Planning for Climate Change in the Coastal Regions of New South Wales

A Discussion Paper

Part 1 The Risk Model for Climate Change

Part 2 The Principal of Planned Retreat

For Land Potentially Effected by Flood till the year 2100

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The Risk Model is an approach for local councils in NSW to plan for future climate change in an equitable and proactive way. It allows local government to approve developments that are under the maximum benchmarks set by the State Government of NSW of 900mm over the present levels while at the same time reduces risks to litigation due to damage of properties from climate change brought by property owners who's developments are below this maximum standard set by the State Government. (Often a maximum standard set by State Governments become a minimum standard for local government.)

The Risk Model and the Principal of Planned Retreat related to Sea Level Rise

Originally Published January 2010 By David Holland

Table of Contents

Executive Summary

Whether you accept climate change as a fact or not, climate change has been put squarely on the agenda for local government in New South Wales. The State government, after carefully considering the science of climate change has accepted a model that predicts that sea levels will rise over the next 90 to 100 years.

After considering all the factors related to climate change and the potential for land to be inundated, the State government has asked local councils to produce a policy document to recognise climate change as a factor to be considered for future planning strategies. As a first step towards the implementation of development standards that will recognise a change in sea levels towards 2100, councils will be required to reassess their current 1 in 100 flood levels to determine an appropriate standard for minimum floor levels of new developments.

The State government has identified an increase in sea levels on the coast of New South Wales of up to 900mm over the next 90 years to the year 2100, but has indicated that until councils can assess new flood level projections, councils should assume the increase in the projected sea level of 900 mm to be a conservative approximation for a new 1 in 100 flood level benchmark. (Ref. Draft Flood Risk Management Guide by the DECCW, 2009, p. 4.)

To avoid future litigation, some local governments have considered this maximum predicted increase in the 1 in 100 flood level suggested by the State to be the minimum increase required to raise floor levels for new building developments from 2010.

This sudden increase in floor levels causes difficulties for developers, political challengers for councillors and eventually will skew the property market and insurance premiums.

It is expected that councils will be conducting detailed flood modelling to further describe the effects of climate change on individual properties with regard to the intensity of flooding expected, however these models will not address the issue of retiring land no longer unusable or suitable for building sites.

This discussion paper investigates a way to assess the risk of property damage due to flood or tidal inundation caused by climate change so that councils can insure against the affects of climate change for the community. In doing so a real value to the risk is

obtained which then gives an economic value to the maintaining of the risk for any particular year up to the year 2100.

The method described in this paper allows any property, existing or new, to be assessed, a premium set and levied to the land owner within the risk areas subject to the gradual encroachment of the affects of sea level rise and the flooding effects of climate change within the coastal landscapes of New South Wales.

The paper discusses how an organised retreat from high risk areas could be implemented by land buy backs using the property market and disincentives to continue to own the land in high risk locations.

The paper investigates how local government can invest in infrastructure for property protection strategies such as sea walls from the flooding effects of climate change, and proposes an equitable system of applying State and Federal grant money for similar investments.

The paper suggests a method of retiring land by a contributions system from at risk landowners. These contributions in the form of a levy would be applied to a fund designed for the buying of land by council for a range of purposes including for recreation use and for rehabilitation to natural areas. These natural areas will include wetlands to replace wetlands lower in the catchment now permanently inundated, and fauna and flora reserves. This land use measure is to give the land a productive use prior to the land being permanently inundated due to the relentless process caused by climate change, processes including sea level rise and more frequent flooding.

The paper concludes by asserting the advantages of using the approach outlined in this paper and highlights the need for councils to work with the market forces of the property market to achieve good outcomes for the community and the environment.

Planning for the effects of Climate Change related to Sea Level Rise in NSW

Discussion paper

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Introduction

Over the years local Councils have established codes and standards for the built environment. These standards and codes have been carefully calibrated to reflect past experience producing best practice outcomes.

Weather data has been collected for many years and also flood level data. Flood mapping uses all this data along with topographical information to calibrate a level on the ground that reflects the likelihood of a flood to occur at a particular location at a particular height above sea level.

These levels are described as a level where a flood might reach in a culmination of weather event causing a flood. There are too recognised ways to measure the risk of these flood events. One is by its risk occurrence in a 100 years period, and the other is measured in a percentage of risk. In simple terms a 1% annual exceedence probability (AEP) flood is approximately equal to a 1 in 100 flood. A 1 in 100 year flood is often expressed as a probability of 1 in 100 average recurrence Interval (ARI) that measures risk in terms of the likelihood of a flood in any particular year exceeding that level. For a more detailed explanation of how to understand the measurement of flood risk and weather event risk go to Bureau of Meteorology, article based on Malcolm Kennedy (1990), also Geoscience Australia on Flood Risks, Chapter 9 by Miriam Middelmann, Bruce Harper and Rob Lacey.

So if one was to say that the last storm event was a one in 20 storm event that would mean that the flooding was to a level that has a risk factor of once in 20 years.

Generally one would consider a 1 in 100 year flood as a one in a lifetime event. Therefore this storm is not considered a normal event. This being the case, to hedge against damage to property and reduce the exposure to council for litigation, a standard flood level that would only happen in this very rare event is maintained as the standard minimum flood level of all residential dwellings approved by Councils.

The 1 in 100 flood level as described in the State government guidelines in its 'Draft Flood Risk Management Guide' is calculated by studying data since flood data has been collected and as such assessed on hard evidence on past events. So you would think the level is petty secure and that only rarely would you expect a devastating flood greater than this level. This means that residential development built above this level will be largely unaffected by all other floods over a period

assessed by flood risk. Only that one flood expected in that period would be a danger to the development.

Climate Change and Climate Change models

With the advent of a growing amount of data and scientists producing predictive models on future weather conditions, it has become apparent over the last 10 years or so that something is happening differently with regard to the weather than has happened in the last 100 years or so.

Studies have shown that there is an increase of CO_2 within the atmosphere. Many scientists believe this to be due to increased burning of carbon-based materials, which as a result releases the carbon stored in that material into the atmosphere in the form of CO_2.

With an increasing amount of CO_2 in the atmosphere and projections of more CO_2 to be released as more carbon based materials are burnt to produce the worlds energy needs, climate scientists have started to become alarmed, believing that with more of this denser gas in the atmosphere, more heat will be retained in the atmosphere from the sun than in the previous several 100 years.

As the atmosphere increases in temperature, so will the surface layers of the world's oceans. As the oceans are the main source of water vapour in our weather patterns, a higher temperature of the oceans of the world will tend to produce more water vapour, which in turn produces larger storms over the various landmasses around the world.

Climate modellers, using temperature data from the past, design computer models to approximate previously known weather events. By extrapolating these results with an increase in atmospheric temperature, larger and more destructive storms were produced on these computer models.

If these models are a true prediction of the results of an increase in ocean temperatures, then coastal regions of Australia are likely to experience, more intense storms.

Regions on the coast of New South Wales (NSW) will be particularly vulnerable to these changing conditions because, NSW has built many coastal towns in low lying areas complying to the standard flood level expressed as 1 in 100 flood level.

Now with this expected increase in flood events and higher seas which may erode sand dunes protecting low lying areas inland, the State Government has asked local councils to develop a policy on climate change to address likely impacts on the land under their control under this new scenario.

The State Government has suggested a rise in the 1 in 100 flood level of up to 900 mm.

This figure is a forecast related to sea level rise, more tidal inundation and higher flood levels in 90 years. However, the effects of these predictions will not be expected in this intensity in 2010. This new projection would be associated with a combined effect of sea level rise, tidal inundation and flooding due to rain events happening at one time in the year 2100.

The three various impacts to a coastal flood would not happen in all areas of the local government area. Low-lying areas isolated from the sea would flood differently to areas open to the sea. This is

why councils have been advised to consider raising the minimum flood level requirements for residential dwellings up to a maximum of 900mm for a 1 in 100 flood event over the 90 years to the year 2100.

Council's perspective to the directive

However, councils see the directive of the State Government as a minimum flood level standard. They reason that a dwelling built today will generally be still standing in 90 years and that to allow a lower standard would open councils up to litigation and damages payments.

Council is obliged to protect its own interests and be responsible in the approval process; thereby insuring that the maximum standard of increased sea level put out by the State becomes the minimum standard for floor levels for council approved developments.

Take note; as we just start the approach towards the end of the 90 years, at which time we will actually expect these extreme conditions, councils under current climate change modelling, introduce policies today to accommodate climate change for these future conditions.

As a result we will see new dwellings in a street standing nearly one metre above similar houses. We will see building costs increase immediately with no likelihood of a flood that will affect the property in the foreseeable future or maybe ever.

What of existing dwellings?

With the new policy and the new maximum standard becoming the minimum, insurance companies will assume that an area of land now declared by council to be flood prone under the year 2100 condition should have higher premiums for householders within the confines of this new zone. Even though no flood is predicted in the area of the magnitude and frequency predicted by climate models, this land will be assumed to be flood prone.

How can council and the community find a way to reduce these costs and better reflect the risk of flooding predicted by the climate model in the years leading up to the 90th year at which time the climate model will predict flood levels in a 1 in 100 year flood to increase at least to 900mm above present expectations.

Should a change in the Climate Model be accommodated in our planning?

What would be the circumstances if the climate model were changed to reflect new data? What if the climate model was to predict more severe conditions in 90 years? What would happen if the climate model predicted less severe circumstances in 90 years?

In either case council could be held responsible for not increasing building standards or for over estimating climate change effects in that locality. Council must find an action plan or strategy to accommodation changes to the climate model as outlined by State Government requirements.

Part 1

The Risk Model for Climate Change

The approach of the risk model is to assess the risk of damage to a property and its built assets caused by added factors attributable to climate change.

Current building standards have assumed that weather data, flood data and tidal data over the last 50 years and up to 100 years are an unchangeable basis for assessing the risk to a property for damage.

Therefore the assumption is that risk of damaging weather and tidal events can be relatively accurately calculated. As a result insurance risks have been assessed and dollar values produced as to how much premium needs to be paid to cover a risk of property damage under the present conditions. But we must understand that the conditions tested over the 100 years have been assumed to be stable and consistent into the future.

With the advent of climate change modelling, we find that weather conditions are set to change over the next 90 years at least.

In addition, not only are scientists predicting weather conditions to change according to the accepted model for climate change, strategies to manage weather risk have to be adaptive to any new science that may modify the climate model, thereby skewing the projected changes to the weather to a more or a less severe scenario to what is predicted over the next 90 years.

Insuring the risk

The answer to this problem may be to assess the risk of damage each year for each property or group of properties with the same characteristics, up to the 90th year. (The 90th year being the year the State government climate change model has elevated the 1 in 100 flood risk 900mmm above the present standard.)

Example 1

This would mean that those dwellings currently existing that have been built with a floor level at the current standards of a 1 in 100 year flood level would be considered a low risk in 2010 but a high risk in 2020.

Example 2

A developer today may have elected to build at a floor level of 100mm above the current 1 in 100 year flood level. This would be considered to have low risk in 2010 and maybe in 2020, but in 2030 it might be considered to have high risk of property damage due to inundation.

Considering the above, potentially, this property would be insured by the insurer as having low risk until the year 2023.

Example 3

A development may be designed and built in 2010 to a floor level designed to meet the expected flood frequency and severity expected in 2030 to reduce risks and insurance premiums to the year 2030. The developer would understand that his development would be a more attractive buy than a dwelling built to the 2010 standard. The developer may also believe that climate change is not as severe as the current climate change model predicts and hedges his 2030 standards against the current model hoping that the model will be altered and relaxed by 2030.

All these scenarios and more will come into play with the flexibility of the Risk Model.

This means that as the overall risk to the all the assets in the local government area rise, the premiums for the potential risk to loss or damage caused by flooding rise under the current Climate Change Model.

This would mean that over time, buildings with low floor levels would be paying very high premiums. Their risk factor may become unviable for the dwellings to continue to be left standing and may be demolished. Unless other works are done around the property to reduce the rise in premiums this attrition of built assets will occur, making the way for new dwellings complying to a standard floor level for that year or future years.

This process gives incentives to reduce risk of damage due to climate change by a reduction of premiums.

Who should be the policyholder for the Insurance against Climate Change?

Although this may be the subject of debate, council or a single State entity should be the insurance policy holder for any risk above the present standards.

To put this case, there are a range of reasons why a regional or a state wide policy holder is more advantageous over many individual land owner policy holders for policies relating to claims for the affects of Climate Change. Below are a few.

(1) Firstly it is desirable to have a compulsory system of cover for all landowners at risk of the effects of climate change due to flood. With a compulsory system of cover council can collect insurance cover for each property with the same seamless system that they collect rates. This document proposes a number of levies for at risk properties including a contribution levy, collected for each property by council commensurate to the risks on the property attributed to climate change. (see Part 2 for other proposed levies)

(2) Currently there is not compulsion under state law for a landowner under freehold title to insure the property against flood. As a result some property owners will elect to take all the risk of flooding and not take up any insurance. In these cases it is likely in the event of a flood due to climate change effects, council will have a legal claim against them from property owners attempting to get compensation for inundation. The basis of the litigation may be related to council's duty of care to protect properties from flooding. With the threat

of this kind of litigation councils will be compelled to build ever bigger structures to mitigate flooding in established areas, thus frustrating efforts for an equitable planned retreat or flood protection program as explained in part 2 of this document.

(3) With a regional approach to risk and the sale of the risk by a council or the State, better premium prices can be negotiated. Premium and planned mitigation works can work in a strategic way to get better outcomes for the management of the risk, the environment and with less social upheaval.

(4) A major reason to have one insurance policy holder in each region is to ensure the best priced premiums. One model for approaching the management of risk through the sale of the risk to insurance institutions and companies is through the tender process. By breaking up the risk into regions and localities and then further categorising the risk into degree of risk in neighbourhoods, a number of tenderers can compete for the purchase of the various risk categories in a range of localities. This will ensure a good price for the premiums for the insurance cover to council and the at risk property owners. If council is able to be involved in the process, a better understanding will be achieved between the seller of the risk and the buyer in the negotiations of price and allow a feedback circuit to strategically reduce risk. (see part 2)

(5) With a single seller of risk such as a council, negotiations can include strategies for planned retreat and applications for funding to State and Federal funding sources to reduce risks and facilitate buyers of risk, such as insurance companies, to accept higher risk based on strategic plans to reduce risk. (see part 2)

How can this insurance be accessed? The flood or weather event would have to be declared by local, State or Federal government as a climate change induced event. It would be generally an event that would equal or exceed the current standards of 1 in 100 flood level and be in the range of a 1 % AEP.

The costs of the premiums should be shared by all property owners who have a risk of damage to their property due to the effects of climate change. In other words, any property built with building standards below the future expected 1 in 100 year flood level for that year, according to the accepted climate model, will be liable for a share of the insurance premium.

Bear in mind that any property risk of any kind below the current flood standards of the 1 in 100 flood level will be the responsibility of the land owner, however any risk due to climate change in accordance with the accepted climate change model will be covered by council's insurance policy and contributions to the premium of the Council's insurance policy will be made by the at risk land owners.

This risk of damage due to climate change is the risk of damage accruing as a result of flooding and climate events that exceed the present 1 in 100 year threshold.

What are the advantages of the Risk Model?

The risk model puts a price on the non-compliance of a dwelling or developments over the standard flood level for that year according to the climate change model. That price is the share of a premium, which relates to the level of risk of non-compliance.

This means that property owners can plan their development with higher standards than are required for that year according to the agreed climate model to hedge against higher premiums in the future. Conversely, developers can build to the current standards if they feel confident that the climate model will be modified to have less impact on the built environment and risk higher premiums in the future.

The model allows for existing dwellings built to the current standards to continue to be occupiable, but ensures the risk to climate change effects are covered on the property by the payment of a share of the Climate Change Insurance premium.

This premium would be small in the early years of the life of the climate model; however the premiums may be prohibitive in later years, forcing redevelopment to the higher standards or abandonment of the land to the affects of climate change.

(A side benefit may be more unoccupied land available as fauna refuges because of the higher risk from inundation of the land.)

One of the over arching benefits to the risk model is that it allows time for the community to adapt to the rigors of the climate change model.

Another advantage of the risk model is that capital investment can be made to reduce the effects of climate change on the property. This will reduce the risk of flood and as a consequence reduce the share of the climate change insurance premium.

Who will pay for capital works to reduce the effects of Climate Change?

Let's first brainstorm some of the likely projects to reduce these effects.

- Seawalls may be built to protect a group of properties from land erosion due to higher tides and storm events.
- Dykes may be built to divert potential floodwaters from a settlement.
- Channels may be built to remove water more quickly from an area close to dwellings.
- Sand nourishment of sand dunes.
- Consolidation of sand dunes by plantings and concrete barriers.
- The construction of barriers in the sea to stop intensive wave action eroding the beaches.

Many options could be employed to reduce this risk.

But how can we pay for this and keep some equity in the process?

It would be up to property owners to consider the costs relating to the construction of such structures. The cost would be borne by council from loans, from council savings or finance institutions. Loan repayments would be by an arrangement with the landowners in a similar way to the way councils recoup costs of capital works like water infrastructure. Each property that benefits from the infrastructure by a reduced risk of climate change impact to their property and a reduced share of the insurance premium would be required to pay a portion of that infrastructure loan.

The loan would be set over a period that would be commensurate with the life of the structure and payments by the landowners would include a share of the loan repayments and a share of maintenance costs of the structure.

Government Grants to Local Authorities for climate change risk reduction.

Any grants by State and Federal governments that are for the purpose of adding infrastructure to the local environment to reduce risk, should be paid to the council's loan account for existing infrastructure investments, set up to provide infrastructure to reduce risk of flood inundation to at risk properties.

Any grant money should not be earmarked to a specific project but to the whole local government area. This allows equity across the local government area and avoids bias towards some landowners who are the beneficiary of cheaper insurance premiums.

This management policy reduces the occurrence of developments that are less appropriate in areas where the principal of planned retreat would operate naturally. This policy also enhances the council's control by allowing a more strategic approach to the process of planning for climate change.

In other words, grants for particular projects create inequities in the risk model and reduces the climate change effects with no economic costs to some landowner, thereby delaying renewal development for that land.

As the benefits of the grants are evenly spread over the whole Local Government area, the equity of the payments of infrastructure loans from landowners at risk will be maintained for existing and for future infrastructure loans. Also the balance of the reduced premiums due to infrastructure improvement will be maintained.

Part 2

The Principal of Planned Retreat for Sea Level Rise

The principal of planned retreat is associated with an understanding of the predictions of sea level rise under the current climate change model. The principal suggested here considers that high risk land should revert back to undeveloped land in preparation for natural processes to overtake the land.

As risks increase on coastal land, more money will need to be found via infrastructure loans or from Government grants to protect land from coastal inundation. As a result it will be incumbent on local governments to decide on priorities where money will be spent to reduce risk associated with climate change. This may mean the construction of additional infrastructure to protect land from sea level rise or a process of buying back privately owned land.

To prevent the distortion of property prices a no action approach by local government is not desirable.

A planned retreat approach is desirable allowing local government to purchased high-risk land to maintain a floor price for property values.

When land is brought into council ownership and not redeveloped it is taken out of the risk model by virtue of it not being able to have any asset damage due to there being no built assets on the property to be damaged by flood.

In most cases high-risk land should be put into public ownership unless communities are willing to pay for the premiums and infrastructure costs associated with keeping high-risk land occupiable.

With this principal we are likely to see island type land outcrops, fortified from the effects of climate change inundation, surrounded by natural land areas occupied by indigenous fauna and flora.

On higher ground, away from the coast where less risk is perceived, less protected developments will occur.

Over all, councils must adopt a retreat strategy to accommodate for the onset of sea level rise, the potential for tidal inundation due to storm surges and the precipitation from larger and more frequent storms.

How should councils raise the funds to buy back land?

In most cases the land purchased by council will be high-risk land, where the premiums for the risk of damage and the cost of any potential mitigation works to reduce the risk on the land are too high for its occupation.

The Risk Model and the Principal of Planned Retreat related to Sea Level Rise

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To make an equitable system of collection of money to purchase at risk land is difficult. If we consider that high-risk land is more likely to be offered for sale because the land attracts a higher insurance premium, then high-risk landowners will pay more in premiums until the land is sold.

So if an additional percentage contribution of the premium was paid to a fund of council's for the purchase of high risk land from all land owners paying their share of the insurance premium for the effects of sea level rise due to climate change was called for in the form of a levy, all at risk land owners would be contributing towards the eventual sale of their own land when it becomes unable to be occupied under heavy insurance premiums. This seems a fair system.

The higher the premium the more a landholder should pay to hold occupancy of risky land. This percentage related to the premium being charged to the landholder would need to be tested to ensure it covered the costs needed but a percentage of between three and five per cent of the value of the premium should be enough considering the time over which the premiums will be paid before a purchase of the land is necessary.

This percentage would be in addition to the premium and be called a climate change levy, to be used to buy back land.

Any land holder can elect to sell land to council, and council should be able to buy the land provided there is a cap on purchases by council for that year and that the most vulnerable land offered by land owners is purchased for that year.

Council then can decide on what it wishes to do with the land under a climate change policy. It may wish to include land in its recreation portfolio, it may wish to redevelop the land in some way by reducing climate change risk by mitigation works, or it may manage the land as wildlife habitat.

Will Planned Retreat affect Property and Land Prices?

Under the risk model, the dynamics of property values will be affected over the long term. However, in the short term where the risk of any climate change effect remains low, property prices will remain relatively unaffected.

As the risks to the property are raised, the climate change components of insurance premiums for the properties will rise, thus making the property less attractive to buyers. Unless mitigation works are completed to reduce the risk, which also have a cost, the property will continue to reduce in value as a residential development allotment.

As properties become unviable to own due to the potential risk associated with climate change, high insurance premiums and/or high loan costs due to mitigation works that are no longer useful to reduce risk of climate change effects, they will be put on the property market or offered to council. Council would be obliged to purchase the property under its buy back scheme, which as mentioned before is caped at a dollar value for that year and gives priority to higher risk properties.

With this retreat mechanism, property values will not be expected to become valueless in high-risk areas and will, to some degree keep the market buoyant.

The implication of the Risk Model through a climate change planning strategy

The implications of climate change will be felt by coastal properties in any local council area located on the coast of New South Wales. Planning for this will be essential. If unchecked, insurance premiums to individual property owners will rise exponentially. Pressure will be brought to bear on councils by property owners and lobbyists to protect the at risk land. Projects will be initiated for reasons less about a planned response to climate change but by political opportunism.

Councils need to act now to plan for both the environmental effects of climate change and the economic effects of climate change. They need to adopt a strategy in planning for climate change that works in conjunction with property market dynamics, carefully directing the market and not working against market processes or in spite of market processes.

Ultimately, the landscape will look very different from today in 2100. It will consist of a few very heavily defended high value properties in the midst of extensive low lying native bush land, salt marsh and estuarine systems. Much of the new development would have retreated to low risk areas above the 1 in 100 year flood level. However, older residential sites will still be occupied but will be redeveloped with higher floor level standards to reduce risk.

With the Risk Model, houses will be modified to the new floor levels through economic forces and incentives rather than by an imposition of council at a particular point in time to raise all floor levels to reduce risks in the year 2100.

Conclusion

The ‘risk model’ is a flexible approach to planning for climate change. Climate science is still developing and new models may yet appear. The ‘risk model for sea level rise’ allows for any change in climate model at any time.

The ‘risk model’ allows for infrastructure improvements to be made to reduce the risks associated with the effects of climate change to land.

The ‘risk model’ has the flexibility for local councils to accept government grants and equitably apply the money to projects across the local government area.

The ‘risk model’ allows for planning for climate change beyond the year 2100, allowing a progressive retreat from the ocean and estuaries as the risk of inundation rises.

Property values are protected by a proposed buy back scheme under ‘the principal of planned retreat’ where councils buy privately owned land to rehabilitate as habitat for indigenous fauna or redevelop with higher protection from the effects of climate change.

Finally, the ‘risk model and principal of planned retreat for sea level rise’ attempts to use market forces to achieve good outcomes when planning authorities are planning for the future effects of

climate change, and at the same time reduces the risks to property associated with adverse weather events caused by climate change, while allowing incremental development to occur that over time will satisfy the goals of planners preparing for climate change.

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