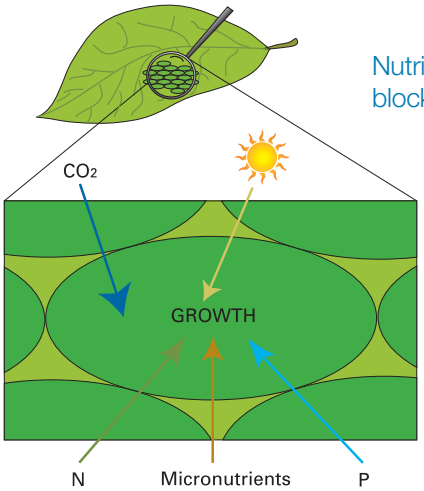
Nutrients in our waterways

Nutrients are an essential ingredient

Plants need nutrients to grow. In particular they need carbon, nitrogen, and phosphorus. Plants in both aquatic ecosystems as well as plants on land need the same nutrients.When plants use carbon dioxide (CO_2) for photosynthesis they produce chemical compounds for growth including carbon (C). Nitrogen (N) is produced when plants, animals, and bacteria decompose. Phosphorus (P) is created through the natural weathering of rocks and soil and rainfall runoff transports it from the land into waterways.

For healthy waterways, the complex and important process of nutrient cycling is vital. Nutrients in waterways are absorbed by aquatic microorganisms (e.g. bacteria) and algae (e.g. phytoplankton). When these organisms die, they decompose and the nutrients are released back into the water where they can be absorbed by other organisms. This is nutrient cycling. Cycling of nutrients may repeat many times until the nutrients are buried in the stream sediment or nitrogen is released to the atmosphere in the form of gas.



Nutrient building blocks in plants

Energy from sunlight is converted into chemical energy through the process of photosynthesis. Carbon dioxide (CO_2) from the atmosphere is converted into chemical compounds, which are used as building blocks for plants to grow. In addition to the carbon (C) from carbon dioxide, nitrogen (N), phosphorus (P), and other micro-nutrients must be obtained from the surrounding environment.

"Waterways need a good balance of nutrients, just like you need a balanced diet. But just as too much food is not good for us, too many nutrients makes waterways sick."

1) Phytoplankton to grow. use sunlight and nutrients

2) Nutrients in phytoplankton pass up the food chain into the fish and zooplankton that graze on the phytoplankton.

3) When phytoplankton, zooplankton or fish die, they fall to the bottom, and are decomposed by bacteria. This process of decomposition releases the nutrients back into the water column to begin the cycle again.

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HEALTHY WATERWAYS
Because we're all in the same boat

Nutrients in waterways also move through the food chain. Phytoplankton absorb the nutrients. Phytoplankton are then consumed by slightly larger microscopic animals called 'zooplankton'. Zooplankton may then be eaten by small fish, which are eaten by larger fish, and so the nutrient uptake continues through the food chain.

When nutrients become a problem

Light, nitrogen, and phosphorus are the main factors that control the growth of aquatic plants. Nitrogen and phosphorus are often found in fertilisers because they stimulate plant growth. These nutrients may become an environmental problem, and a form of pollution, when they enter waterways at a faster rate than they can be used in the food chain and cycled through the system.

High nutrient levels can lead to excessive plant growth, sometimes creating algal blooms. Too much nitrogen in the water appears to be the main cause of algal blooms, particularly in South East Queensland's (SEQ) marine and estuarine waters.

After a bloom of excessive growth, the plants die and as they decompose, the level of dissolved oxygen in the water can be depleted—this is called 'eutrophication'. Eutrophication can cause fish kills and other problems because aquatic animals and plants need a certain level of dissolved oxygen in the water to survive.

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The impacts of eutrophication include fish kills, and it can cause waterways to smell, have brown or green scum, and can cause water treatment problems.

Sources of nutrients in waterways

Nutrients in waterways come from two sources: 'point' sources and 'diffuse' sources. Point source pollution comes from a single point such as from a pipe. Diffuse sources of pollution come from many places within a wide area. Diffuse sources of pollution can include sediment or nutrients from catchment runoff, groundwater, rain, or when airborne pollutants fall to the ground.

Point source pollution

Water from wastewater treatment plants and industrial facilities are point sources of pollution and can contain high levels of nutrients. Recent commitments to improve wastewater treatment by local councils and industries in South East Queensland are dramatically reducing the amounts of nutrients being emptied into waterways.

Diffuse source pollution

Stormwater flowing over the ground picks up loose soil, animal droppings, leaves, litter, and other sources of nutrients and transports them into waterways. This diffuse pollution source is called 'stormwater pollution'.

Clearing vegetation within a catchment also influences the nutrient cycle, as it exposes soil and increases the speed water can move over a landscape. This can lead to both hillslope and gully erosion of soil that contains nutrients.

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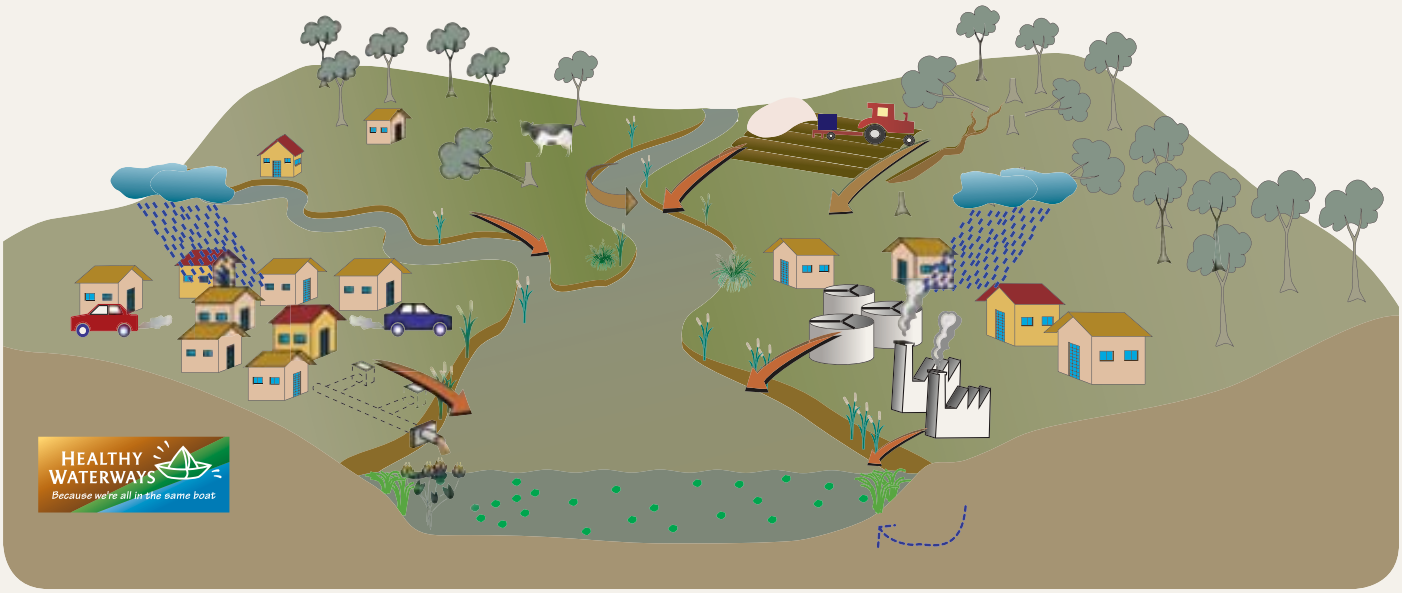
Sediment from building sites is a form of pollution that can deliver sediments and nutrients to waterways.



Point sources (e.g. sewage effluent and industrial waste) contribute a large proportion of nutrients, particularly during the 'dry' season.

Catchment clearing increases the speed that water moves through the landscape, increasing hillside and stream bank erosion, and delivering more nutrients into waterways.

Dissolved and particulate organic and inorganic nitrogen enters waterways as diffuse runoff from the catchment and urban areas.

Addition of fertiliser and soil disturbace increases sediment and nutrient in waterways.

Gaseous (atmospheric) nutrients dissolve in raindrops and enter waterways as rain.

Nutrient transfer to waterways can be via groundwater flow.

Excessive nutrients can lead to algal blooms.

Various nutrient sources from the catchments of South East Queensland.

Many landuse practices such as crop farming and gardening add nutrients to the land as fertiliser. This increases the concentration and quantity of nutrients that can get into aquatic ecosystems following heavy rainfall.

Industrial emissions and exhaust emissions from cars increase atmospheric nutrients, particularly in developed catchments. These airborne nutrients can then enter aquatic ecosystems when they settle out of the air (dry fall) or become dissolved in raindrops.

The SEQ Healthy Waterways Strategy

The SEQ Healthy Waterways Partnership is a collaboration between government, industry, researchers, and the community. *The SEQ Healthy Waterways Strategy 2007–2012* contains over 500 actions, committed to by Partners, to improve the health of our waterways.

Many of these actions are aimed at preventing excessive nutrients entering waterways. The *Point Source Action Plan* in the Strategy includes the following target:

> 'By 2026,100 percent of nutrient loads originating from point sources are prevented from entering receiving waterways and Moreton Bay.'

Key Fact

A biological indicator, or bio-indicator, is a plant or animal that is used to monitor environmental health. Bio-indicators are used in Moreton Bay and local river estuaries to measure levels of nitrogen that comes from wastewater discharges.

Key Learning Area	By the end of Year	Essential Learnings
Science	**7**	Ways of working—Students are able to collect and analyse first- and second-hand data, information, and evidence. Knowledge and understanding—Science as a human endeavour: • Ethical considerations are involved in decisions made about applications of science. • Scientific knowledge can help to make natural, social, and built environments sustainable, ranging from local to global scales. Knowledge and understanding—Life and living: • Different feeding relationships exist within an ecosystem.
	9	Ways of working—Students are able to research and analyse data, information, and evidence. Knowledge and understanding—Life and living: • Changes in ecosystems have causes and consequences that may be predicted. • In ecosystems, organisms interact with each other and their surroundings. Knowledge and understanding—Science as a human endeavour: • Immediate and long-term consequences of human activity can be predicted by considering past and present events.
SOSE	**7**	Ways of working—Students are able to collect and analyse information and evidence from primary and secondary sources. Knowledge and understanding—Place and space: • Sustainability requires a balance between using, conserving, and protecting environments, and involves decisions about how resources are used and managed.
	9	Ways of working—Students are able to research and analyse data, information, and evidence from primary and secondary sources. Knowledge and understanding—Place and space: • Interrelationships between human activity and environments result in particular patterns of land and resource use, and can cause environmental problems.

Source: Queensland Studies Authority, Essential Learnings and Standards, Years 1–9

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SEQ Healthy Waterways Partnership
PO Box 13086, George St, Brisbane, QLD 4003
Phone: (07) 3123 1682 Fax: (07) 3103 4573
www.healthywaterways.org

There are other fact sheets and educational resources available. For more information about the waterways of South East Queensland please visit the Partnership's website: **www.healthywaterways.org**

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