APPENDIX K

APPENDIX K

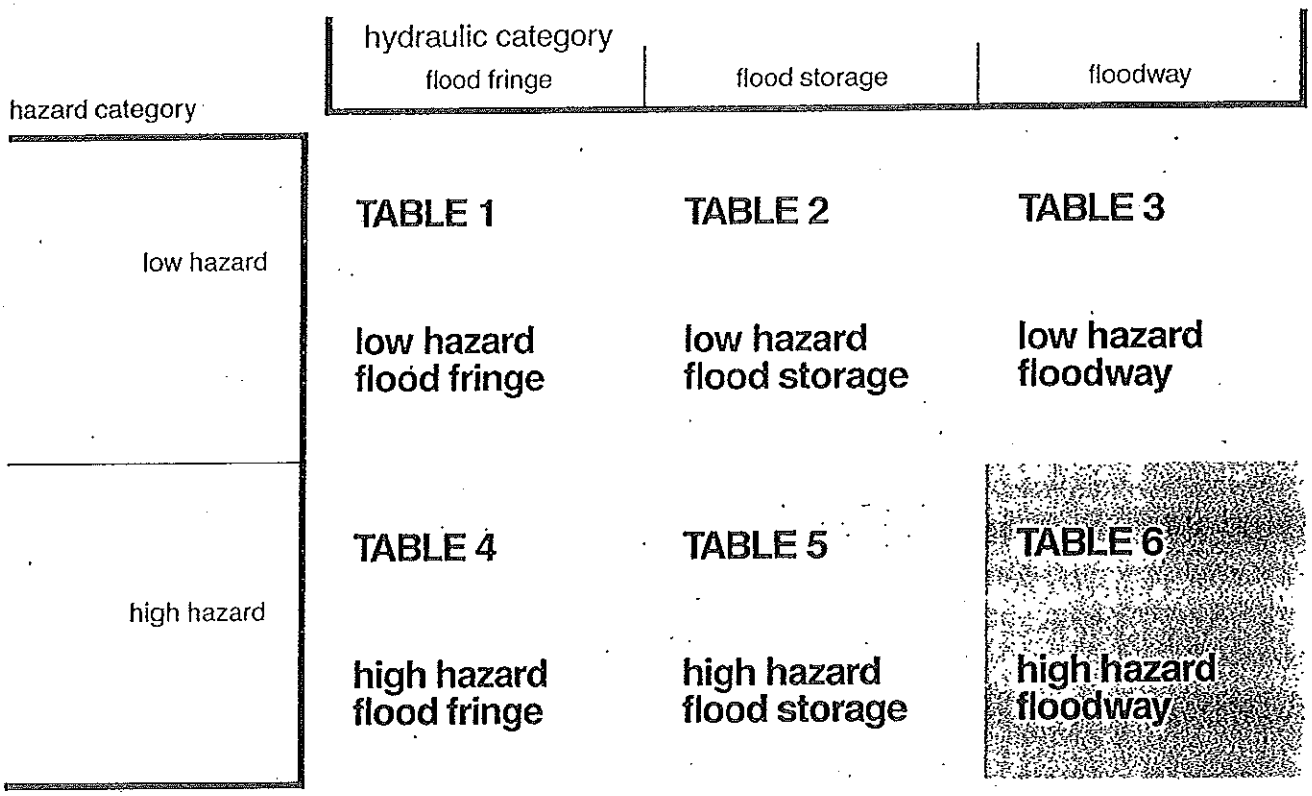
FLOOD LIABLE LAND DEVELOPMENT GUIDELINES

Reproduced from the NSW Government Floodplain Development Manual (1986)

4.5.3 Development Guidelines

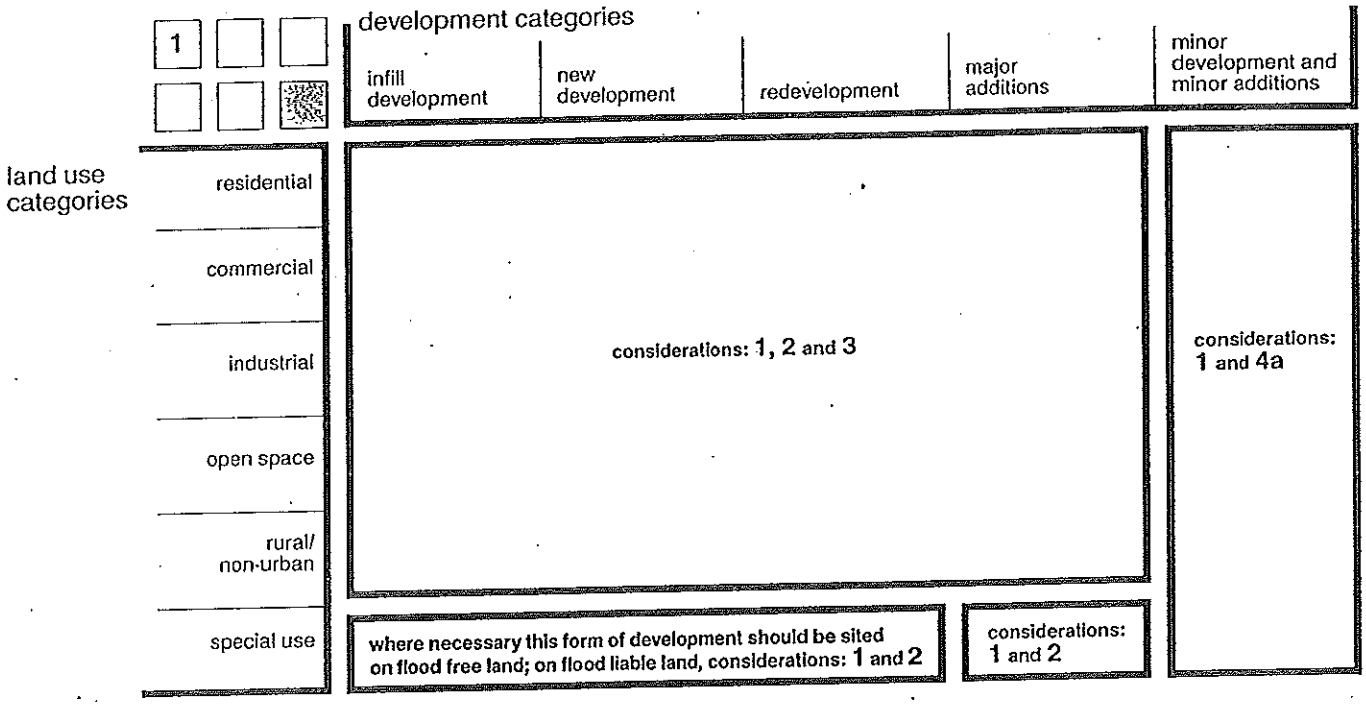
The following tables present guidelines to assist councils in the formulation of floodplain management plans, drafting of development conditions and in assessing the suitability of various types of developments with regard to prevailing flood hazard etc. There are six tables, one for each combination of hydraulic and hazard category (refer Figure 5).

FIGURE 5 Index to Development Guidelines



NOTE: table numbers refer to the appropriate guideline tables

TABLE 1 Development Guidelines Low Hazard — Flood Fringe



nature of flooding

- Water depths are less than 0.8m.
- Should it be necessary, people and their possessions can be evacuated by trucks.
- Able-bodied adults would have little difficulty in wading.
- Damage potential would be low.

implications of flooding

- Developments will not have a significant effect on the depth and speed or distribution of floodwaters.
- Most developments are suitable, except for some special use developments which by their nature are sensitive to flooding or where the use is especially necessary in times of flooding.
- It will not be necessary to check the effect of proposed development on flood behaviour.

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood compatible materials.

2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

   The need to flood-proof commercial and industrial development should be determined on merit.

3. Special consideration should be given to caravan parks as they are difficult to evacuate, a fact which can be compounded by permanent vans and visitors lacking flood awareness. Also, caravans are easily damaged and can float.

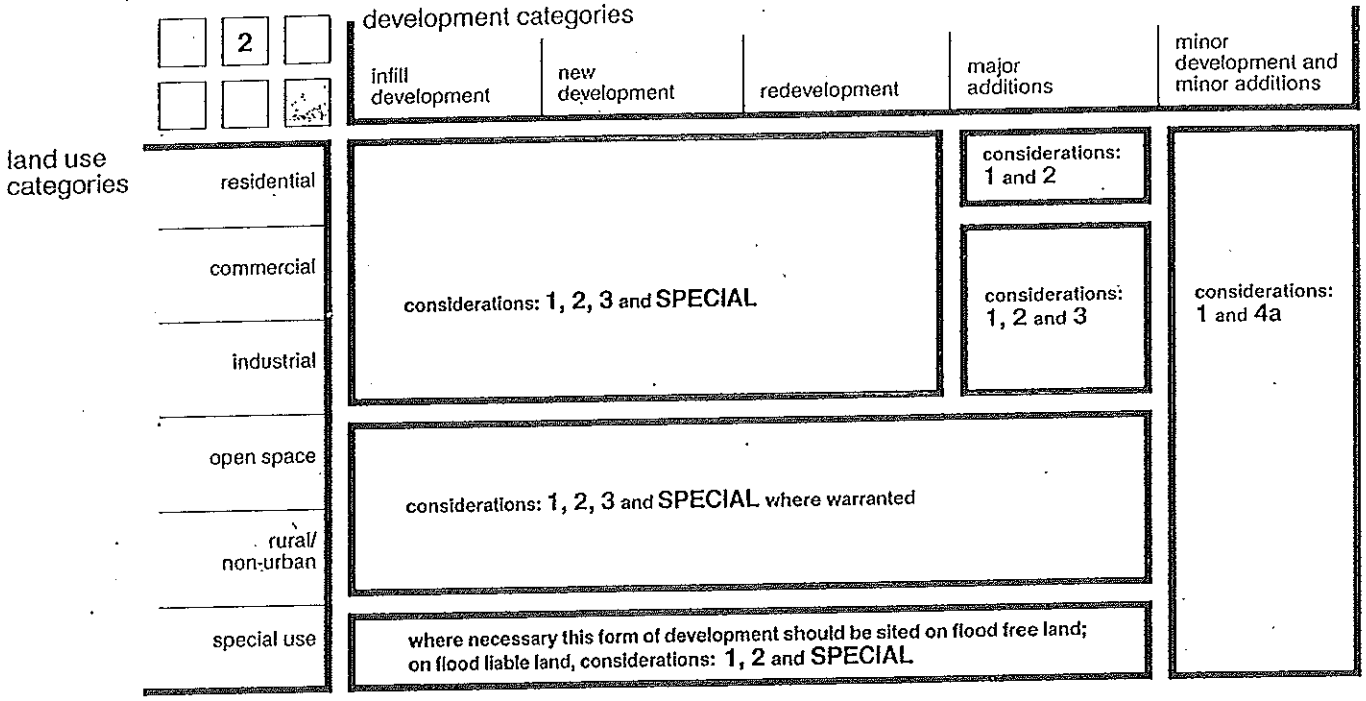
4. (a) The Flood Policy exempts minor development and additions from special controls.

   (b) The potential for damage to development or adverse impacts on flood behaviour may need to be considered in specific cases, which should be treated on their merits.

SPECIAL

Nil.

TABLE 2 Development Guidelines
Low Hazard — Flood Storage



nature of flooding

- Water depths are less than 0.8m.
- Should it be necessary, people and their possessions can be evacuated by trucks.
- Able-bodied adults would have little difficulty in wading.
- Damage potential would be low.

implications of flooding

- The impact of new development on flood storage and therefore flood behaviour needs to be addressed.
- Most developments are compatible, except for some special use developments which by their nature are sensitive to flooding or where the use is especially necessary in times of flooding.

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood compatible materials.
2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

   The need to flood-proof commercial and industrial development should be determined on merit.
3. Special consideration should be given to caravan parks as they are difficult to evacuate, a fact which can be compounded by permanent vans and visitors lacking flood awareness. Also, caravans are easily damaged and can float.
4. (a) The Flood Policy exempts minor development and additions from special controls.

   (b) The potential for damage to development or adverse impacts on flood behaviour may need to be considered in specific cases, which should be treated on their merits.

SPECIAL

- If a new development in a Flood Storage area is likely to cause a significant reduction in storage capacity, the developer or property owner should be required to demonstrate to the consent authority that the proposal will not significantly increase flood levels. If the development would cause a significant increase in flood levels, the developer or property owner should provide adequate and acceptable compensating works to offset the increase. A detailed report by an appropriate consulting engineer should be required in support of a development or building application.

TABLE 3 Development Guidelines Low Hazard — Floodway

land use categories	development categories: infill development	new development	redevelopment	major additions	minor development and minor additions
residential, commercial, industrial	considerations: 1, 2, 3, 5 and SPECIAL				considerations: 1, 4a and 4b
open space, rural/ non-urban	considerations: 1, 2, 3, 5 and SPECIAL where warranted				
special use	where necessary this form of development should be sited on flood free land; on flood liable land, considerations: 1, 2, 5 and SPECIAL				

nature of flooding

- Water depths are less than 0.8m.
- Should it be necessary, people and their possessions can be evacuated by trucks.
- Able-bodied adults would have little difficulty in wading.
- Damage potential would be low.

implications of flooding

- The impact of development on the floodway and therefore flood behaviour needs to be addressed.
- In order to reduce the hazard to existing development, a floodplain management study might be needed to identify appropriate management measures.

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood compatible materials.
2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

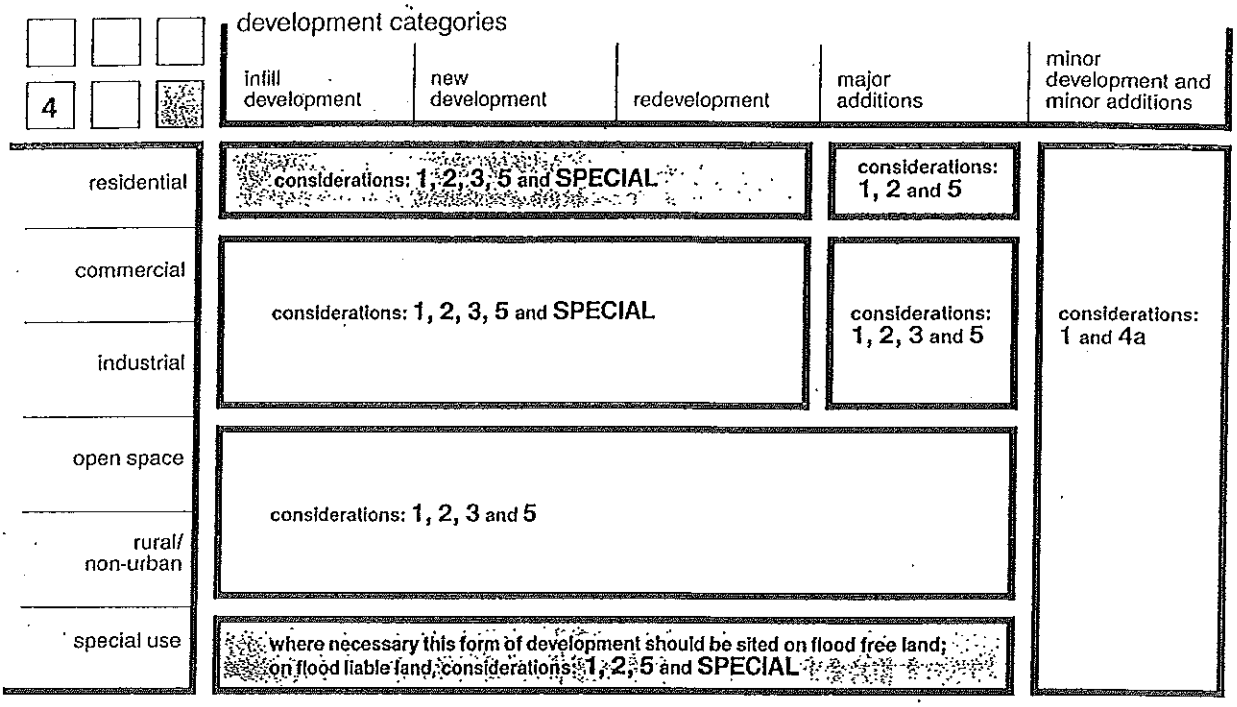
   The need to flood-proof commercial and industrial development should be determined on merit.
3. Special consideration should be given to caravan parks as they are difficult to evacuate, a fact which can be compounded by permanent vans and visitors lacking flood awareness. Also, caravans are easily damaged and can float.
4. (a) The Flood Policy exempts minor development and additions from special controls.

   (b) The potential for damage to development or adverse impacts on flood behaviour may need to be considered in specific cases, which should be treated on their merits.
5. The developer or property owner should demonstrate that any building or structure can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate. A detailed report from an appropriate consulting structural engineer should be required in support of a development or building application.

SPECIAL

- In floodway areas, the property owner or developer should be required to satisfactorily demonstrate to the consent authority that the development will not increase the flood hazard or flood damage to other properties or adversely affect flood behaviour. A detailed report from an appropriate consulting engineer should be required in support of a development or building application.

Development Guidelines
TABLE 4 High Hazard — Flood Fringe



nature of flooding

- Floodwaters are generally over 1m deep and slowly moving.
- Evacuation routes can be cut early in the flood.
- Many buildings can be inundated.
- Evacuation of people and possessions may be difficult and may need to be by boat or helicopter, often at some risk to the operators.
- Social disruption and financial loss could be high.
- There may be danger to life and limb.

implications of flooding

- Developments will not have a significant effect on the depth and speed or distribution of floodwaters.
- It will not be necessary to check the effect of proposed developments on flood behaviour.
- In order to reduce the hazard to existing development, a floodplain management study should be undertaken to identify the appropriate measures.
- Whilst new development is not generally considered appropriate in a high hazard area, it may be acceptable under special conditions. Such conditions should involve a detailed review of the potential flood hazard to the development itself.

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood-compatible materials.
2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

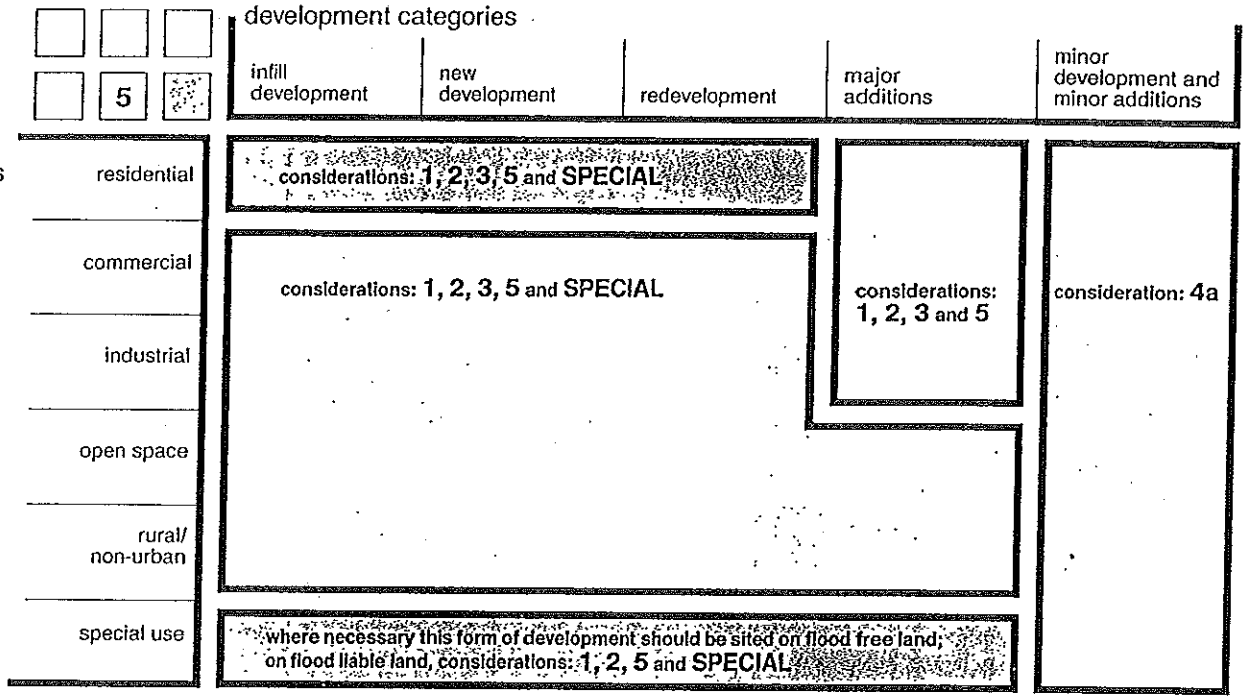
   The need to flood-proof commercial and industrial development should be determined on merit.
3. Special consideration should be given to caravan parks as they are difficult to evacuate, a fact which can be compounded by permanent vans and visitors lacking flood awareness. Also, caravans are easily damaged and can float.
4. (a) The Flood Policy exempts minor development and additions from special controls.

   (b) The potential for damage to development or adverse impacts on flood behaviour may need to be considered in specific cases, which should be treated on their merits.
5. The developer or property owner should demonstrate that any building or structure can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate. A detailed report from an appropriate consulting engineer should be required in support of a development or building application.

SPECIAL

- In high hazard areas, the developer or property owner should be required to satisfactorily demonstrate to the consent authority that permanent, fail-safe, maintenance-free measures are incorporated in the development, to ensure the timely, orderly and safe evacuation of people from that area, should a flood occur. In addition, it should also be demonstrated to the consent authority, that the displacement of these people will not significantly add to the overall cost and community disruption caused by the flood. A detailed report from an appropriate consulting engineer should be required in support of a development or building application.

Development Guidelines
TABLE 5 High Hazard — Flood Storage



nature of flooding

- The depth of floodwaters can be 1m or more.
- The speed of floodwaters is slow, and in effect the floodwaters form a pond.
- Many single storey buildings could be completely inundated and may suffer structural problems due to buoyancy.
- Evacuation of people and possessions may be difficult and may need to be by boat or helicopter, often at some risk to the operators.
- There may be danger to life and limb.
- Social disruption and financial loss could be high.

implications of flooding

- In order to reduce the hazard to existing development, a floodplain management study should be undertaken to identify the appropriate measures.
- The impact of new development on flood storage and therefore on flood behaviour needs to be addressed.
- Whilst new development is not generally considered appropriate in a high hazard area, it may be acceptable under special conditions. Such conditions should involve a detailed review of the impact of the development on flooding and of the potential hazard to the development itself

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood-compatible materials.
2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

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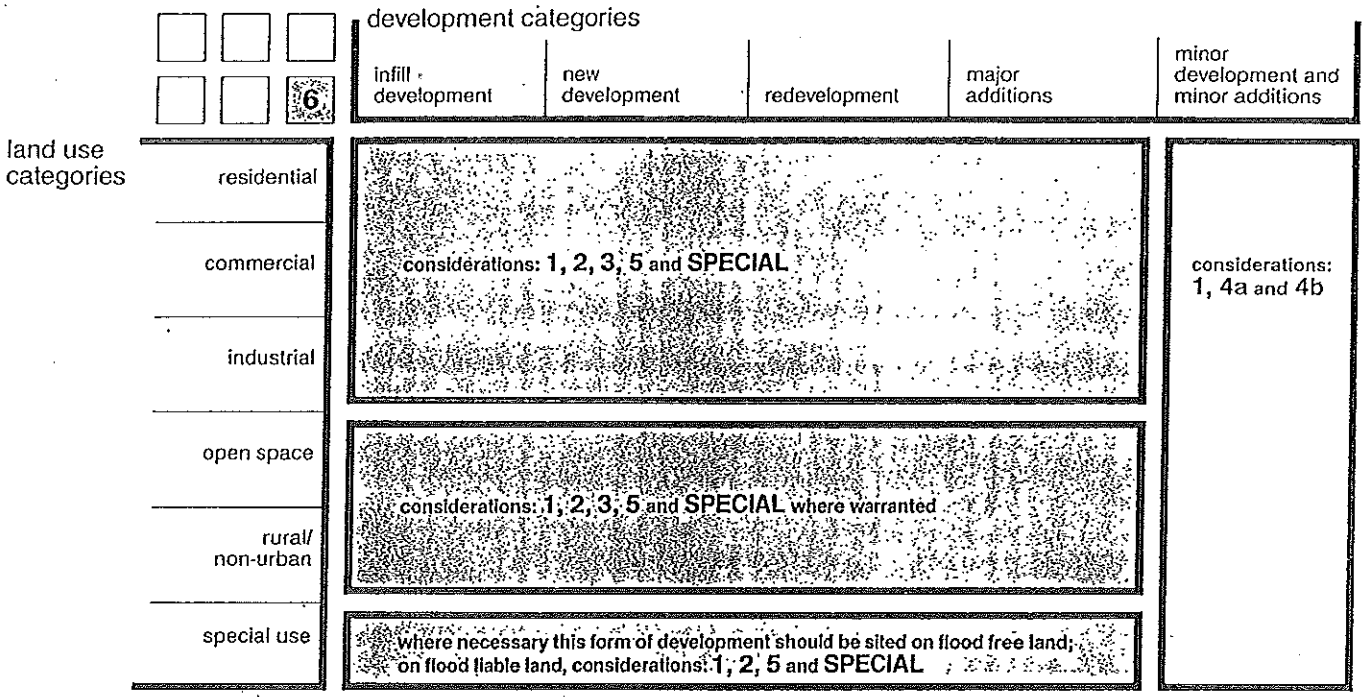
   (b) The potential for damage to development or adverse impacts on flood behaviour may need to be considered in specific cases, which should be treated on their merits.
5. The developer or property owner should demonstrate that any building or structure can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate. A detailed report from an appropriate consulting engineer should be required in support of a development or building application.

SPECIAL

- In high hazard areas, the developer or property owner should be required to satisfactorily demonstrate to the consent authority that permanent, fail-safe, maintenance-free measures are incorporated in the development, to ensure the timely, orderly and safe evacuation of people from that area, should a flood occur. In addition, it should also be demonstrated to the consent authority, that the displacement of these people will not significantly add to the overall cost and community disruption caused by the flood. A detailed report from an appropriate consulting engineer should be required in support of a development or building application.
- If a new development in a Flood Storage area is likely to cause a significant reduction in storage capacity, the developer or property owner should be required to demonstrate to the consent authority that the proposal will not significantly increase flood levels. If the development would cause a significant increase in flood levels the developer or property owners should provide adequate and acceptable compensating works to offset the increase. A detailed report by an appropriate consulting engineer should be required in support of a development or building application.

TABLE 6 Development Guidelines High Hazard — Floodway



nature of flooding

- The depth and speed of floodwaters are such that buildings could sustain major structural damage and in extreme cases, light framed houses could be washed away.
- There could be major difficulties and dangers in evacuating people and their possessions.
- There may be danger to life and limb.
- Social disruption and financial loss could be very high.

implications of flooding

- The impact of development on the floodway and therefore on flood behaviour needs to be addressed.
- In order to reduce the hazard to existing development, a floodplain management study should be undertaken to identify the appropriate measures.
- Whilst new development is not generally considered appropriate in a high hazard floodway area, it may be acceptable under special conditions. Such conditions should involve a detailed review of the impact of new development on flooding and of the potential hazard to new or existing development.

development considerations

1. Any portion of a building or structure subject to inundation should be built from flood-compatible materials.
2. Flood proofing to 0.5m above the standard flood should be required of habitable floors of new residences, including those associated with commercial and industrial development, and of normally occupied floors of special use developments. Whilst this condition would generally apply to major residential extensions, the merits of the case should determine the need.

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- In floodway areas, the property owner or developer should be required to satisfactorily demonstrate to the consent authority that the development will not increase the flood hazard or flood damage to other properties or adversely affect flood behaviour. A detailed report by an appropriate consulting engineer should be required in support of a development or building application.

APPENDIX L

APPENDIX L

DEPARTMENT OF TRANSPORT PERSPECTIVE

ROCKHAMPTON FLOOD MANAGEMENT STUDY RECOMMENDATIONS
DEPARTMENT OF TRANSPORT PERSPECTIVE

The Bruce Highway is a National Highway and its construction and maintenance are funded by the Federal Government which also sets standards and approves improvement strategies for such work.

Upgrading needs are determined in accordance with Road Network Strategies which evaluate the condition of the road and its likely future condition against defined standards. These standards include width/traffic volume, pavement condition (strength and roughness), accident history, flood immunity and other factors such as alignment, intersection capacity and bridge strength.

In determining priority for works, the condition deficiencies are evaluated and cost-effective remedial options determined taking into account whole of life costs. Benefit/cost ratios are calculated which take account of vehicle operating and travel time savings, accident reduction, as well as economic and regional development benefits. The benefits of flood immunity improvements are included.

Within available funds, projects on the current National Highway program in Queensland have an average BCR of 2.5. The Bruce Highway component of the National Highway Planning Program gives BCR > 4.5 for major works. Projects with width deficiencies such as the Cooroy bypass and the southern approaches to Cairns have BCR of 3 - 4.

Following the 1991 floods, the problems and upgrading options at Alligator Creek near Yaamba were re-evaluated. The analysis indicated that this had the highest priority for upgrading on a flood immunity basis over the whole National Highway system in Queensland including the Landsborough and Barkly Highways. Its BCR is 4.8 at 7% discount rate.

The project was approved for construction by the Federal Government and work has commenced on the first stage which involves high level bridges over Alligator and Plentiful Creeks on a deviation of the highway adjacent to the North Coast rail line. The second stage involves raising the road at Smith's Gully north of Yaamba. The whole project is estimated to cost $9.6m and will be completed in late 1993.

At the completion of this work, Rockhampton will no longer be isolated to the north as a result of flooding in the Fitzroy River or in Alligator Creek.

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Because of the relatively shorter times of submergence and the higher costs of remedial work, the same priority is not indicated for the Yeppen flood plain. The results of the Rockhampton Flood Management Study show a BCR of 1.1 at 7% discount rate. It is noted that this analysis has included benefits accruing to local business where this information is not normally available to the Department of Transport. Hence the BCR of 1.1, while relatively high in terms of the current study, is inflated when considered in terms of normal Department of Transport analysis.

In summary, from the "Department of Transport Perspective", and where the Federal Government is the funding authority for National Highway projects, the flood immunity works for the Yeppen Flood Plain are of low BCR value and need to compete with other projects with much higher BCRs for priority and funding considerations. It is on this basis that the Yeppen Flood Plain is assessed as being of relatively low priority and behind other projects in terms of width, travel and operating costs, safety, strength and roughness deficiencies.

At present, there are no plans to upgrade the Yeppen Flood Plain from road funding sources at likely future funding levels.

However if funds are available for the Yeppen project through other programs directed toward mitigation of flood effects then obviously there would be no objection from the Department of Transport to accelerating construction of the necessary remedial works.