WYONG SHIRE COUNCIL

Draft Climate Change Policy

December 2009

Technical Guidelines

TECHNICAL GUIDELINES FOR ADAPTATION TO CLIMATE CHANGE

Table 1 CLIMATE CHANGE PROJECTIONS[9]

The following table outlines the anticipated minimum climate change projections and implications of altered frequencies and intensities of extreme weather, climate and sea level events to be used in all Council's strategic, infrastructure and operational planning.

	Present [1]	Projected Change 2030	Projected Change 2070	Impacts upon Built Environment	Impacts upon Natural Environment	Impact upon Human Aspects
Rainfall[9]						
Annual Average	1094mm	-13 to +7%	-40 to +20%	• Uncertain water quantity and quality for consumption.	• Decreased biodiversity resilience and changes in the distribution of plant and animal species. • Increased risk, severity and incidence of fire. • Increase likelihood and severity of drought. • Decrease in annual surface water run-off.	• Decrease in water supply.
Annual Extreme Rainfall[3] **(Increased flood risk)**		-3 to +12%	-7 to +10%	• Damage to infrastructure. • Stormwater and sewerage systems inundated with frequent sewage overflow. • Power outages, disrupted communication and transport networks.	• Altered river flows and flooding zones. • Increased erosion and sedimentation. • Changes in flood regimes may lead to morphological changes in streams. • Salt gradient and sedimentation will effect catchment and waterway health. • Changes to acid sulphate soil behaviour.	• Changed spread of diseases (such as dengue fever), pests and weeds. • Increased cost of storm damage to property and infrastructure. • Loss of private and public assets.
Rainfall Intensity[7]			+30%			
Evaporation		+1 to +8%	+2 to +24%		• Increased fire risk. • Reduced water availability for ecosystems, potentially leading to increasing eutrophication and algal blooms.	• Decrease in water supply.
Droughts per decade[4]	3	2 to 5	1 to 9			
Extreme Winds	0	-5 to +8%	-16 to +24%			
Fire Days[5]	9	9 t0 11	10 to 15	• Greater impact on urban fringe. • Asset protection zone design. • Greater loss of infrastructure and property. • Landfill destruction. • Power outages, disrupted communication and transport networks.	• Simplification of ecosystems and communities. • Loss of biodiversity. • Air quality impacts.	• Increased asthma from smoke. • Increased risk to personnel. • Increased loss of life. • Reconsider approach to fire management and increased investment in equipment. • Loss or damage to public and private assets.

	Present [1]	Projected Change 2030	Projected Change 2070	Impacts upon Built Environment	Impacts upon Natural Environment	Impact upon Human Aspects
Temperature[9]						
Average	[2] 17 to 26°C	+0.2 to +1.6°C	+0.7 to +4.8°C	• Rise in evaporation rates will reduce moisture balance, increasing vulnerability to water supply shortages • Damage to infrastructure and housing design.	• Degradation of viable habitat. • Limited capacity of some species to disperse to new locations. • Disruption to connectivity reduction/loss of some species. • Shift in distribution of some species – increase in feral distributions. • Reduced ability to adapt and survive. • Reduced resilience of ecosystems. • Changes to fire regimes. • Loss of coastal wetlands.	• Increase in the incidence of asthma (dust, smoke, organisms). • Possible increased cost of agricultural production and/or changed products. • Increase in deaths from heat events. • Increased demand for air conditioning (more energy use). • Energy supply not sufficient as demand increases and supply failures increase. • Interruption to essential services, reduced community accessibility and mobility.
Annual cold days < 0°C	0	0	0			
Days above 35°C	3	4 to 6	4 to 18			
Days above 40°C	0	0 to 1	1 to 4			
Sea Level Rise[8]						
Note: Tuggerah Lakes water surface is between 0.2-0.3m above mean tidal ocean level, therefore although uncertainty exists, it is anticipated that the levels will rise proportionately in line with the projected rise in sea level and this will result in broader areas of inundation around the Lake.		**Projected Change 2050**	**Projected Change 2100**	**Impacts upon Built Environment**	**Impacts upon Natural Environment**	**Impact upon Human Aspects**
		40cm	[6] 93cm	• Increased cost of storm damage to property and infrastructure. • Risk to underground telecommunications systems. • Seafront infrastructure (seawalls, jetties) at risk.	• Increased pressure on dune system – increased saltwater intrusion, coastline erosion and shoreline recession. • Marine inundation of coastal wetlands. • Landward migration of mangrove habitat from tidal inundation. • Loss of saltmarsh. • Changes in habitat due to saltwater intrusion.	• Loss of public space and existing facilities. • Damage to places of cultural significannce. • Interruption to essential services. • Loss of income and tourism by reduction of population growth.

1 Present day conditions for temperature and rainfall represent long-term averages from the Bureau of Meteorology. For extreme temperatures, the present average is based on 1964-2003. For fire danger, the present average is based on 1974-2003. For drought, the present average is for a period centred on 1990.
2 Range represents average July and January maximum temperature.
3 Defined as 1 in 40 year 1-day rainfall total. Values represent the range in seasonal projections from a limited set of climate models for central eastern NSW. However, given strong spatial gradients in extreme rainfall projections (see Hennessy et al., 2004b), these regional results may not be applicable for Sydney.
4 The values for drought represent average monthly drought frequencies, based upon the Bureau of Meteorology's criteria for serious rainfall deficiency (see also Burke et al., 2006).
5 Number of days annually with a "very high" or "extreme" fire danger index. Changes are for 2020 and 2050, respectively, as in Hennessy et al. (2005).
6 Sea level rise projection for 2100 has had the rounding of 3cm removed from the reported 90cm (DECC 2009).
7 NSW Department of Environment and Climate Change 2007 Floodplain Risk Management Guideline entitled *Practical Considerations of Climate Change*.
8 NSW Department of Environment and Climate Change 2009 *Draft Sea Level Rise Technical Guidelines*.
9 Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2006 *Climate Change in Sydney Metropolitan Catchments* Australian Greenhouse Office Councils Group and the Australian Department of Climate Change.

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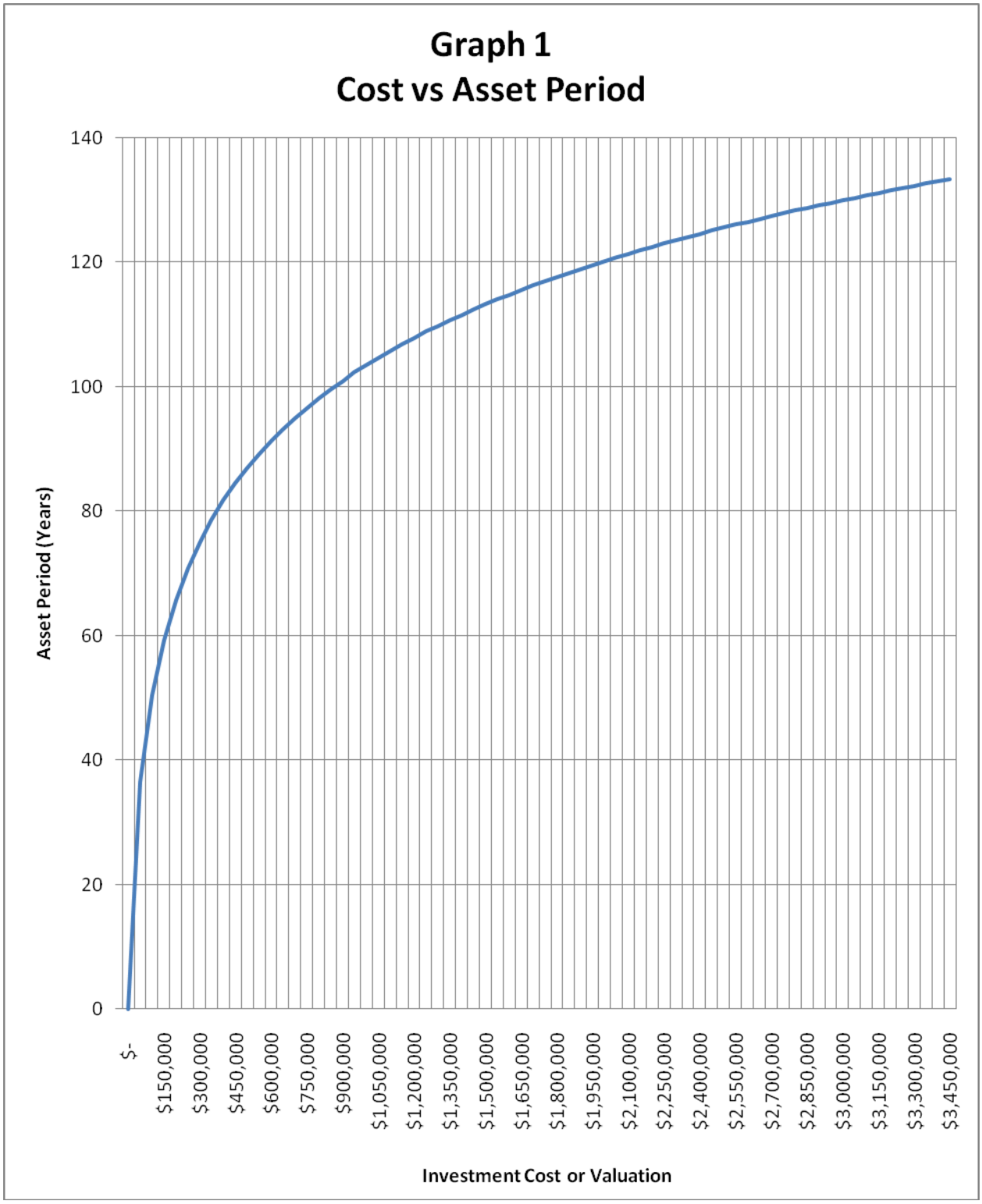

Graph 1
Cost vs Asset Period
Asset Period (Years)
140
120
100
80
60
40
20
0
$-
$150,000
$300,000
$450,000
$600,000
$750,000
$900,000
$1,050,000
$1,200,000
$1,350,000
$1,500,000
$1,650,000
$1,800,000
$1,950,000
$2,100,000
$2,250,000
$2,400,000
$2,550,000
$2,700,000
$2,850,000
$3,000,000
$3,150,000
$3,300,000
$3,450,000
Investment Cost or Valuation

Cost Vs Asset Period

An Asset Period is the time that a development, infrastructure, works or activity maintains a specified level of service and condition, based on community and client expectations. It does not consider the development's commencement or completion date.

Examples

a) An addition or extension with a construction cost of about $50k would equate to approximately a 35-year asset period, while a $100k addition equate to a 50-year asset period.

b) A subdivision with a construction cost of about $1.5m would equate to approximately 115-year asset period.

(Note: the cost of works for subdivisions is not always an appropriate indicator to determine asset period. In this case the standard planning period should be 100 years.

c) An industrial or commercial development with a construction cost estimated at $1.0m would equate to approximately 102-year asset period.

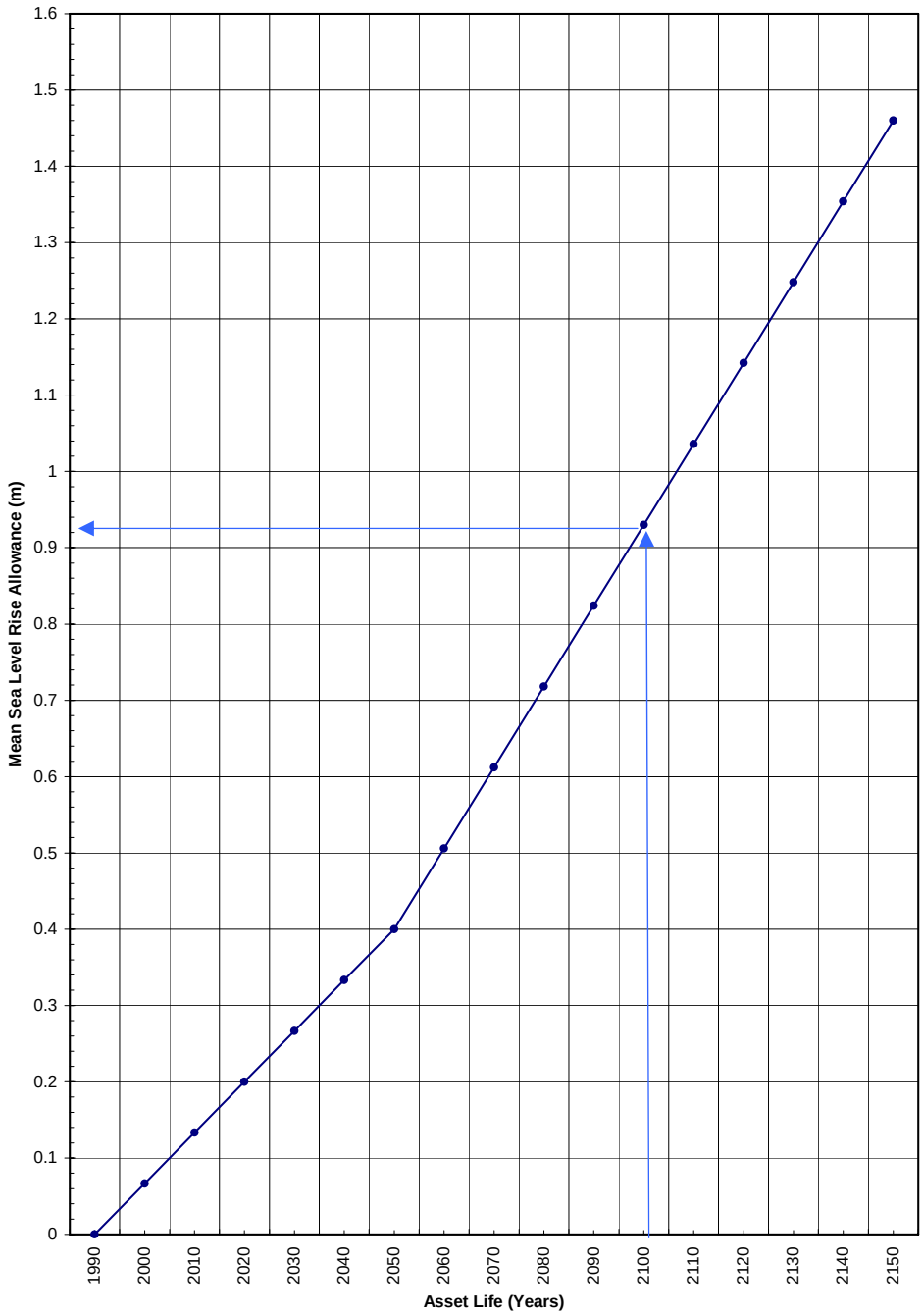
d) A small new dwelling timber framed and hardiplank with an estimated cost $200k would equate to approximately 65-year asset period.

e) A large new dwelling full masonry with an estimated cost $600k would equate to approximately 90-year asset period.

Notes

1) Median cost of new house 07-08 is $272,000 based on ABS sources.
2) Anecdotal evidence indicates that a residential brick veneer dwelling has a 60 to 75 year asset period.
3) 10-year average interest rate is 7.28% and CPI is 3.08% based on RBA sources.
4) Nett rate of growth on investment based on 10-year averages is 4.20%.
5) Curve determined by fixing $300,000 average new residential brick veneer dwelling cost to 75-year asset period.
6) Investment Cost is the capital cost, implementation cost, development cost or valuation of a proposed development, infrastructure or works to construct, enact or activate on a parcel of land, whether private or public. The accumulative Investment Cost of a larger network, community facility or system must be considered when dealing with a small or component of a development.

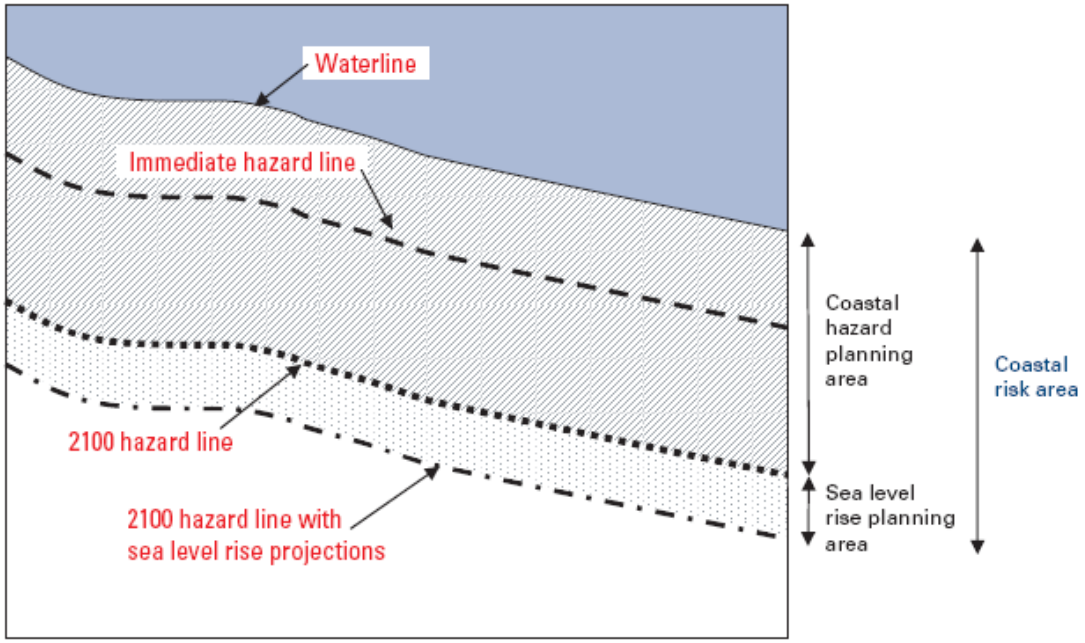
Graph 2: Mean Sea Level Rise Allowance for Asset Life



Climate Change Allowance for Asset Life – based on Mean Sea Level Rise

To allow Council to meet its legislative responsibility and reduce the impacts of climate change on residents, an additional Climate Change Allowance (CCA) is determined, (based on the asset period), to be applied to the current FPL for a development that meets the appropriate criteria.

Figure 1 – Coastal risk areas relating to coastal hazards



Nb: Coastal hazard planning areas and **sea level rise planning areas** are identified in coastal hazard studies undertaken in accordance with the *Coastline Management Manual* and the *draft Coastal Risk Management Guide* (DECCW, 2009a). **Coastal risk area** is the term used in this Guideline to identify the land covered by both the coastal hazard planning area and sea level rise planning area.

Source: Dept of Planning 2009

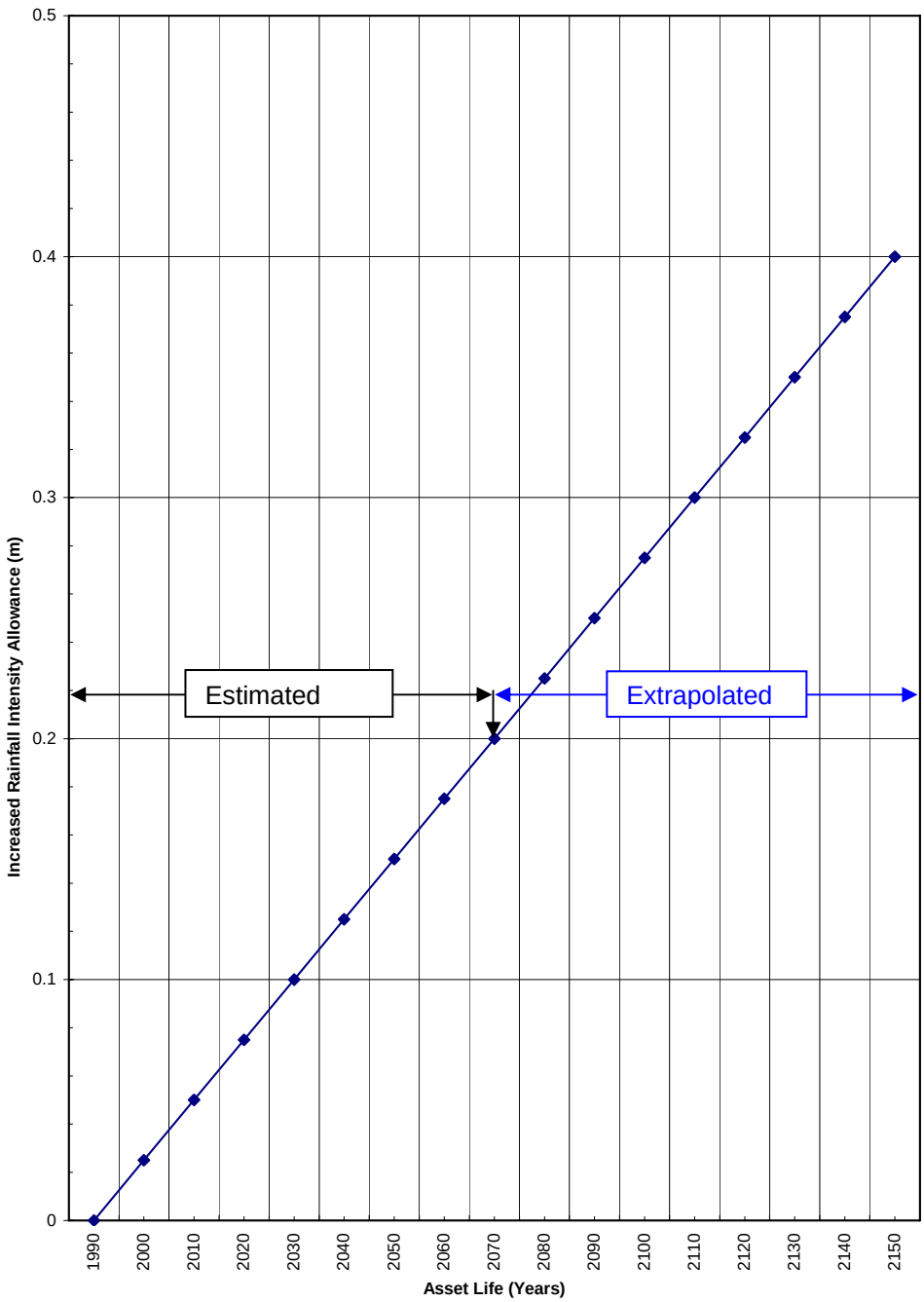
Examples

a) An industrial or commercial development in Lake's hydraulic influence with 102-year Asset Period (AP) activated in 2025; Climate Change Allowance (CCA) would be applied at 1.21m.
b) A new dwelling full masonry adjacent to creek but within hydraulic influence of Lake with 90-year AP activated in 2015; CCA would be applied at 0.98m (Graph-2) plus 0.28m (Graph-3A or 3B)
c) An addition or extensions on coast with 35-year AP but activated in 2040; CCA would be applied at at 0.65m
d) New dwelling timber framed and hardiplank on coast with 65-year AP activated in 2060; CCA @ 1.20m

Note:

1) Sea level rise rates are based on DECCW's Draft Technical Note February 2009, 40cm by 2050 and 93cm by 2100
2) Climate change influences and estimates rely predominantly on sea level rise and rainfall intensity estimates by government and research agencies as it is assumed that the beach berm at The Entrance will permanently fail in the medium term.
3) Asset Life is the time frame within which the Asset Period coincides from a specific start date to its completion date, beyond the Asset Period.
4) Ocean Properties have their FPLs determined by tidal fluctuations, wave run-up and ocean inundation. Mean Sea Level Rise Allowance relies totally only on sea level rise estimates by government and research agencies.
5) Lake Properties are generally located immediately adjacent to the lakes and their FPLs are determined by the ponding influences from the lake system. It can also include those properties well upstream of Lakes and adjacent to a Creek and that have a hydraulic backwater influence from the Lake.

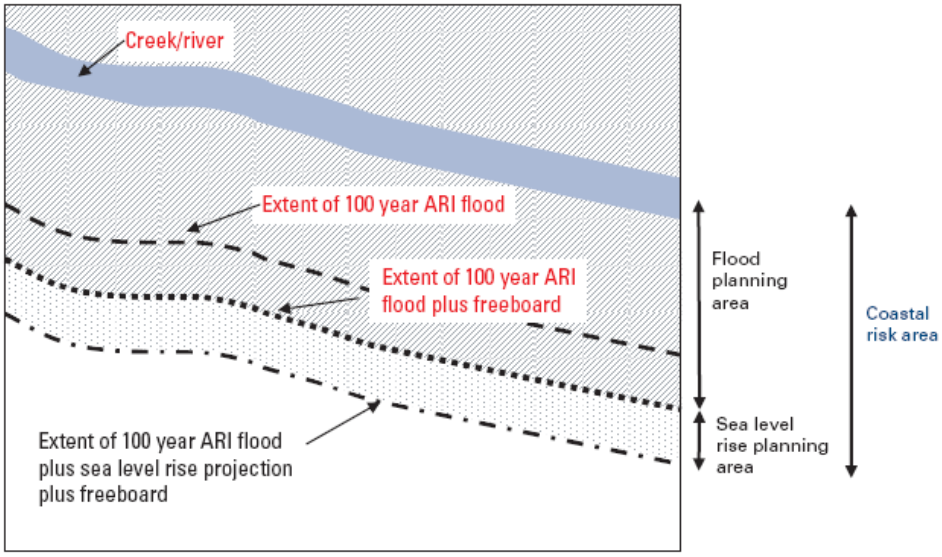
Graph 3A: Increased Rainfall Intensity Allowance for Asset Life (Generic)



Increased Rainfall Intensity (Climate Change) Allowance for Asset Life for Creeks and Rivers Generic (the Porters Creek Flood Study data is used where no specific study has been completed)

Creek Properties have their FPLs determined directly from channel and floodplain hydraulics and are located immediately adjacent to an overland flowpath, floodway, creek or river that does not have a hydraulic influence from the lakes.

Figure 2 – Coastal risk areas relating to coastal flooding



Nb: Flood planning areas and **sea level rise planning areas** are identified in flood studies undertaken in accordance with the *Floodplain Development Manual* and the *draft Flood Risk Management Guide* (DECCW, 2009b). **Coastal risk area** is the term used in this Guideline to identify the land covered by both the flood planning area and sea level rise planning area.

Source: Dept of Planning 2009

Examples

a) A subdivision adjacent to creek system with 115-year AP but activated immediately; would apply a CCA of 0.34m.

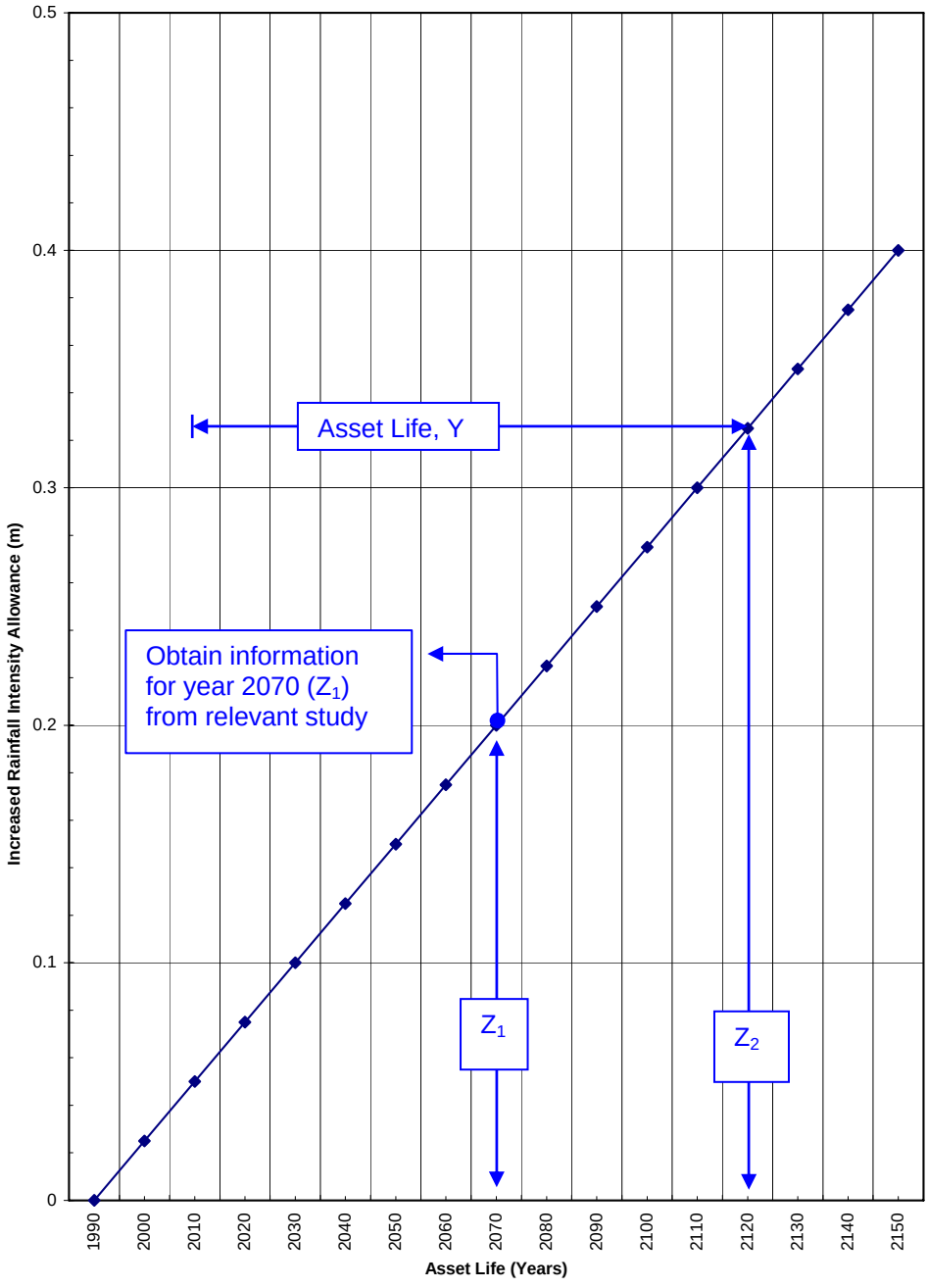
b) An industrial or commercial development in creek's hydraulic influence with 100-year AP activated in 2015; 0.32m.

c) A new dwelling full masonry adjacent to creek but within hydraulic influence of Lake with 90-year AP activated in 2015; would apply a CCA of 0.98m (Graph-2) plus 0.28m (Graph-3A or 3B)

Note:

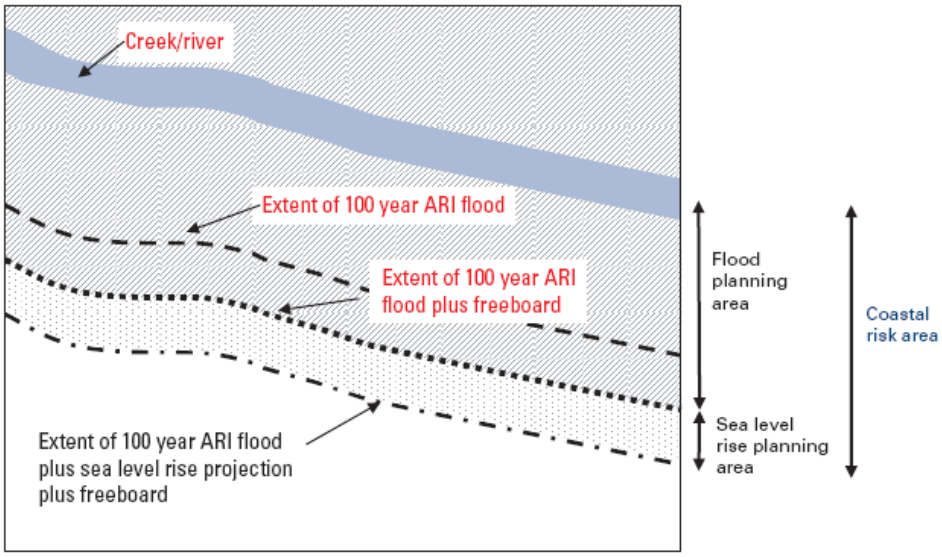
1) Rainfall intensity increases of 30% by 2070 based on DECCW's Practical Consideration of Climate Change - October 2007
2) Climate change influences and estimates rely predominantly on sea level rise and rainfall intensity estimates by government and research agencies as it is assumed that the beach berm at The Entrance will permanently fail in the medium term.
3) Creek flood level rise average of 200mm by 2070 based on 30% increase in 1% AEP design rainfall intensity from Porters Creek Flood Study
4) Asset Life is the time frame within which the Asset Period coincides from a specific start date to its completion date, beyond the Asset Period.

Graph 3B: Increased Rainfall Intensity Allowance for Asset Life
(Flood Study Available with Climate Change information)



Increased Rainfall Intensity (Climate Change) Allowance for Asset Life for Creeks and Rivers (where a specific Flood Study provides climate change information)

Figure 2 – Coastal risk areas relating to coastal flooding



Nb: Flood planning areas and **sea level rise planning areas** are identified in flood studies undertaken in accordance with the *Floodplain Development Manual* and the *draft Flood Risk Management Guide* (DECCW, 2009b). **Coastal risk area** is the term used in this Guideline to identify the land covered by both the flood planning area and sea level rise planning area.

Source: Dept of Planning 2009

Example

A development with an estimated cost of $900,000 will be built in 2010. Graph 1 indicates an equivalent asset period as 105 years. The length of time between year 1990 and 2010 (year application made) is 20. At year 2070, the increased rainfall intensity allowance based on the flood study is 0.20 metres. The climate change allowance due to increased rainfall intensities to the end of the asset life is calculated by:

$$= \frac{0.2 \text{ metres}}{(2070 - 1990) \text{ years}} \times (105 + 20) \text{ years} = 0.3125 \text{ metres}$$

Note:

1) Rainfall intensity increases of 30% by 2070 based on DECCW's Practical Consideration of Climate Change October 2007
2) Climate change influences and estimates rely predominantly on sea level rise and rainfall intensity estimates by government and research agencies as it is assumed that the beach berm at The Entrance will permanently fail in the medium term.
3) Creek Properties have their FPLs determined directly from channel and floodplain hydraulics and are located immediately adjacent to an overland flowpath, floodway, creek or river that does not have a hydraulic influence from the lakes.
4) In absence of increase in rainfall intensity information beyond 2070, increased rainfall intensity allowance obtained from flood study is to be linearly extrapolated to the year to which the asset life has been determined