

3. Land and Water Management Issues

What are the Landuses in a Catchment?

The way that land is managed can be looked at in terms of the way the land is used and what it is used for i.e. "landuse". There are many factors that influence landuse in a catchment. Some of these are historical and reflect the history of settlement of an area and how that might change over time.

Investigate pioneer settlers to your catchment and landuse in the area.

<http://www.heritageaustralia.com.au/links.php?browse=a>

http://www.heritage.nsw.gov.au/07_subnav_18.htm

Other factors that influence landuse include changing relief, elevation, soil fertility, vegetation cover, geology, proximity to transport as well as drainage and supply of water.

Most catchments have a mixture of landuses that vary with the conditions that occur there.

What Management Issues are Created by Different Landuses?

Each landuse causes its own set of impacts on the landscape and management issues to deal with. Each landuse brings with it land management requirements to deal with these impacts and include:

- retention of productive soils;
- maintenance of a substantial vegetation cover; and
- treatment/disposal of by-products or wastes that might contaminate soil, water or air.

Activities that deplete the soils nutrients, soil structure and/or destroy soil microbes will eventually reduce the ability of an area to grow plants productively. Plants are important because their products include: crops that feed animals and people, forests that provide timber as well as a surface cover that helps bind the soil together and provide organic matter that is important for soil formation.

Removal of vegetation cover by overgrazing, land clearing, harvesting/tilling soil, mining and through fire result in soil being exposed so that it can be blown away by wind or carried away by water – this is called erosion.

Investigate causes of soil erosion and the various techniques that can be used to reduce its effects.

<http://www.dpi.nsw.gov.au/agriculture/resources/soils/erosion>

http://www.lands.nsw.gov.au/soil_conservation

Unsustainable activities that do not treat or appropriately dispose of wastes produced by the activity will eventually have an environmental impact. Wastes or by-products, unless treated, recycled or appropriately disposed of, will eventually reach levels that cause environmental problems.



Good vegetation coverage which holds the soil together well, South Coast NSW, source: OceanWatch Australia



Removal of vegetation cover exposing soil to erosion, South Coast NSW, source: OceanWatch Australia

What are Some of the Different Types of Important Landuse?

Landuse in a particular area is broadly regulated by planning laws that are administered by the NSW Department of Planning and Local Government (Councils). Councils prepare Local Environment Plans (LEP) that create landuse zones that identify what sort of landuse is appropriate in each Local Government Area (LGA).

Investigate the Local Environment Plan for your LGA and identify the rural, residential and industrial zone lands.

Conservation Land

In NSW, there is a land reserve system which conserves different vegetation and habitat types. This is done so that NSW will have a representative amount of the State's natural biodiversity preserved for the future. The lead organisation responsible for managing land for these purposes is the Department of Environment and Climate Change (DECC) <http://www.epa.nsw.gov.au/> <http://www.nationalparks.nsw.gov.au/>. Each reserve has a detailed Plan of Management that identifies the priority management issues and options.

Investigate the Plan of Management for a National Park or Nature Reserve in your area.

<http://www.nationalparks.nsw.gov.au/parks.nsf/WebMgmt/HTMLPages+Homepage>

<http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Conservation+plans+for+public+comment+by+DocType>

Forestry

In NSW the Department of Primary Industries - Forests NSW regulates forestry activities within the state. Forests NSW has strict guidelines that it has to operate by so that its activities are sustainable. The requirements vary slightly from region to region but generally guide such things as road and drainage design and construction, buffer zones along streams and the habitat retention requirements that depend on the types of wildlife occurring in a particular area.

Retention of buffer zones and strict sediment and erosion controls for track and trails in forests prevent excess sediment entering waterways. This excess sediment would otherwise make downstream waterways shallower and areas less navigable by boats, more flood prone and, in the estuary, would potentially smother seagrass beds.



*Logged forest, Mid North Coast NSW,
source: OceanWatch Australia*

Identify two important timber types obtained from forests nearby. What are the uses of those timber types? What are the problems confronting foresters if supply of these timber types is to continue?

<http://www.forest.nsw.gov.au/managingsf/default.asp> <http://www.forest.nsw.gov.au/ifo/default.asp>

Agriculture

Agriculture is a broad collection of different land uses that broadly relate to either:

- production and rearing animal livestock; or <http://www.dpi.nsw.gov.au/agriculture/livestock>
- growing plants as produce – crops or horticulture. <http://www.dpi.nsw.gov.au/agriculture/field>
<http://www.dpi.nsw.gov.au/agriculture/horticulture>

Investigate an animal and a plant based type of agriculture. Identify its importance, the issues surrounding that type of agriculture and the environmental problems that can come from that type of agriculture (including impacts on waterways).



*Stock grazing on the banks of a stream,
source: OceanWatch Australia*

These activities are vitally important because they provide people with foodstuffs, clothing and other essential products.

It is also important that these agricultural landuses are carried out sustainably. The NSW DPI Agriculture and Catchment Management Authorities are trying to get more and more rural landowners to ensure that their agricultural practices are up to date and sustainable. Various opportunities such as training, funding and other incentives have been made available to get better environmental outcomes on farms e.g. reduced fertiliser and pesticide use, better feedlot management, protection of waterways (e.g. keeping stock out of streams with off-stream watering points that prevent waste contaminating the waterway). This also reduces erosion of river banks caused by stock and helps retain a healthy riparian zone of native vegetation. Healthy riparian zones are an important filter reducing sediment and nutrient flows and thus maintaining a healthy aquatic environment for good water quality and healthy fish populations.

<http://www.dpi.nsw.gov.au/agriculture/resources> <http://www.dpi.nsw.gov.au/agriculture/farm>

<http://adl.brs.gov.au/mapserv/landuse/>

Mining

Mining and other extractive industries are often large scale and so have the potential to change the landscape on a large scale also. However, the resources they provide are often essential and so the community has to weigh up the environmental costs these types of activity sometimes have when compared to the benefits they provide. Mines often lead to large areas of vegetation being removed, the diversion and sometimes capture of streams as well as changes to salinity and other water quality issues.

<http://www.dpi.nsw.gov.au/minerals/environment/overview>

<http://www.dpi.nsw.gov.au/minerals/geological/mineral-maps-data>

<http://www.dpi.nsw.gov.au/minerals/geological/geological-maps>

Investigate Coal Mining, Iron Ore mining, Bauxite mining. Where are they located, what products do they supply us with and what are the different mining methods used? What are some of the environmental costs of mining in NSW – other parts of Australia?

Residential

Residential land is generally a high intensity landuse. It is usually associated with construction of houses/dwellings for owner occupiers or tenants to live in. These areas usually have most of their natural ground cover removed and have a high proportion of 'hard stand' surfaces such as roofs, driveways, roads and gutters. These areas also have a certain level of services provided such as sewerage, water supply, garbage removal, power, stormwater and perhaps gas and telecommunications. Rain and other water that enters these parts of a catchment often do not get much chance to soak into the ground because of the impervious surfaces (hard surfaces that do not allow water to pass through easily). Chemicals and other wastes and the by-products of activities in such areas are prone to being washed via the stormwater system (gutters and drains) into creek systems. The first flush of rainwater from urban catchments is often full of contaminants, wastes and nutrients. The activities of people in urban catchments can and do have a major effect on water quality downstream as well as the marine environment.

Urbanised areas in particular are also prone to high levels of 'gross pollutants' – rubbish that people drop or leave behind whilst at home at work and at play. These macro pollutants are often plastics and other



Vineyards, Hunter Valley NSW, source: OceanWatch Australia



Urbanised area, Sydney NSW, source: OceanWatch Australia

non-biodegradable substances that contaminate the environment for years. Much of this waste eventually finds its way into the estuary and the sea where it causes many problems for marine life e.g. ingestion, entanglement and strangulation injuries causing death.

Councils, Schools, the Department of Environment and Climate Change and other organisations run various awareness raising and cleanup campaigns from time to time to address urban pollution issues.

Definition:

hard stand surfaces are surfaces that are impervious or won't let water soak in or penetrate. This means that nearly all of the water landing on these surfaces runs off to somewhere else.

<http://www.environment.nsw.gov.au/beach/cpp/index.htm>

<http://www.environment.nsw.gov.au/litter/index.htm>

[http://www.amsa.gov.au/Marine Environment Protection/Protection of Pollution from Ships/](http://www.amsa.gov.au/Marine_Environment_Protection/Protection_of_Pollution_from-Ships/)

<http://www.aad.gov.au/default.asp?casid=3418>

http://www.nationalparks.nsw.gov.au/npws.nsf/content/marine_debris_ktp_declaration

http://www.amcs.org.au/default2.asp?active_page_id=194

Investigate what people can do to prevent poor water quality from urban stormwater runoff.

Industrial

Industrial lands are another type of intense landuse. Industry can be divided into light and heavy industry business types. Some types of industry can cause lots of pollution and these industries are required to be licensed by the NSW Department of Environment and Climate Change (DECC) in NSW to carry out their activity. Other industries and businesses have a responsibility not to pollute the environment but are regulated more locally by Councils.

http://www.nationalparks.nsw.gov.au/npws.nsf/content/marine_debris_ktp_declaration

From time to time DECC, the local Catchment Management Authority and Councils have programs to educate business operators about good 'sustainable' environmental practices and provide incentives for businesses to operate in this way.

Otherwise industrial and business landuses have similar or greater potential to pollute stormwater downstream than residential landuses.

Investigate Solutions to Pollution and the higher risk business types and what sorts of things these businesses should do to be clean and environmentally sustainable.

Definition:

Ecological – ecology is the sum total of all the life processes of all the living things in an area and how they interact with each other and their non living environment at a location.

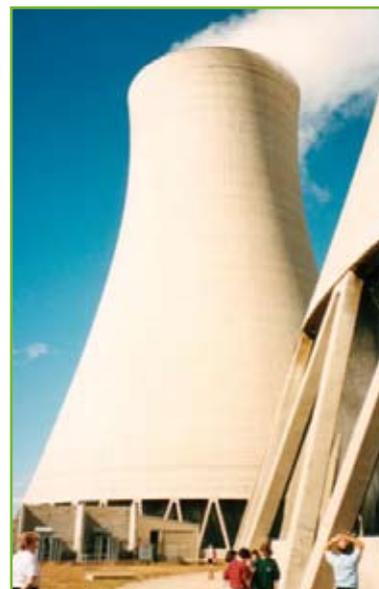
Sustainable – something is considered sustainable if it can continue to happen indefinitely or forever. If we are talking about using a resource then it would be sustainable if that resource was being replaced or redeveloping at the same pace at which it is being used – an example where this might be possible is in forestry where new trees are being grown whilst other older trees are being harvested. When we carry out an activity that affects the ecology of an area then we might say it is sustainable if its impact does not seriously prevent the ecological system from operating into the future.

http://www.environment.nsw.gov.au/for_industry.htm

http://www.environment.nsw.gov.au/for_teachers_and_students.htm



Rubbish collecting on rocks adjacent to the sea, Sydney NSW, source: OceanWatch Australia



Power station discharging waste into the atmosphere, Hunter Valley NSW, source: OceanWatch Australia

<http://www.environment.nsw.gov.au/sustainbus/sustainabilityadvantage.htm>

<http://www.environment.nsw.gov.au/sustainbus/industryandsmallbusiness.htm>

What are Acid Sulfate Soils? (ASS)

ASS are a special example of where landuse planning has to deal with a natural situation where soils in some estuary locations are high in iron sulfides. The high iron sulfide or pyrite is created by deposits of plant materials along with iron oxide rich sediments in moist and oxygen poor locations. The decomposition by microscopic organisms (microbes) that occur in these situations result in pyrite formation.

Landuses in estuaries are prone to exposing acid sulfate soils to the air from their covered locations. Once exposed to the air the sulfides rapidly combine with oxygen from the air to form sulfates which in turn are highly soluble in water create sulfuric acid. The strong acids that are formed by disturbing these soils are able to mobilise otherwise stable deposits of heavy metals and produce toxic levels of aluminium and iron as well. The result is an acidic heavy metal contaminated 'cocktail' in runoff which affects the life processes going on in estuary habitats. Reports of fish kills are often investigated and found to be linked to an ASS incident in the vicinity. Areas that do become exposed to ASS are often lifeless and very expensive to rehabilitate requiring applications of other chemicals and may never recover.

http://www.nrw.qld.gov.au/land/ass/what_are_ass.html

<http://www.environment.gov.au/coasts/cass/pubs/acidsulfate.pdf>



Acid scald on drained farming land, North Coast NSW, source: OceanWatch Australia



When fish are exposed to acid water and heavy toxic metals, fish skin and gills become damaged, increasing the susceptibility of the fish to fungal infections such as 'red-spot' disease, source: Mary Howard Feb 2008.

How is Landuse Regulated?

In NSW the laws and policies of government are what determine the landuse that occurs in a catchment.

In NSW the main piece of legislation that determines urban landuse is the *Environmental Planning and Assessment Act 1979*. This piece of legislation and other regulations determine the land use zoning of a piece of land. In each Council area of NSW there is a Local Environment Plan that decides what the land use zoning will be. Councils then make individual decisions about how a particular piece of land will be used. For example if a piece of land is zoned rural then the owner will be able to do certain basic rural activities without further permissions but other activities might require a special approval.

There is no such legislation that applies to agricultural land-use. The only major legalisation that landholders have to abide by is the *Native Vegetation Act 2003*, the *Native Vegetation Regulation 2005* and the *Threatened Species Conservation Act 1995*, which essentially regulate clearing of native vegetation on their land. However landholders are regulated in their use of pesticides and fertilisers to some degree under the *Pesticides Act 1999* and the *Fertilisers Act 1985*.

Other laws also influence activities in a catchment.

For example there are laws that prevent people's activities from polluting the environment see *Protection of the Environment Operations Act 1997*.

Yet other laws specifically protect wildlife, native vegetation and the activities that can occur in the riparian zone of streams and in wetlands (see Estuaries Fact Sheet and Catchments Fact Sheet).

Catchment Management Authorities (CMA's) have a role along with Councils and other state Government Departments in encouraging best practice standards for all the activities that are allowed to happen and to prevent illegal activities in the catchment. The CMA's investment in NRM is guided by national and Statewide NRM targets. The Statewide targets are set by the Natural Resources Commission see www.nrc.nsw.gov.au

What is Water Management?

Water management in a catchment is generally about the management of water for use by people for drinking and other household uses or its use by business, industry, agriculture and more recently a greater emphasis has also been on providing stream flows to maintain environmental health of the stream itself. These are called 'environmental flows'.

Otherwise water management is generally about the management of runoff in the catchment so that water is diverted as quickly as possible into gutters, drains and other structures during normal rain events (stormwater) or during major rain events managing large amounts of water that overflows from its stream bed (flooding).

<http://waterinfo.nsw.gov.au/sr/StorageSummary.html>

Another important type of water management is wastewater management which is the water, other than rainwater, that leaves houses, factories or other businesses from generally inside processes. This wastewater is often referred to as effluent or sewage.

What are Some Water Supply Issues?

Water supplies are made available by harvesting large quantities of water from the catchment and storing it in large water supply dams or reservoirs. These reservoirs then regulate the release of water so that activities downstream are able to have a more reliable supply of water for irrigation and other on farm uses. In urban areas water from water storage reservoirs is piped to suburbs for human consumption and is referred to as townwater. For people who live adjacent to larger streams they may be able to pump water for household or farm use but the amount of water and the timing of its extraction is often managed by licensing schemes. This prevents too much water being removed from stream flow so there will be some left for others downstream and for the natural flow of the river or creek and the life in the stream itself e.g. fish, tadpoles, water birds, turtles and other aquatic life.

Large water storage reservoirs also have the negative effects of removing the natural flood cycle that is necessary for stream and estuary life processes. These dams also periodically release very cold water flows that are also harmful to downstream aquatic life and are obviously a barrier to fish migration and prevent the completion of fish life cycles. Considerable habitat areas of streams are either lost beneath the storage lake or are unable to be accessed from below the dam wall.

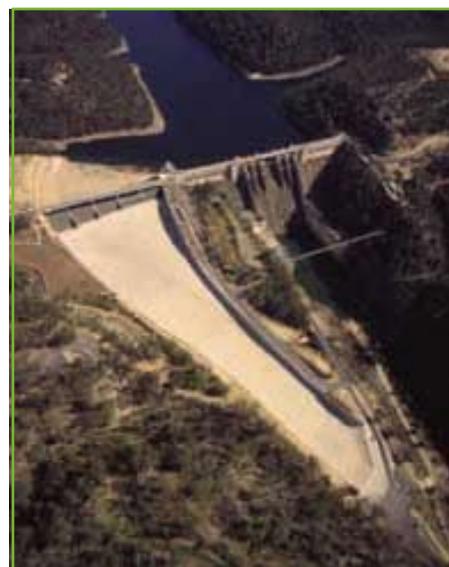
In recent times of severe drought across much of Australia and where water storage reservoirs are low and water restrictions are operating for many people a lot more interest has been shown in water recycling. Some of these ideas involve reuse of grey-water from household shower and washing water.

Other supplies of water include from bores tapping groundwater aquifers. For many aquifers not a lot is known about their size and how quickly they refill when they are depleted and so bores are also often licensed to prevent excess water extraction and harmful effects on Groundwater Dependent Ecosystems (GDE) that need this water to survive. Streamflow during periods without rain often depends on a flow of water from groundwater reserves.

<http://waterinfo.nsw.gov.au/sr/images/regnsw.jpg>



Street gutters and drains, source: OceanWatch Australia



Warragamba dam, source: Sydney Catchment Authority

<http://www.sca.nsw.gov.au/dams-and-water/major-sca-dams>

http://www.sca.nsw.gov.au/_data/assets/pdf_file/0006/1986/watersupplydiagram.pdf

<http://capp.water.usgs.gov/aquiferBasics/>

http://capp.water.usgs.gov/GIP/gw_gip/gw_a.html

Definition: **Aquifer** - an area of underground water that collects in reservoirs beneath the ground usually trapped by bedrock geology. They are important in regulating ground water levels and in sustaining GDEs.

Investigate – drought effects on the reliability of water supply and the alternatives that have been promoted eg desalination plants, stormwater harvesting and water recycling schemes.

What are some of the simple things that individuals can do to save water? Map and identify the location of the main water supply dams in NSW. Where does the water used in your house come from? An example of a GDE? Why are environmental flows important? How are people's attitudes changing towards using recycling water?

<http://www.onkapinga.net/about/aquifers.shtml>

http://www.watercorporation.com.au/W/water_recycling.cfm

<http://www.sydneywater.com.au/EnsuringtheFuture/Desalination/>

<http://www.environment.gov.au/soe/2006/publications/emerging/desal/index.html>

Away from urban areas runoff from the catchment flows along small creeks into larger ones and these streams carry water to an estuary or the sea. Where town water supplies are unavailable or inappropriate sometimes small storage (farm) dams are constructed to harvest runoff from small areas of the catchment of an individual property. Depending on the quantity of water required by a land use it may result in supplies needing to be sourced (pumped) from nearby stream flow or bores tapping groundwater aquifers.

The NSW Government regulates water extraction through the *Water Management Act 2000*. This piece of legislation aims to ensure that there is sufficient water for the environment whilst still providing secure access to water users. A series of water sharing plans are being prepared under this Act which will outline how water will be shared amongst the various users in a catchment whilst ensuring the protection of environmental flows. See <http://naturalresources.nsw.gov.au/water/legislation.shtml> for further information.



Windmill pumping water from aquifer, source: Hunter Central Rivers CMA



Farm dam, Sofala NSW, source: OceanWatch Australia

What is Stormwater?

Stormwater is the surface runoff that follows rainfall events. In urban areas this is usually in greater quantities because of the large areas of 'hardstand' surfaces of the built environment. Roads, footpaths, parking areas all have hard **impermeable** surfaces. This makes them more useful and safer for people to get around more easily. However water rapidly collects on these surfaces unless they are designed with slope to help water runoff quickly and usually in a desired direction where it can be collected and diverted away. Roads and paths usually direct water to kerbs or gutters that then collect runoff and channel it to culverts and drains. Large pipes beneath the ground then carry this water away and divert it into possibly larger pipes before they enter creeks or larger streams. It is the opposite in more natural situations with a lot of water soaking in penetrating the ground and wetting the soil. This takes time to happen and a lot more water needs to fall before there is runoff across the surface compared to hard stand surfaces like concrete and asphalt.

Buildings such as houses, factories and other commercial structures also have rooves made of tiles or iron that also drain rainwater to guttering and then into downpipes. This water also finds its way into the street and kerb side gutter and eventually a stream.

Councils usually spend considerable time and money in their design and construction of roads and footpaths to help stormwater get away as quickly as possible. This helps pedestrians and motorists to get about more safely but what it causes in streams is rapid and high volume flows of short duration straight after a rain event. These high energy flows damage stream beds but are of only short duration because there is little infiltration with most water running off and little entering groundwater. Flows from groundwater have an important role in keeping streams flowing during periods of low rainfall.

Stormwater should not be confused with “sewage” which is waste that comes from household activities usually inside the house. It includes waste water from toilet, sinks, showers, basins, baths and washing. This water is carried away as waste via a different piped (sewerage) system usually to a Sewage Treatment Plant (STP) where wastes are removed and the water treated until it is of an acceptable standard to be released back into the environment. The level of treatment of sewage in STPs varies depending on the STP. The best standard for aquatic health is tertiary treatment with reverse osmosis, however this is expensive and only available at the most modern STPs.

In other locations it is probably the best option to opt for maximum reuse of effluent to minimise discharges into waterways or the sea via ocean outfalls. Effluent entering waterways through either inefficient STP processes or via overflows during flood events do have a negative impact on aquatic life and fisheries. There is a high risk associated with effluent contamination especially for the oyster industry where microbes filtered by oysters can cause result in human infections e.g. Wallis Lake hepatitis B outbreak 1998).

Investigate – sewage sludge and its use as a fertiliser, STP treatment processes of sewage, composting toilets and other rural effluent treatment methods, issues of ocean outfalls in urban areas,

<http://www.epa.nsw.gov.au/water/sewagetreatment.htm>

<http://earthsci.org/education/teacher/basicgeol/sewage/sewage.html>

<http://www.awa.asn.au/Content/NavigationMenu2/Information/SpecialInterestGroups/SewageTreatment/default.htm>

<http://www.sydneywater.com.au/OurSystemsandOperations/>

<http://www.sydneywater.com.au/OurSystemsandOperations/WastewaterTreatmentLevels/>

<http://www.sydneywater.com.au/OurSystemsandOperations/WastewaterTreatmentPlants/>

<http://www.sydneywater.com.au/Publications/FactSheets/SWAssetsSTPs.pdf#Page=1>

<http://www.stormwater.asn.au/storm.asp>

<http://www.epa.nsw.gov.au/stormwater/hsieteachguide/index.htm>

<http://www.epa.nsw.gov.au/stormwater/hsieteachguide/strmwtrandsewage.htm>

<http://www.publish.csiro.au/samples/UrbanStorm.pdf>

<http://www.epa.nsw.gov.au/resources/scwsud.pdf>

<http://www.environment.gov.au/coasts/pollution/usi/>



Roadside gutters and drains collect stormwater which then flows through pipes that discharge into creeks, rivers, the ocean or other waterways, source: OceanWatch Australia



Pipe carrying stormwater from gutters and drains and emptying in the ocean, Manly NSW, source: OceanWatch Australia



Impervious surfaces in a Sydney city street, source: OceanWatch Australia

What is a Floodplain?

Floodplains, as their name suggests, are the part of the catchment that can experience overland flow when stream beds are unable to carry large amounts of water that fall during heavy storm events or prolonged periods of rain.

Floodplains are also some of the most fertile and productive lands, the most easily developed land and often very desirable places to live.

These realities can create problems for the catchment and the people working or living on a floodplain.

Flood Mitigation

People have designed structures and other ways to try and contain or regulate flood risks. All these features are designed to either retard or restrict flow, to increase the stream beds capacity to hold water or to act as safety valves that allow floodwaters to get away more quickly after flooding. Whilst these structures may have beneficial effects for people during flood events they may also have negative effects on the aquatic environment through elimination of natural flooding cycles that inundate wetlands, create seasonal breeding habitat, provide silt deposits that enrich natural systems and interfere with lifecycles and migratory patterns of marine and estuary life.

Dams and weirs may be barriers to fish migration, although species differ in their abilities to swim, leap or even climb over barriers. A large number of NSW coastal rivers have weirs built around the tidal limit to limit saline intrusion. These are potential barriers to organisms which require freshwater for part of their life cycle.

In many parts of Australia actions are now being taken to reverse the damage caused by flood mitigation works in the past. NSW Department of Primary Industries has been at the forefront of improving the management of over 1000 floodgates in coastal NSW. Over 70 floodgates are now being actively managed, restoring important habitats to estuarine fish.

What are Levees?

Levees are natural high points created by a stream depositing materials that help contain the stream to a channel at times of higher flow. Levees can also be modified or created by people to change flood patterns on a floodplain. Built levees are generally walls made out of earth, concrete or rock that act as the last line of defence to protect towns and land with important assets. They usually only protect property against small floods, divert flood waters or possibly provide more time for people to prepare before flooding of property occurs. When maximum flood levels are reached many levees are not high enough to prevent the flooding of townships and property from occurring. Constructed levees often alter natural flooding cycles and inundation of some wetlands. When these cycles are stopped



Floodgates closed to stop floodwaters flowing onto sugar cane fields on the floodplain, source: OceanWatch Australia



Weir across a creek, source: OceanWatch Australia



Actively managed floodgates, to allow fish passage and salt water to naturally flow upstream, source: OceanWatch Australia

natural ecological cycles are also altered and this may impact on stream and estuary life.

Why are Floodgates Built?

Floodgates are sometimes placed in streams to restrict or divert flows. They are able to be opened to allow increased flows to enter gated parts of a stream or at other times to be closed and prevent water from entering. Floodgates may also be designed to operate as a safety valve and allow flood water to escape more readily. Floodgates may also interfere with natural tidal flows and so affect life in streams and the natural processes of mangroves, saltmarsh and some wetlands that function as nursery areas. They may also interfere with natural fish migrations and prevent the fish from accessing areas where they need to feed and breed.

Importance of weirs and dams vs. importance of natural flooding events

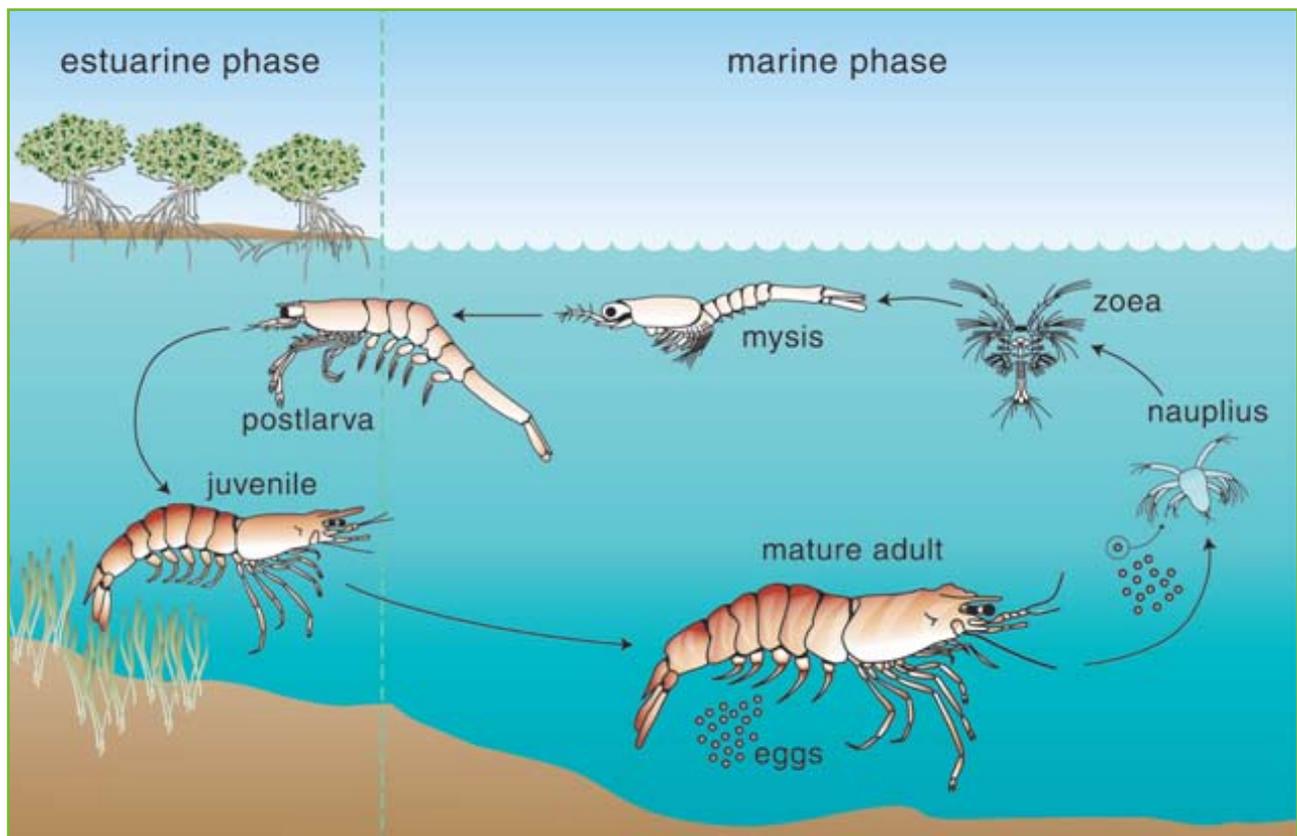
Weirs and dams are usually constructed in places to take advantage of geography. Where a stream flows through a narrow gap in high mountains a dam can be placed to hold back a large water storage reservoir. This serves two purposes, it can collect water for drinking or irrigation during dry periods when rains do not arrive and they may also reduce the devastating effect of downstream flooding by holding back some water and regulating its release. Weirs are often placed near the boundary where salt water and freshwater in streams



Levee on Hunter River NSW, source: www.abc.net.au



Floodgates on Crookhaven River, NSW, source: NSW DPI



Prawns need to move between different parts of the river, estuary and ocean to complete their lifecycle, source: CSIRO

mix. The weirs prevent upstream inflow of salt water from the sea as well as create a local captured body for local irrigation and water use that is reliably fresh.

Whilst these are positive benefits for people there are a number of negative effects of dams.

Many plants and animals have adapted to floods. A flood signals the time for prawns to move into the estuary and marine waters to breed. Pools left after floodwaters recede are used by aquatic insects and frogs which then provide food for waterbirds. The rich sediments deposited by floodwaters nourish the soils of floodplains and in fact many plants are dependent on the periodic inundation to survive and successfully propagate.

Without floods pollution builds up in rivers to the level where poor water quality can occur. The flushing action of floods also lowers salinity levels within the upper floodplain.

The rich sediments deposited by floodwaters nourish the soils of floodplains and in fact many plants are dependent on the periodic inundation to survive and successfully propagate.

<http://www.dpws.nsw.gov.au/Buildings+and+Infrastructure/Water+Services/Fishways.htm>

http://www.fisheries.nsw.gov.au/aquatic_habitats/fish_passage2

Today many weirs are being replaced or removed altogether because of the effect they have on natural migrations of aquatic animals eg fish, turtles and the platypus. The NSW DPI has a policy to have fish passage structures incorporated into any new or altered in-stream dam or weir. Furthermore, installing these types of in stream structures which change the natural flow of rivers and streams is listed as a key threatening process under the *Fisheries Management Act 1994* and thus a permit is required from DPI (Fisheries). Changing the natural flow of rivers floodplains and wetlands is also listed as a key threatening process under the *Threatened Species Conservation Act 1995* and thus any works which may result in such a change require approval from DECC.

Sometimes the barrier created by dams and weirs can also result nutrient build up in the stagnant water that can accumulate upstream of the barrier. Weed and algal 'blooms' of growth occur where these ideal conditions for plant growth are created.

Other flood mitigation works and their impacts of these works

People have also attempted in the past to widen, straighten and line some creek beds with concrete to help get flood waters away from areas as quickly as possible. These engineering solutions to flooding often have major environmental consequences that are made worse by the fact that riparian vegetation is removed and natural stream bed functions are removed along with the filtering effect of adjacent wetlands.

The Cooks River, Muddy Creek and Alexandra Channel with their concrete lined channels have had the dubious reputation for having some of the worst measures of environmental health in NSW. Programs are underway to improve some of these problems.

<http://www.canterbury.nsw.gov.au/www/html/170-cooknet---the-cooks-river-portal.asp>

<http://www.epa.nsw.gov.au/stormwater/casestudies/cooksdetailed.htm>

http://www.epa.nsw.gov.au/soe/97/ch3/14_1.htm



Fishway built such that fish can move around structures such as weirs, Lane Cove National Park NSW, source: OceanWatch Australia



Concrete lined channel, Cooks River NSW, source: NSW DPI (Scott Nicholls)

Why is Fishing and Aquaculture a Special Activity in a Catchment?

Fishing and aquaculture has a special place in the catchment.

Probably more than any other activity this industry is exposed to the end results of all the other upstream activities in the catchment.

The fishing industry harvests fish and other seafood products that rely heavily on the health of the catchment and the estuary in particular.

Poor landuse practices can cause pollution, siltation and degradation of the sensitive estuary habitats that are the nursery for many estuary and marine species vital to the seafood industry.



Fish kill Richmond River NSW, linked to poor land management practices

Aquaculture which has been, until more recent times, largely dominated by oyster growing is another part of the industry that relies heavily on a clean, functional estuary. Contaminants from poor human landuse activities also heavily impacts on this part of the industry.

- Fishing and oyster areas have to be closed when water quality does not meet health standards or food safety standards. High levels of bacteria from animal and human waste (especially faecal coliforms) have resulted in areas closed to oyster farming and fishing in estuaries. It is better for these industries if this waste is kept out of streams and estuaries and better also for the health of the aquatic environment.
- Outflows from acid sulfate soils can cause sickness in fish and even fish kills and result in closure of a river or estuary to fishing. These outflows can also have negative impacts on oyster health and result in closures to oyster farming or very poor yields.
- The oyster industry monitors water quality in harvest areas to ensure that oysters are safe to eat.
- Commercial fishers, oyster farmers, oyster openers and fishers' cooperatives, seafood stores and processors and non-shellfish aquaculture in NSW now all operate food safety programs run by NSW Food Authority. Thus it is essential that landuse activities and water use within a catchment are managed such that they do not pollute and degrade water quality in rivers and estuaries.

http://images.google.com.au/imgres?imgurl=http://www.fisheries.nsw.gov.au/data/assets/image/0005/108491/7-key-tips.jpg&imgrefurl=http://www.fisheries.nsw.gov.au/aquatic_habitats/rehabilitating-habitats/rehabilitation-program&h=200&w=141&sz=30&hl=en&start=19&um=1&tbnid=EKKPCInhfo-5xM:&tbnh=104&tbnw=73&prev=/images%3Fq%3Dfloodgates%2Bmacleay%2Briver%26um%3D1%26hl%3Den%26rlz%3D1T4SUNA_enAU259AU263%26sa%3DN

Some Other Ways that Governments, Groups and Individuals Responded to the Land and Water Management Issues Affecting the Environment

Governments at all levels have departments and internal organisation that reflects or has been influenced by the need to manage land and water.

AUSTRALIAN GOVERNMENT

The Australian Government has embarked upon several initiatives/programs to address land and water issues in coastal environments. Some of these include:

- [Australia's National Programme of Action for the Protection of the Marine Environment from Land-Based Activities](#)
- [Coastal Catchments Initiative](#)
- National Strategy for the Management of Coastal Acid Sulfate Soils

- National Cooperative Approach to Integrated Coastal Zone Management – Framework and Implementation Plan

See <http://www.environment.gov.au/coasts/index.html>

“Caring For Country” is a new initiative which will address Natural Resource Management issues across Australia. It will combine some of the Australian Government’s existing programs and initiatives such as:

- Natural Heritage Trust (funded groups and organisations to protect and restore the environment and natural resources);
- National Action Plan for Salinity and Water Quality;
- National Landcare Program (encouraged farmers to adopt sustainable management practices, and improve their productivity, profitability and the condition of our natural resources, both on and off farms);
- Environmental Stewardship Program; and the
- Working on Country Indigenous Land and Environmental Program.

See www.nrm.gov.au for further information

The Australian Government has several Agencies that have been established to address and manage land and water issues. These include

- The Department of [Agriculture, Fisheries and Forestry](#) ;
- The Department of [Environment, Water, Heritage and the Arts](#) ;
- The Department of [Innovation, Industry, Science and Research](#) ; and
- The Department of [Resources, Energy and Tourism](#)

Visit the websites above to see how these Departments are dealing with various issues.

STATE GOVERNMENT

Thirteen **Catchment Management Authorities (CMAs)** have been established across the State by the New South Wales Government to ensure that communities have a say in how natural resources are managed in their catchments.

They are responsible for involving communities in the management of the natural resource issues facing their region, and are the primary means of issuing funding from the NSW and Commonwealth Governments to help land managers improve and restore their natural resources.

The CMAs work in partnership with the community, local government, State Government agencies, industry, business and individuals. This partnership approach is one of the most effective in achieving outcomes (see Fact Sheet on Clarence Valley Floodplain Project, as an example).

The NSW Government has established a number of other Departments to address various land and water issues including:

- NSW Department of Primary Industries www.dpi.nsw.gov.au;
- Department of Water and Energy (DWE) www.dwe.nsw.gov.au;
- NSW Department of Environment and Climate Change www.decc.nsw.gov.au;



National Coastal Acid Sulfate Soil Committee investigating acid sulfate soils, source: OceanWatch Australia



Joint project with Northern Rivers CMA working with community LandCare community groups to rehabilitate riparian vegetation, source: LandCare Australia

- NSW Department of Planning www.planning.nsw.gov.au; and
- NSW Maritime www.maritime.nsw.gov.au

For example The NSW Government has previously funded a [Urban Stormwater Program and Beachwatch Program](#) run by DECC. This program focussed on raising awareness about the potential for stormwater to cause pollution and ways that people could help reduce this. These programs have helped reduce stormwater pollution and pollution of receiving waterways.

Visit the websites above to learn more about the initiatives/programs of these state government agencies that address many of the land and water management issues outlined in this fact sheet.

LOCAL GOVERNMENT

Local governments play a vital part in catchment management through catchment planning schemes. Local government authorities manage and regulate many of the activities which impact on catchment condition. These management activities include:

- land-use zoning (see previous pages);
- stormwater management and sewerage and drainage provision;
- regulation of development including the clearing of land;
- erosion and sediment management;
- Development Control Plans requiring water sensitive urban design; and
- waste disposal regulations and facilities; and
- involvement with other organisations and landholders in specific land and water rehabilitation projects e.g. Clarence Floodplain project.

See the NSW Department of Local Government for the list of all local councils in NSW and browse individual websites for various initiatives www.dlg.nsw.gov.au

GROUPS and INDIVIDUALS

Individuals and groups can all contribute to the sustainable use of land and water resources in catchments. They can do this by:

- minimising their impact through waste minimisation and careful waste disposal;
- carrying out remedial works on affected land and water;
- sustainable use of resources;
- volunteering for rehabilitation projects (contact your local council to see how you can be involved);
- supporting government and group initiatives to improve land and water resources;
- complying with the law; and
- students, farmers, townspeople, business owners, workers all have a role to play as individuals.

Non-government organisations also play an important role in coordinating groups to work together to improve the sustainable use of land and water in catchments.

For example, Ocean Watch Australia's "Tide to Table" program involved working with community groups, Local Government, Catchment Management Authorities and other land managers on a number of on-ground projects to repair and restore fish habitat and address water quality across coastal catchments. It is not only



Sediment erosion controls, South Coast NSW, source: OceanWatch Australia



Community planting day as part of OceanWatch Australia's Tide to Table Program

the coastal freshwater, estuarine and marine environments that benefit from such efforts however, industries such as the seafood industry critically depend on healthy aquatic environments (for more information see www.oceanwatch.org.au).

Sources of Further Information

NSW Government Catchment Management Authority at <http://www.cma.nsw.gov.au/index.html>

Clarence Valley Council at <http://www.clarence.nsw.gov.au>

OceanWatch Australia at www.oceanwatch.org.au

Wetland Care Australia www.wetlandcare.org.au

Nature Conservation Council of NSW www.nccnsw.org.au

What Can You and Your School Do?

Schools can register to be part of “Sustainable Schools NSW”, an initiative managed by the NSW Department of Environment and Climate Change (DECC) and the NSW Department of Education and Training. Through this Program, schools are helped to develop their own School Environmental Management Plan (SEMP) that looks at curriculum, management of resources, and management of school grounds with lots of fun actions to help improve the local school environment and reduce the impact of the school community on the environment. For more information see <http://www.sustainableschools.nsw.edu.au>

Furthermore, there are many ways that you can help reduce your impact on the environment in your day to day life. For example DECC’s Initiative “It’s a Living Thing” suggests many ways you can help reduce your impact on water quality and water quantity (how much water you use) e.g.;

1. installing AAA-rated showerheads – you can save around 10 litres of water a minute;
2. installing water saving devices like dual-flush toilets, tap aerators and other flow regulators in your taps and showerheads;
3. choosing appliances and whitegoods with a high water saving rating;
4. turning off the tap while cleaning your teeth – you can save around 5 litres of water every time;
5. keeping pipes and taps in good order – fix leaks and dripping taps promptly;
6. turning on your washing machine and dishwasher only when you have a full load;
7. reusing water from your bath, shower and laundry to water your garden;
8. using a broom to clear and clean hard surfaces;
9. reducing the use of household chemicals by buying less, using less and looking for safer alternatives;
10. using water-based paints – only buy enough for the job at hand to avoid unnecessary wastage;
11. using non-toxic ways to repel pests; and
12. not pouring unwanted oils and chemicals into drains, toilets or where they may end up in our waterways.



http://www.livingthing.net.au/WYKD_h1.htm

For further initiatives see <http://www.livingthing.net.au>