

Bushfire impacts on water quality

The NSW Government is undertaking rapid assessment to identify soil erosion hazards to minimise the risks of sediment and nutrient pollution entering our rivers and streams.

We are using spatial data on rainfall amount and intensity, fire intensity, land cover, topography, soil erodibility and proximity to sensitive aquatic receptors to identify the areas of greatest risk.

This information will be used to prioritise on the ground sediment and erosion controls to minimise water quality impacts.

Water quality impacts after fires

Bushfires can impact the water quality of our waterways through increased levels of:

- nutrients (including nitrogen and phosphorus). High intensity fires can volatilise organic matter, with nutrients (and other contaminants) in the vegetation being oxidised and becoming water soluble.
- particulate carbon as well as salts, nutrients, trace metals and other contaminants present within ash. Metals such as manganese, iron, copper and zinc usually increase as a result of ash from burnt vegetation.
- suspended solids and turbidity. Large debris flows can temporarily reduce dissolved oxygen resulting in fish kills.
- unburned organic matter that washes into streams and reduces dissolved oxygen as it decomposes.
- sulphate concentrations through oxidation of sulphur in soil organic matter and burnt plant litter leachate.

Rapidly increased water temperature during fires can result in fish kills and following fire, the loss of riverbank vegetation cover can also increase daily maximum temperatures, effecting algal growth and dissolved oxygen concentrations. During the Black Saturday bushfires in Victoria, temperatures in streams and ponds were reported to have reached 55°C.

Generally, the degree to which water quality is affected by fire depends on factors such as:

- landscape (steep slopes have an increased erosion risk)

- size, extent and intensity of the fire (larger, more intense fires have an increased impact)
- magnitude of post-fire rainfall events (intense storms with heavy rainfall increase erosion)
- time period between the fire and a significant rainfall event (longer time periods enable regrowth to occur, reducing erosion)
- type of surrounding vegetation (steep, dry forested areas have an increased risk)
- soil type and depth (erodible soils have a greater water quality impact).

Fire increases the potential for runoff and erosion. Debris flows are erosion events that sometimes occur after fire, involving a fast-moving mass of unconsolidated, saturated debris. The sediment runoff following fires carries high levels of ash and charcoal that immediately impacts water quality.

What can be done to minimise impacts to water quality following fire?

Post-fire there are several key actions that can minimise further impacts on waterways (and prior to rainfall where possible):

- installation of erosion and sediment control measures to prevent debris being washed into waterways e.g. silt fences, hay bales and planting vegetation such as grasses, shrubs and trees to stabilise soils
- rehabilitation of any control lines and access tracks. The NSW Rural Fire Service (RFS) and National Parks and Wildlife Service (NPWS) have guidance on appropriate erosion and sediment control standards for access tracks
- prioritisation of restoration of burnt riverbank vegetation zones
- instream floating booms and silt curtains to limit the dispersion of ash and sediment within sensitive waterways such as drinking water storages and aquaculture
- establishing a targeted water quality monitoring program where sensitive receptors could be impacted.



In all instances, resourcing will necessitate identifying priority areas for mitigation and rehabilitation. Priority areas/catchments could include, for example, drinking water catchments and waterways with sensitive receptors such as oyster leases and sea grasses.

Key contaminants of concern for water managers include:

- increased suspended solids and turbidity
- increased nutrients (particularly nitrogen and phosphorus) and an increased risk of toxic algal blooms
- increased metal concentrations (particularly manganese, iron, copper and zinc).

Impacts of fire suppression activities

Low water availability due to drought conditions and high evaporative losses from storages can result in limited water supplies to control fires. Alternative strategies to control fires will be increasingly required due to scarcity of water.

This includes increased use of fire retardants, dry containment lines, seawater and recycled water. The application of these fire control measures can impact the quality of our waterways.

Fire retardants

Fire retardants that are used to fight fires contain chemicals that are essentially fertilisers (85% water, 10% fertiliser and 5% other constituents such as colour additives, thickeners, corrosion inhibitors and bactericides).

It should be noted that fire-related impacts on waterways, such as high turbidity levels and elevated nutrient loads, have a potentially greater impact on waterways than the potential impacts of fire retardant chemicals.

For example, sediment runoff entering streams after rain can increase hundreds of times compared to unburnt catchments.

Can bushfires impact drinking water supplies?

Historically there have been incidents where bushfires have impeded drinking water quality resulting in water being unfit for consumption.

For example, rainfall following the 2019 bushfires

within the Tenterfield region saw large quantities of ash entering Tenterfield Dam, resulting in elevated turbidity, odour and increased chlorine dosing, necessitating the residents to boil water from October to December 2019. Fish kills were also observed.

Heavy rainfall after bushfires may also increase contaminants in raw water that will present challenges to drinking water treatment. Water utilities in bushfire affected areas should be prepared to increase water quality monitoring and optimise treatment processes.

Local Public Health Units and Department of Planning, Industry and Environment - Water are working closely with affected councils to help them prepare for possible impacts following rainfall.

Research indicates impacts to water quality in drinking water reservoirs is influenced by the attenuating capacity of the reservoir, size, current storage levels and extent of stratification.

Bushfires can also disrupt power supply and destroy water infrastructure such as pumping stations and treatment plants, resulting in water quality impacts and supply disruption.

More information is available in the fact sheet Managing risks to town drinking water quality after bushfires at:

www.industry.nsw.gov.au/_data/assets/pdf_file/0004/288058/managing-risks-to-town-drinking-water-quality-after-bushfire.pdf

Can bushfires affect rainwater tanks?

Rainwater may be contaminated by debris, dead birds or animals, fire retardants, or large amounts of ash. The presence of ash and debris in rainwater is unlikely to be a health risk but could affect the appearance and taste. Fire retardants currently used in Australia are of low toxicity but may also affect the appearance and taste of rainwater.

If you are concerned that your rainwater tastes, looks or smells unusual, or you suspect your rainwater has been contaminated, use an alternative safe water supply.

Further information is available from the NSW Health website at:



www.health.nsw.gov.au/environment/water/Pages/rain-water-bushfires.aspx

Alternative sources of water for fire suppression

Recycled Water

The use of recycled water is supported where it is safe to do so.

The suitability of recycled water to extinguish fires depends on the level of treatment and the potential risks to the environment. For example, recycled water can have elevated nutrient or residual chlorine levels. Where feasible, these risks can be minimised by dilution with other water sources e.g. mixing with river water.

For most bush firefighting purposes, the use of treated wastewater will be at rates at which any remaining pollutants such as nutrients, pathogens and chlorine are unlikely to pose a significant and long-term ecological risk. The benefits of using recycled water normally outweigh any environmental risks and the risks of a bushfire continuing to burn.

Seawater

Seawater can be used for water bombing operations in reserves along the coast and estuaries. The adverse impact of salt water on the environment increases the further the location is from the coast as biota and the environment generally become less salt tolerant.

Exclusion zones

As a precaution to water quality impacts, firefighting procedures generally specify a 100m exclusion zone around waterways for aerial application of retardants, seawater and use of water enhancers. WaterNSW stipulates a 200m exclusion zone around drinking water reservoirs.

Did you know? Port Macquarie-Hastings Council is currently using tertiary treated, recycled water to extinguish a peat fire at Lindfield Park Road that has been burning since July 2019.

'Dry' fire-fighting techniques

Machinery like bulldozers and graders are often used to construct containment lines, or in the case of grass fires, heavy plant can be used to smother fires rather than douse them. These works can leave soil exposed and susceptible to erosion. Actions taken during the fire can help reduce impacts to water quality, including using GPS units to track the location of control lines to enable rapid rehabilitation post fire.

Helpful resources

Bushfires, in addition to current drought conditions, increase the level of stress on native fish populations. Further information on bushfire impacts on aquatic environments and fish kills in NSW and response actions can be found at:

www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills

www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills/bushfire-impacts-on-native-fish

A factsheet on bushfires and town water quality can be found at:

www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/drought-update/drought-information

A factsheet on rainwater and bushfires can be found at:

www.health.nsw.gov.au/environment/water/Pages/rain-water-bushfires.aspx

A factsheet on stock water impacted by bushfire ash and debris can be found at:

www.ils.nsw.gov.au/emergency/bushfires

WaterNSW maintains a database of algal alerts where algal cell numbers exceed the relevant guideline levels. Red, Amber and Green Alerts provide an indication whether the algal bloom is toxic to humans and animals, and should not be used for drinking, stock watering, or for recreation.

For further information: www.waternsw.com.au/water-quality/algae

NSW Environment Protection Authority

Email: info@epa.nsw.gov.au

Website: www.epa.nsw.gov.au

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