

2. Catchments

What is a Catchment?

A catchment is an area of land, usually bounded by mountains, over which water flows and is collected by the natural landscape. In a catchment, all rain and run-off water eventually flows into a creek, river, lake, lagoon or the ocean.

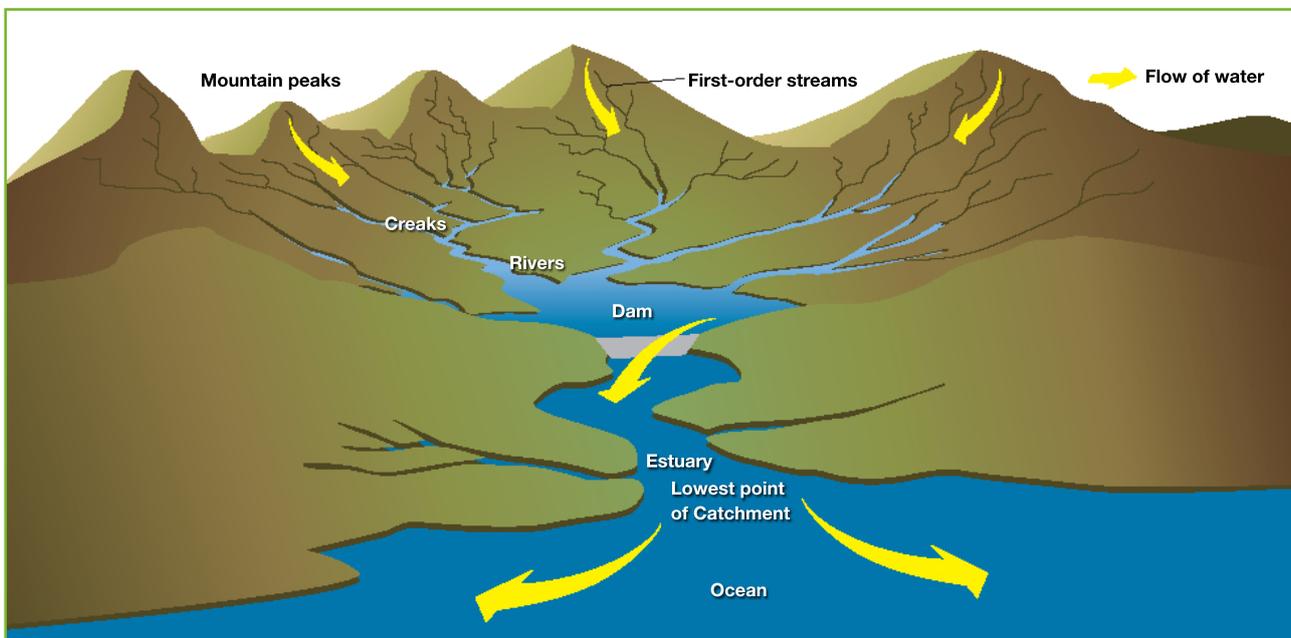
In some places small catchment areas join up to form a larger catchment. These small catchments are sometimes called sub-catchments. Adjoining catchments are separated by higher points, usually a ridge or mountain, these boundaries are called watersheds.

Everyone lives in a catchment!

Investigate

What catchment do I live in?

Catchments can vary in size. Some are very large and drain huge areas of NSW e.g. Murray Darling Basin and others can be very small and may collect water from over just a few square kilometres e.g. a small coastal lagoon catchment.



Schematic diagram of a catchment

Water Flow Through a Catchment – impacts on quality and quantity

Water flows in catchments include both, surface flows – overland flow and within stream flow, as well as flows below the surface – ground water flow, and both are important.

The water that collects in a catchment often shows the effect of some or all of the activities and land uses that people are undertaking in that catchment. People need to remember that what someone does upstream will affect someone else downstream.

The behaviour and quality of water flow in a catchment may have significant affect on living things and also seriously influence human activities.

For example:

Pollution

Human activities and industry produce wastes. When these wastes find their way into water ways it becomes pollution and affects natural processes and human activity downstream. Some of these types of waste include household refuse, industrial waste, sewage, animal waste, agricultural waste, fertilisers and pesticides (among others) find their way into the surrounding environment and end up in streams.



Landfill South Coast NSW, source: OceanWatch Australia



Sewage treatment plant, source: Bega Valley Shire Council

Ground cover removal

Most areas of the land naturally have a cover of vegetation. This vegetation whether it is forest, shrubland or grassland helps hold the soil together and prevent it from being eroded and carried away. When the ground surface is disturbed or has its vegetation cover removed by development, land clearing or deforestation, it affects the flow and quality of water in the catchment. It also increases the amount of sediment and nutrient carried by the water. This can cause downstream effects like turbidity, siltation, algal blooms and the smothering of sensitive environments like wetlands and important estuary plants like seagrasses. Development often replaces natural groundcover with hard impervious surfaces like roads, pavements and roofs. These 'hardstand' surfaces prevent water infiltrating the soil and result in much heavier and immediate flows downstream.

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



Cleared land for development Mid North Coast NSW, source: OceanWatch Australia

Water storage and flood mitigation

People often build dams and weirs and flood gates in streams for a variety of purposes. Generally these include water storage for human consumption and irrigation, to prevent upstream flow of salt water from estuaries and to regulate flows after heavy rain to prevent flooding. In stream structures like dams and weirs act as a barrier to fish migrations, they also often result in very cold water being released as torrents into the lower catchment and this affects aquatic life downstream. Other structures like weirs and gates may interfere with the normal tidal flows of salt water and the normal wetting and drying cycle of the tide. Dams and weirs often interfere with migration of fish and the normal practice of cold water release from lower level outlets of storage dams may also interfere with normal breeding patterns. Natural vegetation types like mangroves and saltmarsh are also often degraded by changes to these natural tidal cycles. All new dams (or when dams require modification) are required to install fishways or have designs that allow fish passage. The preferred design also has multilevel release points so that water released from dams is not all cold water.



Weir on Ourimbah Creek, Central Coast NSW, source: NSW DPI/Wyong Shire Council

Water extraction

Human activities often require a large supply of water. This results in water being extracted from the catchment and either pumped or diverted from streams for crop irrigation, industrial processes, watering

stock and for cooling in power generation. Groundwater may also be extracted from underground reserves called aquifers. During times of drought in particular these activities may lead to reduced stream flow and depletion of aquifers. Some vegetation types are dependent on natural flows or supplies of water such as wetland vegetation communities and Groundwater Dependent Ecosystems (GDE). The natural life cycles of some animals and plants are highly dependent on flows of water being maintained and aquifers may take a long time to recharge when emptied. Natural seasonal or episodic cycles of flooding may also be important 'triggers' for life cycle stages in some aquatic flora and fauna species.

Investigate

A selection of the factors above that has an effect on runoff or are affected by runoff.

Dams – Sydney Catchment Authority
<http://www.sca.nsw.gov.au/dams-and-water>

Dams – State Water
http://www.statewater.com.au/dams_weirs.htm

Dams – rural dams
<http://www.dnr.nsw.gov.au/water/dams.shtml>

Natural Resources – water management
<http://naturalresources.nsw.gov.au/water/index.shtml>

Flooding <http://naturalresources.nsw.gov.au/floodplains/risk.shtml>

Aquifers <http://www.onkaparinga.net/about/aquifers.shtml>

GDE
http://www.connectedwater.gov.au/framework/ground_dependant_ecosystems.html

Agricultural practices effect on runoff

Irrigation
http://www.mirrigation.com.au/AboutUs/Water_for_Life.htm

Flood management
<http://www.ses.nsw.gov.au/infopages/2192.html>

What are the Main Parts of a Catchment?

The main parts of a catchment are:

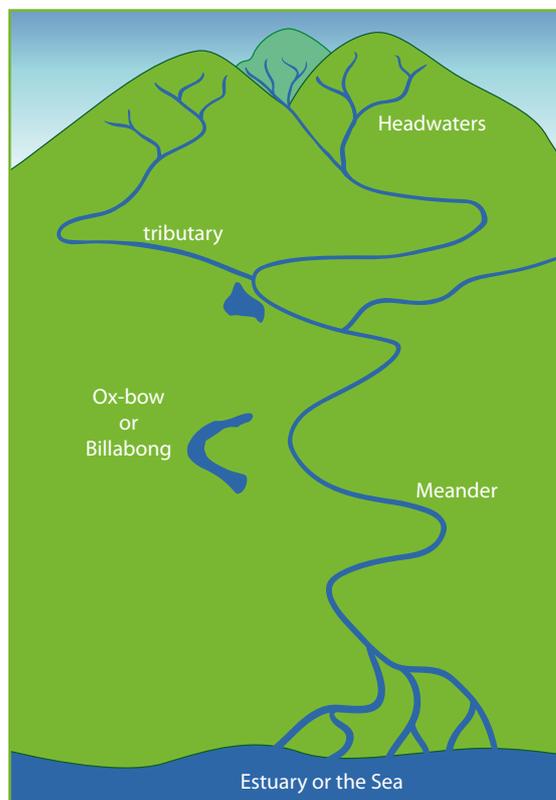
- the watershed which is a boundary that separates one catchment and its flows from the neighbouring catchment;
- the headwaters which are generally the more elevated parts of a catchment (usually hills or mountains and with most runoff collecting into many small but often steep sided channels that collect together and form a rapid flow quickly after rain);
- the mid reaches of a catchment, where the stream begins to slow down and widen (typically it forms features such as meanders, levees and ox-bows or billabongs); and
- the lower reach of a catchment which is usually the delta where a stream enters an estuary or the sea.



Floodgates on Crookhaven River NSW, source: NSW DPI (T Townsend)



Rock ramp fishway, Karuah River NSW, source: NSW DPI (Scott Nichols)



Schematic diagram of parts of a catchment

The mid and lower reaches of the catchment generally form its floodplain.

The different parts of a catchment provide a number of very important habitats.

These include:

- riparian habitats; and
- wetland habitats.

Riparian Habitats

The riparian zone is an area immediately surrounding a stream. It consists of the banks, stream bed and the adjacent land. The width of the riparian zone will differ depending on the size and behaviour of the stream and also the part of the stream. The riparian zone can be thought of as an area that influences or is influenced by its watercourse. <http://www.amlnrm.sa.gov.au/LinkClick.aspx?fileticket=ABP1i5kmt%2B8%3D&tabid=548>

Riparian zones are extremely important because of the wide range of species and environmental processes that occur there. Protecting and repairing riparian zones results in significant improvement in catchment health. Riparian vegetation provides shade and keeps water temperatures cooler and may assist the survival of fish. Shaded conditions are also less encouraging for aquatic weed growth. Riparian vegetation stabilises the soil on riverbanks and reduces erosion. Exposed roots from riparian tree growth and fallen logs and stumps form snags in natural streams are important habitat for fish and other aquatic animals.

Wetland Habitats

Wetlands can be broadly defined to include areas such as swamps, marshes, billabongs, lakes, saltmarshes, mudflats, mangroves, coral reefs, fens, peatlands, or even bodies of water that can be natural or artificial, permanent or temporary. Water in wetland areas can be static or flowing, fresh, brackish or saline. <http://www.environment.gov.au/water/environmental/wetlands/about.html>

Wetlands are extremely important because they make up one of the most productive ecosystems on Earth. They provide habitat, water and abundant food for many different kinds of animals. These include: birds, frogs, invertebrates and fish. Wetlands are a refuge area for plants and animals in drought and a nursery area for fish and migratory birds. Water passing through a wetland is filtered and cleaned and the overall health of a catchment area is improved by its functions. <http://www.waterwatchadelaide.net.au/index.php?page=information-6>

In the past, wetlands were thought to be wastelands and were often reclaimed for farming, housing and industrial land uses. Today we know how important the functions of wetlands are. We should all appreciate their environmental, social and economic value and significance. Governments and communities in many places around the world are now involved in wetland management, conservation, restoration and construction projects.

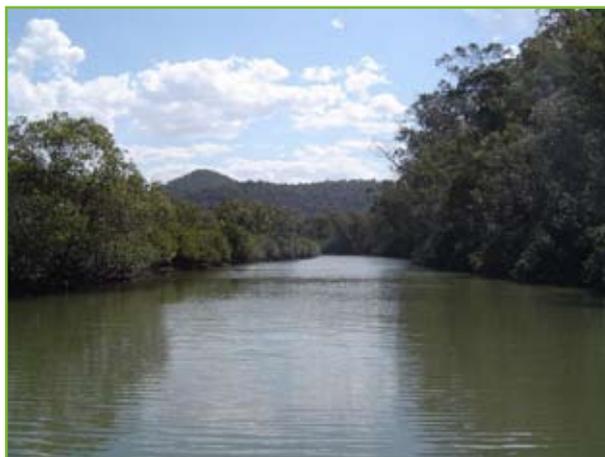
<http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Ramsar+wetlands>

<http://www.environment.gov.au/epbc/matters/ramsar.html>

Some legislation that protects wetland and riparian habitats

A variety of legislation has also been put in place that is designed to protect riparian habitats and wetlands in NSW and Australia. Some of these are:

- *Coastal Wetlands are protected under the Environmental Planning and Assessment Act 1979 via NSW State Environmental Planning Policy No. 14 – SEPP 14.* This restricts development in such wetland areas and places significant extra emphasis on the assessment process for any development that is proposed.



Healthy riparian vegetation, Hawkesbury River NSW, source: OceanWatch Australia



Coastal wetlands, Pittwater NSW, source: OceanWatch Australia

- Rivers and streams are also protected under the *Water Management Act 2000* which requires that certain works and activities in or near streams requires a permit. This provides further protection to the riparian zones of catchments.
- Ramsar Wetlands are wetlands that have been recognised for their unique qualities, significance for conservation of biological diversity or are rare Australia is a signatory to the International Convention on Wetlands of International Importance that gives recognition to these wetlands. This is a inter-governmental treaty between nations aiming to conserve and manage these significant wetlands.

<http://www.environment.gov.au/water/environmental/wetlands/ramsar/index.html>

To give effect to this status “Ramsar” wetlands are protected as a matter of national environmental significance (NES) by the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) which aims to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.

- These habitats are afforded further protection under the *Rivers and Foreshores Improvement Act 1948*. People who wish to undertake works or activities that involve excavation near the waters edge or which will change or block the flow of the waterway must seek a permit under this Act.

www.legislation.nsw.gov.au

Catchment Management

In NSW the state government has established Catchment Management Authorities (CMA) to guide better landuse practices and Natural Resource Management (NRM) so that activities become sustainable and support the national agenda for Ecologically Sustainable Development (ESD). CMAs have been set up to ensure local input into the management of catchments is achieved with priorities for action determined by local needs and issues.

It is important to remember, all activities within a catchment have some impact on the aquatic environment and flow downstream impacting on the estuary and eventually the marine environment. Fish life and other aquatic organisms need these habitats to survive.

<http://www.cma.nsw.gov.au/>

<http://naturalresources.nsw.gov.au/aboutus/index.shtml>

<http://www.nrc.nsw.gov.au/>

Investigate

The local CMA its functions and targets, a selection of the water flow influences in catchments listed above.

Sources of Additional Information

Flooding Safety <http://www.nationalsecurity.gov.au/agd/ema/emaSchools.nsf>

Water Management http://education.melbournewater.com.au/content/floods_explorer/floods_explorer.asp#

<http://www.ses.nsw.gov.au/students/>

Aquifer Management <http://naturalresources.nsw.gov.au/water/aquifers.shtml>

Requirements of GDEs <http://www.environment.gov.au/water/publications/environmental/rivers/nrhp/groundwater.html>

Agriculture and Water <http://www.dpi.nsw.gov.au/agriculture/resources/water>

RAMSAR wetlands http://www.ramsar.org/index_about_ramsar.htm