

The NSW Sand and
Gravel Extraction Policy
for Non Tidal Rivers

*A component of the
NSW State Rivers
and Estuaries Policy*

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A Component of the State Rivers and Estuaries Policy.



New South Wales Government

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Addendum to 1996 printing of this policy.

Since 1992, all of the NSW government departments mentioned in the policy have been renamed. The most significant change is that the Department of Water Resources has been merged with the Department of Conservation and Land Management to become the Department of Land and Water Conservation. This new department has also taken in the part of the former Public Works Department that administered the tidal aspects of the Rivers and Foreshores Improvement Act. The Department of Planning is now the Department of Urban Affairs and Planning.

A Sand and Gravel Extraction Policy for Non Tidal Rivers in NSW

Executive Summary

Evidence of environmental problems associated with river sand and gravel extraction is increasing. So also is the community's expectation of river systems. Future management decisions must be based on the principle of sustainable development - sustainability not only of the sand and gravel resources but also of other river uses and values.

As a component of the State Rivers and Estuaries Policy, the **SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS** has three major objectives:

1. To ensure that extraction of sand and gravel from the State's non tidal rivers is undertaken on a sustainable use basis.
2. To manage such extraction in a way which minimises any detrimental effects on the riverine environment thereby protecting other river uses and values.
3. To ensure that the extraction policy is consistent with the aims of other Government policies and initiatives.

Extraction of river sand and gravel has the potential for serious impact on many aspects of the environment. On the other hand, river sand and gravel is an economically important resource. It is a main source of aggregate for the construction industry and is used commonly for road base.

Although legislative controls are administered by various government agencies, little provision is made to address the cumulative effects of a number of operations on the one river.

Mechanisms to address this issue are especially important in growth areas because the level of demand for sand and gravel is related directly to the level of development activity and regional population growth. Increasing pressure to upgrade both State and local road networks will create unprecedented demand for sand and gravel, especially in the North Coast region.

Recent findings by consultants indicate that already, many rivers are unstable and alternative non-river sources of aggregate will be required increasingly in the future. Some overseas countries have had to spend many millions of dollars repairing river systems damaged by sand and gravel extraction. NSW is still in a position to manage the problem before it causes such widespread and costly damage. Management strategies for some rivers may need to be much more conservative than in the past.

Clearly stated and publicly discussed mechanisms must be put in place, if sand and gravel resources from the State's non tidal rivers are to be available for future generations, and if other river uses and values are to be maintained.

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS identifies six mechanisms by which its objectives may be achieved:-

- (i) Continued use of the Department of Water Resources' interim management strategies designed to minimise environmental impacts.
- (ii) Preparation and use of management plans for extraction of sand and gravel from non tidal rivers to minimise cumulative impacts.
- (iii) Continued assessment of rates of sand and gravel movement in the State's rivers and use of this data in the management plans.
- (iv) Liaison and co-operation with major markets for sand and gravel to minimise illegal activity.
- (v) Liaison and co-operation with related government authorities to identify alternative land based sources of aggregate and encourage their development consistent with the objectives of this policy.
- (vi) Setting up of monitoring programs to report on the effectiveness of these mechanisms in achieving policy objectives.

A combination of these mechanisms will allow for recognition of different requirements for different conditions throughout the State and even for different conditions in different sections of the same river. It will also allow for better water and land use management, and give the construction industry a clear indication of available resources for its planning purposes.

Part I: The Objectives

1.0 Introduction

Rivers are very important community assets which generate a wide range of benefits including values for ecological habitat, fisheries, agriculture and recreation. They provide amenities with urban, industrial and social significance. Rivers are also important sources of sand and gravel essential for the construction industry and the provision of road base.

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS has three major objectives:

- 1. To ensure that extraction of sand and gravel from the State's non tidal rivers is undertaken on a sustainable use basis.**

For the purposes of this policy, sustainable use is that which is within the capacity of a river to withstand and still maintain relative stability of its geomorphic and ecological characteristics. Resource use which is not sustainable ultimately results in resource depletion, decline in geomorphic and ecological functions and loss of productivity of the system as a whole.

The concept of sustainable use as applied to natural resources is therefore in essence no different from the concept of optimal rates of use of physical and financial assets, which are defined in terms of design capacities and real rates of return respectively.

The absolute definition and practical application of the sustainable use concept, as applied to extraction of sand and gravel from within an active river channel, retains some unresolved difficulties. Nonetheless, a greater consideration of rivers' sensitivity to change will help make resource management decisions more compatible with sustainability objectives.

- 2. To manage such extraction in a way which minimises any detrimental effects on the riverine environment thereby protecting other river uses and values.**

As part of the sustainability objective, management strategies for river sand and gravel extraction should ensure that the activity does not jeopardise the sustainability of other appropriate river uses and values.

Removal of any material from within an active river channel will result in some changed erosion and deposition patterns which in turn may cause changes to ecological characteristics. Monitoring the changes to river systems following the implementation of management strategies will be crucial to the establishment of acceptable levels of sand and gravel extraction.

- 3. To ensure that the extraction policy is consistent with the aims of other Government policies and initiatives.**

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS is but one of a suite of policies encompassed within the State Rivers and Estuaries Policy. This in turn fits within the framework of Total

Catchment Management. As far as practicable the interactions between policy levels and components need to be compatible. Co-ordination of the functions of various State and local government agencies is also required as is discussed in Section 3.1.

Clearly these objectives will often conflict with each other, which means that a degree of compromise will have to be reached in subsequent management decisions. The degree of compromise should reflect the perceived economic, social and environmental goals of the community.

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS has been developed in consultation with all State and local government agencies, the extractive industry, the environmental lobby and other interested members of the community. Consideration has been given to all issues raised in response to a discussion paper released in September 1990 and a series of public meetings held in April 1991. A full list of submissions received is provided in the appendix. This widespread consultation with all sections of the community and other government agencies has resulted in a policy which seeks to provide an essential balance between the needs of industry and the concerns for environmental protection.

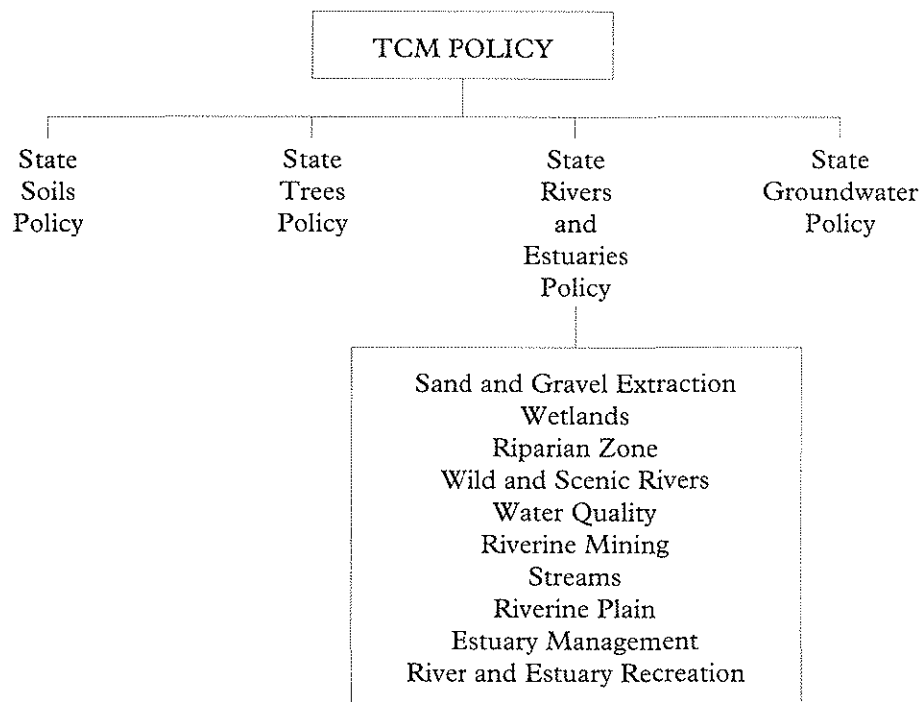
2.0 The State Rivers and Estuaries Policy

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS is a component of the State Rivers and Estuaries Policy. The latter encompasses a suite of component policies each of which will focus on the management of a specific set of resource values - in this case the commercial sand and gravel resource. Figure 1 shows the relationship between the various levels of government policy and illustrates the suite of component policies encompassed by the State Rivers and Estuaries Policy.

In recent years there has been increasing awareness of, and concern about, the declining condition of the State's rivers and estuaries. The NSW Government has recognised the importance of managing the natural resources of rivers and their floodplains by introducing the State Rivers and Estuaries Policy. The purpose is to ensure that rivers and riverine resources can continue to support appropriate economic, social and environmental uses.

The primary purpose of the State Rivers and Estuaries Policy is to provide a cohesive and integrated approach to the management of our rivers and estuaries. Whilst one comprehensive policy encompassing the management of all the interrelated elements may be philosophically desirable, the scale and diversity of these elements make it necessary, in practice, to deal with them under a number of component policies.

Figure 1. Levels of Government Policy within the Framework of Total Catchment Management



3.0 Total Catchment Management

The policy levels shown in Figure 1 illustrate the Government's commitment to integrating the management of water and land resources in line with the principles of Total Catchment Management (TCM).

TCM recognises that:-

- * soils, trees, rivers and groundwater systems are interrelated components within individual catchments;
- * water catchments are the logical units for natural resource planning and management;
- * it is a vehicle for resolving conflict and co-ordinating actions both between Government authorities and between Government and the community; and
- * landholders and land users have legitimate rights in the decision making process.

3.1 Co-ordination between Government Authorities

Separate agencies exist for water, soil conservation, fisheries, pollution control and land. Each of these agencies has a legitimate interest in related aspects controlled by other agencies. The overlap of responsibilities may result in conflict or duplication of activities. The principles of TCM provide a framework for co-ordination and co-operation.

The need for such co-ordination is particularly relevant to the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS due to the large number of State Government departments with statutory responsibility in this activity, as well as local government which is responsible for planning controls and development consents.

3.2 Co-ordination between Government and the Community

Public agencies are not the only bodies with legitimate and valid interests in the water, land and other natural resources within catchments. The community at large, individual landholders, environmental groups, recreational groups, extractors and the construction and landscape industries all have legitimate interests in how natural resources such as sand and gravel, as well as rivers themselves, are used.

These diverse interests, which often result in conflicts and disputes, have to be accommodated. It is essential that the community and the government agencies be involved in a process which allows these multiple views to be considered.

The establishment of TCM committees is seen as an effective way of creating a link between the community and government agencies.

4.0 Scope

4.1 Non Tidal

As the name suggests, the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS is limited in scope to inland rivers and to those portions of coastal rivers upstream of the tidal influence. It specifically excludes the tidal zone in recognition of two factors:-

- (i) The geomorphic processes operating in non tidal and tidal zones are quite different.

Flow in the non tidal portion of rivers is uni-directional and the zone is characterised by sediment throughput. On the other hand, the tidal zone is essentially a sediment sink with tidal influence creating a bi-directional flow.

As a result, the geomorphic effects of removing sand and gravel from these two zones are also quite different and require different management strategies.

- (ii) The administrative responsibilities operating in non tidal and tidal zones are divided between the Departments of Water Resources and Public Works respectively.

Obviously extraction in non tidal reaches can affect tidal zones and, to a lesser extent, extraction from tidal zones can impact on the lower portions of non tidal rivers. This is discussed in Section 6.1.2 and will be elaborated upon in the ESTUARY MANAGEMENT POLICY which Public Works has stated will be developed as a complementary component of the Rivers and Estuaries Policy.

4.2 Active River Channel

Whilst the principles espoused in the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS also apply to extraction from adjacent floodplains, the scope of management strategies outlined in this policy are limited to extraction of sand and gravel from active river channels only. This is in recognition of the fluvial processes operating within river channels. Because of their dynamic nature, removal of sand and gravel has the potential to impact far more seriously on these processes than would be the case in a land based operation. The impacts of land based operations are addressed more comprehensively by existing environmental impact assessment procedures than are river based activities. This is especially so due to the potential for serious cumulative effects within active river channels. Details of alternative sources are discussed in Sections 6.3.2 and 7.7.

4.3 Non Minerals

Sand and gravel are not defined as “minerals” under the Mining Act. Although extraction of minerals as defined by the Mining Act is not addressed specifically by this policy, the effect of such mining within active river channels has the same potential for damage to the riverine environment. The Department of Mineral Resources is responsible for the management of all mining proposals in NSW. However, conditions placed on Mining Leases in and near rivers are consistent with advice from the Department of Water Resources which applies the same management strategies as outlined in Section 7.1. The Department of Mineral Resources has stated that it intends to develop a complementary component policy to deal specifically with mining proposals in, under and near rivers and their floodplains.

5.0 Background

5.1 The Need for a Sand and Gravel Extraction Policy for Non Tidal Rivers

Like many resource management decisions, those related to river sand and gravel extraction have been based historically on perceived short term benefits with the rights of the individual prevailing.

More recently, it has become clear that short term benefits must be weighed and balanced against the resulting long term effects of resource depletion and decline in the state of the environment. This has arisen from:-

- * increasing evidence of potential problems from over-extraction of river sand and gravel;
- * the community's increasing demands on, and expectation of, river systems.

Therefore, future management decisions about river sand and gravel extraction should be based on the principle of sustainable development, not just of the sand and gravel resource but also of other river uses and values. In this context, sustainable development means that resources should be used in ways that do

not jeopardise future use of all river resources. This principle implies using rivers according to their capacity to sustain those uses in the long term.

Management decisions should also be compatible with the Department of Water Resources' responsibility to maximise the long term benefits of the State's water and related resources which include sand and gravel. This responsibility forms part of the Department's charter - as outlined in the Water Administration Act - to foster the economic development of the State in a way which is compatible with the environmental and social needs of the community. Management decisions therefore should also include as much input as possible from the community, industry and other agencies.

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS will help to ensure that such management decisions are implemented on a State-wide basis.

5.2 Legislation

Extraction of river sand and gravel has the potential to impact seriously on many aspects of the environment as is discussed in Section 6.1. On the other hand, river sand and gravel is also an economically important resource. It is a main source of aggregate for the construction industry and is widely used for road base. Accordingly, the Government has not banned such extraction but regulates it to minimise adverse impacts.

The need for this control has been recognised for many years. It is reflected in a number of legislative controls administered by various government agencies as outlined below.

- * The Environmental Planning and Assessment Act:- administered by Department of Planning in conjunction with local government has very specific requirements for all extractive industries including river sand and gravel.

Under a local environmental plan (LEP) or its equivalent, a proposed new extractive industry can be permissible with or without consent or prohibited within each zone of the LEP. The local council can give the provisions applicable to any particular site. Details of the approval process are given in Section 5.3.

- * The Rivers and Foreshores Improvement Act:- administered by the Department of Water Resources for non tidal streams and the Public Works Department for tidal streams, requires that a permit be obtained prior to any excavation on freehold protected river land by a private person or company. Protected river land includes land within, or within 40 metres of, the banks of any watercourse. This requirement applies regardless of whether or not an excavation is for commercial purposes.

The Act also gives these Departments responsibility to ensure that excavations undertaken by a public authority, or those undertaken on Crown land or for mining purposes, do not detrimentally affect protected river land.

Where the excavation is for the purpose of an extractive industry, a permit is not issued unless consent has been obtained under the Environmental Planning and Assessment Act or unless "existing or continuing uses" have been determined. This is explained in detail in Section 5.3.

- * The Crown Lands Act:- administered by the Department of Conservation and Land Management, requires that Leases/Licences be obtained prior to the removal of material from Crown land.

Recent changes to this legislation require that a land assessment be completed and placed on public exhibition, prior to any decisions as to the proposed issue of a lease/licence for extraction of materials from Crown land. As Permissive Occupancies issued under the old legislation expire, they may be renewed as leases or licences subject to appropriate land assessments. To ensure that the Crown does not forgo appropriate royalties, applications to remove material from assumed freehold land may have to be accompanied by proof of ownership of the riverbed.

Extraction of material from Crown land in the Western Division is controlled by Regional Environmental Plan Number 1 for Extractive Industry in the Western Division. The REP requires that an applicant for a quarry licence must prepare an environmental management and rehabilitation plan and submit this to the consent authority when the prospective operator makes application for development consent.

- * The Forestry Act:- administered by the Forestry Commission requires that extraction of sand and gravel from streams within dedicated State Forests must be authorised by a Forest Materials Licence. Clearing of timber on Crown - timber lands (ie, vacant Crown land and certain leases granted under the Crown Lands Act) must be authorised under the Forestry Act. Should extraction involve clearing on such lands, a Clearing Licence may be required.
- * The Soil Conservation Act:- administered by the Department of Conservation and Land Management (incorporating the Soil Conservation Service), requires that approval be obtained prior to the destruction of any tree within 20 metres of a prescribed stream, or on any other land mapped as steep or environmentally sensitive.
- * The Fisheries and Oyster Farms Act:- administered by NSW Agriculture and Fisheries, requires that local councils undertaking works of dredging or reclamation obtain prior approval from the Minister. Similar work undertaken or authorised by a public authority must be notified.
- * Acts administered by the State Pollution Control Commission require that licences be obtained for air, noise and water emissions.
- * The National Parks and Wildlife Act:- administered by the National Parks and Wildlife Service, protects Aboriginal sites and relics. These cannot be disturbed without the prior approval of the responsible Minister.

Most of the approvals under the above legislation are issued on a piecemeal basis. Little attention has been given to the cumulative effects which a number

of existing or future operations may have on the river system as a whole. Section 7.4 outlines a mechanism by which this can be addressed.

5.3 Present Approval Process for Sand and Gravel Extraction from Non Tidal Rivers

In many areas where extractive industries are likely to be proposed, they will be permissible with consent under the Environmental Planning and Assessment Act. This means a development application must be made to the appropriate consent authority, usually the local council. The consent authority can either refuse consent or grant consent with or without conditions. Conditions can impose restrictions on various aspects of the development including times of operation, rehabilitation, traffic control, noise, etc.

Extractive industry is a "designated development" (as defined in Schedule 3 of the Environmental Planning and Assessment Regulation). This means that, where a development application is required, an environmental impact statement (EIS) must also be submitted and a council cannot consider an application without one. It is a requirement that anyone preparing an EIS asks the Director of the Department of Planning about particular matters to be considered in an EIS. These are known as Director's requirements and are requested by the person (e.g. a consultant) who is preparing the EIS.

The Department of Planning has produced "Environmental Impact Assessment Guidelines; Extractive Industry" which is one of a series on environmental impact assessment. It gives general guidance on the issues an EIS for extractive industry should address and complements any specific Director's requirements.

An EIS is publicly exhibited and anyone can make comments on the proposal. The local council must take these submissions into account when deciding whether to give consent and, if so, in setting any conditions. Anyone who makes a submission objecting to a designated development has a specific right to challenge a consent in the Land and Environment Court within one month of notice of the consent. A proponent can challenge refusal of consent or any conditions of consent within a year of notice of determination.

If an extractive industry is permissible without consent and an approval (e.g. a licence or other permission) is required from one or more government authorities, such as the Department of Water Resources or the State Pollution Control Commission, each authority must consider the environmental impacts of the proposal. If an authority decides a proposed extractive operation is likely to significantly affect the environment an EIS must be prepared before an application for a licence or permission can be decided.

Where the Department of Conservation and Land Management consent is required in respect of Crown land, such consent will be dependent upon the outcome of land assessments pursuant to the Crown Lands Act 1989.

In some circumstances existing or continuing use rights may allow an extractive operation to continue without the need for development consent, however there are limitations. No summary can deal comprehensively with every situation and

so proponents are advised to consult with the local council. The council, as the consent authority, will decide the requirements on the particular details of each case.

The Environmental Planning and Assessment Act defines existing use as one which began legally but would now be prohibited; and continuing use (or "existing consent") as one which started legally but under a subsequent planning instrument would require consent. In general, existing and continuing uses cannot be expanded without a new consent from the local council. In particular, for existing and continuing uses, the Act prohibits any unauthorised expansion in the area of land or a work actually physically used and any unauthorised intensification of a use. If the use ceases for 12 months it is assumed to be abandoned and recommencement would be treated as if it were a new proposal, as described earlier.

Existing or continuing use status does not allow extraction to continue without limit. It is intended to provide a balance between the interests of existing operations and the need to consider environmental impacts.

Where it is intended to expand, intensify or change an operation which may be an existing or continuing use it is important that the local government is consulted. The council will decide if a development application and EIS will be needed. Where the bed of the river is Crown land, the Department of Conservation and Land Management will similarly need to be consulted.

Once development consent or an 'existing and continuing use rights' determination has been given by local government, the proponent must apply for a permit from the Department of Water Resources if freehold land or, if Crown land, a lease/licence from the Department of Conservation and Land Management. The proponent may be required to undertake a title search to determine land tenure. In either case, the Department of Water Resources requires the proponent to furnish details of the proposal such as survey plans and cross sections. If the Department determines that the proposal will not detrimentally affect protected river land, a permit under the Rivers and Foreshores Improvement Act is issued over freehold land. If Crown land, the Department concurs with a lease/licence being issued by the Department of Conservation and Land Management.

Again, in either case, the Department of Water Resources imposes a number of standard and site specific conditions to minimise detrimental effects on the riverine environment. The conditions also specify details of any rehabilitation required post extraction. During the life of the operation, officers from the Department of Water Resources undertake regular monitoring inspections to ensure compliance with conditions. Similarly, in respect of Crown land, the Department of Conservation and Land Management will monitor compliance with lease/licence conditions.

Other licences and permits may be required as set out in the previous Section depending on the nature of the operation.

In recent years there have been moves to integrate this approval process. Liaison is continuing between the various agencies involved.

Part II: Issues

6.0 Issues Related to River Sand and Gravel Extraction

Management of river sand and gravel extraction is a complex process involving many often conflicting issues. As resource managers, Government agencies perform a careful balancing act between development and environmental protection. The concept of sustainable development is particularly relevant to this policy as, like water, sand and gravel are finite resources. This section sets out the main issues involved.

6.1 Environmental Impacts

The environmental impacts of sand and gravel extraction from the State's rivers can be far ranging. The following section outlines potential impacts that are directly related to the responsibilities of the Department of Water Resources as well as other impacts which come under the legislative responsibility of other State and local government agencies. Co-operative action by those agencies regarding their areas of responsibility will be especially valuable in the successful implementation of this policy.

It should be noted that the following impacts are normally addressed by an Environmental Impact Statement (EIS) submitted when a development application is made to local government.

6.1.1 Areas of Special Significance

As outlined in Part 1, the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS is only one of a suite of component policies encompassed by the State Rivers and Estuaries Policy.

Management of sand and gravel extraction must ensure that the activity does not conflict with the aims of other component policies. Wild and scenic rivers, wetlands and designated recreational areas are all places where sand and gravel extraction would have a highly visible and adverse impact. Extraction should not be considered in such areas. Furthermore, no extraction of sand and gravel is permitted within national parks, nature reserves, historic sites and aboriginal places dedicated under the National Parks and Wildlife Act. Where extraction is proposed adjacent to or immediately upstream of any area dedicated under this Act, consideration should be given to the special significance and possible environmental impacts on these areas.

6.1.2 Estuaries and Tidal Streams

Extraction of sand and gravel from the non tidal parts of coastal rivers can impact on tidal areas. Excavation below water level disturbs fine grained sediments which are easily transported for long distances downstream. These may impact on fish habitats and oyster farms in tidal areas. Any increase in bed and bank erosion as a result of extraction will similarly increase sedimentation within the estuarine zone. Conversely, removal of sand and gravel from the non tidal parts of rivers can reduce the amounts transported to and deposited within estuarine areas.

The interface area between non tidal and tidal zones is especially vulnerable. Unrestricted dredging operations in this area may result in extension of the saline limit further upstream.

Direct extraction of sand and gravel from tidal reaches of streams is not discussed. This is to form part of the component ESTUARY MANAGEMENT POLICY shown in Figure 1 to be prepared by Public Works.

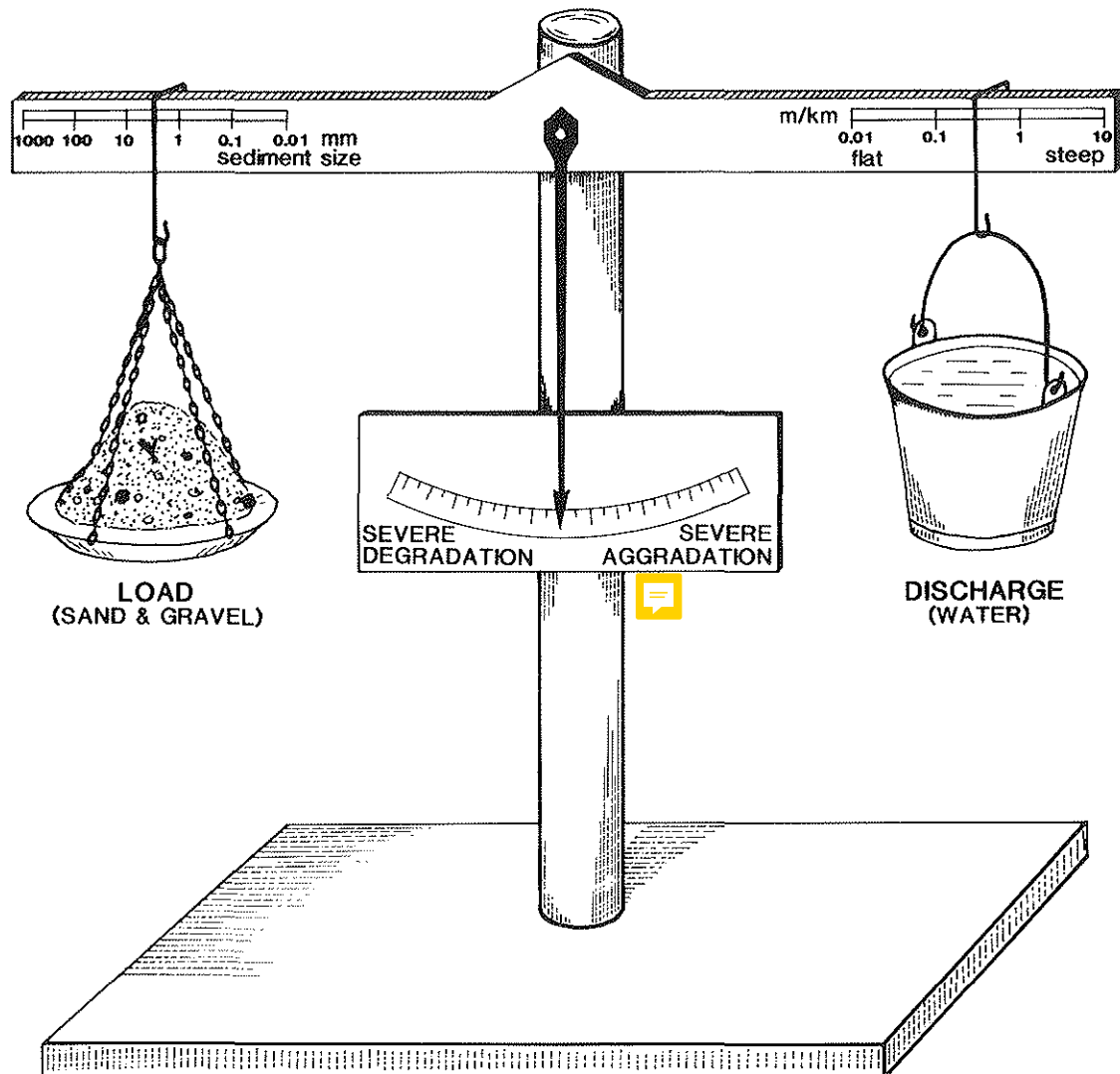
6.1.3 Geomorphology

Over the long term, rivers are naturally erosive features of the landscape. They have migrated across their floodplains from side to side of the valley floors, transporting sediment from upland areas to the sea or inland lakes and low lands. Increased rates of river erosion and other channel changes can occur in the shorter term, due to both natural and human induced changes. These changes include increases in the size, magnitude and frequency of floods; changed flow regime due to river regulation; and over-extraction of river sand and gravel (Nanson and Erskine, 1988; Erskine and Warner, 1988; Erskine et al, 1985).

These relationships are depicted diagrammatically in Figure 2, which shows that the impact of river sand and gravel extraction is interlinked with the nature of the sediment load, sediment size, steepness of channel and discharge. A change to any one of these parameters will cause a corresponding change elsewhere. Such changes may cause increases in erosion or deposition and channel re-alignment.

Figure 2. Natural Components of River Equilibrium

Adapted from J. McManus (1985)



6.1.4 Riverbed and Bank Erosion

When bedload (sand and gravel) removal from a section of river exceeds the amount being transported into it from upstream, there is a net sediment loss to the system (Erskine et al, 1985). In simple terms, the river responds by eroding its bed or banks or both. Which of these actually occurs depends on the composition of the bed and banks along with their susceptibility to erosion.

Where river banks are comprised of rock or are stabilised by a full vegetation cover of grass, shrubs and trees, erosion tends to occur in the bed of the river resulting in bed lowering.

Where river banks are comprised of alluvium and are not stabilised by vegetation or where the bed is armoured with large gravel, erosion tends to take place on the banks, resulting in channel widening.

If bed lowering becomes significant, banks will be undermined and overall channel enlargement will result.

A common misconception is that removal of sand and gravel from the inside of a bend will reduce erosion of the opposite bank. Whilst in some cases this is true, the cumulative effect of a number of such works on the one river can actually make the erosion worse.

In addition to problems associated with net sediment loss, **excavation below existing bed level may be a direct cause of bank collapse.** It may also cause headward erosion of the bed directly upstream of the excavation. This type of erosion is due to localised increase in slope, caused by the hole left in the riverbed. The localised increase in slope increases the river's capacity to scour its bed upstream of the hole. In turn it can lead to bank collapse upstream of the extraction site. Bed lowering can also occur downstream of the hole due to the break in bedload movement. As sand and gravel is moved along the riverbed it becomes trapped in the excavated hole. The water flowing immediately downstream of the hole is relatively sediment deficient and therefore tends to pick up material from the riverbed for some distance downstream of the hole. If the riverbed is armoured with large gravel or is composed of bedrock, the river will pick up material from the banks instead (Galay, 1983; Erskine, 1990).

The potential for increased riverbed and bank erosion is especially important in rivers where there are a number of extraction sites. To date the cumulative effect of a large number of small operations has not been controlled. Proposed management plans for individual rivers will help to cater for this deficiency as outlined in Section 7.4.

6.1.5 Siltation

Increases in riverbed and bank erosion, as either direct or indirect results of river sand and gravel extraction, will release sediments into the river system. Most of the finer sediments (sand, silt and clay) released from

erosion of alluvial banks will be transported downstream, often for considerable distances. Increased siltation in these downstream areas can cause problems to navigation; bury and destroy sea grass beds important for fisheries production; and adversely impact on flooding in the area.

6.1.6 Groundwater Quality and Quantity

Extraction of sand and gravel from river channels has the potential to affect the quality and quantity of water taken into floodplain aquifers. This is especially the case if extraction is below the water table.

If extraction is below the riverbed level, groundwater recharge from rivers to floodplain aquifers may be severely reduced. This will impact adversely on bores and wells in the area. The same effect will occur if the riverbed becomes lowered through erosion processes that can be associated with extraction.

6.1.7 Vegetation

Extraction of river sand and gravel often involves direct clearing of vegetation.

Indirectly, destabilisation of the banks by any of the above erosion processes associated with sand and gravel extraction, may cause trees to fall into the stream. Once there, these may deflect water onto opposite banks aggravating or causing more erosion.

Construction of access tracks and processing sites associated with the extraction process can also involve clearing of vegetation.

6.1.8 Riparian Habitat

Increased riverbed and bank erosion, destruction of vegetation and siltation will all affect riparian and aquatic habitats adversely. Birds and mammals may be affected, especially where the surrounding floodplain has been cleared. In this case, riparian vegetation forms important wildlife corridors often linking forested areas.

6.1.9 Water Quality

Extraction of material from below water level (dredging) disturbs fine grained sediment and nutrients, thus increasing suspended solids both at the site and downstream. Suspended solids adversely affect many water users and ecosystems. They can significantly increase water treatment costs, especially where they act as a substrate for bacteria and so increase the problems and costs of disinfection in water treatment plants. Suspended solids may smother attached vegetation and sediments downstream of the activity, and also act as a substrate for nutrients which can increase algal growth.

Extraction of material from below bed level creates holes which can reduce river velocities at the site sufficiently for algae to grow and then seed

downstream waters. These organisms can produce taste, odour and toxicity problems. Removal of shallows by dredging reduces the nutrient assimilative capacity of rivers, resulting in greater availability of nutrients for phytoplankton. The phytoplankton blooms and increased suspended solids will increase stream turbidity and hence reduce visibility.

Loss of gravel bars which control pool water level (from either direct extraction or associated erosion) will lower water levels. This may deny water to pumps for irrigation and/or domestic supplies. It may also decrease depths available for instream fauna.

Plant, vehicles and machinery involved in gravel extraction operations can contribute inadvertently to river pollution through leakage of oils and fuels. Runoff from disturbed soils and ablution facilities can also affect water quality adversely.

6.1.10 Aquatic Habitat

Excavations close to and below water level can directly destroy instream habitats of fish, platypus and other aquatic fauna.

Non tidal rivers perform a vital ecological role in maintaining essential aquatic habitats. River sand and gravel extraction can impact significantly on the total ecology of a stream from the lowest order - benthic communities - to the higher order - fish and platypus. Extraction below water level, especially that which lowers the bed level, has the greatest potential for detrimentally affecting aquatic habitat.

Riverbed extraction can affect the benthic community directly. Dramatic declines have been recorded in dredged areas (Pearson and Jones, 1975). Apart from the intrinsic values of these species, they are important food sources for fish (Harris, 1985).

The macrophyte community also may be affected adversely by sand and gravel extraction below water level. These aquatic plants support diverse invertebrate communities and are critical to the production and breeding migration of some fish species including Australian Bass (SPCC, 1984). Macrophytes are also important for nutrient assimilation and appear to be affected by direct disturbance, steep batters, loss of shallows and increased turbidity (SPCC, 1977).

Fish populations may be affected adversely by a reduced food supply, and by other consequences of dredging such as changes to pool:riffle ratios and increased turbidity. Increased turbidity will also depress the amount of light available for photosynthesis. Consequently the productive base of a river's ecosystem will be reduced.

In some streams, removing gravel bars even only above low flow water level can significantly impact on fish spawning and feeding areas during high flows. Disturbing or removing a trout or salmon spawning bed, bank or shallow is illegal under the Fisheries and Oyster Farms Act.

6.1.11 Aboriginal Sites

Aboriginal sites and artifacts are significant to particular Aboriginal communities as they provide direct links with their traditional cultures. They are also important to archaeologists studying how different cultures developed (NPWS, 1986). Such sites therefore need to be preserved and protected carefully.

Many Aboriginal sites have been found throughout NSW adjacent to rivers. In the Murray Valley and Riverina there is a long history of sand and gravel extraction destroying Aboriginal sites, particularly burial grounds. The sorts of sites most likely to be damaged by sand and gravel extraction from non tidal rivers are burial grounds, open camp sites, middens and mounds.

6.1.12 Other Environmental Impacts

Increased noise, dust and visual pollution may result from extractive industries. Additional truck movements can damage roads and excessive hours of operation can be a nuisance to people living in surrounding areas.

In many rivers all the above potential impacts can be controlled by specific conditions for particular extraction sites. There will be some rivers, however, where the value to other users will be such that extraction may need to be precluded. Similarly, where past extraction has over-taxed a river system, future extraction may need to be precluded until the river has recovered sufficiently, if it does so at all.

6.2 Demand For Sand And Gravel

Extraction of river sand and gravel provides aggregate necessary for roadbase and the construction industry. The demand therefore is related directly to the level of development activity and regional population growth.

6.2.1 Growth Areas

Metropolitan areas, major rural towns and holiday centres are all areas of high demand for sand and gravel. This is especially so in the North Coast region between Port Macquarie and Coffs Harbour, which is one of the most rapidly developing areas in the State. Sydney, Tamworth, Wagga, the Hunter Valley and the south east area near the ACT are also areas of high demand. Historically, most aggregate supplies have been obtained from nearby rivers as this material is cleaner, more easily extracted and cheaper, and usually involves shorter haulage than material from hard rock quarries. This extraction is putting increasing pressure on the systems in these areas, not only in terms of river stability but also in terms of competing uses.

6.2.2 Roads and Traffic Authority (RTA)

Increased development has been accompanied by upgrading of main roads. The RTA is one of the main buyers of gravel from private contractors. As a government authority, it may also extract material from rivers for its own

use without permission from the Department of Water Resources. The Department can, however, stop any work it deems is detrimental to a stream and can require restoration works.

Discussions are being held with the RTA to introduce mechanisms by which the supply of river sand and gravel will be monitored more closely. This is discussed in Section 7.6. Growing pressure to upgrade road networks will create unprecedented demand for aggregate, especially in the North Coast region. In recognition of these problems, the RTA has a number of demand management strategies in place. These are discussed in Section 8.3.

6.2.3 Local Councils

Increased development increases revenue from rates and also increases the demand for upgraded local road networks. Like the RTA, local councils do not need the Department's permission although again, the Department can stop work it deems is detrimental to a stream and can require restoration works. Local councils are also significant buyers of gravel from private contractors.

The provisions of the Environmental Planning and Assessment Act apply to both local councils and the RTA as they do to private operators.

6.2.4 Private Contractors

Although there are a number of large scale extractors near metropolitan areas, small scale extractive industries predominate on non tidal streams. They supply the RTA and local councils as well as supplying private developers and the construction industry.

Even though these operations are small scale, they are usually concentrated in significant numbers. Each has considerable private investment in trucks, excavators, crushing plants and other equipment. State-wide, the total investment by private extractors is substantial.

6.3 Supply of Sand and Gravel

There is no doubt that demand for aggregate in areas such as the North Coast has increased over the last ten years and will continue to do so for a long time to come. Better planning is required to ensure that the supply will be able to sustain this level of development.

6.3.1 Diminishing River Sources

There are many examples of rivers throughout the State where it can be shown that river sand and gravel is a finite resource.

In the North Coast region most rivers show signs of resource depletion; apart from the Macleay and upper Hastings Rivers, there are no streams within that region which have sizeable gravel reserves within reasonable

access to markets. This conforms with recent Australian research which notes that few, if any, rivers along the NSW coast carry abundant sediment loads despite steep gradients and frequent large magnitude floods. (Erskine 1986; Hean and Nanson, 1987; and Nanson and Erskine, 1988).

6.3.2 Alternative Non River Sources

As reserves in rivers are depleted, alternative non river sources must be investigated.

The Victorian and overseas experience indicates that if instream extraction is to be reduced in the longer term then a major effort now into identification of alternative off-stream resources should be initiated. This will be of considerable assistance to extractors and managers alike.

The Department of Mineral Resources has the expertise to undertake such investigations and would be in the best position to co-ordinate input from other State and local agencies on a regional basis. This is discussed further in Section 8.5.

Increasingly, hard rock quarries in the hinterland of growth centres will be required to supply aggregate. Off-river sources such as old gravel deposits within floodplains and river terraces may also provide alternatives to in-channel extractions. Adverse effects on all aspects of the land environment and groundwater would need to be assessed fully. Effects on groundwater will depend on the permeability of the aquifers, how deep the excavations would be and the type of rehabilitation undertaken.

The importance of the effect on groundwater will depend on which aquifers are affected, and whether they support town water supplies and/or other wells. Consistency would be required with regional groundwater plans produced by the Department of Water Resources.

Alternative sources of aggregate that appear least environmentally damaging include planned lakes schemes such as Penrith Lakes and oceanic extraction. The former would localise operations, isolate them from vulnerable rivers and rehabilitate the sites. The latter would tap vast resources and is currently the subject of proposals and environmental impact assessment. It is probable that the geomorphic and ecological consequences of both these alternatives would be much less than those of riverbed extraction (Griffin, 1990).

6.3.3 Approval Process for Alternative Sources

Like all extractive industries, development of a hardrock quarry or a commercial floodplain operation usually requires full development consent and the preparation of an EIS as explained in Sections 5.2 and 5.3.

Consent authorities for these alternative source operations may need to recognise that they could be replacing more environmentally damaging in-stream extractions. When discussing alternatives in EIS's for land based

operations (which is required by the EPA Regulation) a proponent could draw attention to in-stream alternatives being more environmentally damaging where this is the case. The increasing demand for development and the decreasing availability of river sand and gravel will make land based operations more viable.

6.4 Cost Recovery

The legislative requirements outlined in Section 5.2 mean that the cost of controlling river sand and gravel extraction can be quite substantial. Although some costs are borne by extractors, many have been borne historically by the Government.

Where material is extracted from Crown land these costs are partly recouped by rents, fees, charges and royalty payments. This always applies in tidal areas as the beds of estuaries belong to the Crown. In non tidal rivers, the beds are often privately owned and any royalty payments made by extractors go to the landowners. To date, the Department of Water Resources has not charged extractors for permits nor has it charged them for the cost of monitoring operations.

Assessing potential detrimental effects, issuing permits and regularly monitoring compliance with conditions involves a sizeable portion of taxpayers' money. In line with the NSW Government's cost recovery program, the Departments of Water Resources and Public Works are formalising ways in which this issue can be addressed. Legislation was passed in Parliament in December 1991 which will permit a cost recovery program to be initiated.

Part III: Implementation Mechanisms

7.0 Department of Water Resources Initiatives

The Department of Water Resources has been responsible for several initiatives in the control of river sand and gravel extraction.

Prior to 1982 the Rivers and Foreshores Improvement Act only covered river banks and land within 40 metres of them. Following submissions from the Departments of Water Resources and Public Works, the Act was amended to also cover river beds. Since then the Department has issued permits for approved sites, devised permit conditions for individual sites and closely monitored the impact of operations on river systems.

Over the last ten years it has become increasingly obvious that many rivers are being over-extracted and that significant channel enlargements have resulted. Accordingly, a set of interim management strategies was formulated and has been in use since 1987. Conditions applied to permits issued by the Department were changed in line with these strategies but management was still on a site by site basis. Cumulative effects are not controlled adequately by this process.

In response to this, two parallel programs have been initiated. One is an assessment of how much bedload (sand and gravel) is being transported by the State's rivers and the other is a detailed assessment of existing gravel deposits and the condition of rivers close to centres of high demand for sand and gravel. These initiatives are discussed below.

7.1 Interim Management Strategies

The present management strategies used by the Department of Water Resources were developed to limit increased rates of riverbed and bank erosion resulting from sand and gravel extraction. They also reduce the impact of extraction on many other aspects of the river environment - especially water quality and instream habitat.

The strategies are designed for four general situations:

- (i) Extraction below normal low flow water level is allowed only where there are structural controls - e.g. between bedrock bars or in backwater pools upstream of weirs and dams.
- (ii) Extraction below existing bed level is allowed only where there is objective evidence of recent bed aggradation (raising). In this case, excavation is allowed only to the pre-aggradation long-term bed profile.
- (iii) Where there are no controls to prevent bed lowering, excavation is limited to harvesting the tops of bars and islands above low flow water level. The only exception to this is where proponents are willing to backfill any excavated holes with suitable material. In these relatively rare cases, strict limits are placed on the sizes of holes at any one point in time and buffers must be maintained to isolate excavations from the active flow.

- (iv) Where there is objective evidence of existing overall channel enlargement, no excavation of active bedload material is allowed and extractors are directed to inactive terrace or floodplain deposits.

These strategies are interim in that they are not related quantitatively to the amount of material being transported by rivers and therefore cannot account fully for cumulative effects.

It is crucial for future management to monitor cumulative effects on a river valley basis as discussed in Section 9.1. Such monitoring will include periodical review of permit conditions to assess whether changes are required in response to monitoring results.

7.2 Assessment of Bedload Transport Rates

The relative impact of river sand and gravel extraction is dependent on the proportion of total bedload removed from a reach of stream. Therefore, realistic quantification of bedload transport rates would assist better management of the industry.

Several researchers have attempted to quantify bedload movement by using predictive equations developed overseas. Unfortunately, these do not appear to work for Australian conditions (Hean and Nanson, 1987).

To estimate the rate of gravel movement through NSW streams the Department has set up measurement sites on 'typical' gravel bed streams close to centres of development. This is a long term project as data collection is dependent on frequency of significant floods as well as availability of staff and funds. It is hoped that eventually the data can be used to formulate predictive equations for NSW conditions. This will enable estimation of bedload movement to be extended to similar streams outside those presently being measured.

In the short term, management strategies will still have to be based on more qualitative volume restrictions.

7.3 Assessment of Existing Gravel Deposits and River Stability

The interim strategies outlined in Section 7.1 require some objective knowledge of the existing state of a river before allowing or refusing extraction permits. This is especially important where a number of operations have been in existence for many years.

Accordingly, in 1989/90 the Department employed consultants Resource Planning Pty Ltd to collect data on nine north coast rivers. Each river was chosen for proximity to centres of high demand for sand and gravel, and also for perceived sensitivity due to past rates of extraction.

The consultants' brief included:-

- * assessing whether the rivers are relatively stable or have undergone increased rates of erosion over the last forty years;
- * mapping all sand and gravel deposits within the river beds on 1:25000 topographic sheets;

- * describing those deposits which have extraction potential to allow further assessment.

Evidence of recent channel enlargement was reported for extensive reaches of most rivers surveyed. Whilst it was recognised that some erosion is due to natural and other human activities, the consultants were of the opinion that over-extraction of sand and gravel had exacerbated the problem.

The consultants' reports indicate there is very limited potential for continued extraction and certainly none for increased rates of extraction from the rivers they surveyed.

The findings to date support the view that alternative sources of aggregate supply will have to be sought in the very near future. If not prime alluvial land may be lost through increased riverbed and bank erosion.

This will be a very sensitive issue as some existing operations may need to relocate. It is recommended that, wherever possible, any government action to phase extraction out of an area should be done over as long a period as possible. This will limit personal hardship to existing operators and give them enough lead time to seek new locations.

7.4 River Management Plans for Extraction of Sand and Gravel from Non Tidal Rivers

The data collected by the consultants will be used to prepare management plans for individual rivers. These will show areas where extraction may have minimal detrimental effect so long as site-specific conditions are followed. They will also identify sections of rivers where extraction should be phased out and where rehabilitation of damaged sites is required.

The plans will also identify sections of streams where extraction cannot take place because of requirements for nutrient assimilation, recreation and aquatic habitat.

Preparation of the plans involves:-

- (i) Identifying the existing relative stability of each river, noting sites of major erosion.
- (ii) Identifying all sand and gravel deposits within the riverine corridor.
- (iii) Identifying those deposits where extraction would have minimal detrimental effect on the ecological and physical stability of the river system, given a set of site-specific conditions.
- (iv) Estimating maximum annual volumes per section of stream which could be extracted without significant detrimental effect. Necessarily this will be conservative until more quantitative data is available from the bedload studies.
- (v) Inviting input from local councils, Department of Conservation and Land Management and other State government agencies involved with environmental assessment legislation.

- (vi) Using all the above to decide which sites can be considered for extraction and mapping these on 1:25000 or other suitable topographic sheets. These will form the basis of the draft plan. The plan will include general conditions and guidelines to minimise detrimental effects on the river environment and to provide for suitable rehabilitation after extraction.
- (vii) Supplying the draft plans to local councils and seeking their co-operation to present them to their communities for comment. It will then be possible for Councils to decide from which of the sites the volume in (iv) can be removed. In this way local councils will retain their planning and consent responsibilities. It will also preserve flexibility to account for local conditions.

The management plans will be prepared in full consultation with other government agencies to ensure that all aspects of economic and environmental assessment are considered. They will be discussed publicly at the draft stage so that extractors and other community interest groups can have input.

When finalised, the plans will be used in conjunction with existing legislation. Local councils will be able to incorporate provisions in local environmental plans which complement the river management plans. This will be at the discretion of individual Councils.

The Environmental Planning and Assessment Act sets out the matters a local council must take into account when considering whether to give consent. One of these is any relevant representation made by a government authority. As river management plans are produced by the Department of Water Resources these will be notified to councils as submissions for this purpose. An EIS should relate the proposed extractive industry to any applicable river management plan.

Guidelines from other approval agencies will be included in the plans so that an applicant will know that as long as a proposal lies within the guidelines it will have greater likelihood of gaining approval. Proponents guided by river management plans will be able to avoid expenditure on applications which are unlikely to be approved. If required, information provided in the plans may be used as input to individual Environmental Impact Statements. Wherever possible, the plans will incorporate sufficient information to reduce the need for additional studies by proponents thus significantly reducing individual application costs.

The plans will assist the Departments of Water Resources and Conservation and Land Management to decide whether to renew permits or leases/licences for sites which have 'existing and continuing use rights' or previous development consents. They will not negate the need for approvals from any State or local government agency. Conditions attached to permits issued by the Department of Water Resources will be consistent with the interim strategies outlined in Section 7.1 and will be complementary to regional groundwater management plans prepared by the Department.

In this way, the plans will:-

- * integrate the management of sand and gravel extraction from non tidal rivers;
- * integrate input from government agencies and the community;
- * allow for assessment of cumulative impacts on river stability;
- * allow for better land use planning and management;
- * provide a clear set of conditions and guidelines to protect the riverine environment;
- * give proponents a clearer indication of the likely outcome of their applications;
- * decrease individual application costs whilst protecting the environment;
- * give the construction industry a clear indication of available resources to enable rational planning;
- * assist local government, the Department of Water Resources and the Department of Conservation and Land Management in their decision making processes;
- * maintain development consent and planning powers with local government.

7.5 Areas Not Covered by Management Plans.

The management plans proposed in Section 7.4 will take some time to prepare. Priority will be given to areas where demand for aggregate is highest and where past extraction rates have contributed to increased rates of erosion.

Until the plans are completed, and in areas where plans will not be prepared, the existing approval process will continue as outlined in Section 5.3. Environmental Impact Statements and development consents from local government will still be required for new developments. Following development consent or recognition that 'existing and continuing use rights' apply, the Department of Water Resources will continue to issue permits and conditions in accordance with the interim management strategies outlined in Section 7.1. Each site will continue to be monitored closely to ensure that permit conditions are complied with and that the operation is not affecting the river adversely.

7.6 Management of Illegal Activity

Management strategies, assessment of impacts and permit conditions to safeguard the river environment are all of no avail unless adequate resources are allocated to police and monitor all extraction sites. All management agencies must ensure that extractors are authorised and comply with permit/licence conditions. This necessitates site inspections on a regular basis and the commitment of adequate resources to prosecution of illegal activity or work contrary to conditions.

Community groups can also make a significant contribution to management of illegal activity. TCM committees are in an excellent position to report any operations which they believe to be unauthorised or not complying with permit and development consent conditions.

The extractive industry itself is in a good position to be self regulatory, as actions by a few individuals can adversely affect the reputation and viability of the industry as a whole.

To protect the rights of legal operators, it is recommended that co-operation be sought from the major markets for sand and gravel to minimise illegal activity. These would include local councils and concrete manufacturers. The RTA has already instituted procedures requiring tenders for river sand and gravel to show proof of authorisation.

7.7 Identification of Alternative Aggregate Sources

The scope of the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS does not extend to identification of alternative sources. The emphasis of the policy is to outline the special sensitivity of the river channel environment to extraction and the complexity in predicting the impacts with any certainty.

Whilst a full environmental assessment will be required for any alternative source extraction it must be recognised that the effects of extraction from dryland deposits are much easier to predict and to control than those from aquatic extraction.

Accordingly, the policy encourages development of mechanisms by which non-river sources of aggregate can be identified and their development encouraged. TCM committees together with local government, regional state agencies and the industry itself are in an excellent position to initiate and encourage programs on a catchment basis to:-

- (i) Identify all sources of aggregate including location, quantity and quality;
- (ii) Identify market needs and locations of demand; and
- (iii) Develop marketing and transport strategies aimed at utilising all aggregate sources on a sustainable and environmentally acceptable basis.

Relevant state agencies include Mineral Resources, Planning, Water Resources, Conservation and Land Management, Forestry, Public Works and the RTA.

Such catchment based resource inventories will complement the mechanisms outlined in the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS whilst ensuring that an essential industry remains viable.

8.0 Other Agency Initiatives

8.1 Western Lands Commission

In conjunction with the Department of Planning, the Commission has prepared Regional Environmental Plan No. 1 for Extractive Industries in the Western Division. This plan, formally made on 8 December 1989, covers all extractive activity in the Western Division of the State and contains provision for referencing the Department of Water Resources. This will ensure that conditions on leases/licences issued will be consistent with the management strategies outlined in Section 7.1.

8.2 Department of Conservation and Land Management

Pursuant to the Crown Lands Act 1989, a land assessment will be conducted and placed on exhibition prior to any decision as to the future use of Crown land. As part of the land assessment methodology, the Department of Water Resources will be initially referenced where a proposed land assessment study area includes or abuts a non tidal river. This will again ensure that where leases/licences are issued for activities on Crown land, conditions will be consistent with the management strategies outlined in Section 7.1.

Under the direction of the State Catchment Management Co-ordinating Committee, a State natural resources management strategy is being developed. The strategy will establish benchmarks, guidelines and targets for management of the State's natural resources. More specific catchment management strategies will then be developed for each of the river and lake catchments in NSW. The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS complements these broader strategies.

The Department of Conservation and Land Management has indicated that it strongly supports the Management Plans outlined in Section 7.4 and will participate in their preparation.

8.3 Roads and Traffic Authority

As a major market for river sand and gravel, the RTA has a significant role in demand management for the resource. In recognition of the need to conserve scarce aggregate resources, the RTA endeavours to:-

- * ensure that its specifications do not contain requirements excessive to the satisfactory performance of the product;
- * utilise the more widely occurring inferior products by stabilising or upgrading them;
- * limit the need to import material onto new construction by making maximum use of in-situ resources;
- * upgrade the natural subgrade material by in-situ stabilization;
- * introduce new techniques to reduce the quantities of imported material required to ensure satisfactory pavement performance;

- * utilise "waste" products such as coal washery waste and blast furnace slag wherever feasible.

The RTA will be involved in the implementation of the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS on an area-by-area basis.

8.4 Department of Planning

The Department of Planning will include the consideration of any relevant river management plan outlined in Section 7.4 in Director's requirements for environmental impact statements for proposed extractive operations from non tidal rivers.

Where appropriate the Department will continue to include a requirement in regional environmental plans (REPs) that local councils include protection for major extractive resources, including those away from rivers in local environmental plans protection for major extractive resources, including those away from rivers. The North Coast REP and other broad regional REPs already have such a provision. Sydney REP No. 9 - Extractive Industry and Sydney REP No. 11 - Penrith Lakes Scheme make special provisions to ensure the availability of extractive materials near Sydney.

The publications "Extractive Industry, Environmental Impact Assessment Guidelines" and "Manual for Environmental Impact Assessment" (which describes procedures), and regional environmental plans are available from offices of the Department of Planning.

8.5 Department of Mineral Resources

In consultation with the Departments of Planning, Water Resources, Public Works, Conservation and Land Management and the RTA, the Department of Mineral Resources is encouraged to undertake an inventory of off-river aggregate sources. These sources could include extensive floodplain deposits such as were identified recently in the Hunter Valley, or hard rock sources such as those being considered for the North Coast region. Accelerated identification of alternative sources is necessary if they are not to be sterilised by competing and incompatible land uses.

Liaison between the various agencies at a regional level may be the best method of identifying the appropriate supply and demand characteristics of a particular region as outlined in Section 7.7.

9.0 Performance Measures and Monitoring Programs

Monitoring and reporting of the condition of rivers being used for sand and gravel extraction will be an important tool in influencing management of the industry. It will create a greater awareness of river degradation problems and of the effectiveness of management strategies.

9.1 Large Scale Monitoring Programs

Monitoring and reporting on a large scale serves a range of purposes including:-

- (i) Development of base line data for determining priorities.

The consultants' reports on nine north coast rivers are the beginning of a program which eventually will cover major rivers throughout the State. These reports will form an inventory of the sand and gravel resource available from the State's non tidal rivers close to areas of high demand for aggregate. They will also give an indication of the condition of the rivers surveyed and allow comparisons over time.

- (ii) Identification of trends in river stability.

As well as monitoring individual sites, it is important that rivers covered by management plans be monitored on a regular basis throughout the affected reaches. Cross sectional surveys should be established both upstream and downstream of extraction sites. These cross sections should be marked permanently and related to permanent bench marks. Re-survey after significant floods will indicate the effectiveness of current policies and management strategies. It is recommended that local government be involved in this process because of its role as a major stakeholder.

- (iii) Detailed evaluation of the performance of specific local management strategies.

Both quantitative and qualitative reporting could be used to discuss and illustrate trends and to highlight major problems or successes. Sampling processes should not be restricted solely to measurement of the physical properties of the rivers. They should extend also to ecological characteristics and stakeholders' satisfaction with the management strategies.

9.2 Individual Site Monitoring

Compliance monitoring of development conditions for individual sites is equally as important as large scale monitoring programs which assess cumulative impacts. Each development consent includes conditions placed on the operation by a number of government agencies as discussed in Section 5.2. Even where 'existing and continuing use rights' negate the need for development consent, a number of permits/licences are required all of which have certain conditions attached.

In general, each agency responsible for the issuing of particular permits/licences should monitor the compliance of conditions pertinent to its area of expertise. It will be crucial for the successful management of river extractive industries that compliance with conditions is enforced strictly and that any breaches are dealt with suitably. It is recommended that, whenever practicable, local government take on an active role in co-ordination of enforcement.

9.3 Community Monitoring

As well as government monitoring programs, encouragement of inputs from local communities is recommended. Inputs could include:-

- * data collected by local community groups including extractors;
- * reports by local 'care' groups and riparian landowners;
- * reports by local environmental or recreational interest groups;
- * reports by local TCM Committees;
- * reports by local government.

Data from such monitoring processes would be included in the State Rivers and Estuaries Policy reporting programs. That policy recommends preparation and dissemination of Annual Regional River Reports which would cover all issues relevant to the State Rivers and Estuaries Policy and its various components. The audience for such reports would be primarily the regional and local government authorities and the regional community. Collation of the report would be the responsibility of either regional TCM Committees or a nominated regional agency.

10.0 Summary and Conclusion

As stated in Section 1.0 the SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS has three major objectives.

1. To ensure that extraction of sand and gravel from the State's non tidal rivers is undertaken on a sustainable use basis.
2. To manage such extraction in a way which minimises any detrimental effects on the riverine environment, thereby protecting other river uses and values.
3. To ensure that the extraction policy is consistent with the aims of other Government policies and initiatives.

These objectives contain the principles of sustainable resource management, environmental protection and compatibility of government policies. Clearly stated and publicly discussed mechanisms must be put in place, if sand and gravel resources from the State's non tidal rivers are to be available for future generations, and if other river uses and values are to be maintained.

The SAND AND GRAVEL EXTRACTION POLICY FOR NON TIDAL RIVERS has identified six mechanisms by which its objectives may be achieved:-

- (i) Continued use of the Department of Water Resources interim management strategies designed to minimise environmental impacts.
- (ii) Preparation and use of management plans for extraction of sand and gravel from non tidal rivers to minimise cumulative effects.
- (iii) Continued assessment of rates of sand and gravel movement in the State's rivers and use of this data in the management plans.

- (iv) Liaison and co-operation with major markets for sand and gravel to minimise illegal activity.
- (v) Liaison and co-operation with related government authorities to identify alternative land based sources of aggregate and encourage their development consistent with the objectives of this policy.
- (vi) Establishment of monitoring programs to report on the effectiveness of these mechanisms in achieving policy objectives.

It is clear from the consultants' reports on North Coast rivers, as well as from evidence from other parts of the State, that many rivers are in a serious state of decline.

There are many natural causes which may increase the rate of riverbed and bank erosion. However, extraction of large amounts of sand and gravel from within the channels has exacerbated the situation in many rivers.

Past experience in some areas of the State has shown that crisis point can be reached. In other areas, increasing conflict with other river uses has made extraction of sand and gravel a less viable option.

If these situations are not to be repeated elsewhere, management strategies for some rivers may need to be much more conservative than in the past.

A combination of the above mechanisms will allow for recognition of different requirements for different conditions throughout the State. It will also allow for different conditions in different sections of the same river.

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12.0 Glossary of Terms

Aggradation:	the long term build up of sediment (sand, silt or gravel) on a length of riverbed.
Aggregate:	any of several hard materials such as sand, gravel or crushed stone used for mixing with a cementing material to form concrete, mortar or plaster; or used alone, as in railroad ballast, road base or graded fill.
Aquifer:	a layer of sand, porous rock or gravel which holds water and allows water to percolate through it, yielding economically significant quantities to wells and springs.
Bed armouring:	a surface layer of large gravel particles which overlays and protects finer sediments beneath it.
Bed degradation:	the long-term erosion of sediment from a length of riverbed so as to lower its overall surface level.
Bedload:	the larger, heavier material such as coarse sand, gravel and boulders carried along the bed of a river by a range of flows.
Benthos:	collective term for animals and plants living on the bottom of the sea and fresh waters.
Dredging:	removal of material from below water level.
EIS:	Environmental Impact Statement, a document which must accompany development applications to local councils for any "designated" developments. Preparation of these statements is a requirement of the Environmental Planning and Assessment Act. The statements must describe the impacts proposals will have on the social, natural and economic environment.
Estuary:	that part of a river where fresh water comes into contact with sea water and which is affected by tides.
Flow regime:	the long term flow pattern in a river which results from the rainfall-runoff relationships in the catchment.
Groundwater:	subsurface water (often tapped by bores and wells).
Groundwater recharge:	the amount of water added to groundwater either from a stream along an aquifer or from rainwater infiltrating through the soil.
Hardrock quarry:	the extraction of aggregate from an open-cut mine in bedrock, usually the side of a hill.
Instream needs:	the water quantity and quality required by aquatic flora and fauna and for recreation and aesthetic uses.
Macrophytes:	aquatic plants larger than algae

Non tidal:	the freshwater part of rivers not influenced by tides.
Nutrient assimilative capacity:	the ability of a body of water and its associated sediments to dilute and absorb nutrients (inability to do so can result in algal blooms).
Phytoplankton:	free-floating microscopic plants that live suspended in a body of water.
Pool:	a body of still or slow moving water held back in a river by a downstream control such as a bedrock or gravel bar.
Riffle:	shallow gravel bar separating pools.
Riparian:	riverside.
Riverbed:	that part of a river contained between high banks. During normal low flow conditions, much of the riverbed may be exposed above water level.
River regulation:	the control of water flow in a river by artificial means such as dams and weirs.
River stability/ equilibrium:	the existence in a stream channel of a balance or grade between erosion and deposition that remains the same over a period of years.
River terrace:	a wide, flat land surface running more or less parallel to a river somewhat above the general level of the river banks. It represents the remains of a higher floodplain, stream bed or valley floor that was abandoned when the river eroded down to its present level.
Road base:	crushed gravel and/or rock used for road construction.
Runoff:	that part of rainfall which finds its way into stream channels after some of it has evaporated, been taken up by plants or seeped deep into the ground.
TCM:	Total Catchment Management. Co-ordinated and integrated land and water management within the physical boundaries of a catchment. Now part of State and Federal Government policy whereby community involvement is actively sought in management decisions.

13.0 APPENDIX: Submissions to Policy Development

Willow Bank Company ALBURY	A.J. & P.G. Raymond BELLINGEN
Albury City Council ALBURY	M.A. Mills BELLINGEN
Hume Shire Council ALBURY	Bellingen & Plateau Conservation Society BELLINGEN
Rural Water Supply Commission of Victoria ARMADALE VICTORIA	Berrigan Shire Council BERRIGAN
University of New England Centre of Water Policy Research ARMIDALE	Nambucca Valley Association BOWRAVILLE
Dr. R. Haworth University of New England ARMIDALE	NSW Farmers Assoc Nambucca Branch BOWRAVILLE
Department of Local Government BANKSTOWN	F.L. Hoffman BOWRAVILLE
State Pollution Control Commission BANKSTOWN	P.M. Skinner BOWRAVILLE
Bathurst City Council BATHURST	E.A. Grace BOWRAVILLE
L. C. Wheatley BEGA	D.S. Perks BOWRAVILLE
W. Watson BEGA	A.C. & M.J. Ussher BOWRAVILLE
Bega Valley Shire Council BEGA	K. & P. Richardson BOWRAVILLE
Bellingen Shire TCM Committee BELLINGEN	J.P. Ryan BOWRAVILLE
R. Trengrove BELLINGEN	B.J. Allen BOWRAVILLE
Bellingen Chamber of Commerce BELLINGEN	M. O'Donnell BOWRAVILLE
R. Cummings BELLINGEN	S.D. Glyde BOWRAVILLE
I.W. Fordham BELLINGEN	W.R. & M.B. Young BOWRAVILLE
	North Arm Land Care Group BOWRAVILLE

Batson Sand & Gravel Pty Ltd
BYRON BAY

Nepean Dredging Pty Ltd
CAMDEN

Camden Municipal Council
CAMDEN

ACT Dept of Environment Land & Planning
CANBERRA

Conservation Council of the South-Eastern
Region and Canberra
CANBERRA

Dr R.J. Wasson CSIRO Division of Water
Resources
CANBERRA CITY

Richmond River Shire Council
CASINO

Department of Conservation and Land
Management
CHATSWOOD

L. Markland
COFFS HABROUR

Coffs Harbour Environment Centre
COFFS HARBOUR

G. Hill
COFFS HARBOUR

Coffs Harbour City Council
COFFS HARBOUR

Cooma-Monaro Shire Council
COOMA

J. Crawther
CORAKI

L. Parr R.A.G.E
CRANEBROOK

I. Cameron
DAIRYVILLE

Bass Sydney
DHARRUK

Woollahra Municipal Council
DOUBLE BAY

R.H. Jones
EDEN

Australian Conservation Foundation
FITZROY VICTORIA

R.A. Paterson
GEROGERY

K. Graham
GLENIFFER

Ku-Ring-Gai Municipal Council
GORDON

Dept of Planning Northern Region
GRAFTON

Clarence River County Council Flood
Mitigation Authority
GRAFTON

Copmanhurst Shire Council
GRAFTON

Keech's Mini-Mix Pty Ltd
GUNNEDAH

Jugiong Quarries Pty Ltd
HARDEN

NSW Farmers Association
HAY

Roads and Traffic Authority
HAYMARKET

Department of Agriculture
HAYMARKET

Holbrook Shire Council
HOLBROOK

National Parks and Wildlife Service
HURSTVILLE

Blue Mountains City Council
KATOOMBA

C.R. Butterfield
KEMPSEY

Dr W. Erskine University of NSW
KENSINGTON

Kogarah Municipal Council
KOGARAH

Lane Cove Municipal Council
 LANE COVE
 Murrumbidgee River Mngt Board
 LEETON

 Leeton Shire Council
 LEETON

 Lismore City Council
 LISMORE

 Department of Housing
 LIVERPOOL

 Liverpool City Council
 LIVERPOOL

 Lockhart Shire Council
 LOCKHART

 J. & B. Ross
 MACKSVILLE

 W.J. Thomas
 MACKSVILLE

 Nambucca Valley Gravel Extractors &
 Carrying Contractors
 MACKSVILLE

 J.D. & B. I. Fortescue
 MACKSVILLE

 Nambucca Shire Council
 MACKSVILLE

 Everett Earthmoving Pty Ltd
 MAITLAND

 Hunter Valley Conservation Trust
 MAITLAND

 Sunraysia Mallee Branch Aust Conservation
 Foundation
 MILDURA VIC

 M Collins & Sons Pty Ltd
 MILPERRA

 Moree Plains Shire Council
 MOREE

 Mudgee Shire Council
 MUDGEE

 Tweed Valley Conservation Trust
 MURWILLUMBAH

H. Illingworth
 NARRABRI

 Narrabri Shire Council
 NARRABRI

 Cooks River TCM Committee
 NEWCASTLE

 Department of Conservation and Land
 Management
 ORANGE

 The Readymix Farley Group (NSW)
 PARRAMATTA

 Penrith City Council
 PENRITH

 Penrith Lakes Corporation
 PENRITH

 Wollondilly Shire Council
 PICTON

 Hastings Municipal Council
 PORT MACQUARIE

 Kinhill Engineers Pty Ltd
 RAILWAY SQUARE

 F.S. Charfe
 RANDWICK

 Coastal Protection Group
 REPTON

 Caldera Environment Centre
 SOUTH MURWILLUMBAH

 Department of Minerals and Energy
 ST LEONARDS

 Department of Minerals and Energy
 ST LEONARDS

 Pioneer Quarries (Sydney) Pty Ltd
 ST PETERS

 North Coast Environment Council
 STUARTS POINT

 Forestry Commission of NSW
 SYDNEY

 Public Works Department
 SYDNEY

Local Government and Shire Association
SYDNEY

Department of Planning
SYDNEY

Department of Lands
SYDNEY

Nature Conservation Council
SYDNEY

Prof. R.F. Warner University of Sydney
SYDNEY

Chamber of Mines Metals & Extractive
Industries (NSW)
SYDNEY

National Parks Association
SYDNEY SOUTH

Water Board
SYDNEY SOUTH

Australian Museum
SYDNEY SOUTH

Coast & Wetlands Society
SYDNEY SOUTH

Roads & Traffic Authority
TAMWORTH

Department of Conservation and Land
Management
TAMWORTH

G. Kelly
TAMWORTH

W.S. Machin Member for Manning
TAREE

Taree City Council
TAREE

D. Rees
THORA

The Nepean River Committee
WARIMOO

D. Daley
WAUCHOPE

Boral Resources (NSW) Pty Ltd
WENTWORTHVILLE

Nepean Hawkesbury Catchment
Management Council
WINDSOR

M.O.S.E.S
WINDSOR

C.H.A.N.G.E.
WISEMANS FERRY

A. McPaul
WOLUMLA