <li>• Represent operational support activities to support incident management teams</li> <li>• May be point or polygon / line based features</li> <li>• Medium scale: 1:100,000 – 250,000</li> </ul>
Event/ Incident	Incident Control Centre, Incident Management Team	<ul style="list-style-type: none"> <li>• Information to assist regional planning</li> <li>• High level resolution mapping of area of concern or incident</li> <li>• May be point or polygon / line based features</li> <li>• Detail scale: 1:10,000 – 50,000</li> </ul>

## 4.2 Elements of a Standards

This section outlines the key elements of the standard.

### 4.2.1 Symbology Framework

The All-Hazards Symbology will be set out in a framework that clearly defines each feature and symbols and how they should be used. The framework will be flexible enough to incorporate the addition of new features as they are recognised and adopted.

The symbology framework will be defined by three major parameters:

- Categories
- Status
- Definition

The following section further describes these three key parameters.



#### 4.2.2 Categories

Historically, the symbolology associated with various forms of mapping have included a level of categorisation. Typical examples of this categorisation can be found on standard topographic maps where symbols associated with features such as roads, hydrology or terrain features usually share some common graphic characteristics. The concept of grouping symbols into categories is particularly important for emergency management as the timely interpretation of information displayed on the map is critical. Grouping symbols into categories improves the ability of map users to recognise key features in a timely manner.

The FGDC has implemented a four category system for symbols; however, project consultation has identified a simpler three classification system as more appropriate for an Australasian Standard. The following table describes the recommended categories versus those developed by the FGDC.

**Table 7. Categorisation of Symbols:**

Recommended Categories	Recommended Definition	FGDC Categories
<b>Incidents</b>	Features relevant to incidents for any hazards including natural event, civil activities, policing and counter terrorism	Incidents
		Natural Events
<b>Operations</b>	Features relevant to planned and operational responses to events and incidents including supporting intelligence	Operations
<b>Assets</b>	Assets or infrastructure that are relevant to an incident or event or operational response; assets at risk, or critical infrastructure that requires protection	Infrastructure

Under each Category there will Sub-categories or themes defined such as:







Incident – Biological; Fire; Hazardous Material; Natural Events; etc

Operations – General; Fire; Medical; Search & Rescue; Transport; etc

Assets – General; Fire; etc

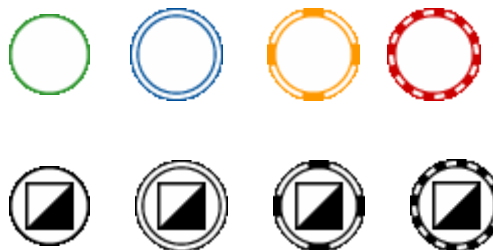
Features represented by point symbols, in each of the three categories will be clearly recognised by their frame shapes (diamonds, circles, and rectangles). The frame shapes recommended to visually classify features in their respective groups (Incidents, Operations, and Assets) are consistent with those used by the FGDC, as represented in Table 8. There is no consistent graphical feature that will identify the category of other symbolology (lines, polygons); however, these features may be labelled with a point feature symbol.

**Table 8. Frame Shapes:**

Proposed Frame Shapes	FGDC
<b>Incidents</b> 	<b>Incidents</b> <b>Natural Events</b> 
<b>Operations</b> 	<b>Operations</b> 
<b>Assets</b> 	<b>Infrastructure</b> 

#### 4.2.3 Status

As previously described, the FGDC US Homeland Security Symbology Set includes a damage/operational status level. These four levels are used to indicate the level of damage associated with Infrastructure, or the operational status of features associated with Operational activities. There is no status levels applied to Incidents. A system of colours and frame patterns are used to communicate the damage/operational status levels as shown in Figure 4.




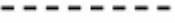



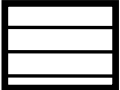


**Figure 4: FGDC damage/operational status levels  
(low to high severity)**

The project audit results indicated that EM agencies have not developed a consistent approach to indicating status although consultation has found a high level of support for it.

The implementation of various status levels is recommended for the Australasian Standard. However, rather than applying the status levels universally across whole categories, status would only be used with features where the definition for the type of status was clearly established. In many cases, status will only have two values, for example, Unconfirmed and Confirmed. In addition, status will apply to specific Incident features. Status may be assigned to features with point and line, and potentially polygon geometries. Wherever practical, the approach set out in Table 9 will be consistently used to represent up to four states.

**Table 9. Representation of Status:**

Geometry	Status - 1	Status - 2	Status - 3	Status - 4
<b>Point</b>	Possible 	Planned Probable Unconfirmed Predicted 	Completed Confirmed Active 	
<b>Line</b>		Planned Probable Unconfirmed Predicted 	Completed Confirmed Active 	Contained Controlled 
<b>Polygon</b>		Planned Probable Unconfirmed Predicted 	Completed Confirmed Active 	

The principle of a broken line to indicate future or projected location and a solid line to indicate a present or actual location of a feature is based on styles described in the United Nations Military Symbols Handbook.

The cartographic representation for status is designed to be clearly distinguishable and less dependent on intricate detail than the FGDC approach.

A clear definition of the meaning of the status or rating would be provided in the feature framework. In general, a rating is temporal and so it should be accompanied by a time and date stamp as annotation or labelling.

#### 4.2.4 Definitions

As previously highlighted in the result of the audit of symbology and their use, some EM features are replicated across agencies but with different meanings or use. Obviously this could have disastrous consequences.

A critical component of the framework must be an agreed definition for each feature so that it can be applied and recognised consistently. The definitions will be based on authoritative sources and will need to be managed as part of the symbol governance arrangements.

Implementation of a standard approach to feature definitions is expected to impact many agencies to varying degrees. Where there are changes in the definition of commonly used terms, it will impact on the existing operational practices, training material, system documentation and operational procedures. Clearly the rollout of standard terms and their accompanying definitions will need to be supported by awareness raising and training activities.

Where possible, definitions should be developed with key representative bodies and agencies including EMA, AFAC and other appropriate bodies.

#### 4.2.5 Technical Considerations

The consultation of stakeholders identified a number of issues that need to be taken into consideration when designing and creating the actual symbols. These design criteria are set out in Table 10.

**Table 10. Technical Criteria**

Criteria	Requirement
Effective in Black & White and Colour	Essential
Suited to both paper and digital media	Essential
Available as True Type Fonts, ESRI Styles and Web compatible formats	Essential
Include guidelines for annotation or labelling	Use optional
Some defined symbols need to be able to be hand drawn	Essential
Effective over backgrounds of aerial photographs/ satellite imagery and topographic mapping	Essential

### 4.3 Feature Symbol Framework

The symbols are described in a framework that is designed to clearly define type, purpose and application of each feature. The framework is largely based on the FGDC approach and is designed to cater for all EM hazards and practices. The following table describes each element of the framework.

**Table 11. The Elements Making Up the Framework**

Framework Item	Description	Example of Use
<b>Category</b>	Framework category	Incident
<b>Theme</b>	Themes or sub-category within a category	Fire
<b>Feature</b>	Name of feature	Fire Edge
<b>Geometry</b>	Point, line or polygon	Line
<b>Status</b>	Status of feature; NA if relevant	1:Predicted; 2:Going; 3:Controlled
<b>Symbol</b>	Cartographic representation, may be point, line or polygon	1    - - - - - 2    _____ 3    = = = = =
<b>Hand-drawn Symbol</b>	Symbolism to use when drawing by hand; NA if not applicable	_____ (status)
<b>Definition</b>	Agreed definition and source	Any part of the boundary of a fire at a given time. (Source: AFAC Glossary of Rural Fire Terminology)
<b>Guidelines</b>	Usage notes and guidelines, including example of use for different hazards	Label with standard date and time. Use at Regional and Jurisdictional levels

#### 4.4 Principles Defining Symbols

The following set of principles are recommended to define the Australasian Standard symbols.

1. Features will be represented with point, line or polygon symbols depending on their geometry and the scale of the map display
2. Where practical, symbols will be drawn from existing standards and practices; in particular those established by the AIIMS, FGDC (and NZ Fire Service variation), as well as other relevant national and international agencies.
3. The point symbols will be a mixture of picture type (FGDC style) symbols that are self evident and letter acronyms where they provide quick recognition. The intention is to avoid developing a large range of overly complex picture (FGDC style) symbols that require high resolution to be clearly interpreted. Point symbols may be used at any scale or level of hierarchy and would be unique across the entire framework.
4. Polygon and line cartographic representations will be defined for specific features. The focus for their use will be at regional and event/incident levels. The cartographic representations for features should be unique within a hazard response type but not necessarily across all hazards.
5. Polygon and line features should either be labelled or assigned a unique point symbol to aid recognition and depiction at regional or jurisdictional levels (where polygons or lines are not shown).
6. Colour will be used to enhance recognition of a symbol but will not be required to interpret a symbol. The standard symbol set may include colours for symbols as a guide.
7. The labelling of the date and time of the status of particular features will be recommended, however, rather than labelling individual features, map products depicting situation status may be generated with a standard date and time group and replace the need for individual feature labelling.
8. A standard should be adopted for the date and time group. NZFS have adopted a convention based on ISO 8601 that defines the international standard date notation as: YYYY-MM-DD. [YYYY] indicates a year with century. [MM] indicates the month of the year, 01 through 12. [DD] indicates the day of that month, from 01 through 31. For example, '5th of April 1981' may be represented as '1981-04-05' in the extended format, or '19810405' in the basic format.
9. Features that need to be identified or verified on the ground (i.e. at the event level), will be designed to allow the feature to be drawn by hand onto a topographic map that can be faxed to a command/control centre. In some cases, a specific hand drawn symbol may replace the standard symbol. The same hand drawn symbols may be used across different hazard responses to reduce the number of unique hand drawn symbols.
10. The base symbol for assets (including infrastructure) is a transparent rectangle to all allow underlying features on a topographic map or aerial image to be visible.
11. Symbols that represent important safety features such as Refuge and Evacuation Areas are defined with a yellow triangle, based on a recommendation by GISSOP.

These principles have been used to define the initial set of Australasian Standard symbols described in the next section. The principles would also be used to define symbols for additional features as they are identified for inclusion into the standard set.

## 5. Initial Set of Symbols

To expedite implementation of the Australasian Standard symbols, an initial set of 81 features and their symbols have been identified and described. This section describes initial set of features and their symbols and discusses the issues that need to be addressed to support implementation.

### 5.1 Initial Feature Symbols

The initial set of 81 features are based on symbols that are already well defined by EM agencies especially wildfire response agencies. The feature list may not satisfy the complete mapping requirements for wildfire response but should cover at least 80% of their needs. This initial set is intended to focus on limited hazard types but provide a base that can built on to meet broader EM and CT needs in future.

The following table summarises the initial symbol set; that is Australasian Standard Symbols Version. The anticipated level of use for each symbol is provided as a guide ie Jurisdictional, Regional or Event level.

**Table 12: Australasian Standard Symbols Version – Summary**

Category	Theme	Feature	Levels of Use		
			Juris	Regn	Event

#### Incident

1.1	General	Incident (generic)			
1.2	Criminal	Bomb Threat			
1.3	Criminal	Bomb			
1.4	Biological	Insect Plague			
1.5	Biological	Animal Health			
1.6	Biological	Plant Health			
1.7	Fire	Fire			
1.8	Fire	Fire Origin			
1.9	Fire	Fire Hot Spot			
1.10	Fire	Spot Fire			
1.11	Fire	Burnt Area			
1.12	Fire	Fire Perimeter/ Boundary			
1.13	Fire	Fire Edge			
1.14	Hazardous Material	Hazardous Material Incident			
1.15	Hazardous Material	Oil Spill			
1.16	Hazardous Material	Gas Leak			
1.17	Hazardous Material	Radioactive Material			
1.18	Natural Event	Tropical Cyclone			
1.19	Natural Event	Earthquake			
1.20	Natural Event	Flood			
1.21	Natural Event	Flooded Area			
1.22	Natural Event	Landslide			
1.23	Natural Event	Thunderstorm			
1.24	Natural Event	Storm Surge			
1.25	Natural Event	Tsunami			

1.26	Transportation	Air Incident			
1.27	Transportation	Marine Incident			
1.28	Transportation	Rail Incident			
1.29	Transportation	Vehicle Incident			

### Assets

2.1	General	Asset (Generic)			
2.2	General	Indigenous Site			
2.3	General	Hazardous Material Storage			
2.4	General	Historic Site			
2.5	General	Significant Flora			
2.6	General	Significant Fauna			
2.7	Fire	Fire Sensitive Asset			
2.8	Fire	Machine Sensitive Asset			
2.9	Fire	Threatened Asset			

### Operations

3.1	General	Access Points			
3.2	General	Area of Interest			
3.3	General	Assembly Area			
3.4	General	Base Camp			
3.5	General	Control Area			
3.6	General	Control / Operations Point			
3.7	General	Declaration Area			
3.8	General	Escape Route (point)			
3.9	General	Escape Route (line)			
3.10	General	Evacuation Route			
3.11	General	Evacuation Area			
3.12	General	Evacuation Centre			
3.13	General	Animal Shelter			
3.14	General	Refuge			
3.15	General	Incident Command/ Control Centre			
3.16	General	Division Boundary			
3.17	General	Division Command			
3.18	General	Sector Boundary			
3.19	General	Sector Command			
3.20	General	Staging Area			
3.21	General	Portable Weather Station			
3.22	General	Portable Radio Repeater			
3.23	General	Wind Observation			
3.24	Fire	Fire Direction			
3.25	Fire	Aerial Ignition			
3.26	Fire	Back Burn			
3.27	Fire	Machine Cut Track			
3.28	Fire	Fire Control Line			
3.29	Fire	Fire Engine/ Vehicle			
3.30	Fire	Water Point			
3.31	Fire	Water Point Helicopter			
3.32	Fire	Water Point Vehicle			
3.33	Flood	Sand Bag Levee			



3.34	Law Enforcement	Police Vehicle			
3.35	Medical	Ambulance Location			
3.36	Medical	First Aid Station			
3.37	Search & Rescue	Potential Victim			
3.38	Search & Rescue	Victim Location Confirmed			
3.39	Search & Rescue	Victim Located Dead			
3.40	Search & Rescue	Victim Extracted Alive			
3.41	Search & Rescue	Victim Extracted Dead			
3.42	Transport	Airbase			
3.43	Transport	Helibase			
3.44	Transport	Helipad			
3.45	Transport	Road Closure / Traffic Control Point			

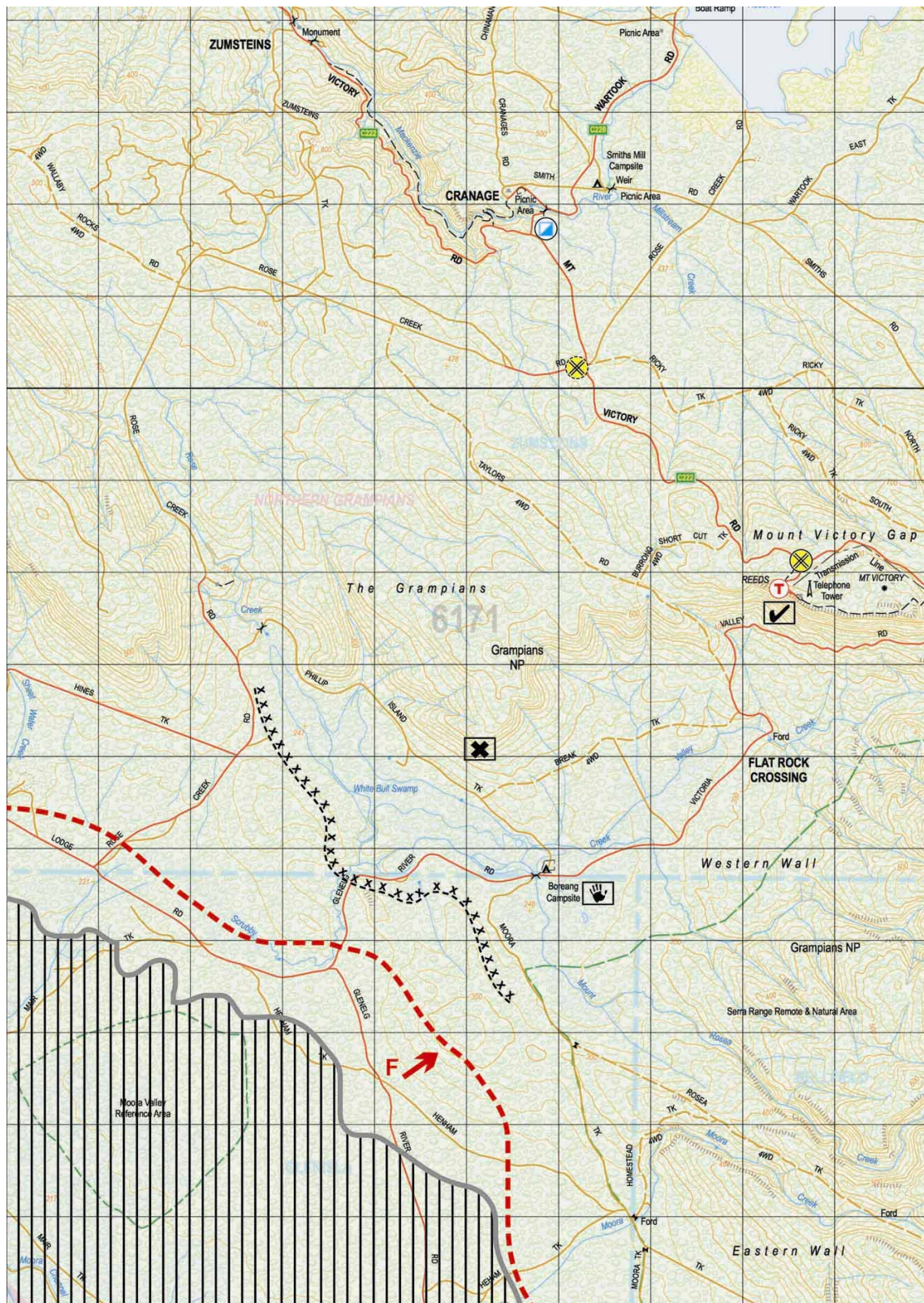
Refer to Appendix D All Hazard Features and Symbols for the full description of the initial feature symbols. Each of the recommended features are described in their respective framework category.

Point symbols should be used at 24 point size and not used in maps where they are represented below 12 point size. Point symbols should be 'haloed' where they are hard to differentiate from the background. Line and Polygon symbols should also be 'haloed' where appropriate ie over imagery

As previously discussed, the set of symbols are designed to support the hierarchy of control, from high-level Jurisdictional, Regional to Event/Incident including field use. The following figures (5, 6 and 7) provide examples of map products using the proposed Australasian All hazard Symbology set (refer to Appendix D for symbol descriptions).

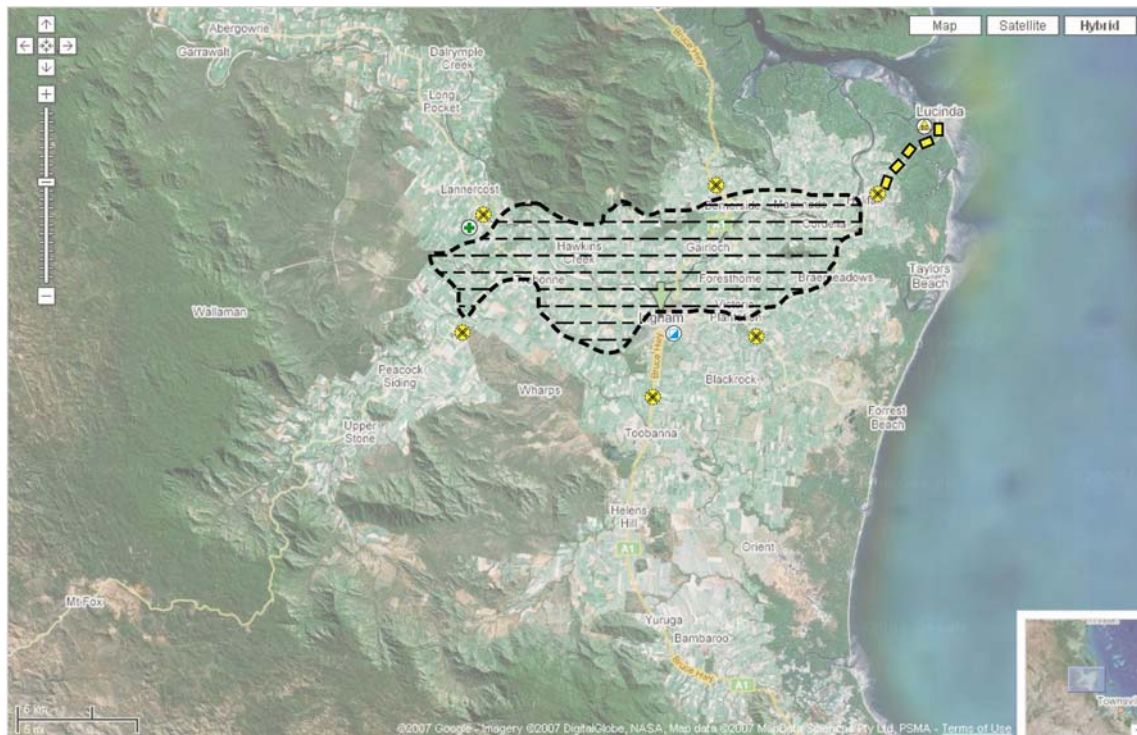
Figure 5 shows an event/incident level map for a fire incident, produced from a GIS using a typical topographic backdrop. Figure 6 shows a regional level map for a 'flood incident'. In this example, the symbols have been shown over the top of a Google map image. A predicted flood area is shown along with planned road closure points, evacuation routes, evacuation centres and a control centre. Figure 7 shows a 'state wide control centre' (jurisdictional) view of Western Australia in a typical web mapping interface. In this example, there are a number of incidents occurring simultaneously in Western Australia and detailed information on an incident is accessed via clicking on the symbol (e.g. the storm symbol).

In the case of an event map (Figure 5), a subset of the features have symbols that need to be able to be captured in the field to update the Common Operating Picture. Those features are defined in the framework and given a symbol that can be readily hand drawn.

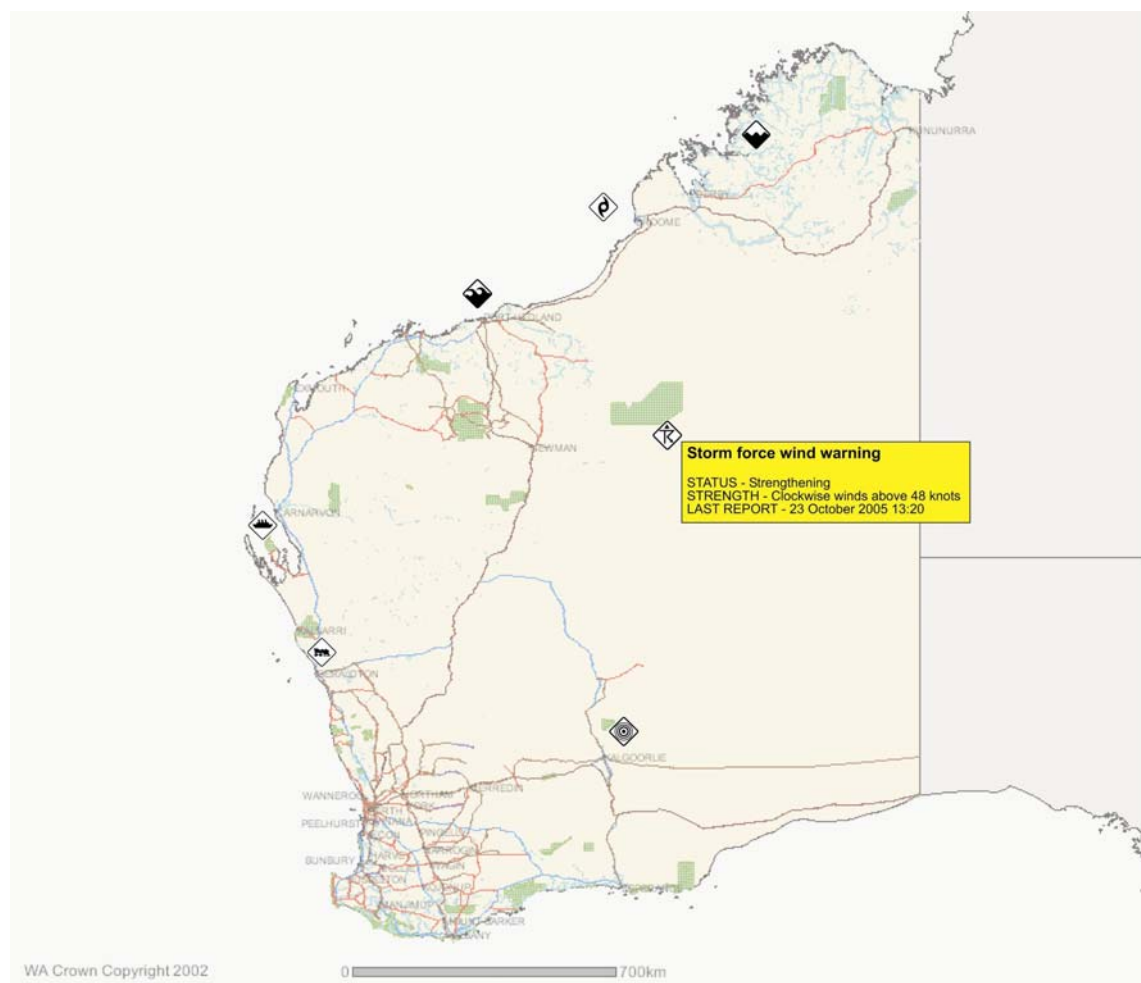


**Figure 5: Event/Incident Map Example**





**Figure 6: Regional Map Example**



**Figure 7: Jurisdictional Map Example**

## 5.2 Gaps & Priorities

This section discusses the gaps in existing symbols and the priority areas for additional work.

There are a broad range of features not represented in the Australasian Standard Symbols Version. As previously described, the focus for the initial set, as described in the previous section, was to establish a foundation for EM response with a particular focus on wildfire that could be expanded to accommodate all hazards across the EM sector, as well as law enforcement and national security sectors.

The areas for expansion of the Australasian Standard Symbols can be broadly categorised in order of priority as:

1. Incident and related operational responses to meet needs across the all hazard EM spectrum
2. Assets category to provide information on vulnerable assets and other features
3. Law enforcement sector including civil disturbance, criminal activity and police operations
4. National security sector including counter terrorism and critical infrastructure protection

There are clearly a broad range of topics under each of these four areas that need to be further explored and features identified for mapping symbols.

The immediate recommended priority area for further development of features to incorporate into the Australasian All-Hazards Symbology standard is under: 1. EM Incident and related operational responses. In particular, the next version of the features is recommended on identifying and developing features for:

- Flood, severe Weather and Tsunami
- Search and Rescue
- Hazardous Material

Expansion of symbology across these hazard types will enable the SES and equivalent organisations to be more fully engaged in adoption of the Australasian All-Hazards Symbology standard.

### 5.3 Implementation Risks

This section documents the potential risks and / or constraints to broad implementation of the Australasian All-Hazards Symbology.

There are significant risks or potential issues that would impair successful adoption of the Australasian All-Hazards Symbology standard. A broad range of risks were identified by the project through stakeholder consultation and documented in a risk management matrix.

The following risks were identified as having a high impact on successful implementation of the new standard.

- ESO's failure to adopt new standard including terminology and symbology, i.e. organisations not prepared to alter current practices
- Members, especially volunteers in the field, resistant to change and won't take up training and adoption of symbology
- Given that IT is often seen as not mainstream to business to many ESOs, implementation may be seen as niche and given low organisational priority
- Cost of implementation of standard, limits or hinders adoption. Cost of training, software and systems, and logistics of implementation. Especially costs to regional and volunteer organisations
- New standard not wholly adopted. Risk of employment of multiple standards and approaches, or incomplete adoption of standard across agencies.
- New symbols not easily interpreted or understood. Symbol may be seen as too complex; too simplified; unfamiliar; maps overloaded
- Symbology does not meet business requirements of specific EM sectors. For example, perceived low level of relevance to urban environments eg. structure fire
- Standard is too considered too hard or difficult to implement especially for agencies with small GIS capacity
- Standard is too loosely defined and results in ambiguity and undermining the purpose of the project

In summary, the primary risks can be categorised as those related to:

- Limited adoption by agencies due lack of acceptance of the standard or low prioritisation by agencies
- Constraints to adoption presented by costs of changes to systems, procedures and training
- Symbols do not meet needs of the sector

Mechanisms to address these implementation issues are further explored in Section 6.2.

The full table of risks identified and recommended mitigation actions and responsible parties are set out in Appendix E Implementation Risks.

## 5.4 Governance

This section sets out the recommended governance arrangements for the Australasian All Hazard Symbology.

Broad adoption of a standard Australasian All Hazard Symbology will require clear and dedicated arrangements to ensure that the catalogue of features is updated where improvements are identified and expanded to incorporate broader incident types and operational practices. The process of considering modifications and additional features will require industry consultation and moderation by authoritative bodies.

A three tier arrangement is recommended governance for the implementing and maintaining the Australasian All Hazard Symbology.

The following table sets out the three recommended roles, their scope and the agencies or bodies proposed to fulfil these roles.

**Table 13 Governance Roles**

Role	Scope	Bodies
<b>Custodian</b>	<ul style="list-style-type: none"> <li>• Custodian for Australasian All Hazard Symbology.</li> <li>• Coordinate and oversee activities of Steering Committee and Operational Authority</li> <li>• Final decision on the scope of the symbology catalogue and implementation</li> </ul>	Emergency Management Australia (at least in the short-medium term)
<b>Steering Committee</b>	<ul style="list-style-type: none"> <li>• Recommend scope of new versions (additions and amendments)</li> <li>• Coordinate consultative processes for new versions</li> <li>• Recommend new versions and implementation strategies to Custodian</li> </ul>	NIMAG/ NSINS <ul style="list-style-type: none"> <li>○ National Information Management Advisory Group</li> <li>○ National Spatial Information for National Security</li> </ul>
<b>Operational Authority</b>	<ul style="list-style-type: none"> <li>• Develop and maintain the Australasian All-Hazards symbology catalogue</li> <li>• Implement WEB site to promote and make the symbology catalogue accessible</li> <li>• Contact point for information about the symbology catalogue</li> <li>• Collect and document stakeholder feedback for consideration by the Steering Committee</li> </ul>	AHSWG/ EMSINA <ul style="list-style-type: none"> <li>○ All-Hazards Symbols Working Group</li> <li>○ Emergency Management Spatial Information Network Australia</li> </ul>

It is important that custodianship resides with an organisation of substance with long-term aims and dedicated resources. It is recommended that Emergency Management Australia adopt the role of custodian. This organisation takes overall custodianship responsibility for the development and promulgation of the Australasian All Hazard Symbolology.

*A custodian of a fundamental dataset, or a component of that dataset, is an agency recognised by ANZLIC as having the responsibility to ensure that a fundamental dataset is collected and maintained according to specifications and priorities determined by consultation with the user community, and made available to the community... (ANZLIC Custodianship Guidelines 1998)*

The Steering Committee is responsible for leading the development of new versions of the standard, including scope, consultation and implementation. The Steering Committee operates on behalf of the Custodian. Representation of the Steering Committee is determined by the Custodian and may be adjusted to reflect new interests as they are identified for inclusion into the standard symbolology.

The Operational Authority will lead the support and development of the symbolology resources, including website, symbol formats and respond to requests for information. It is important the Operational Authority is staffed with dedicated full-time resources to ensure that requests for support are acted upon promptly.

## 5.5 Formal Approval as Accredited Australian Standard

This section discusses whether the recommended Australasian All Hazard Symbolology should be submitted for formal accreditation as an Australian – New Zealand (AS/NZS) endorsed Standard.

As described by Standards Australia, ‘A Standard is a published document which sets out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently performs in the way it was intended.

*Standards establish a common language which defines quality and establishes safety criteria. Standards and conformance are the keys to ensuring the quality and consistency of physical, chemical and biological measurement throughout Australian society and the economy’.* (www.standards.org.au)

There would be many advantages to seeking formal accreditation of the Australasian All Hazard Symbolology as an Australian (AS) or Australian – New Zealand (AS/NZS) endorsed Standard. This endorsement by an independent external agency that the All Hazard Symbolology meets the needs of the EM (and CT) profession would serve as a powerful argument to support adoption of the symbolology by the practicing agencies. Although broad consultation undertaken for this report highlighted a high degree of recognition of the importance of a consistent approach to the use of symbols, there is still expected to be resistance to broad adoption. Certification of the All-Hazards Symbols will highlight the recognition of the symbol catalogue and aid in the justification of business cases to support adoption or conversion of processes and systems.

Accreditation would also signal the importance of compliance to the IT and GIS industry that supply software.

Formal accreditation would also aid international recognition of the Australian-New Zealand approach. The proposed symbolology fulfils a role that is not currently met by any existing Standards and is designed to complement the US FGDC approach. There is an opportunity for Australia and New Zealand to

contribute to development of an international approach to the use of map symbols, especially at the operational level.

The time frame for developing and certifying an accredited standard is expected to be lengthy. The ICSM is recommended to continue to develop and implement the first version of the All Hazard Symbology with endorsement from peak bodies while exploring formal accreditation by Standards Australia.



## 6. Plan of Action

This section sets out a recommended plan of action for the next twelve months.

### 6.1 Key Activities

Over the next twelve months, the key activities required for the implementation of the All-Hazards Symbology are broken into three stages. Each of the \* marked tasks are further described in the next section.

#### 1. Initial Awareness, Test and Refine

- Distribute this report to interested parties and request comments. Review the comments.
- Promote the symbology catalogue to peak bodies and EM agencies to raise initial awareness
- Formally approach software vendors to seek their assurance that they will commit to incorporation of symbols into their products
- Create functional set of symbols and accompanying catalogue to enable testing in ESRI and MapInfo GIS and web applications.
- Road test and evaluate the recommended symbology with identified EM agencies\*
- Refine the All-Hazards Symbols and their documentation.

These activities should be undertaken over a four month period.

#### 2. Governance and Operational Arrangements

- Establish governance and operational arrangements
- Formalise acceptance and endorsement of the All-Hazards Symbols
- Investigate and decide on certification as AS/NZS Standard

These activities should be undertaken over a four month period in concert with the testing process so that arrangements are in place to support endorsement and commence implementation.

#### 3. Implement the All-Hazards Symbols

- Make the All-Hazards Symbols and supporting documentation available
- Design and develop website to promote awareness of All-Hazards Symbols, enable dissemination and capture comments/ feedback\*
- Implement high-level awareness campaign including formal launch
- Contract development of 'train the trainer' training program to promulgate adoption
- Establish incentive scheme to assist conversion/adoption\*
- Establish maintenance and feedback processes
- Plan and scope Version 1.1

This final set of tasks is expected to take approximately six to nine months and would commence once the governance and operational arrangements were instituted. The first step of making the Report available could be done once the mechanisms for maintenance and capturing feedback are agreed and documented.

## 6.2 Further Descriptions

This section further describes three key activities that address significant constraints to implementation.

### 1. Test and evaluate the recommended symbology with identified EM agencies

It is important to verify that the proposed symbols and framework meet the needs of EM sector by enabling a practical assessment (road testing) by line response agencies.

The testing of the first draft symbols should be undertaken by agencies identified as representative of the EM wildfire response as this is the focus for the first set of symbols. A small number of agencies would be selected that ideally operate ESRI and MapInfo platforms and web-based applications. Prior to testing, a set of evaluation criteria should be developed to enable a transparent assessment of the outcomes. The testing would be undertaken over a 3 – 4 week period.

### 2. Design and develop website to promote awareness of All-Hazards Symbols, enable dissemination and capture comments/ feedback

Lack of acceptance of the importance of the symbology standard is a significant risk to implementation. It is vital to use a multi-pronged approach to promote the symbology standard and make it as readily accessible to practitioners as possible. One key mechanism will be a website that enables users to self service their enquiries about the All-Hazards Symbols.

The All-Hazards Symbols website should include features of the FGDC website that enables users to learn more about the symbols, download the latest copy, download example maps and read a Frequently Asked Questions (FAQ).

[www.fgdc.gov/HSWG](http://www.fgdc.gov/HSWG)

In addition, the Australian Antarctic Data Centre operates a website that provides public access to a library of symbols used for Australian and Antarctic marine work. The complete library can be viewed and searched by the public, but only symbology custodians can edit or create symbols. The All-Hazards Symbols website could also enable registered users to contribute proposed changes or new symbols for review.

[aadc-maps.aad.gov.au/aadc/symbology](http://aadc-maps.aad.gov.au/aadc/symbology)

### 3. Establish incentive scheme to assist conversion/adoption

The cost of conversion of existing system applications, GIS and map tools, and potentially operational procedures and training is expected to be substantial and impose a barrier to adoption. The ICSM are recommended to establish a funding mechanism to assist agencies to undertake conversion of existing processes and software.

In addition, a well designed website and training packages would assist to reduce the operational costs of supporting transition to the standard.

## Appendices

Appendix A – Symbology Audit - Agencies Consulted

Appendix B – Symbology Audit- Results

Appendix C – Workshop Summaries

Appendix D – All Hazard Features and Symbols

Appendix E – Implementation Risks

Appendix F – Glossary of Abbreviations

Appendix G – Responses to Final Draft Report