Nutrients
The grower must demonstrate they have adopted the following minimum standards in their first audit;

- *Have nutrient crop budgets that:*
  - *Account for plant uptake and nutrient inputs, and*
  - *Are informed by a minimum of one soil mineral nitrogen test per crop per annum.*

Vegetable crops obtain the majority of nutrients required for growth from the soil. As vegetable crops often have a short growing season, a high concentration of nutrients, particularly nitrogen for many crops, is necessary to support fast nutrient uptake (Reid & Morton, 2019).

To calculate the nutrients required to grow a successful crop, growers require an understanding of plant nutrient uptake in order to achieve their target yield. The currently available, or will potentially become available during the crops growing season, are taken into account on the input side of the budget. The balance then determines the quantity of fertiliser inputs that are required to achieve the target yield. This information forms the basis of a nutrient crop budget, which compares crop inputs with crop outputs.

Requiring a nutrient crop budget as a minimum standard is an effective tool to ensure nutrient planning is evidence-based i.e. growers are applying what the crop requires, which reduces the risk of nutrient loss to the environment.

One soil mineral nitrogen test per annum is proposed. Nitrogen, particularly nitrate is a key concern for freshwater. Because of its soluble nature, the quantity of inorganic (i.e. plant-available) nitrogen in soils varies significantly and is dependent on mineralisation rates, plant uptake, and losses from drainage events (Norris et al., n.d.). Mineral nitrogen (Min-N) testing quantifies the amount of ammonium and nitrate in the soil that is immediately available for crop uptake (Beare, 2022). Testing for soil mineral nitrogen is proposed as a minimum standard to ensure growers account for the nitrogen already available in the soil. This will reduce the risk of over-application of nitrogen and the risk of loss to freshwater.

The Nutrient Management Code of Practice requires commercial vegetable growing blocks, assessed as medium or high nutrient loss risk, to conduct crop nutrient budgets and representative soil tests to inform these budgets. Vegetable growers are also required to use the Nitrogen Risk Assessment Tool (Appendix in the Code of Practice) to drive further nutrient management practice change to manage medium and high risk blocks.

Nutrients

Fertiliser application practices that:

- *Ground application using well granulated fertilisers to minimise drift, and*
- *Use spreading equipment that is calibrated annually.*

Referring to a study on the application of phosphorus (P) fertiliser, following good fertiliser management practices (4Rs - right fertiliser, rate place, right time, and right rate), P fertiliser was found to contribute to less than 10% of farm P losses, in comparison to losses of 30-80%, when the 4R advice was not followed (Our Land and Water, n.d.). This means fertiliser application practices, in addition to careful planning of the product and rate applied (informed by nutrient budgeting), is critical to reducing nutrient losses to the environment.

Two requirements for fertiliser application practices are proposed, including the *use of well granulated fertilisers to minimise drift*, and the *annual calibration of spreading equipment*.

Vegetable growers use a wide range of fertilisers in a range of application methods. While liquid fertilisers are used, solid fertilisers, specifically granular fertilisers, are used most often (Reid & Morton, 2019). A key risk resulting from the use of fertiliser is off-target drift (Fertiliser Association of New Zealand, 2023). Fertiliser drift is the movement of fertiliser away from the intended target area, during or shortly after application. In comparison to a powdered blend for example, well granulated fertilisers can reduce this risk of drift and potential contamination of surrounding waterways (Fertiliser Association of New Zealand, 2023).

Erosion and sediment control

5m uncultivated setbacks from rivers, or contouring such that water flows to a sediment treatment device rather than flowing into the water course via overland flow, or at least a 4m vegetated buffer strip.

The annual calibration of spreading equipment is proposed as a minimum standard to help ensure nutrients are applied evenly, at the right rate, over the target application area (Bloomer, n.d.) – this is a key part of fulfilling the 4Rs advice for nutrient management. As granular fertilisers are most commonly used by vegetable growers to apply nutrients (Reid & Morton, 2019), spreaders are used to apply these types of fertilisers. Regularly testing and checking spreader equipment is performing correctly (i.e. through calibration) reduces the potential contamination of waterbodies near the application area and reduces the risk of yield reductions and/or additional leaching losses, for example, if the spreader is non-uniform in its application (Bloomer, n.d.).

The use of buffer zones, including uncultivated setbacks or vegetated buffer strips, is an established management practice for reducing the impact of agricultural activities, including vegetable production, on surrounding waterways and waterbodies (Tanner et al., 2020). The Erosion and Sediment Control Code of Practice includes direction on the designing and maintaining vegetated buffer strips, bunding, decanting earth bunds, and sediment retention ponds.

As the minimum standards need to be achieved immediately, as opposed to being staged over several years through the farm plan, an uncultivated setback is included in the minimum standard as it can be implemented immediately. Growers leave a strip/reduce their total cultivation area. Buffer strips predominantly reduce sediment loss through high infiltration rates. This can be achieved through uncultivated setbacks. These will be further improved over time through establishing vegetated buffers or other sediment treatment devices.

Erosion and sediment control
The slope of any land cultivated for commercial vegetable production must be 10 degrees or less, calculated as a block average.

Very few if any cultivated land has an average slope of greater than 10 degrees (17%). Slope is the main driver of erosion. Above 10 degrees modelled rates of erosion are greater than 40 t/ha. While sediment control practices can be put in place where high erosion rates are predicted, i.e., when the slope is greater than 10 degrees, these require very careful design and would need to be considerably larger than the industry COP of 1% (100 m^3/ha).

Irrigation

A farm scale irrigation plan that accounts for crop demand, growing area, rainfall, evapotranspiration, soil water holding capacity, and irrigation system performance.

An irrigation plan includes the justification of the annual and daily peak water demand. This is a combination of crop water demand, based on 90% reliability, planted area, and irrigation system performance (typically 80%-90%).

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