



# Out Of The Fire

*Lessons From Managing Risk In Emergency Services*

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# Purpose

- Allocation of resources based on the risk profile of each place
- Assessment of whether resources are effectively allocated
- Benchmarking between agencies
- Decision-making tool for new investments
- Generic application of this approach to all organisations,
- Including education authorities

# Background

- 3 Emergency Services Agencies : CFS, MFS, SES
- 2 Peak Volunteer Groups
- Firefighters Union
- Priority for the SAFECOM Board
- Lack of progress

# Principles

- The over-riding outcome is safer communities.
- treatments to risk will be considered from the perspective of community safety not historical precedent.
- Resources allocated to areas of greatest need, current and future, based on evidenced risk.
- “Like risk” should receive “like fire and emergency cover”.
- Emergency service delivery based on seamless integration and cooperation.

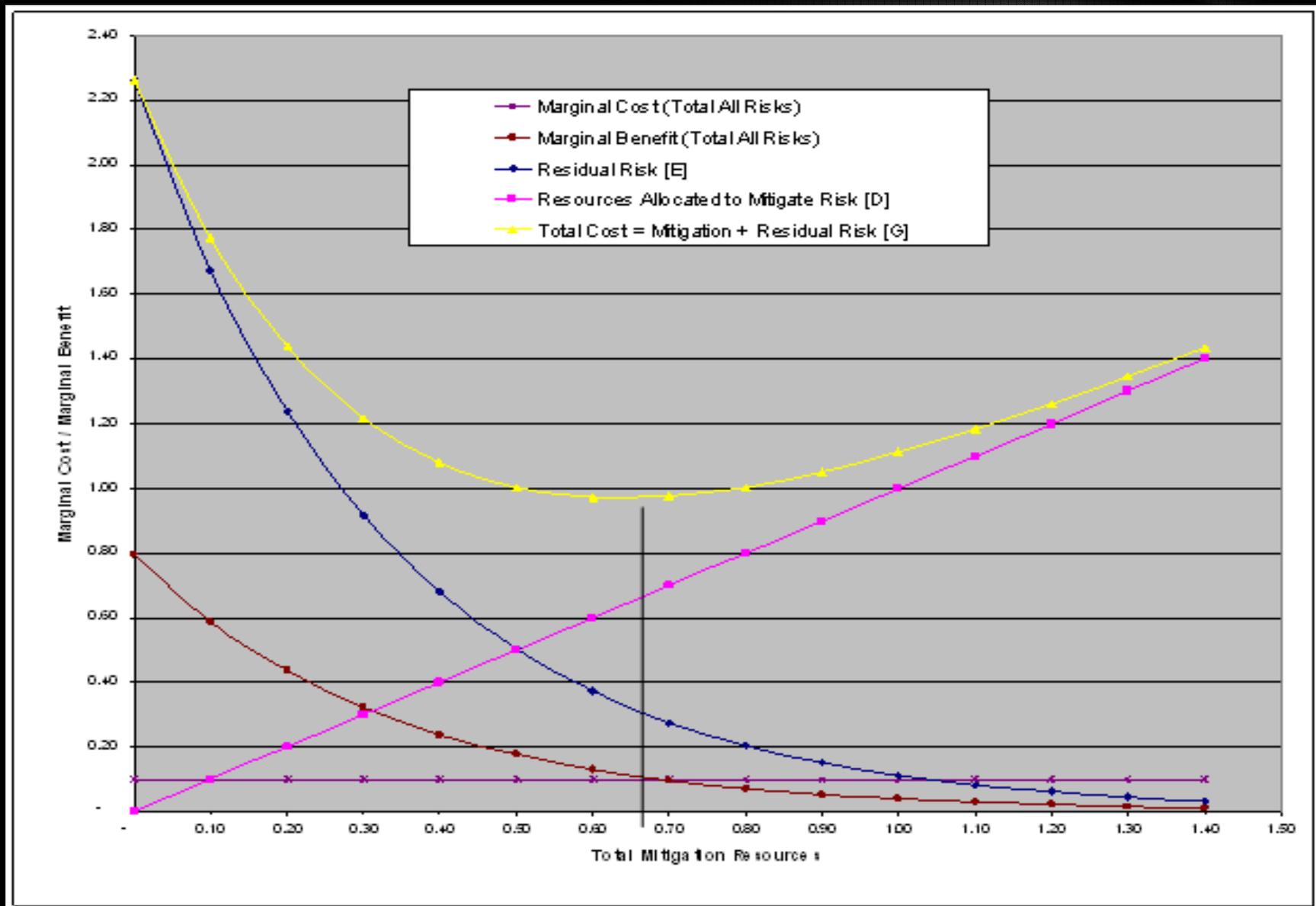
# More Principles

- take account of economic, environmental and social considerations.
- The safety and welfare of emergency services members is highest priority.
- Change management issues need to be considered including the potential impact on communities.
- Risk treatment standards are independent of service provider.
- Transparency & Simplicity

# Understanding Risk

<i>\$bn</i>		
<i>A</i>	<i>10.0</i>	<i>Unmitigated Risk (likelihood % x consequence \$)</i>
<i>B</i>	<i>1.8</i>	<i>Cost of Mitigation by SA Community (includes prevention,</i>
<i>C</i>	<i>0.2</i>	<i>Cost of Mitigation by Emergency Services Agencies</i>
<i>D = B+C</i>	<i>2.0</i>	<i>Total Cost of Mitigation</i> <span style="float: right;"><b>Cost</b></span>
<i>E</i>	<i>2.5</i>	<i>Residual mitigated risk (likelihood % x consequence \$)</i>
<i>F = A-E</i>	<i>7.5</i>	<i>Reduction in Risk Due to Total Mitigation</i> <span style="float: right;"><b>Benefit</b></span>
<i>G = D+E</i>	<i>4.5</i>	<i>Total Cost to Community</i>
<i>H = F/C</i>	<i>3.75</i>	<i>Benefit/Cost Ratio</i>

# Risk Relationships



# Differences in Evaluation Approach

Approach	Perspective	Valuation	Objective	Time preference
Financial	concerned with the cashflows from the agency's point of view.	concerned only with items that have an observed price.	concerned with maximising profitability or minimising cost.	concerned with converting future costs and benefits to a single point in time.
Economic, Social and Environmental	concerned with costs and benefits that accrue to the whole community	quantifies costs and benefits that are not necessarily valued in markets. In many cases it will not be sensible to assign \$ to these costs and benefits.	assists in identifying initiatives that maximise net total benefits.	
Budget	concerned with revenues and outlays that affect the whole of government	concerned only with items that have an observed price.	assesses the impact on State debt, net operating balance and net Lending.	takes no explicit account of the time preference of outlays and receipts.

From: The Guidelines for the Evaluation of Public Sector Initiatives SA Treasury

# Accounting Versus Costing

Actual rather than theoretical costs were used because:

- Actual costs reflect what actually happens not what should happen
- A comparison of ideal service standards to actual risk will not by itself provide information on where things need to change.
- Any attempt to produce “ideal” service standards is unlikely to gain support from all stakeholders.
- “Ideal” service standards may result in missed opportunities and less than optimal effectiveness.

# Measuring Risk

- Risk analysis is the systematic process to understand the nature of and to deduce the level of risk.
- The level of risk is determined by combining consequence and likelihood.
- Likelihood is the chance of an event happening. Consequence is the outcome of an event, should it occur.

# Likelihoods and Consequences

Risk	Likelihood	Consequence
Non-Structural Fire	Incident History	Calculated by different property values at each location and constant standard valuation of human life x population at each location
Structure Fire	Incident History	Calculated by different property values at each location and constant standard valuation of human life x population at each location
Road accident rescue	Incident History	Calculated constant standard valuation at each crash location based on research papers
Flood	Incident History	Calculated constant standard valuation at each flood location based on research papers
Storm/Wind /Tree Down	Incident History	Calculated constant standard valuation at each storm location based on research papers

# Likelihoods and Consequences

Risk	Likelihood	Consequence
Hazardous Material including Leaks & Spills	Incident History	N/A
False Alarm & Investigation	Incident History	N/A
Search or Rescue (not Car Crash or Animal)	Incident History	N/A
Earthquake	N/A	N/A
Tsunami	N/A	N/A
Other	Incident History	N/A

# Allocating Risk to Locations

Risks are measured at three levels:

- The systemic or state-wide level,
- The geographic group level (based predominantly on the CFS groups)
- The cost centre level, which allocates risks to the brigades, stations and units that responded to each risk incident.
- Some risks such as earthquake are only considered at the state-wide level as they are infrequent and resourcing for mitigating these risks is centralised.

# Non-Structural Fire

- Incidents over a ten year period x  
Consequence based on the value of  
buildings and human life in each location.
- Multiple regression analysis revealed that  
non-structure fire risk is, as expected, a  
statistically significant component of the  
implicit rationale for resource allocation  
within the emergency services sector.

# Structural Fire

- Incidents over a ten year period x  
Consequence based on the value of  
buildings and human life in each location.
- Multiple regression analysis revealed that  
non-structure fire risk is, as expected, a  
statistically significant component of the  
implicit rationale for resource allocation  
within the emergency services sector.
- Inclusion of Economic or Business  
Discontinuity Losses from Structural Fire  
made no difference to analysis

# Road accident rescue

- Incidents over the 5 year period x  
Consequence based on an estimate of the economic losses from different categories of road accident by the Bureau of Infrastructure, Transport and Regional Economics
- The multiple regression analysis revealed that road crash rescue risk is, as expected, a statistically significant component of the implicit rationale for resource allocation within the emergency services sector.

# Other Risks

- Hazardous Material including Leaks & Spills (HazMat) are small but statistically significant.
- Floods are not statistically significant.
- Storm/Wind/Tree Down incidents are not statistically significant.
- False Alarm & Investigation. It is not known in advance that a false alarm is in fact not an actual fire and as such it would be difficult to justify a resource allocation policy that did not include this activity.
- Search or Rescue (not Car Crash) are not statistically significant.

# Emerging and Future Risks

- An example of a changed (increased) risk profile is an outer suburb, which has more higher density housing now than it did on average for the ten years prior to 2007.
- An example of an emerging or future risk that is changed (increased) is Buckland Park near Virginia where a large housing development is soon to be built on a flood plain.
- If the emergency services sector failed to respond to a major flood or structure fire at Buckland park, reliance on only historical data would be unlikely to satisfy any external review or enquiry such as that by the coroner.
- There is a duty of the emergency sector management to moderate the statistical approach with their expert assessment of emerging risks.

# Unquantifiable Risks

- Tsunami
- Earthquake
- Search and Rescue

# Activities not related to Risk

- public relations,
- welfare,
- community service,
- animal rescue.

# Measuring Resources

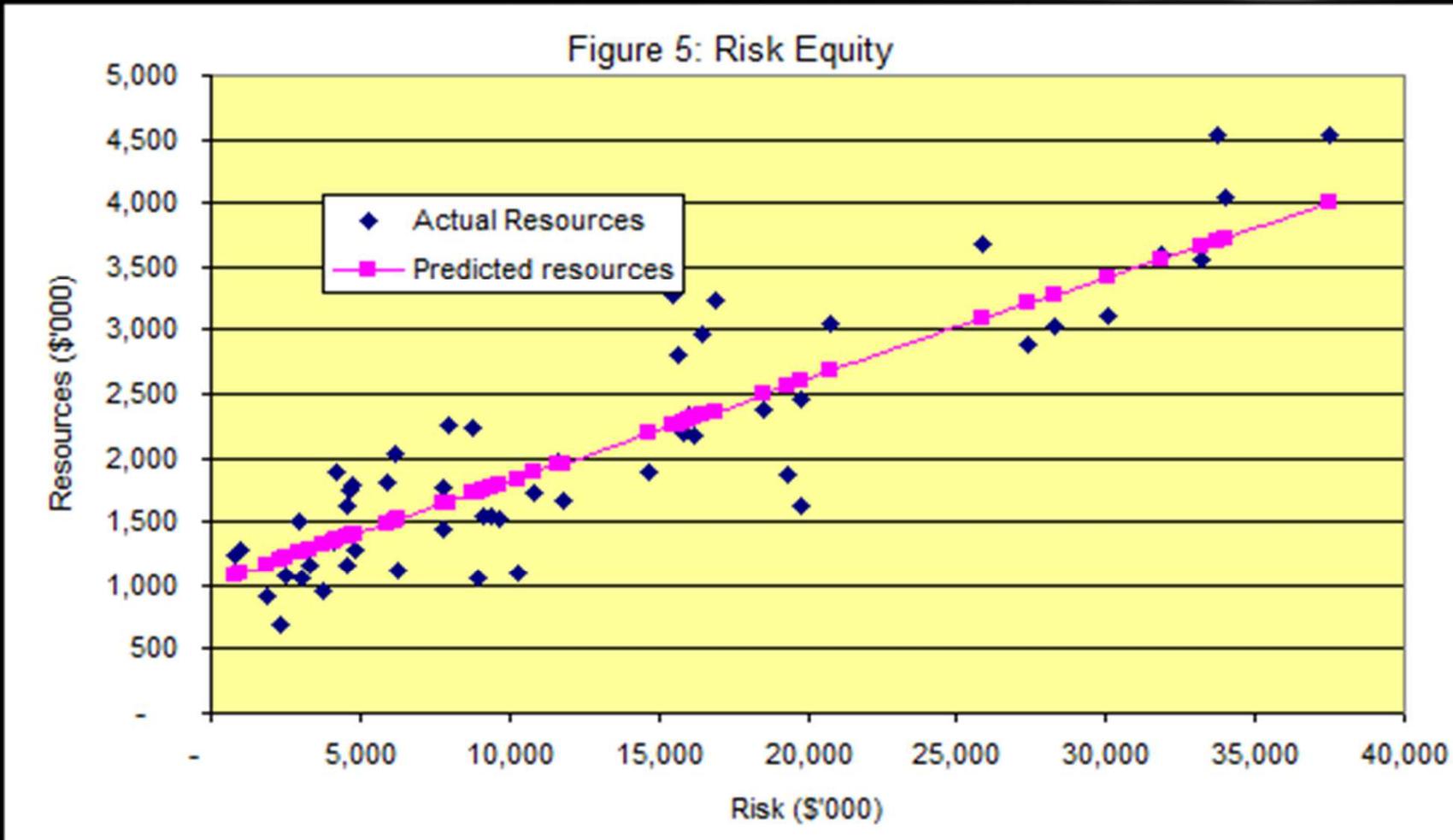
- Attribution of Costs
- Volunteer Costs
- Vehicles, Plant and Equipment
- Land and Buildings

# Comparing Risk and Resources

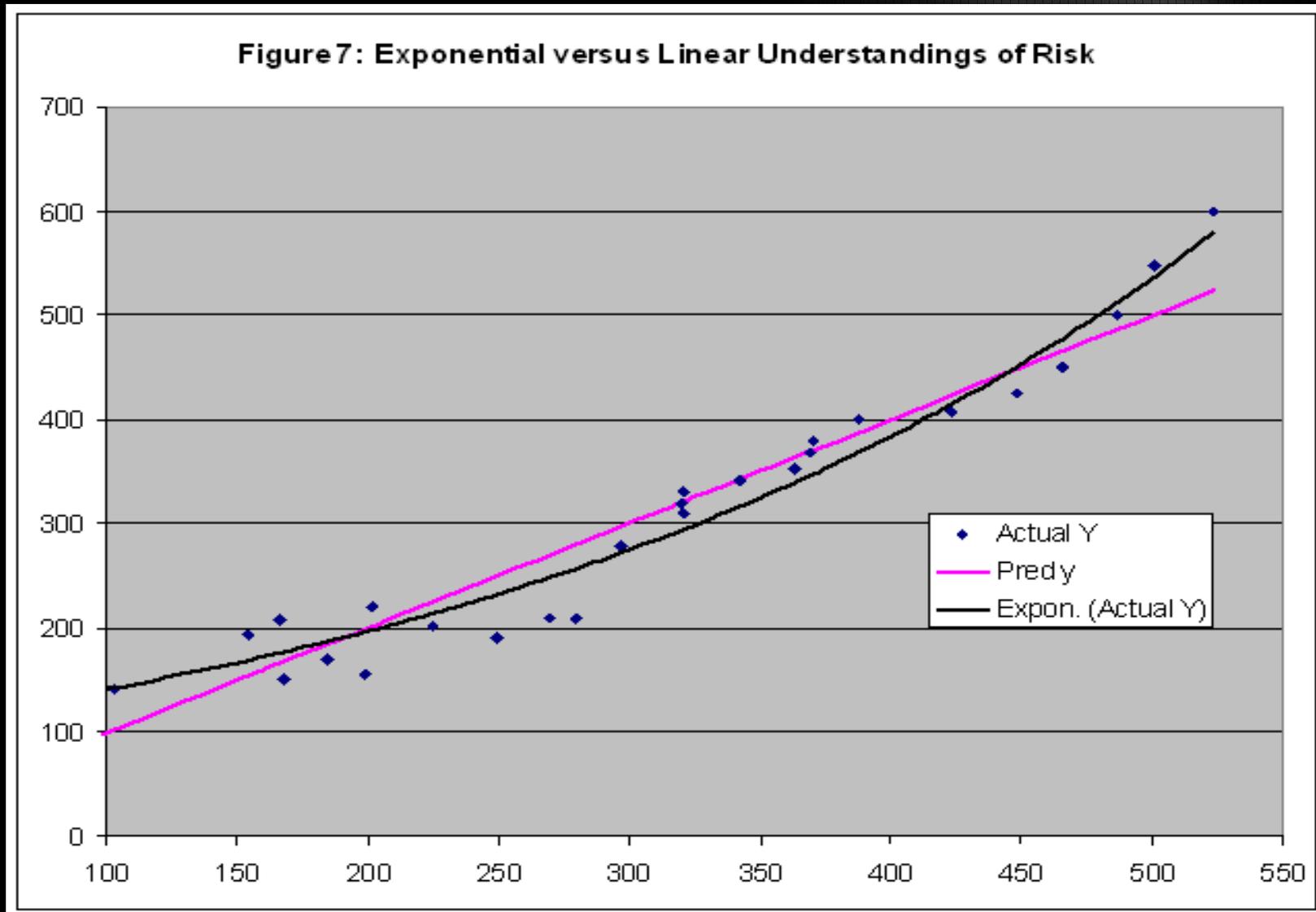
The analysis examined:

- what resources are actually allocated to each brigade/station/unit, and
- what resources would have been allocated if the only criteria were to allocate based solely on the risk profile of each location.
- The individual brigade/station/unit information aggregated to larger notional geographic groupings.

# Multiple Regression

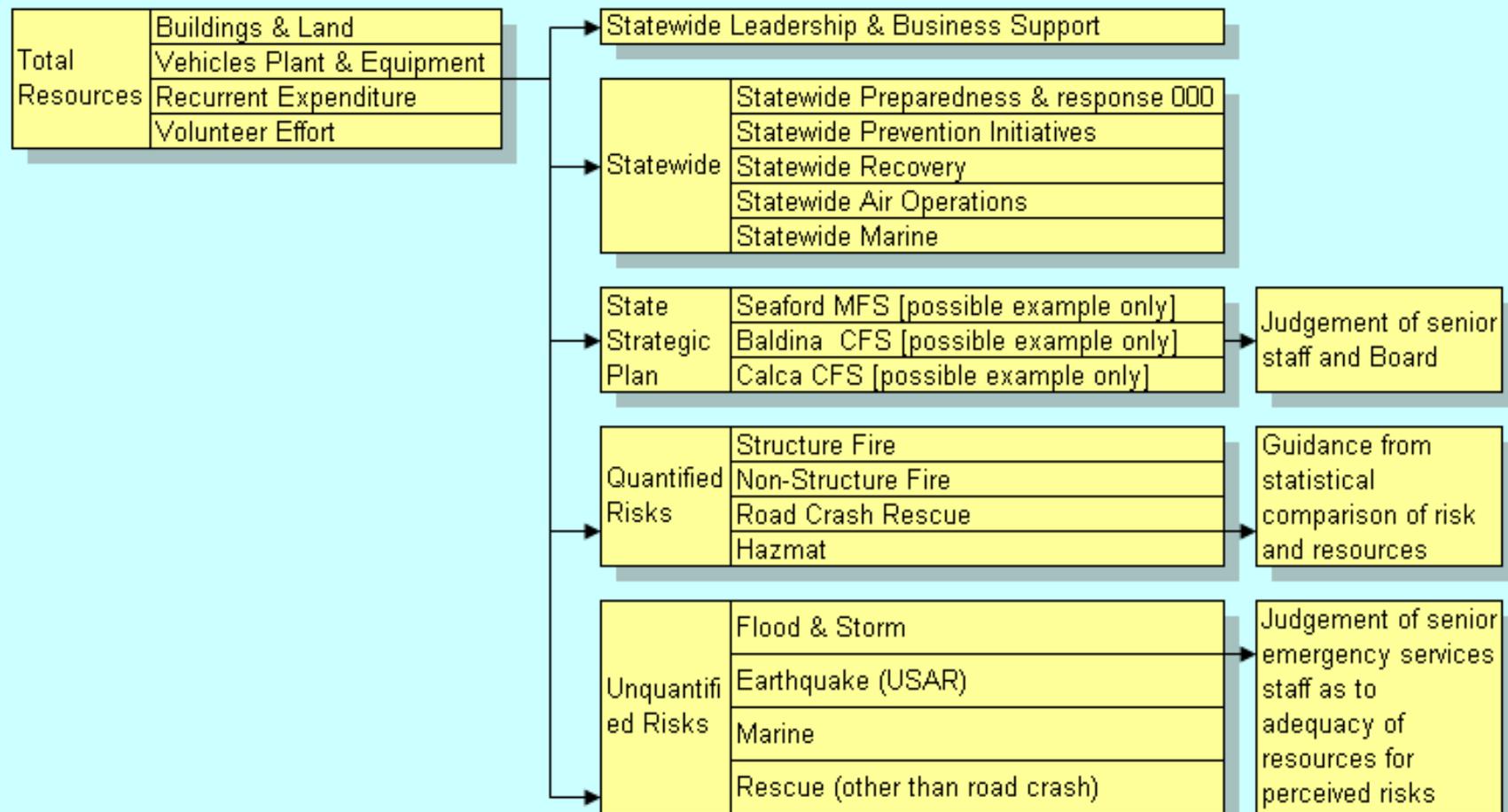


# Investigation of non-linear function



# Framework for the Emergency Service Delivery

Figure 8: Systemic Allocation of Resources



# Allocation of Resources

		CFS	MFS	SAFECOM	SES	TOTAL	
Site Related Costs	Site Allocation	53,891,009	78,800,049	-	10,170,717	142,861,774	55.2
	Indirect Allocation	31,438,083	18,507,040	-	6,502,426	56,447,548	21.8
	Total Allocation	85,329,091	97,307,089	-	16,673,143	199,309,322	77.0
State Wide Risk Related Costs	Statewide Preparedness & response 000	-	4,681,731	56,635	30,350	4,768,716	1.8
	Air Operations	6,743,913	-	-	-	6,743,913	2.6
	Prevention	4,450,175	2,765,231	98,297	-	7,313,704	2.8
	HAZMAT	139,614	562,313	-	-	701,927	0.3
	USAR	-	1,835,776	-	-	1,835,776	0.7
	Search & Rescue (Not USAR)	-	-	-	14,731	14,731	0.0
	Recovery	-	538,576	-	-	538,576	0.2
	Marine	-	1,504,298	-	211,461	1,715,759	0.7
	Total Direct Risk Related	96,662,794	109,195,014	154,932	16,929,686	222,942,426	86.1
HQ Costs	State Office leadership & Support	7,250,909	8,020,440	16,809,918	3,517,658	35,598,926	13.8
Costs Excluded from Analysis	Adjustment to Worker Compensation Liability in Balance Sheet	2,013,812	-1,401,413	-220,133	-464,809	-72,543	0.0
	Allocated to Overseas and Interstate Aid	-	29,069	-	-	29,069	0.0
	Allocated to Cost Centres Excluded from Analysis (sites about to be sold or land purchased in anticipation of future building)	3,369	228,801	214	89,870	322,254	0.1
	Grand Total	105,930,884	116,071,912	16,744,931	20,072,404	258,820,132	100
Analysis	State Office leadership & Support as of Total	7%	7%	100%	18%	14%	

# How well resources match risk

A benchmark of the degree to which resources are currently allocated based on risk, where:

- Resources includes the value of paid staff, volunteers, vehicles plant and equipment and buildings and land, and
- Risk is the likelihood of an emergency based on incidence data x the consequence of the emergency in terms of human life and assets.
- the total cost of mitigating risk to the community is compared to the total value of the risk to the community.

# Annual Review

The benchmark will change over time due to:

- Strategic or operational changes put in place by the emergency services agencies.
- The underlying risk profile of individual locations changes (eg. people move to new suburbs or roads improve).
- The quality of the data improves.

# The Benchmark as a Tool

The benchmark is also a useful tool for Management to assess proposals for change:

- would a proposed additional appliance at a particular location result in the benchmark increasing or reducing?
- would the proposed closure of a station or the opening of a brigade result in the benchmark increasing or reducing?

# Generic Approach to all organisations

## Usual Risks:

- Fraud
- Occupational Health & Safety
- Market
- Reputational
- Client Safety

## Optimisation of Risk Mitigation

# Initial Risk Plan Adjusted $R_2=0.02$

	Risk	Mitigation Activity	Mitigation Cost	Risk Reduction Benefit	BC Ratio
1	Cheque is stolen	separation of Duties	10,000	1	0.0
2	Uninsured cars	specialised insurance	4,590	70,000	15.3
3	Under-insured Properties	regular review	20,000	180,000	9.0
4	Reputational Risk Bad publicity from inappropriate staff behaviour	training	15,000	280,000	18.7
5	Client funds used for staff purchase	separation of Duties & modification to CRM	100,000	19,000	0.2
100	Etc Etc	Etc Etc	100,000	1,000	0.0
	Total		249,590	550,001	2.2

# Revised Risk Plan Adjusted $R_2=0.62$

	Risk	Mitigation Activity	Mitigation Cost	Risk Reduction Benefit	BC Ratio
1	Cheque is stolen	separation of Duties	-	-	#N/A
2	Uninsured cars	specialised insurance	4,590	70,000	15.3
3	Under-insured Properties	regular review	20,000	180,000	9.0
4	Reputational Risk Bad publicity from inappropriate staff behaviour	training	15,000	280,000	18.7
5	Client funds used for staff purchase	separation of Duties & modification to CRM	-	-	#N/A
100	Etc Etc	Etc Etc	-	-	#N/A
	Total		39,590	530,000	13.4

# Revised Risk Plan Adjusted R2=0.93

	Risk	Mitigation Activity	Mitigation Cost	Risk Reduction Benefit	BC Ratio
1	Cheque is stolen	separation of Duties	-	-	#N/A
2	Uninsured cars	specialised insurance	4,590	70,000	15.3
3	Under-insured Properties	regular review	20,000	180,000	9.0
4	Reputational Risk Bad publicity from inappropriate staff behaviour	training	200,000	7,000,000	35.0
5	Client funds used for staff purchase	separation of Duties & modification to CRM	-	-	#N/A
100	Etc Etc	Etc Etc	-	-	#N/A
	Total		224,590	7,250,000	32.3

# Application to Education Authorities

Risk that a child will not:

- be safe
- Be healthy
- Learn
- Thrive

Evaluation of interventions and programs  
from a risk perspective

Consequence (failure to complete  
schooling) x Likelihood

# Acknowledgements

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Thank You