

# Advanced Nitrogen in the Environment

3-Day June 2026 Annual Workshop for Scientists and Technical Professionals

By Selva Selvarajah PhD

In Dunedin, Christchurch & Hamilton

Authoritative, Critical and Up-to-date Compilation on N in the Environment



Nitrogen (N) is a critical nutrient to all lives. It is also a key water contaminant. Unlike other nutrients and contaminants, N undergoes the most complex biological processes in soil, water and wastewater. It is not surprising unlike other plant available nutrients, laboratory-based plant available soil-N test remains elusive to date.

Judging by the frequently, nationally and regionally reported declining New Zealand freshwater quality in which N contamination has been most dominant, it is becoming crucial to access high quality information in managing N in the environment effectively.

If you have been involved in expert technical advice, tertiary education, research, planning, consultancy work associated with in N in the environment and wish to access high-quality technical information in N in the environment, this is your best opportunity since this rare training is not accessible elsewhere, nationally or globally.

You can be confident that you will not only gather new insights to N management in the environment from the 3-full day interactive training but will retain the privilege to access one of the most extensive, high quality and well researched technical manual (>200 pages with illustrations and >300 references) for ongoing reference.

### Why should you attend this workshop?

- To extend or break your existing boundaries in N and P knowledge.
- The workshop will result in better understanding of the complex N transformation processes in soil, water and wastewater.
- You will acquire additional and new knowledge which will widen your horizon in N monitoring, researching and reporting.
- Your application of knowledge in consenting, compliance monitoring and planning will enable quality input.

**Who could benefit from this workshop?** Regional council scientists, technical staff (within planning, consents and compliance) and science managers, hydrogeologists, freshwater and soil scientists, nutrient model/management specialists, technical consultants, independent hearing commissioners, academics and postgraduate students.

**About ENVIROKNOWLEDGE®:** An independent high quality NZ consultancy which specialises in technical training, research and advisory in RMA implementation, nitrogen in the environment, wastewater treatment, non-point and point source contamination management.

**About the workshop provider:** Selva Selvarajah (PhD in Soil Science, Lincoln University) has 21 years of regional council experience (13 years as Director Resource Management). He has sound applied science and legislative knowledge in soil, water and wastewater management and excellent presentation (6 keynote papers & presentations in NZ and overseas) and workshop delivery (more than 450 local government, consultancy, industry, CRI and academic professionals attended a range of workshops since 2015) skills. His workshops are independent and of high quality, well researched and presented (e.g., “Effective Regional Council Consents Process”, “Wastewater Management under the RMA” and *Effective Farm Nutrient Management under the RMA*). He holds the 2017 Advanced Sustainable Nutrient Management Massey University and the MfE Making Good Decisions Chair certifications. He has authored more than 100 publications, reports, newspaper articles (visit [www.enviroknowledge.co.nz](http://www.enviroknowledge.co.nz) or <https://www.researchgate.net/profile/Selva-Selvarajah> for reports and publications).

Please register with your full name, employer name and position at [sustain@enviroknowledge.co.nz](mailto:sustain@enviroknowledge.co.nz).

**Registration closing date:**

**5 June 2026**

**Daily workshop time:**

**9.00 am to 5.00 pm**

**<sup>1</sup>Workshop fee/person:**

**\$1575.00 (excl GST)**

<sup>1</sup> Discount of 5% for 3-5 attendees and 10% for ≥6 attendees from the same organisation can be applied.

Workshop Venue	Dates
Dunedin– Alhambra Oaks Motor Lodge, 558 Great King Street	8-10 June 2026
Christchurch – Russley Golf Club, 428 Memorial Avenue	17-19 June 2026
Hamilton- Aaron Court Motor Inn, 250 Ulster Street	22-24 June 2026

**Workshop fee:** Includes lunch, tea/coffee, full colour hardcopy manual (>200 pages with 300 references), certificate of attendance and 3-month clarification support on workshop contents.

# 3-Day Advanced Nitrogen in the Environment Workshop

## Table of contents

1. Why is N knowledge critical?
2. Resource Management Act
3. NPS for Freshwater Management 2020
4. RMA water plans basics
  - a. Water allocations
  - b. Minimum flows/aquifer restrictions
  - c. Land use and discharges
  - d. Setting freshwater quality limits
5. Cultural considerations
  - a. Statutory acknowledgments
  - b. Te mana o te Wai
  - c. Te Ao Māori and mātauranga Māori
6. Nitrogen basics
7. Microbiology basics
  - a. Types of microbes
  - b. Why is microbial energy important in the context of N processes?
  - c. Microbial energy generation processes
    - i. Fermentation
    - ii. Respiration
    - iii. Photosynthesis
  - d. Why are sources of microbial energy and carbon important?
  - e. Microbial enzymes kinetics
  - f. Molecular biology
    - i. DNA and RNA
    - ii. Polymerase chain reaction (PCR)
  - g. Bacterial identification and enumeration
8. Soil, water and wastewater are different microbial environments
  - a. Soil
  - b. Freshwater
  - c. Marine water
  - d. Wastewater
9. Hydrology- basics
  - a. Groundwater
  - b. Surface water
  - c. Groundwater and surface water interactions
10. The mystery of N immobilisation or assimilation process
  - a. Ammonium and nitrate assimilation process
  - b. Soil
  - c. Water
  - d. Wastewater
  - e. Why do nutrient models ignore soil-N immobilisation?
11. Organic nitrogen mineralisation
  - a. Wastewater
  - b. Aerobic and anaerobic N-mineralisation
  - c. Mineralisation in the aquatic ecosystems
12. Nitrification
  - a. Nitrification evolution
  - b. Nitrification enzymic processes
  - c. Nitrification by archaea

- d. Nitrification by heterotrophs and fungi
  - e. *Comammox*
  - f. Nitrification in soil
  - g. Nitrification in water
  - h. Why is nitrification challenging for wastewater engineers?
13. How can nitrate be treated or mitigated?
    - a. Bacterial denitrification process
    - b. Reasons for N<sub>2</sub>O emissions
    - c. Denitrification in soil
    - d. Marine water denitrification
    - e. Do we know enough about N attenuation in freshwater?
    - f. Could NZ benefit from non-conventional wastewater denitrification process?
  14. Biological N fixation is a critical process in soil and water
    - a. What is unique about the N fixing enzyme nitrogenase?
    - b. Biological N fixation in soils
    - c. Biological N fixation in water
  15. Is soil ammonia volatilisation process well understood?
  16. Is N deposition critical in catchment N studies?
  17. Nitrate leaching is a significant RMA issue
    - a. Charges in soil
    - b. Role of soil water
    - c. Sources of NO<sub>3</sub><sup>-</sup>
    - d. Limitations of leaching measurements and estimates
  18. Is plant uptake of N straight forward?
    - a. Ammonium uptake
    - b. Nitrate uptake
    - c. Dissolved organic N (DON) uptake
    - d. N use efficiency
  19. Environmental impacts of poor N management
    - a. Impacts of gaseous N
    - b. Impacts of organic-N
    - c. Impacts of ammoniacal-N
    - d. Impacts of nitrate
  20. Understanding the effects of nitrate on human and animal health
    - a. Methaemoglobinaemia
    - b. Colorectal cancer
    - c. Nitrate poisoning in livestock
  21. Phosphorus in the environment
    - a. Soil phosphorus
    - b. Factors affecting soil-P availability and pasture uptake
    - c. P fertilisers
    - d. P assimilation and mineralisation in soil
    - e. P losses from soil
    - f. Should we continue with Olsen-P?
    - g. Water phosphorus
    - h. Wastewater phosphorus
  22. Why is understanding C:N:P ratio critical?
    - a. Soil
    - b. Water
    - c. Wastewater
  23. Do we know enough about algal blooms?
    - a. Surface water
    - b. Marine water
    - c. Is chlorophyll *a* sufficient to manage algal blooms?
    - d. Should we consider cyanobacteria more seriously?
  24. Role of earthworms in soil N cycle

25. Science of farm effluent
  - a. Using farm effluent as nutrient source
  - b. How do the treatment ponds work?
26. Understanding farm management on dairy farms
  - a. Breed potential
  - b. Animal feed requirement
  - c. Irrigation management
  - d. Fertiliser management
  - e. Soil management
27. Land uses and nitrate leaching
  - a. Limited role of nutrient models in scientific research
  - b. Dairy
  - c. Sheep
  - d. Beef
  - e. Cropping
  - f. Market gardening
  - g. Fruit growing
  - h. Viticulture
28. Science and effectiveness of N mitigation measures
  - a. Principles of nutrient mitigation measures
  - b. Riparian margins
  - c. Farm dairy effluent storage and deferred irrigation
  - d. Winter housing or restricting grazing
  - e. Nitrification inhibitor -DCD
  - f. Organic farming
  - g. Regenerative farming
  - h. Feed manipulation
  - i. Wetlands
    - i. Natural wetlands
    - ii. Constructed wetlands
    - iii. Floating wetlands
  - j. Nitrate leaching mitigation strategies
29. Polluted lakes/ponds restoration
  - a. Principles of lake water quality deterioration and restoration
  - b. Nutrient containment and cycling
    - i. Aeration
    - ii. Use of algaecides/weedicides
    - iii. Submerged barley strawbales
    - iv. Ultrasonic treatment
    - v. Nutrient inactivation
    - vi. Biological manipulation
    - vii. Shading
    - viii. Water augmentation
  - c. Nutrient avoidance and removal
    - i. Birdlife management
    - ii. Harvesting biomass
    - iii. Sediment removal
    - iv. Opportunistic biomass removal by water level manipulation
    - v. Duckweed and azolla management
30. Is  $^{15}\text{N}$  stable isotope a reliable tool in tracking sources of N pollution?
31. Understanding Overseer nutrient model
  - a. Understanding data and model terminologies
  - b. Overseer evolution
  - c. Overseer coverage and land uses
  - d. How does it work?
  - e. Constraints

- f. How are nutrient losses calculated?
  - g. Data management
  - h. Overseer outputs assessment
  - i. Overseer leaching and P-runoff sensitivity assessment
  - j. Overseer data output uncertainty assessment
  - k. How to reduce input and output error in Overseer?
32. Wastewater treatments and N treatment efficiency
- a. Basic wastewater treatment principles
  - b. Treatment systems to treat nitrogen
33. Using land treatment to treat nitrogen effectively
34. Understanding and preparing for zero-carbon 2050
- a. Greenhouse gases and effects
  - b. Our emissions
  - c. Our international obligations
  - d. Our response
  - e. Understanding farm GHG emissions and the IPCC requirements
    - i. Methane
    - ii. Nitrous oxides
    - iii. CO<sub>2</sub> emissions from lime and urea application
  - f. Atmospheric chemistry
  - g. Mitigation measures
35. NPSFM 2020 attributes assessment
- a. Attributes interpretation including *net ecosystem metabolism*
36. Nitrogen monitoring in the environment
- a. Methods to assess N processes
  - b. Nitrogen monitoring
    - i. Water
    - ii. Wastewater
    - iii. Soil
37. Quality reporting
- a. How can we improve the regional and MfE SOE reporting?
  - b. Should councils be involved in N research?
  - c. Research reporting
  - d. How to identify high quality refereed journal papers?