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MANAGED FLOODING?

INTEGRATED CATCHMENT MANAGEMENT NEEDED TO AVOID FLOODING AND POLLUTION IN COROMANDEL

A heart-breaking scene: an inflated holiday weekend population (high sewage load), two days of continuous heavy rain (up to 30mm per hour), flood waters flowing through up to 30 houses depositing silt and sewage (according to the media, One News 2003 a,b), an influx of firemen pumping out houses, yards and sewers, then house contents strewn through yards and over fences (Figures 1 and 2).

This Easter 2003 storm was the second to hit Coromandel township (Figure 3) in less than 12 months. Even after a thorough scrub-out some of these houses were unfit for habitation. The impact was aggravated by previous decisions on town layout and drainage infrastructure.

As is typical in New Zealand towns the sewage treatment plant is located on flat low lying land so that sewage pumping is minimised by taking advantage of gravity flow. Partly treated sewage is held in oxidation ponds. The sewage treatment plant is located in the river floodplain some 500m upstream from the harbour. Residential development has occurred over past decades in the area downstream of the sewage plant, some of it presumably preceding the plant. When the river flooded on April 19 and 20,2003, the floodwaters filled the flood plain including the area occupied by the oxidation ponds. It is unclear whether the oxidation pond shown in Figure 4 was breached before or during the storm Floodwaters from the sewage treatment site then flowed into Whangarahi Stream and through houses in the lower flood plain and eventually into the harbour.

Upstream of the oxidation pond there is another vulnerable subdivision on the flood plain. This is the retirement village, which was constructed behind a low dyke in the mid-1990s (Figure 5). During the storm, the floodwaters over-topped the dyke and entered many of the 20 or so houses in the retirement village (Figure 6). These retirees are vulnerable citizens least able to cope with the trauma and expense of flood damaged houses and ruined gardens.

Integrated Catchment Planning, Development and Management

Flood damage would have been greatly reduced if planners and decision-makers had taken account of catchment characteristics. There are diverse factors contributing to the damage at Coromandel, much of which could have been avoided had better local planning decisions been made over the preceding decades. In order for planners to have foreseen and avoided the sequence of events associated with this and similar floods in Coromandel, planning needed to be based upon Integrated Catchment Management (ICM).

ICM sees the environment we manage as a complex assemblage of interacting ecosystems that operate within a landscape (Bowden 2002). which in this case is a catchment. Effective ICM depends on a comprehensive understanding of the components of the catchment and their interactions (Reimold 1998). ICM allows physical hydrology to be linked with research and management of, for example, water quality, vegetation dynamics, and land use (Bowden 2002). ICM enables professionals, local authorities and communities to work together to address common biophysical and social issues that may result from the cumulative effects of successive and often minor decisions made over a long time horizon within a single catchment.

This technique takes into account all threats to the environment and human health instead of regulating specific pollutants and pollutant sources. It includes identifying existing priority and potential future problems, which afford a measurable risk to human health, ecological resources, desired uses of the waters, or a combination of these. Reimold and Singer 1998:35

Some research in North America has been slanted towards investigating the social and political influence on catchment management, and how consequent catchment recognition has influenced society (van Roon and Knight 2004). Water management planning uses a consensus-building process to achieve social change (Heathcote, 1998).

The general ICM approach includes:

- developing an understanding of catchment components and processes and of water uses, water users, and their needs;
- identifying and ranking problems to be solved or beneficial uses to be restored;
- setting goals;
- setting planning constraints and decision criteria;
- comparing management alternatives and eliminating alternatives that are not feasible because of time, cost, space, or other constraints;
- determining the economic and environmental

Figure 1: Furniture and carpets from a Coromandel house emptied into the flooded yard.

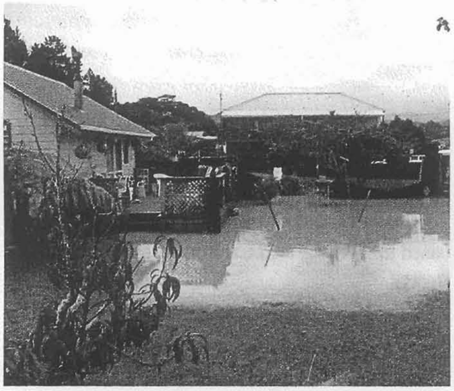

Figure 2: A flooded Corornandel garden downstream of the sewage treatment plant.

impacts, legal implications and effectiveness of remaining alternatives; and

- choosing good management strategies and developing clear implementation procedures (Ibid).

The planning process is dynamic and continuous with several tasks or steps under way simultaneously. Planning direction may change with political forces or community consensus. ICM must be responsive and adaptive to changing conditions. A good plan is a framework for continued dialogue, for incorporation of new technologies, management thinking and the community's vision of an ideal watershed state (Heathcote 1998).

This planning and management approach has as its focus water resource management within understood and quantified economic and social constraints. There is a need to understand every issue, object or process within the catchment that contributes to the priority issues or problems within that catchment in order to find solutions to that problem. This enables the spending of limited funds on that issue, remediation of which gives the highest benefit.

Biophysical terrestrial components of the catchment may be improved during this ICM approach only if they contribute to beneficial outcomes for water. However, truly integrated catchment management should address the simultaneous optimisation of positive outcomes for all biophysical components of the catchment. In other words, the sustainable management of terrestrial ecosystems typically leads to the

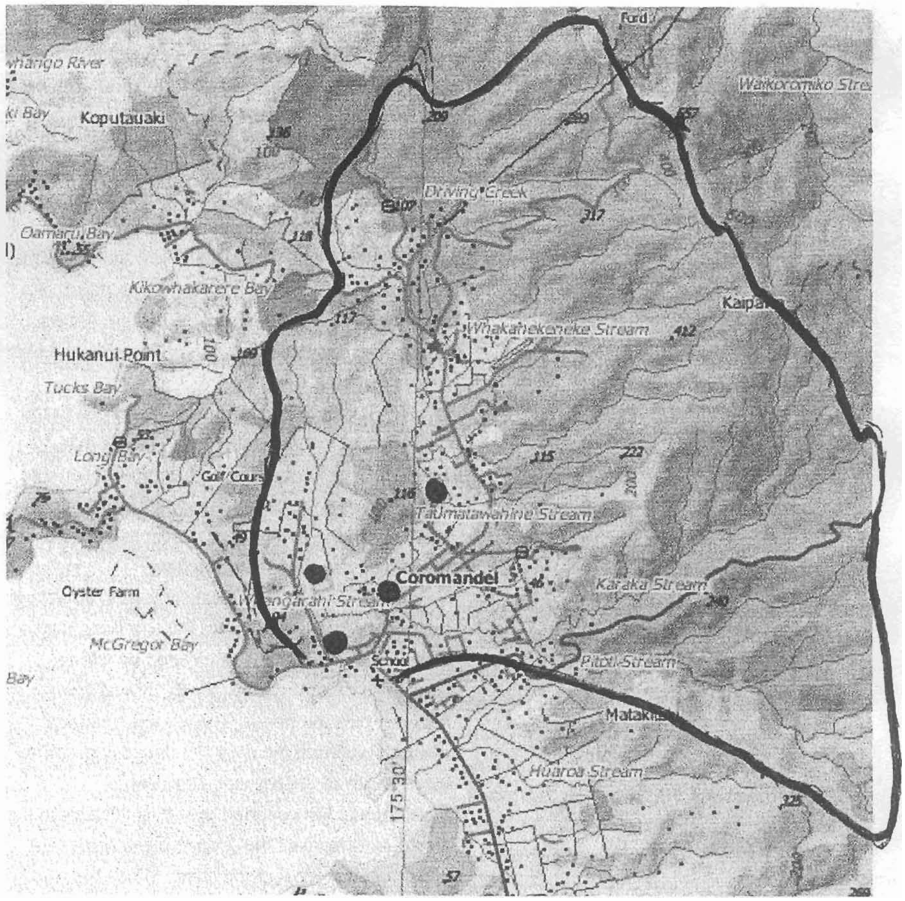

Figure 3: The catchment of river tributaries that converge in Corornandel township. Red dots: flooding locations - Albert Street (top right), retirement village (centre), the sewage treatment plant (top left) and lower Hauraki Road (lower). Source: NZTopoOnline, extracted April 2003, Crown Copyright Reserved.

Figure 4 (left): The breached embankment of the sewage oxidation pond at Coromandel.
Figure 5 (right: The dyke that failed to keep floodwaters out of the retirement village at Corornandel. Furniture and vegetation debris suspended at the top of the fence line shows how high the floodwaters were with respect to the dyke. The remainder of the floodplain that was well submerged during the event is visible to the left.

simultaneous ecological sustainability of receiving water ecosystems. The reverse may not always hold.

Solving **Coromandel's** Problems in an **ICM** Context

Many questions require answering in Coromandel before solutions can be found to current pollution and flooding problems. These include:

- Development in the catchment and housing in Coromandel township have occurred simultaneously over more than a century. Land uses that are contributing to flooding and erosion in the catchment upstream of the township need reassessment. Unlike other rivers in Coromandel township the one causing this flood damage was heavily discoloured during the storm of April 19 - 20, by suspended clay material from the catchment (Figure 7). The river referred to flows parallel to Rings Road and lies North East of the village shopping area. Unlike in the catchments of adjacent clean flowing rivers, this turbidity suggests the presence of upstream land uses that have left soil surfaces vulnerable to erosion. Landowners in the upper catchment might be encouraged and assisted with increased forestry conversion and riparian revegetation in the interests of residents in the lower parts of the township and sedimentation of local harbours (Figure 8) and their marine farms. Whatever the sequence of development, property investment in the town now puts pressure on upper-catchment control of runoff.

- It is questionable whether the sewage treatment plant should have been built on the flood plain. Presumably the site is low relative to much of the town and therefore maximises gravity flow of sewage. Sewage from the Hauraki Road houses down-river from the sewage plant (and any others at the harbour edge) must still however require to be pumped to the treatment plant. The flooding of the sewage treatment site was predictable and steps were hopefully taken to minimise the escape of sewage during flooding. Coromandel Harbour has many shellfish farms (Figure 9) that depend upon a planktonic food supply. An oyster farm is located in McGregors Bay, immediately north-east of the mouth of Whangarahi Stream which flooded. The presence in the harbour of sewage bacteria and viruses that may be filtered by shellfish would require at least a temporary closure of harvesting from any nearby farms. If the present location of the sewage treatment plant was perceived to be the only viable site, oyster farm leases in the nearby McGregors Bay should not have been granted consent.

Figure 6: A house in the retirement village showing sodden carpets on the drive and curtains knotted to clear the floor.

- It is also questionable whether the retirement village should have more recently been built on the floodplain between two rivers. Whether this subdivision was planned by Council or approved as a result of landowner pressure for a district plan change and resource consents, the Council must carry responsibility. Higher land elsewhere in Coromandel may have been more suitable for the purpose although the Council undoubtedly considered the ease of accessibility for retirees of this flat site close to the village.

Coromandel flooding and pollution demonstrate the necessity of integrated ICM as a basis for land use (pastoral, residential), water use (marine farming) and infrastructure (sewage treatment) planning in mixed catchments. The water cycle is the driver of adverse effects.

Current water quantity and quality issues were not foreseen as an integral part of past long-term development planning in this Coromandel catchment for several reasons. Historically the catchment was probably not used as an administrative unit by the local council. Town planning and administrative practice in New Zealand prior to the Resource Management Act 1991 separated towns from their rural hinterland.

As was typical in the past in small town New Zealand valley floors, wetlands and flood plains were seen as convenient cheap land on which to locate community facilities such as refuse landfills and sewage treatment facilities. Wetlands were drained and the higher risk of leaching and flood infiltration of waste facilities was 'made-light-of or ignored. As a result flood plains and lost wetlands such as those of lower Hauraki Road, Coromandel have had their natural functions compromised.

Figure 7: clay discoloured river on the Coromandel Peninsula similar in colour to that causing the damage in Coromandel township.

Lost wetlands and floodplains denuded of forest not only represent a major biodiversity loss in New Zealand (MfE 1997b) but also no longer act as reservoirs detaining and filtering floodwaters before harbour entry. Consequently harbours become infilled with soft sediments encouraging the spread of mangroves that are now popular targets for 'community management' or eradication (Farnsworth, La Bonte and La Bonte 2002).

Environment Waikato agreed to work with the Coromandel community in 2003 to lessen the risk

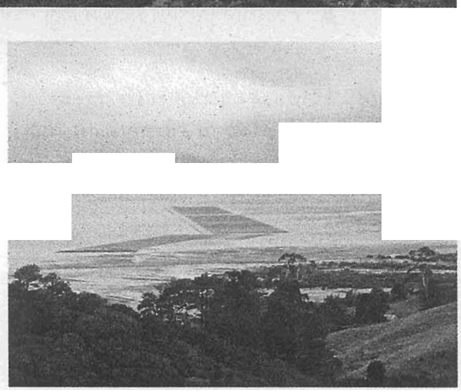

Figure 8 (top): Discolouration of Coromandel Harbours by eroded sediment from land sources.
Figure 9 (bottom): Extensive Coromandel marine farms.

to people and property from flooding (EW 2003). Councillor Evan Penny says:

"The Regional council has already been working on identifying flood hazards, considering options and improving Civil Defence response, flood warning systems and clearance works. The work so far has been extensive and costly, with inadequate provision in current budgets to support it. The risk to communities in the area remains high, but there's not enough money for river and catchment management advice and assistance" (EW 2003).

Flood management should emphasise avoidance rather than remediation. The reduction of stormwater generation in the catchment should be emphasised rather than priority being given to the clearing of streams of woody debris essential for stream ecological function (Collier et al. 1995; Collier and Halliday 2000).

CONCLUSIONS

At Coromandel the inappropriate juxtaposition of activities poses a threat to the ongoing viability of every one of those activities. Questions arise regarding liability for past decisions, the burden of costs and possible compensation. The sequence of development is important in identifying which parties *are* responsible and which parties have been compromised.

Applying the principles of sustainable management to each of the activities within the Coromandel catchment of concern, would require that water quality and quantity changes in the river and harbour be minimised as a result of each activity. Under the Resource Management Act 1991 (s. 5c) there is the requirement to avoid, remedy and mitigate the adverse effects of activities on the environment. Most opportunities for avoidance have been lost to past decisions within this catchment. In view of the inappropriate juxtaposition of existing activities, a set of trade-offs may now be necessary to enable their co-existence. What changes will be most beneficial and who should pay for them?

Some or all of the following actions may prevent a repetition of Easter 2003:

- Management of activities upstream to minimise peak storm flows. This might be achieved by, increased forestry and construction of storm water retention basins and rain-gardens in the catchment. This would provide both source control and gradual release of stormwater after storm events.
- Relocation or storm proofing of the sewage treatment facility.
- Halt all future expansion of urban use within the lower catchment floodplain including expansion of the retirement village on parts of the land at Allman Drive and Courthouse Lane that *are* low lying, and of permanent or holiday housing along Hauraki Road.
- Increase the height of the dyke between the river and the retirement village.

In addition it may be necessary to decline further marine farm applications for leases in Coromandel Harbour or shellfish processing plants dependent on harbour waters for processing, in the vicinity of the river mouth near Hauraki Road.

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