

# Into The Future

Without knowledge there is limited understanding and without facts and analysis, we are unable to effectively plan for the future. As stewards of the land and its associated resources, it is our responsibility to ensure a continuation of a groundwater availability for all.

At the Marlborough District Council, the environmental science and hydrology team monitor our hydrological resources and conduct investigations into the sustainability of the resource for future generations. The current group consists of:

- Peter Davidson - Groundwater Scientist
- Val Wadsworth - Environmental Scientist, Hydrology
- Mike Ede - Team Leader Hydrology
- Amy Nicholson - Environmental Monitoring Officer
- Peter Hamill - Environmental Scientist, Aquatic Biota



From Left to Right: Mike Ede, Amy Nicholson, Peter Davidson, Val Wadsworth, Peter Hamill

It is imperative that the Marlborough District Council continues the excellent work that has been carried out over the last 30 years involving monitoring, new discoveries through exploration and ongoing analysis.

It has been suggested that our freshwater resources will “pay the bills” in the future and this will of course, necessitate a greater awareness of the availability of the resource itself. A scarcity could be economic disaster and it will be increasingly important that we understand what is going on within our groundwater systems on a day to day basis.

As we push our resources harder, the links between the rivers, springs and wetlands become even more apparent and can not be treated as independent of each other. It is this kind of management that will assume greater importance as we move into the future.

# Glossary Of Terms

**$\delta^{18}\text{O}$**  - the ratio of Oxygen-18/Oxygen-16 relative to an international standard and used to determine the source of water.

**Abstraction** - the removal of water from any natural water source.

**Aerobic** - oxygen rich groundwater.

**Alluvium** - clay, silt, sand, gravel, or other material deposited by rivers and forms most of Marlborough's aquifers.

**Anaerobic** - oxygen deficient groundwater.

**Anisotropy** - aquifer properties that vary depending on flow direction.

**Annulus** - space between the outside of the well casing and the surrounding geological formations or the inside of the casing and pipes.

**Aquiclude** - a layer of impermeable material forming a barrier to vertical flow of groundwater.

**Aquifer** - a permeable water-bearing formation through which water moves and yields water to wells at a sufficient rate to be a practical source of water supply.

**Aquifer test** - a field procedure where water is pumped from a well at a measured rate while observing the drawdown in other wells nearby to calculate aquifer characteristics.

**Aquitard** - a relatively impermeable formation containing water but incapable of transmitting water in significant quantities. Usually separating two aquifers or overlying a semi-confined aquifer.

**Array** - pattern of laying out geophysical equipment.

**Artesian** - confined aquifer water which is under sufficient pressure to rise above ground level in a well.

**Baseflow** - stream flow during long periods when no rainfall has occurred and commonly provided by groundwater.

**Braided river** - channel/river/stream that consists of a number of smaller channels separated by gravel bars.

**Boundary Effect** - geological or hydrological properties that affect the development of the cone of drawdown in a well. Boundaries have either a recharge or barrier effect on drawdown.

**Colluvium** - sediments found at the foot of a slope that have been deposited by gravity.

**Conductivity** - a measure of the ease with which an electric current passes through water. Groundwater conductivity is related to dissolved mineral content.

**Cone of depression** - depression of the groundwater surface which defines the area of influence of a well.

**Confined aquifer** - aquifer which is isolated from above and below by impermeable layers.

**Cumec** - a measure of river or stream flow, abbreviated from cubic metres per second.

**Datum** - origin used to relate the elevation of groundwater levels. Hydrological observations in this document use the MDC Rivers and Drainage datum which is similar to mean sea level.

**Denitrification** - natural biochemical process which reduces nitrate-nitrogen and is usually associated with oxygen deficient aquifer conditions.

**Drawdown** - fall in water level due to the pumping of a well.

**Ephemeral river** - a river that flows for only part of the year.

**Equipotentials** - contours of equal aquifer pressure or groundwater elevation.

**Eutrophication** - waterways that become choked with weeds and algae due to increased nutrient levels.

**Fault** - fracture in the earth's crust along which movement has occurred.

**Flow-net** - map of groundwater slope showing contours of equal elevation.

**Formation** - a division of geological strata related by age and environment of deposition.

**Greywacke** - hard, grey, fine grained sandstone.

**Heavy metals** - metals such as arsenic, cadmium, cobalt, chromium, copper, mercury, nickel, lead, tin and zinc. Even at low concentrations, these metals can be toxic to plant and animal life.

**Heterogeneous** - aquifer properties which vary depending on location.

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**Holocene** - a geological period which began 11,700 years ago and continues to the present.

**Homogeneous** - aquifer properties which are the same regardless of location.

**Hydraulic conductivity** - property of a saturated porous medium which determines the relationship between the aquifer throughflow and the hydraulic gradient driving it.

**Hydraulic gradient** - the slope of the aquifer water table.

**Hydrogeology** - the study of aquifers and groundwater.

**Hydrograph** - a graphical plot of water level observations against time.

**Infiltration** - flow of water through the soil surface into a porous medium.

**Isohyet** - a line on a map or chart connecting areas of equal rainfall.

**Isotropy** - aquifer properties are the same in all directions.

**Leakage** - the vertical movement of water through an aquitard. Leakage can be induced when pumping lowers the pressure of a confined aquifer.

**Lense** - small geological body or groundwater layer.

**Massif** - a rock more resistant to erosion than the surrounding rock.

**Milliequivalents** - milliequivalents per litre are used to standardise the proportions of salts in groundwater and compare the chemical composition of different well waters.

**Miocene** - a geological period that extends from about 23 to 5.3 million years ago.

**Orogeny** - period of mountain building.

**Permeability** - a measure of the capacity of an aquifer material to transmit water.

**Piezometer** - small diameter observation well used to measure aquifer characteristics or sample water quality.

**Pleistocene** - a geological period that extends from 2.5 million to 12,000 years ago. The Pleistocene spans the period of recent glacial and interglacial episodes.

**Pliocene** - a geological period that extends from 5.3 million to 2.5 million years before present.

**Quaternary** - a geological period that comprises the Holocene and Pleistocene periods.

**Recharge** - the addition of water from other sources to an aquifer.

**Recharge area** - area where surface water from rain, irrigation or streams infiltrates to groundwater.

**Reduction** - chemical process normally associated with low oxygen aquifers.

**Riparian** - the area next to a waterbody.

**Runoff** - water that flows across the land surface and does not soak into the ground. Also the quickflow component of rainfall that contributes to riverflow.

**Salt-water intrusion** - when the natural sea water interface invades groundwater and affects wells.

**Schist** - a rock that has been buried to such a great depth that it has been flattened by heat and pressure.

**Sediment** - material usually inorganic transported by water.

**Seismic survey** - the exploration of a subsurface geologic structure by means of seismic waves which are generated artificially.

**Sinusoidal** - natural variation in aquifer levels influenced by ocean tides that follow a sine wave.

**Specific capacity** - a term used to describe well productivity. Specific capacity is determined by pumping a well at a constant rate for a specified duration, usually 30 minutes to two hours. The specific capacity of the pumped well is the rate of discharge divided by the drawdown.

**Specific yield** - a term used to describe water stored within pore spaces of unconfined aquifers. Storage in pore spaces is much greater than elastic storage in confined aquifers (often some 1000 times greater). Subsequently, pumping effects travel more slowly in unconfined aquifers, and longer pumping periods are required to achieve the same drawdown effects.

**Spring** - a flow of groundwater coming to the surface.

**Stage** - river or well water height.

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**Storativity** - a measure of the storage characteristic of an aquifer. In confined aquifers it refers to elastic storage (contraction and expansion of water and aquifer matrix). In unconfined aquifers it is a measure of the water released from the pores between grains as a result of flow under gravity (specific yield).

**Strata** - layers of sedimentary rock or soil with internally consistent characteristics that distinguish them from other layers.

**Stream depletion** - the loss of stream or river flow as a direct result of groundwater pumping

**Terrace** - a flat topographic surface formed by the erosion or deposition of sediments by a river.

**Transmissivity** - rate at which water is transferred through a unit width of an aquifer under a unit hydraulic gradient.

**Unconfined aquifer** - an aquifer where groundwater is freely connected to the atmosphere and is free to rise and fall.

**Vadose zone** - area above the water table where the sediments are unsaturated.

**Water table** - the interface between groundwater and the soil substrate or air.

**Well** - hole dug, or shaft sunk in the ground for obtaining groundwater.

**Wetted front** - the downstream edge of channel flow in an ephemeral river.

# Abbreviations And Units

**$\delta^{18}\text{O}$**  - Ratio of Oxygen-18/Oxygen-16.

**$\text{‰}$**  - parts per thousand.

**BBC** - Blenheim Borough Council.

**Ca** - calcium.

**Cl** - chloride.

**CRI** - Crown Research Institute.

**Cumec** - cubic metres per second.

**DSIR** - Department of Scientific and Industrial Research.

**ESR** - Institute of Environmental and Scientific Research.

**FRGA** - Fairhall River Gravels Aquifer.

**GNS** - Institute of Geological and Nuclear Sciences.

**$\text{g/m}^3$**  - grams per cubic metre.

**ha** -hectare.

**$\text{HCO}_3$**  - bicarbonate.

**K** - potassium.

**km** - kilometre.

**l/s** - litres per second.

**m** - metre.

**m/day** - metres per day.

**$\text{m}^2/\text{day}$**  - square metres per day.

**$\text{m}^3/\text{day}$**  - cubic metres per day.

**$\text{m}^3/\text{day}/\text{m}^2$**  - cubic metres per day per square metre.

**$\text{m}^3/\text{hour}$**  - cubic metres per hour.

**m/s** - metres per second.

**$\text{m}^3/\text{s}$**  - cubic metres per second.

**MCC** - Marlborough County Council.

**MCRWB** - Marlborough Catchment and Regional Water Board.

**MDC** - Marlborough District Council.

**meq/l** - milliequivalents per litre.

**Mg** - magnesuim.

**mm** - millimetres.

**mm/day** - millimetres per day.

**mm/year** - millimetres per year.

**mS/m** - millisiemens per metre.

**MWD** - Ministry of Works and Development.

**Na** - sodium.

**NGMP** - national groundwater monitoring programme.

**NZGS** - New Zealand Geological Survey.

**ppm** - parts per million.

**RSA** - Rarangi Shallow Aquifer.

**SH1** - State Highway 1.

**SH6** - State Highway 6.

**SH63** - State Highway 63.

**$\text{SO}_4$**  - sulphate.

**SVIS** - Southern Valleys Irrigation Scheme.

**TRGA** - Taylor River Gravels Aquifer

**WACS** - Wairau Aquifer Coastal Sector.