Rethinking Flooding as a Town Planning Opportunity not a Constraint

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Abstract:

Floodplain risk management studies and plans identify areas of significant flood risk and often recommend building modifications such as house raising or voluntary purchase to deal with existing unacceptable risks and planning controls to deal with future risks. The building modification schemes are expensive and slow to implement and the planning controls also take a long time to have any significant impact in areas which have already been developed.

Strategic town planning acknowledges flooding as a constraint and development in areas of significant flood risk is generally avoided unless there are strong economic drivers for development in those areas.

But what if areas of significant flood risk were considered by town planners as areas with an opportunity for urban renewal and the economics of redevelopment was used to mitigate flood risks? What if strategic planning studies were seen by flood engineers within councils as opportunities for accelerating voluntary purchase? Are there ways in which urban renewal in a flood free location can remove high risk properties from the floodplain?

This paper presents a number of case studies which demonstrates how rethinking flood risk and its role in town planning can identify opportunities for using the economics of urban renewal to reduce flood risks in ways which town planners and flood engineers often don't traditionally consider.

Introduction

The NSW Floodplain Development Manual (DECC, 2005) states that balanced floodplain risk management plans must address three types of risks:

Existing flood risk – is associated with the current development on flood prone land

Future flood risk – is associated with any new development on flood prone land

Continuing flood risk –is the residual risk in existing and future development areas after risk management measures are implemented

The Manual also states that there are basically three ways of managing flood risk:

- *Flood Modification* - moving floodwaters away from the more vulnerable parts of the flood plain to the less vulnerable parts

- *Property Modification* – removing or modifying existing development where is in incompatible with the flood risk or controlling new development and redevelopment so that it is compatible with the flood risk

- *Response Modification* – changing people's behaviour so that it is appropriate to the flood risk

In highly urbanised catchments there is often limited space for flood modification options.

For example, detention basins need large tracts of open space high enough in the catchment that they have a downstream benefit and far enough downstream that they control a significant proportion of the runoff. They also need sufficient topographic variation that large volumes of water can be stored. Such space with such specific requirements is rarely available.

Levees or other flow diversion structures will most likely just push water away from one vulnerable group of buildings and into another. Similarly, increasing the size of channels or culverts often either requires removal of the buildings which are to be protected or it increases the flood risks to properties immediately downstream.

That is why in fully developed urban catchments there is a heavy reliance on property modification to reduce flood risks.

This paper is focused on property modification measures and how they are used to manage existing and future flood risks in fully developed urban catchments. It compares two traditional approaches to property modification and identifies a number of limitations with those approaches. It then suggests a third, hybrid approach which has the potential to accelerate the reduction of flood risk at minimal cost to government and property owners.

Some case studies are provided to illustrate the ideas presented in the paper which also highlight some of the challenges with the alternative approach. The paper makes reference to procedures in the NSW Floodplain Development Manual (DECC, 2005) and the requirements of the *NSW Environmental Planning and Assessment Act, 1979* but the principles discussed are equally applicable in other jurisdictions.

Property Modification Options

There are a suite of property modification options available to reduce floodplain risks in existing urban areas these include:

- Voluntary purchase
- Voluntary house raising
- Redevelopment restrictions

Voluntary Purchase (VP) is a recognised and effective floodplain risk management measure for managing existing flood risk. It can be an effective strategy where it is impractical or uneconomic to mitigate the high flood hazard to an existing property and it is more appropriate to cease occupation to meet personal safety and flood loss reduction objectives. Properties are purchased by government at fair market value and only when voluntarily offered. The buildings are demolished and the area ultimately rezoned to limit uses to flood compatible uses such as public open space.

Voluntary House Raising (VHR) can be used to reduce the frequency of exposure to flood damage of a house and its contents by reducing the frequency of above floor flooding. It involves jacking up the whole building and supporting it with its floor at a higher level. The cost of the house raising can be paid by the owner or be partly or fully subsidised by government.

Redevelopment restrictions can be applied through planning instruments such as local environmental plans (LEPs) or development control plans (DCPs) which can stipulate the type of landuse, building design requirements such as minimum floor levels and flood resistant materials, and emergency access provision. These development controls will not address existing risk, they will only reduce future risk and only when a property is redeveloped. The cost of meeting these requirements is met by the property developer and ultimately passed onto the property owner and occupier.

Traditional Approaches to Floodplain Management

I would suggest that there are two broad approaches to dealing with flooding issues in highly developed urban areas. For want of better terms I have labelled them the Floodplain Management Approach and the Strategic Planning Approach.

The Floodplain Management Approach arises from implementation of the steps in the NSW Floodplain Development Manual or similar processes in other jurisdictions and can be characterised by the flow diagram in Fig 1 in relation to property modification on the floodplain.

The Floodplain Management Approach illustrated picks up after all options to modify flood behaviour have been explored and options to modify properties are being investigated. It takes the stance that where existing development is not compatible with the flood risk then planning controls should be used to either:

- prohibit future redevelopment if it is not possible to undertake redevelopment which is compatible with the flood risk;
- or restrict redevelopment so that it is done in a way which is compatible with the flood risk by specifying minimum floor levels, building materials, design features or access requirements.

Where redevelopment is prohibited because of the flood risk, an assessment will be made as to whether there is an economic and/or social justification for the high risk buildings to be modified through a voluntary house raising scheme or, in the highest risk cases, a voluntary purchase scheme.

If the benefits can be shown to exceed the costs then voluntary house raising or voluntary purchase will be offered to the property owners, subject to the availability of funds. These funds usually come from a combination of Federal, State and Local government contributions and there are a large number of properties around Australia which are at risk from various hazards, not just flooding, competing for a small pool of funds.

There are several disadvantages of this approach:

- prohibition of redevelopment means that unless the highest risk properties are raised or razed they remain an unacceptable risk in perpetuity
- if restrictions on redevelopment mean that it is only possible to replace like with like (e.g. a single dwelling with a single dwelling) but with higher floors, more expensive materials and complex designs then, there is a disincentive to redevelopment
- the heavy reliance on government funding and, in the case of voluntary house raising schemes, a contribution from the property owner means that modifications take many years, if they are funded at all
- voluntary purchase schemes can result in a patchwork of vacant blocks if some owners do not want to sell or if houses in between happen to already have high floor levels and it is harder to economically justify their purchase. This limits what uses the open space which has been created can be put to.
- Not all homes are structurally suited to house raising and those which are raised can look out of place in the streetscape

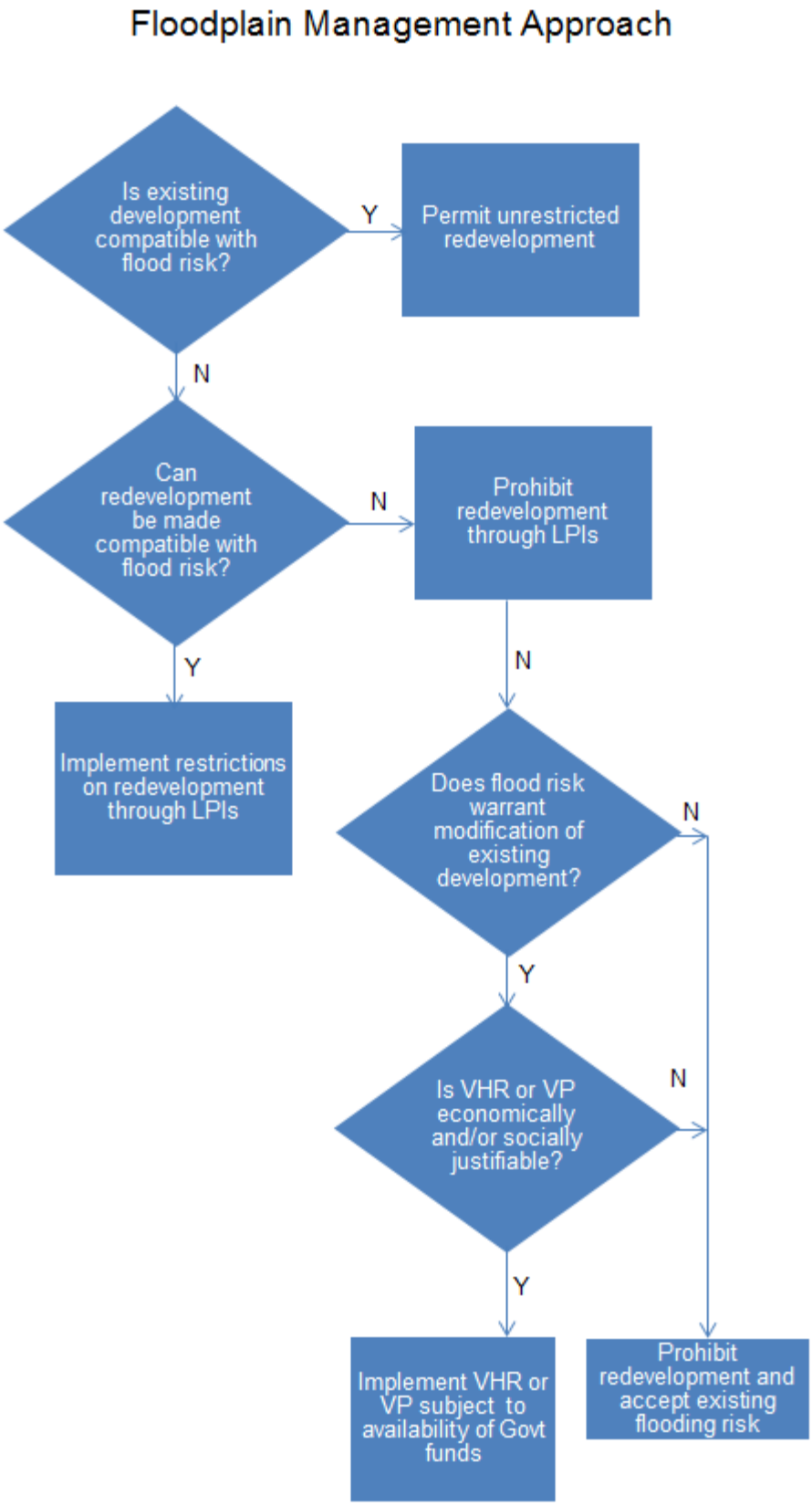

Figure 1: Floodplain Management Approach

In contrast to that is what I will refer to as the Strategic Planning Approach (Figure2). It arises from implementation of the steps in the making of a Local Environment Plan in accordance with the NSW Environmental Planning and Assessment Act, 1979 or equivalent processes in other jurisdictions.

It begins by asking the question whether there is an economic or social justification for changing the existing landuse. If there is no such justification the land zoning remains as it has been and any existing flood risks are dealt with by following the engineering approach described previously.

If there is justification for changing the landuse then constraints to landuse are investigated, one of which may be flooding. If the flood risks would prohibit the alternative use under consideration then the land is not rezoned and the engineering approach is again the default process for managing the flood risk.

If the flood risks would not prohibit the preferred alternative landuse then the question can be asked whether flooding would restrict the landuse. If the answer is no, then the land can be rezoned and no planning controls need be applied in relation to flooding.

If flooding would restrict the landuse then the appropriate planning controls are incorporated into the planning instrument to ensure that redevelopment is compatible with the flood risks.

If the land is rezoned for an alternative use in an urban area it is usually for a higher value landuse. Low density residential can be converted to commercial, industrial or higher density residential uses or, commercial or industrial land is converted to high density residential land.

All of these land upzonings require the provision of onsite car parking and, often in the case of higher density residential development, a stipulated amount of private open space all of which are part of the costs of redevelopment. The location of these areas within the development are at the discretion of the developer but are subject to approval by Council.

Higher density residential development often requires the provision of additional public open space within the neighbourhood and Councils either collect developer contributions to pay for the purchase of land for that public open space or use Council funds. The location of this open space will be dictated by proximity to the area of increased urban density, connection to existing open space and possibly constraints which make it less suitable for urban development.

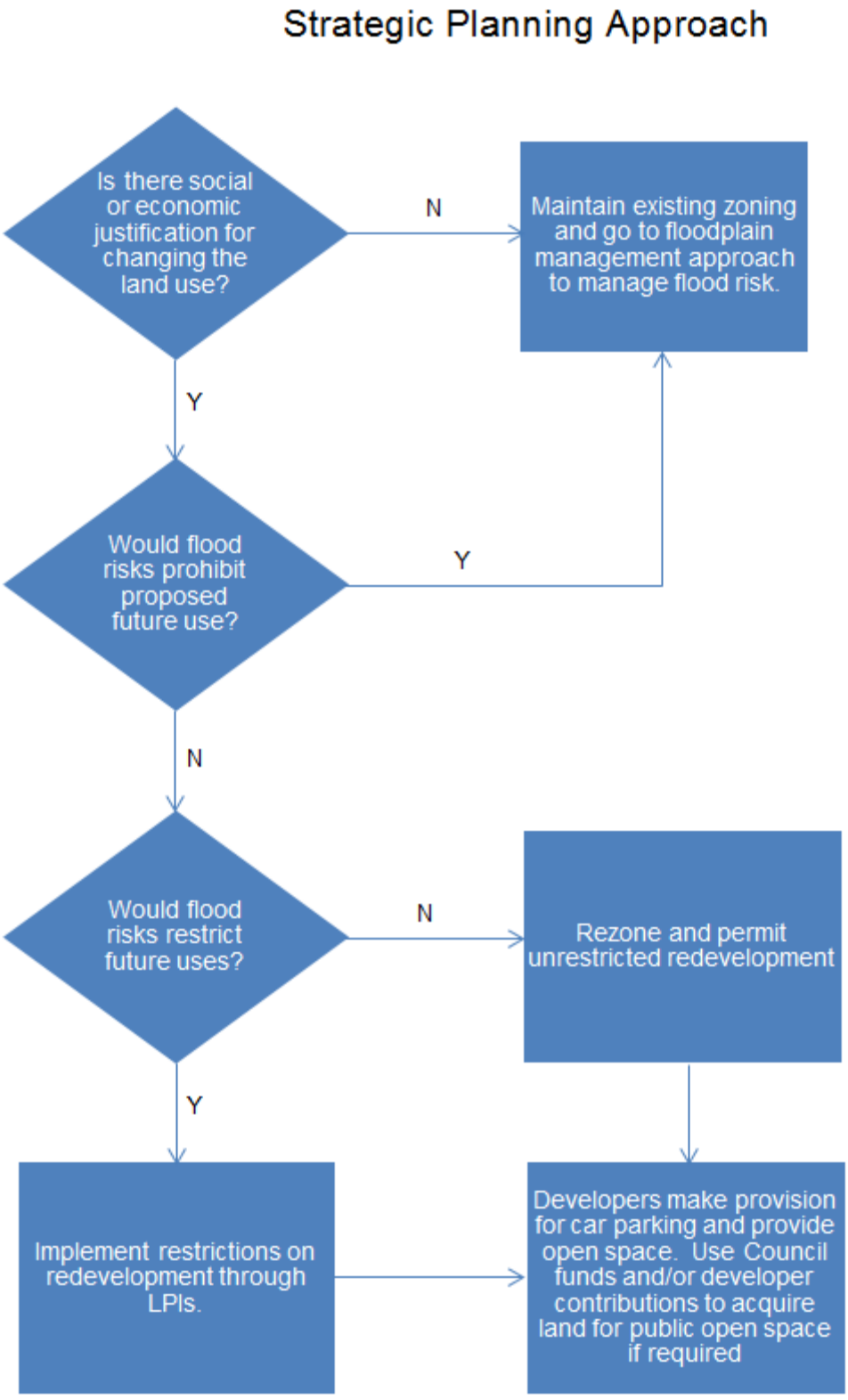

Figure 2: Strategic Planning Approach

The disadvantages of the Strategic Planning Approach are:

- It does not address areas with unacceptable flood risk
- It does not consider development controls as a means of locating less vulnerable parts of developments (car parking, private open space) into higher flood risk areas
- It does not consider flood risk as a driver to the location of public open space

I acknowledge that the summaries of the foregoing approaches are somewhat simplified but they illustrate a very different approach to dealing with flooding issues by Council depending on whether they are undertaking floodplain risk management or strategic planning. This disconnect between the two has been acknowledged by others (Grech and Bewsher, 2007, 2009 & 2010) and it suggests than in many councils in NSW there is a lack of communication between those parts of council responsible for implementing each approach.

An Alternative Approach

I would suggest that councils should take a hybrid approach which is illustrated in Figure 3 and should be initiated whenever a floodplain risk management study is being undertaken or a strategic planning study (urban redevelopment strategy, open space strategy, local environmental study) is being prepared.

I admit that the flow diagram in Figure 3 is perhaps not the exact representation of the approach I am suggesting but it is close.

My premise is that we should be looking at the floodplain and deciding what is the highest and best use which each part of the floodplain could be put to in light of its flood risks irrespective of what the current land uses or zonings are.

If the existing land use is the highest and best use then the land zoning and planning controls need to be used to maintain the existing use.

If a higher and better land use can be compatible with the flood risk then we need to explore whether there is justification for a change of use. There could be social or economic drivers for changing landuse but there could also be constraints such as traffic and transport, visual impacts or local character which make upzoning unacceptable.

If neither the existing use or a higher use is compatible with the flood risk then backzoning to a lower use such as public open space may be the preferred alternative from a flood risk management point of view.

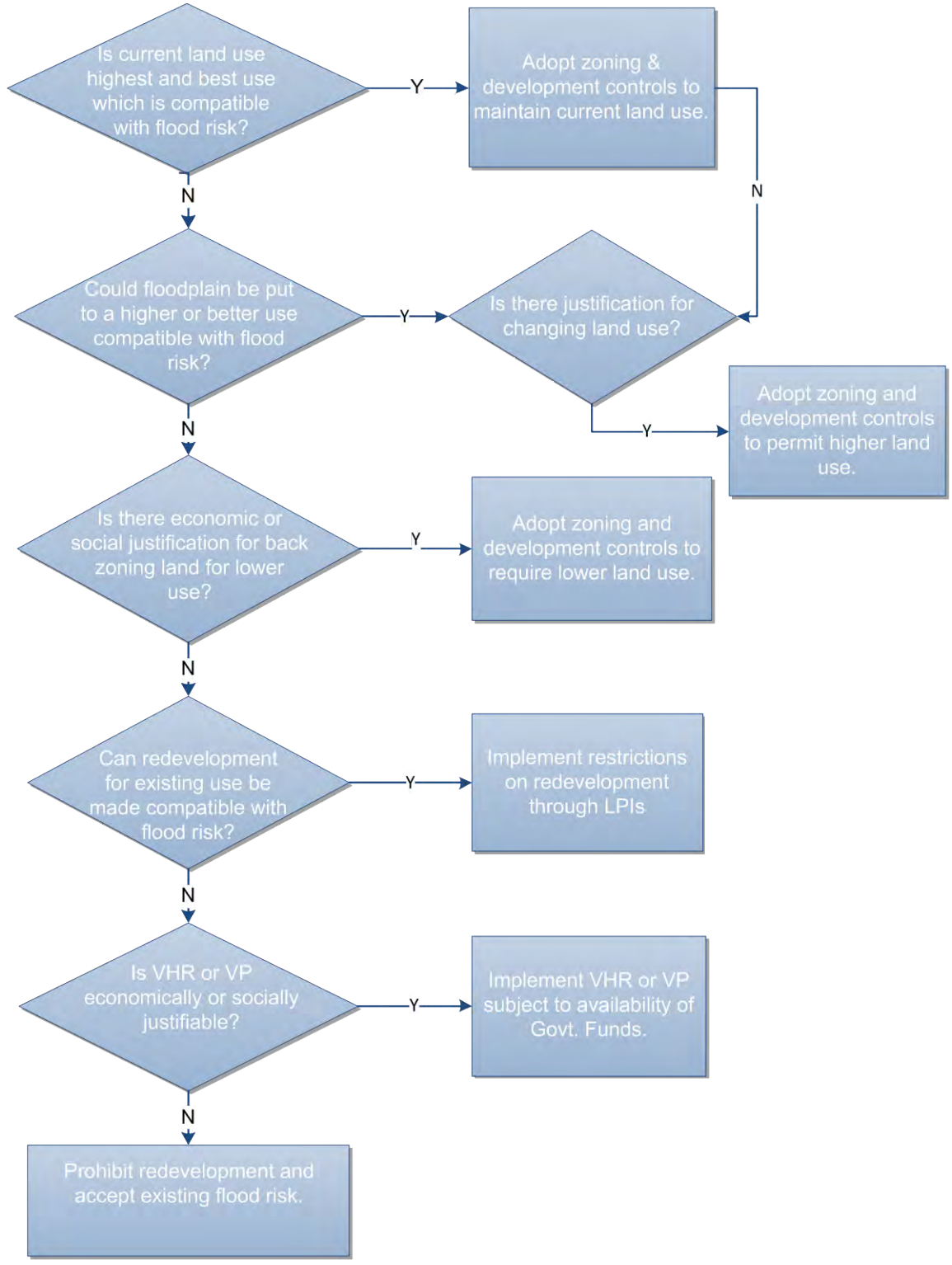

Figure 3: Hybrid Approach

Back zoning can only proceed if it can be economically or socially justified. For example, a commercial development needs car parking and if the commercial premises are placed in the lower flood risk area the higher floor risk area can be justifiably designated for car parking. Or an increase in residential density in the neighbourhood may generate the demand for more public open space in which case the high flood risk land could be rezoned for open space and purchased using developer contributions.

If none of the above are suitable options only then is the application of more stringent development controls for redevelopment with the same use as the existing use resorted to as on option.

If more stringent development controls will not reduce the flood risk sufficiently then voluntary house raising or voluntary purchase need to be explored.

While I am aware of examples of where something like this hybrid approach have been followed, from my experience it appears to be the exception rather than the rule. To illustrate what can be (or might have been) achieved by this approach I present a number of case studies. In most instances I have removed any information which identifies the locations but these are all actual cases.

Some Case Studies

Case Study 1

This is a highly urbanised an overland flow catchment where high in the catchment there is a considerable concentration of flows with extreme flood hazards in the PMF. There are several houses with above floor flooding in the 20% and 5% AEP events and there is no space for any type of flood modification works (Figure 4).

The housing in the area is typically 1950's fibro and weatherboard cottages on 1,000m^2 blocks. Some blocks have been redeveloped with dual occupancies, duplexes or large free standing brick homes. Immediately to the east land was rezoned several years ago and those blocks have been almost completely redeveloped with residential flat buildings.

The flood studies were undertaken several years ago and, before a floodplain risk management study and plan was prepared, interim planning controls were imposed which essentially prohibited any redevelopment on the most flood affected properties other than replacing buildings with like for like but with higher floor levels and more flood compatible building materials.

Using the hybrid approach elaborated upon earlier, the highest risk area was considered in terms of what would be an ideal land uses given the flood risks. This is shown in Figure 5. This would have a band of open space through the centre of this block with high density residential development on either side. The open space could be a combination of public open space where the flood risks are highest and private open space (yards) where the flood risk is more moderate with higher density residential development in the areas of lowest flood risk.

To achieve this it was suggested that the area be rezoned with the central strip given a recreational zoning and the surrounding land be given a high density residential zoning. In this way the redevelopment pays for the acquisition of the land for the common public open space and the development controls ensure that the private open space is in the areas of moderate flood risk. There was even the potential to provide some flood mitigation storage in the created open space which would benefit downstream properties.

In this particular case a residential development strategy had already been developed by the town planners in Council for this part of the LGA which was recommending increased residential density in a number of areas like this. This area was overlooked because of its known flooding problems and because of traffic issues. By the time the floodplain management study was being undertaken it was too late to include it in the residential development strategy. An opportunity had been missed.

However, the increased residential densities proposed by the residential development strategy meant that more public open space was required and developer contributions would be collected to purchase land for increased public open space. An open space strategy had also been developed by the Council's town planners which identified the number and size of new parks which needed to be created in various precincts and this was a precinct which needed a new park. This therefore presented the possibility of using developer contributions to purchase properties within this zone which had the highest flood risks and create a park which the community needed.

There were three houses which were identified in this area which would suffer above floor flooding in a 20% AEP event, one which would be flooded in a 5% AEP event and one which would be flooded in a 1% event. In addition there was a house in between with a floor level above the 1% event and also a vacant block of land. While a case could be made for the benefits of voluntary purchase of the houses affected up to the 5% event, they could only be purchased subject to the availability of funds to Council. The use of voluntary purchase funds to buy the less flood prone house in between could not be justified.

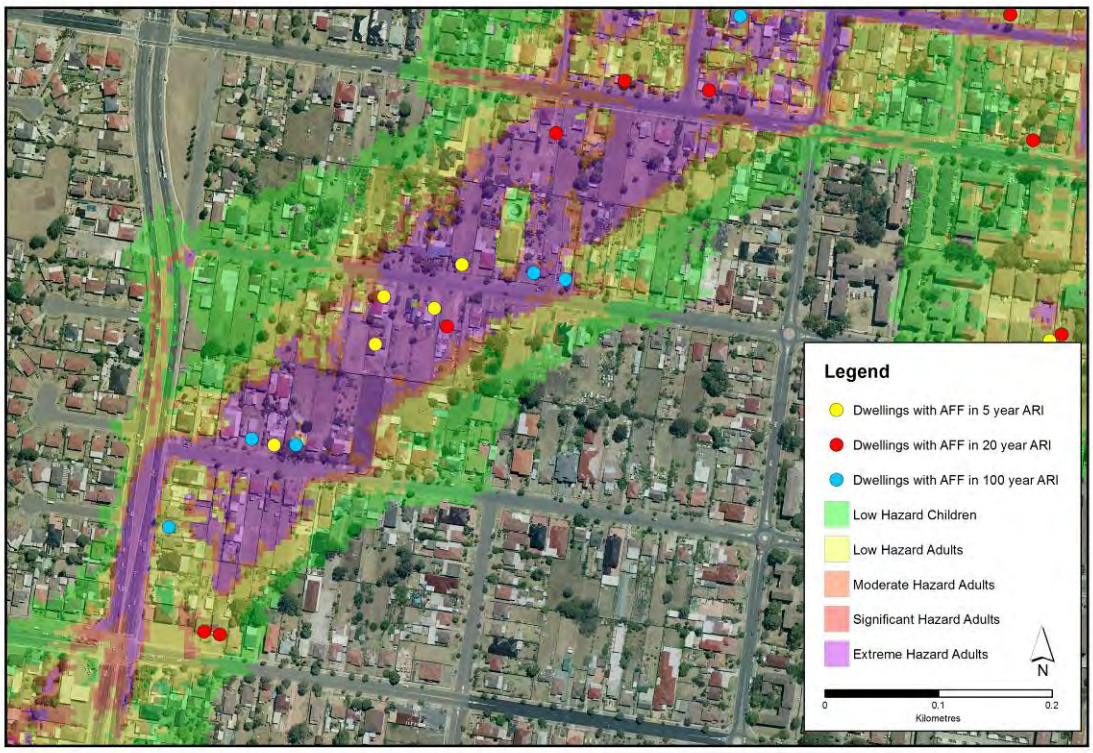

Figure 4: Hazard mapping and dwellings with above floor flooding

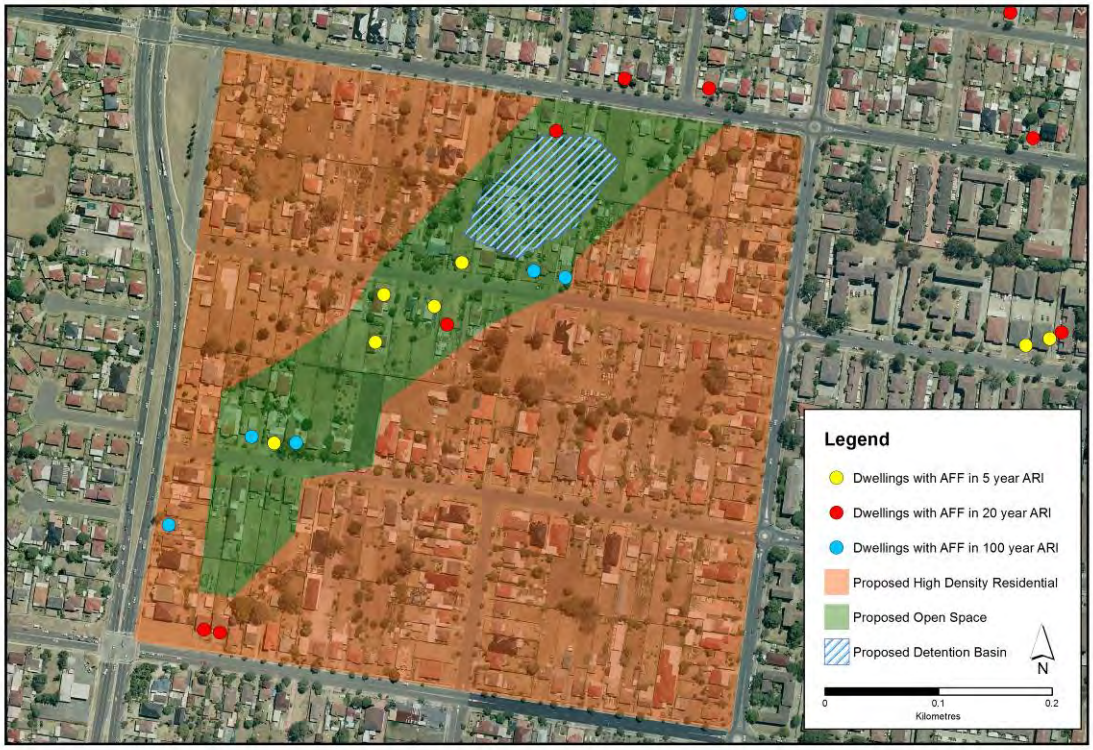

Figure 5: Highest and best uses compatible with flood hazard

The suggestion was therefore made to use developer contributions to purchase four or five properties in the extreme flood hazard zone, three of which had four dwellings with frequent above floor flooding risks, to create a much needed local park (Figure 6). This could be done more quickly than waiting for Government funding for voluntary purchase and would not use any Council or other Government funds.

However, while exploring this option we were provided with an updated airphoto of the area and it became apparent that Council has already purchased properties in the area to create a park (Figure 6). The problem was that it was immediately adjacent to the high flood hazard properties in a low flood hazard area.

In this particular case two opportunities for improved floodplain management outcomes had been missed because floodplain management and urban planning processes were taking place in parallel rather than flood risks being considered via a hybrid approach.

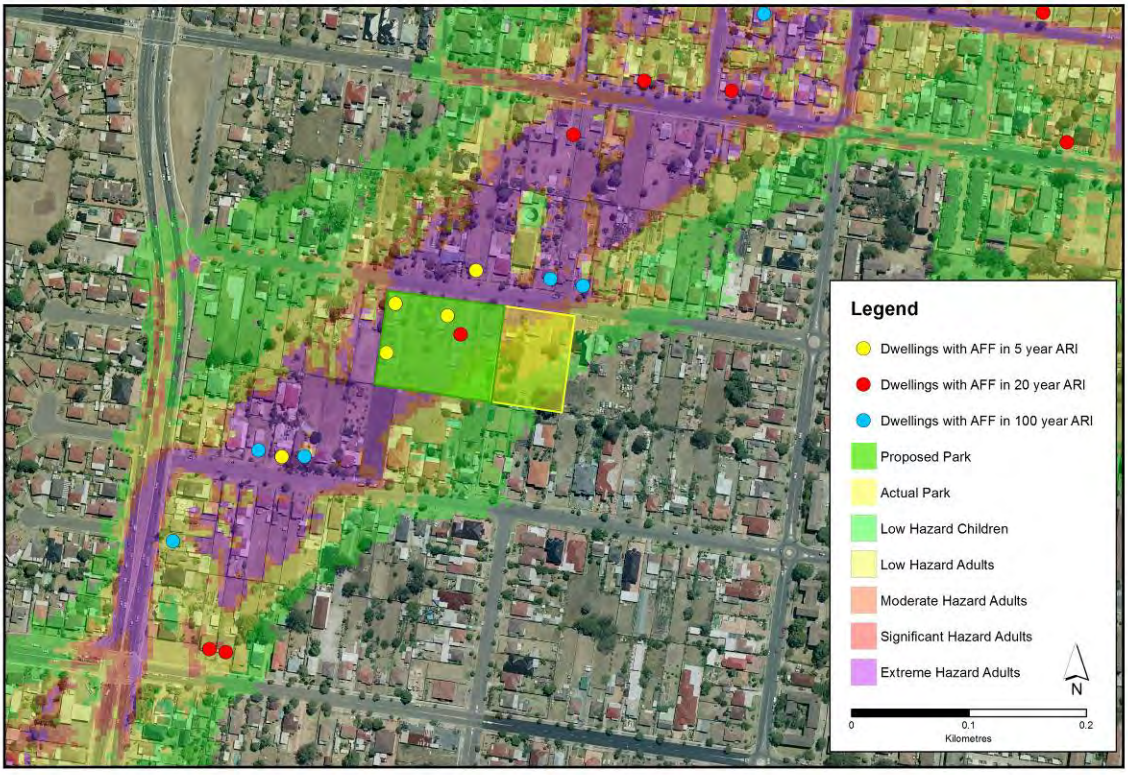

Figure 6: Potential area for park compared to created park

Case Study 2

This is a highly urbanised catchment which has a channelised creek running through the middle of it. There is a shopping strip and shopping mall surrounded by low density residential development with a large area of open space adjacent to the shopping mall.

The council in this case study area has an urban renewal plan based around a new Town Centre. It includes an larger business precinct surrounded by precincts classed for medium density and high density residential development (Figure 7).

There is a considerable area with high to extreme flood hazards in the PMF (Figure 8). Simply following the draft urban renewal plan would see increased commercial and urban development in areas of high to extreme flood hazard and the use of some of the lower hazard areas for commercial development and car parking.

Using the hybrid approach, the highest hazard areas were suggested as either open space or car parking areas (Figure 9). To achieve this some of the existing shops would have to be demolished to create car parking and some of the residential areas would be rezoned for open space. The quid pro quo is that some of the open space could be rezoned for commercial development and others for medium or high density residential development. While the revised plan would result in a slightly lesser area of medium density residential development, I believed that there was enough increase in urban density to be generally consistent with the goals of the proposed rezoning.

As far as I am aware the idea was never put to the Council planners because it was considered outside of the scope of our brief.

Figure 7: Council Draft Urban Renewal Plan

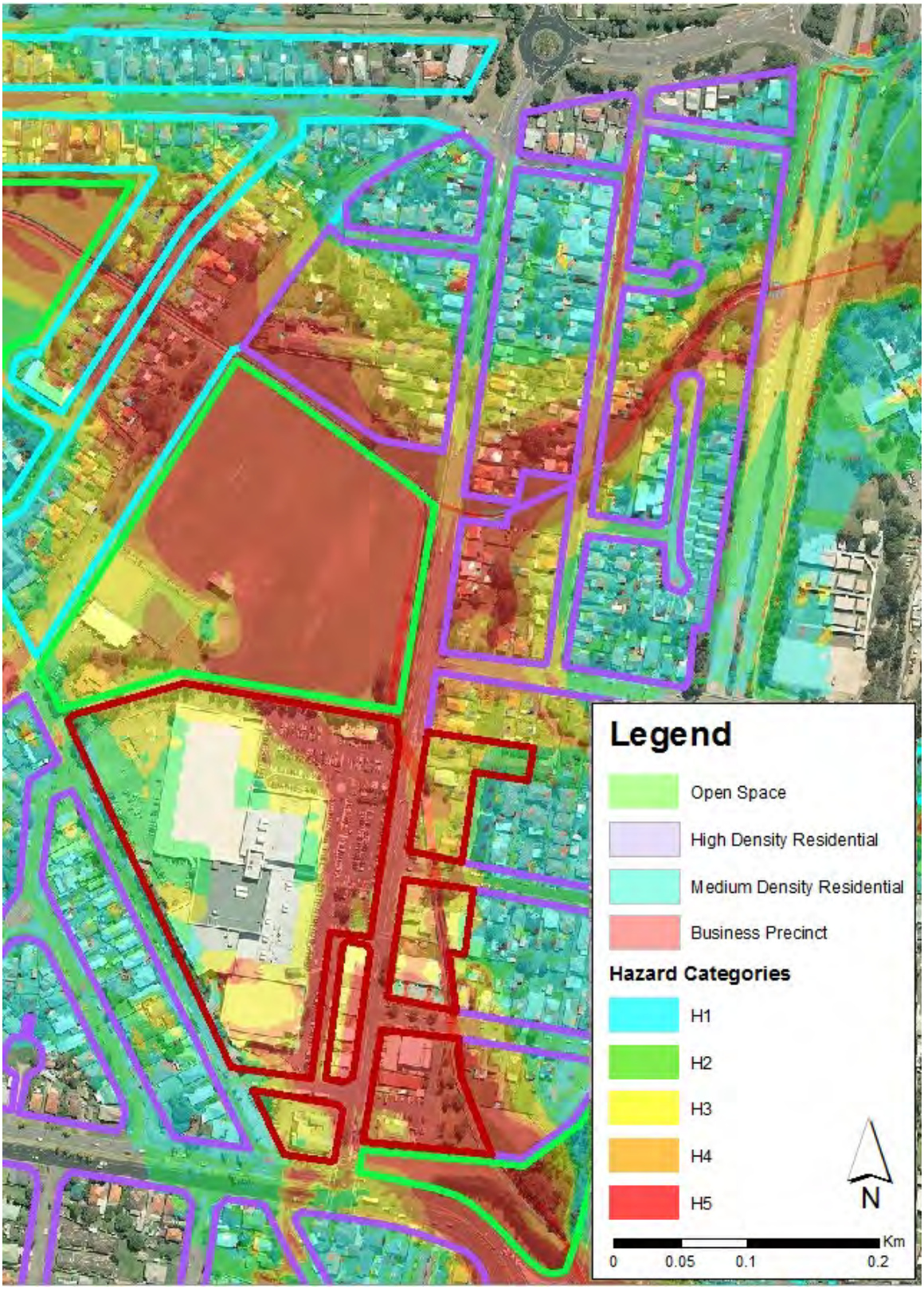

Figure 8: Council Draft Urban Renewal Plan and flood hazards

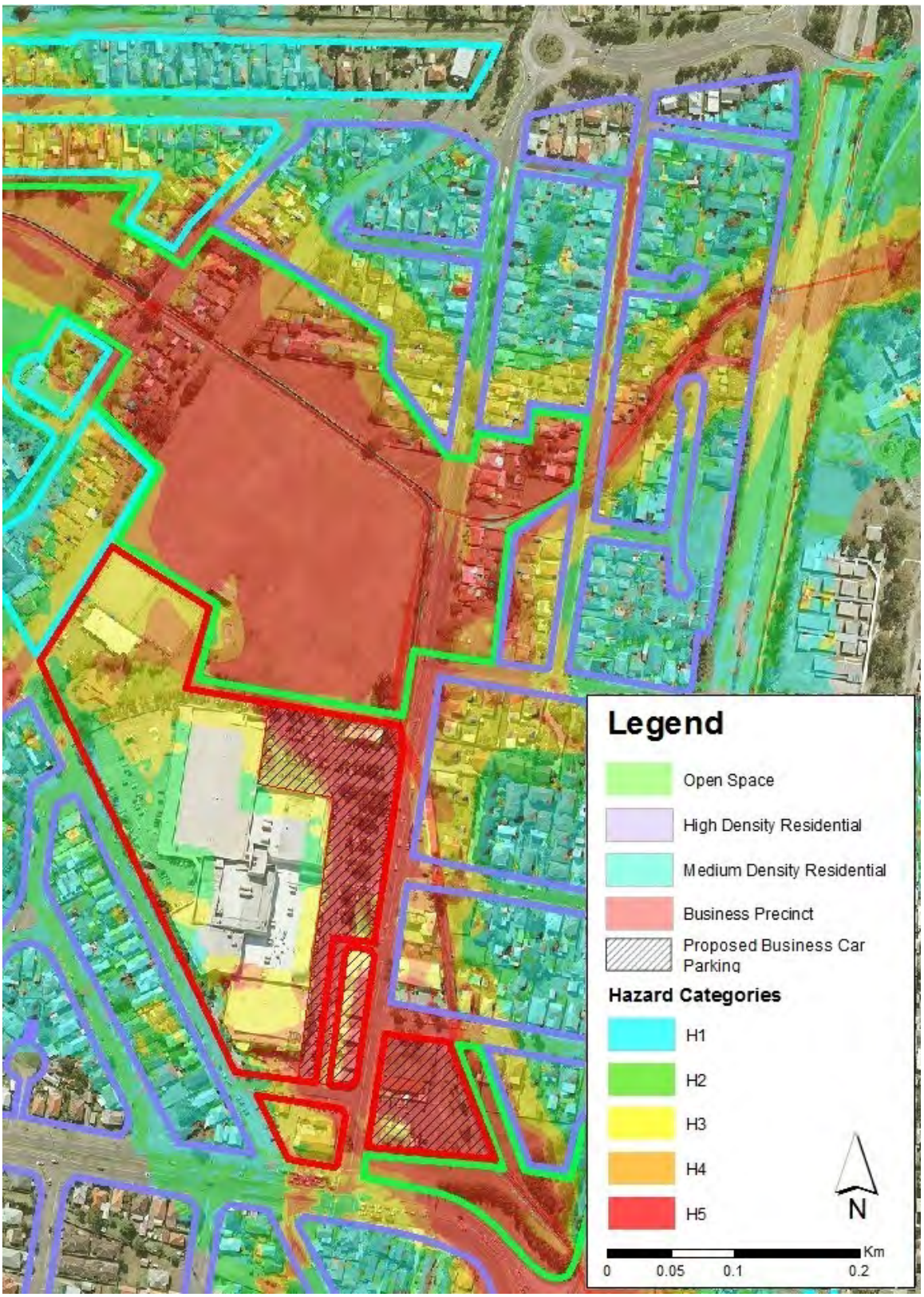

Figure 9: Alternative Urban Renewal Plan Recognising Flood Hazards

Case Study 3

Area 1

This is highly urbanised catchment with a major creek and several channelised tributaries. There are hundreds of houses throughout the study area which would suffer above floor flooding in a 1% AEP event and several houses which would experience above floor flooding in events as small as a 20% AEP (Figure 10). There is limited space for any type of effective flood modification works.

Much of the study area has been rezoned for medium density housing and those areas which have not been, permit the construction of dual occupancy dwellings. This has increased the demand for public open space and council is actively considering an open space strategy.

Using the hybrid approach elaborated upon earlier, two areas within the catchment were identified which are in need of additional open space and where there are dwellings with a high risk of above floor flooding.

In one location its proximity to the local high school would enable it to be utilised regularly by the school which could access the new park via an existing stormwater pipe easement (Figure 11). The second location is a block of properties zoned low density ajacent to areas which have recently been rezoned for medium and high density housing.

As far as I am aware both of these options are being actively investigated by Council.

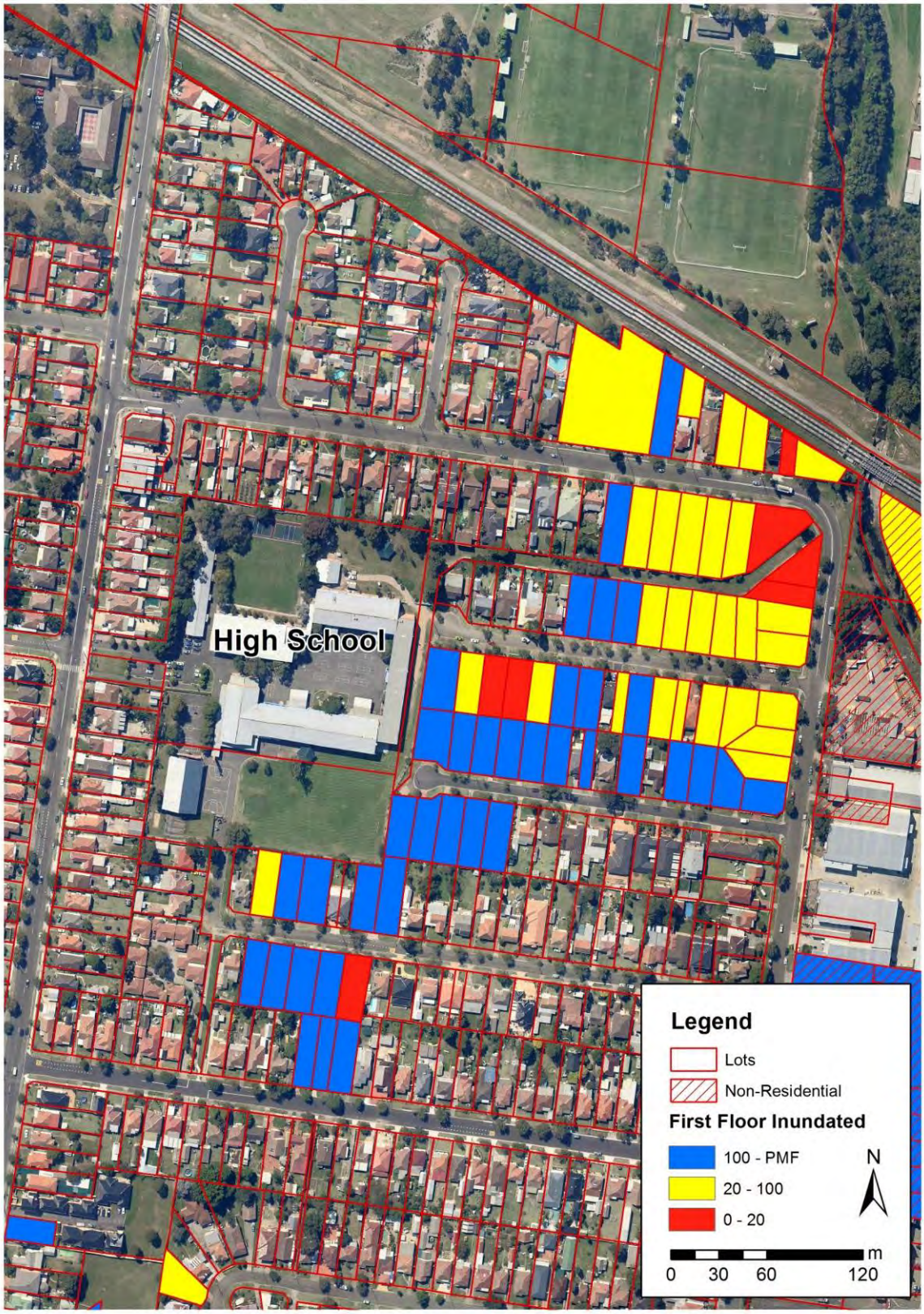

Figure 10: Lots with first floor inundation during a flood

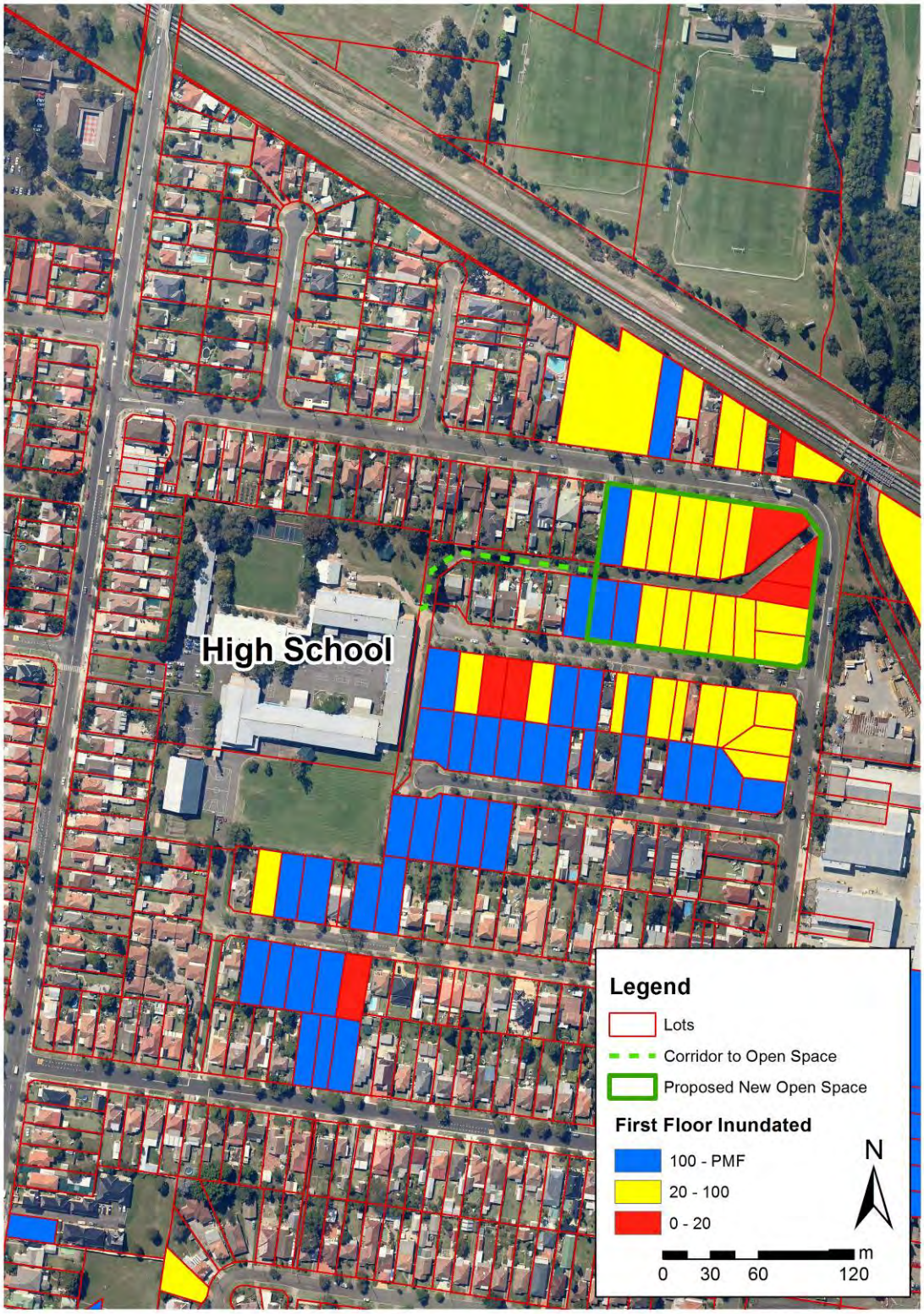

Figure 11: Proposed rezoning to turn dwellings with frequent above floor flooding into open space

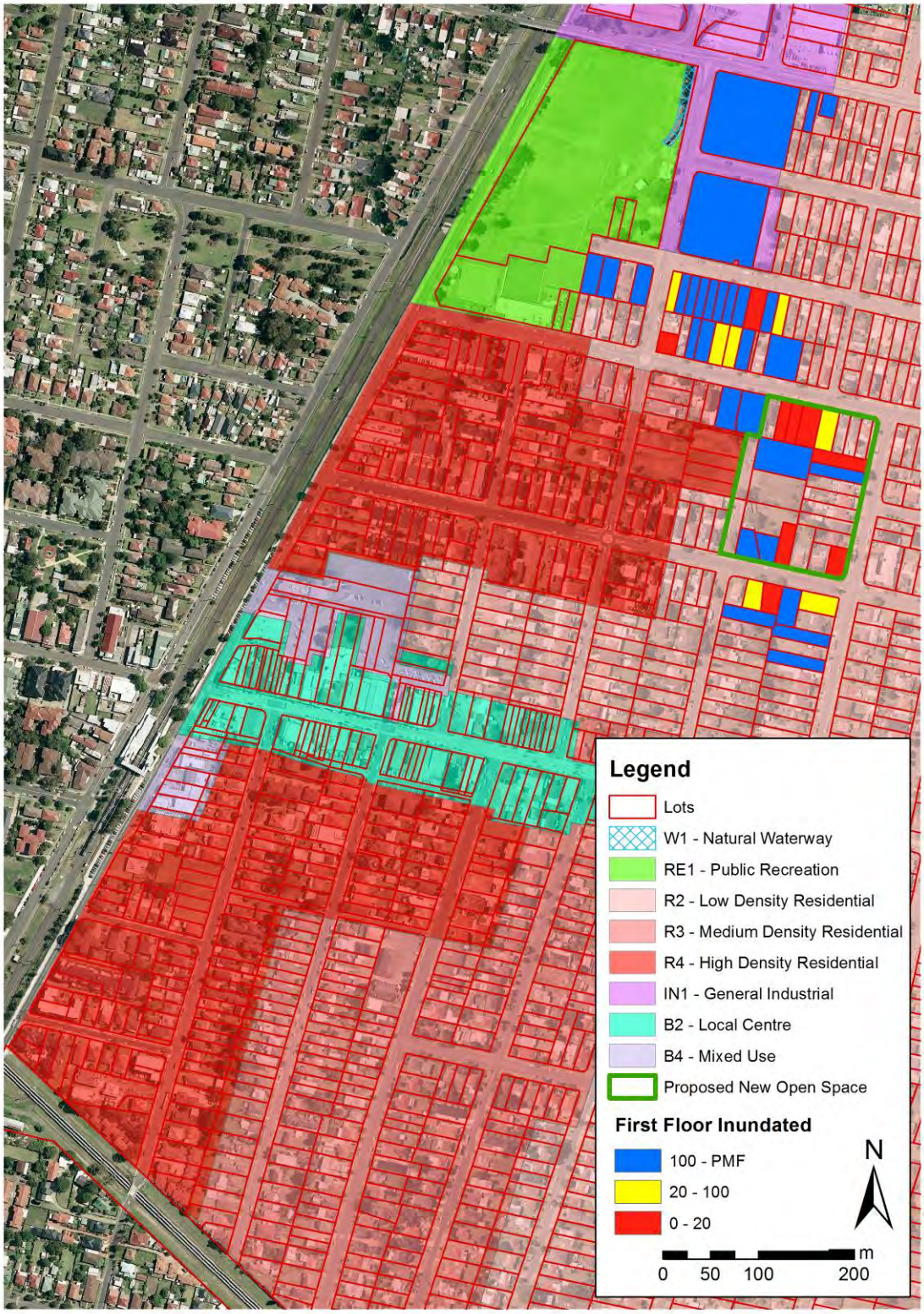

Figure 12: Proposed rezoning to turn dwellings with frequent above floor flooding into open space

Case Study 4

This is a highly urbanised local government area with numerous creeks and concrete lined channels. A new LEP was being prepared to conform to the NSW Government Standard LEP template and the opportunity was taken to rezone areas for high density residential uses.

A section of one catchment (Figure 13) is used to illustrate the approach this council took. There is a formalised drainage channel running though the catchment with overland flowpaths which feed into it.

Current LEP land use zoning includes some land zoned for open space along these drainage corridors but residential and other development abuts them in a number of locations (figure 14). When Council's flood risk precincts are overlaid on the air photo it is apparent that large areas of existing development lie within the medium risk precinct which is defined by the limit of the 1% AEP event (Figure 15). While most of the houses within this precinct would not experience above floor flooding, many would experience it in much more frequent floods. Throughout the LGA there are many houses which, because of their flood risks, have been identified as suitable for voluntary purchase if and when funds become available.

In the draft LEP areas of land have been identified for urban consolidation (R3 – medium density and R4 – high density residential zonings). This means that more open space is needed as compensation. The additional land zoned for open space in the draft LEP is generally contiguous with existing open space and much of it has been placed occurs linear corridors in medium to high risk flood precincts (Figure 16).

Some of these back zoned properties are those which have been on Council's list for voluntary purchase for many years but lack of funds has prevented that from occurring. Once the new LEP is approved redevelopment at higher densities will take place and developers will pay contributions to Council for the creation of open space. Those whose land has been rezoned as open space will not be allowed to redevelop but can sell their land to Council at market rates. Council can then use the developer contributions to purchase these properties to both create the needed open space but also to remove the dwellings which have long had an unacceptable flood risk.

Figure 13: Urban Catchment

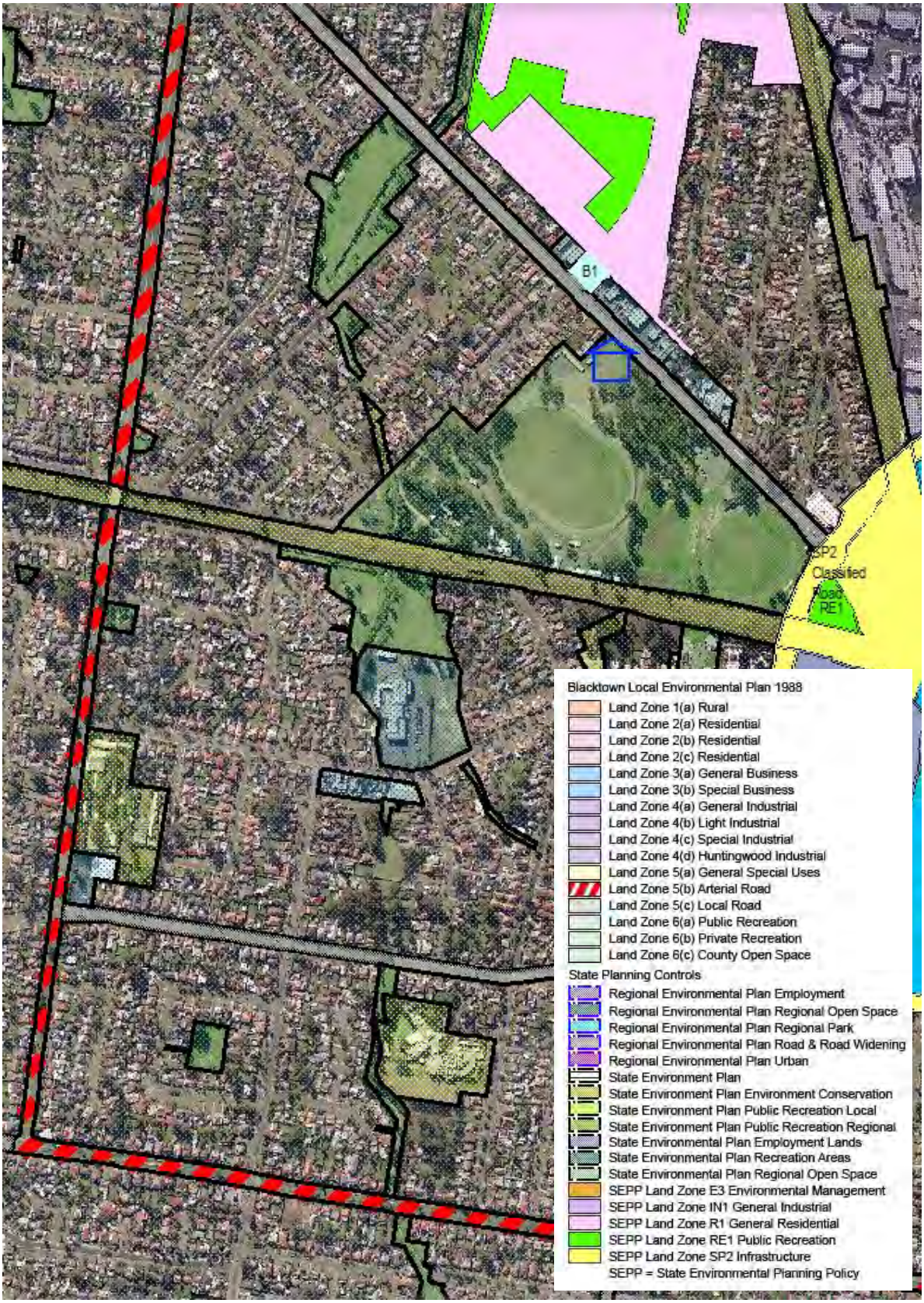

Figure 14: Current LEP land use zoning

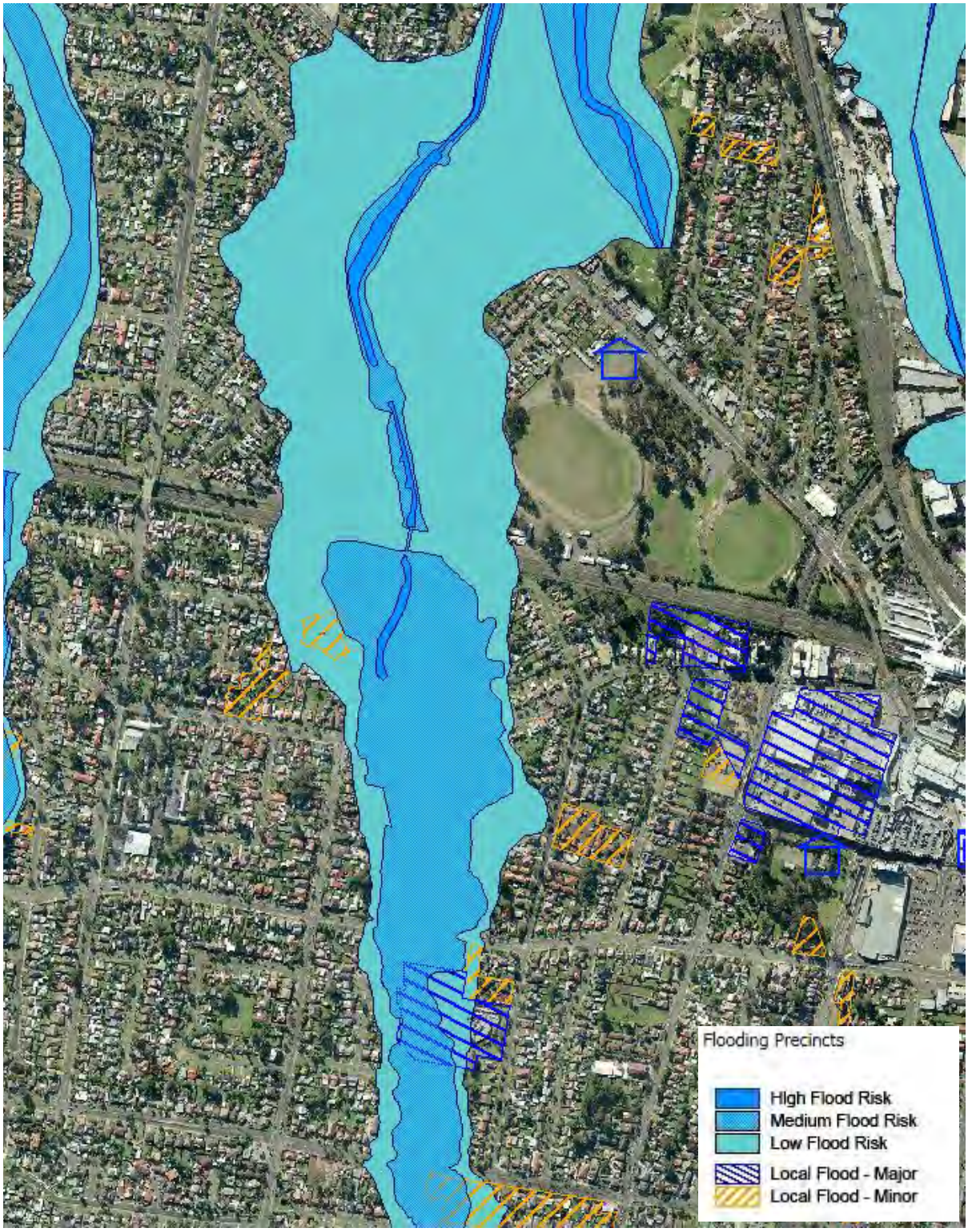

Figure 15: Flood precincts

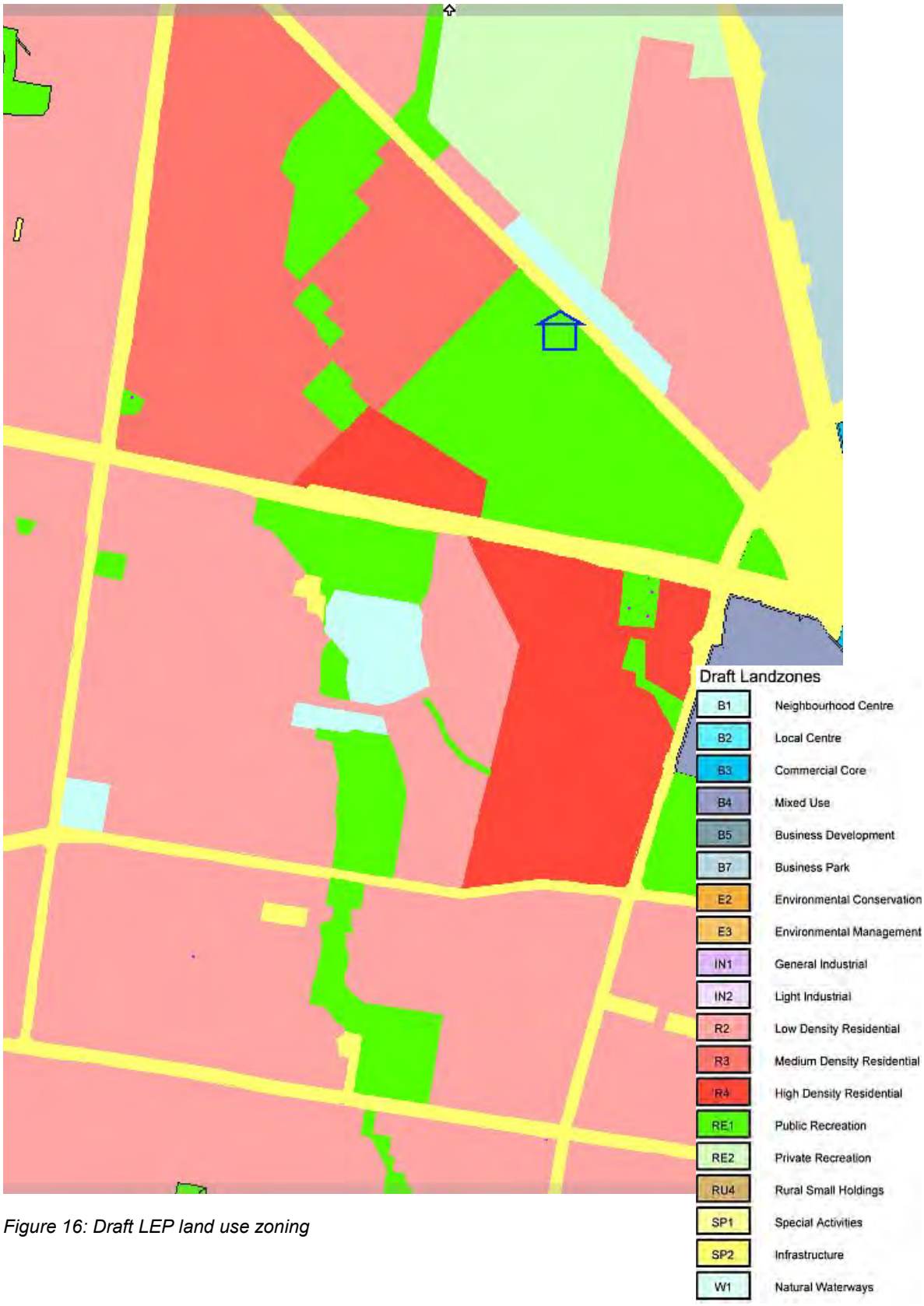

Figure 16: Draft LEP land use zoning

Conclusion

In highly urbanised catchments town planning processes provide the opportunity to reduce existing flood risks and floodplain management processes provide the opportunity to deliver better future town planning outcomes. Undertaking either in isolation of the other can lead to suboptimal land uses and increase the future costs of floodplain management for councils and property owners.

Floodplain management considerations need to be integrated early in town planning studies to deliver the best outcomes. Floodplain managers need to be alert to the various town planning investigations and strategies being undertaken in their local government area and need to get involved using the hybrid approach proposed in this paper rather than leaving it up to the town planners to use their traditional approach and then use the floodplain management approach at a different time.

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