

## DEVELOPMENT OF A NITROGEN RISK SCORECARD

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### **Abstract**

Fonterra's Nitrogen Management Programme has been running since 2012/13 season. The programme formed part of Fonterra's commitments under the Sustainable Dairying: Water Accord, collecting nutrient management data and modelling it in OVERSEER<sup>®</sup> using agreed industry protocols to report a nitrogen leaching to water and nitrogen use efficiency figure to all farmers.

The Nitrogen Programme has been successful in raising farmer awareness of the environmental risks around nitrogen; however, there are limitations to reporting whole farm level metrics when trying to focus farmer action on specific practices that are contributing to the nitrogen loss risk.

As a result, Fonterra have been developing an alternative approach to delivering our Nitrogen Programme in a way that better fits with our strategic focus of achieving good farming practice outcomes through Farm Environment Plans (FEP's).

This led to the development of a Nitrogen Risk Scorecard, a tool that provides for a simplified objective assessment of the level of risk of nitrogen loss from a farm. The Scorecard uses annual farmer data relating to six key farm practices and applies a level of risk to each of those practices against a set of benchmark parameters. The Scorecard also includes a weighted aggregated risk score for the property.

With no manual data processing, the Scorecard is a practical cost-effective method of identifying high risk farms or inefficient management practices. Our Sustainable Dairy Advisors can then focus their time to supporting farmers and utilising the Scorecard to help inform the type of actions appropriate to manage the risks through tailored Farm Environment Plans.

It's our view that the Scorecard may have a place in regulated catchments due to its ability to simplify the implementation process and decrease the costs and complexity of managing nitrogen. A method that reports on factors understood by, and within the control of farmers, is more likely to lead to enduring change than the current focus on a modelled whole farm leaching number.

### **Introduction**

Fonterra, like others, have recognised that getting farmers to Good Farming Practice (GFP) and beyond is best achieved through robust actions delivered through tailored FEP's. As a result, the focus of our farmer support programmes have shifted away from being single issue focused

programmes such as water way stock exclusion and effluent management to the delivery of FEP's with Fonterra committing to every farmer having a FEP by 2025. This shift in focus is one of the key drivers for the development of the Scorecard and this paper expands on this and the other key drivers for the Scorecards creation, the methodology used in its development and how the Scorecard will be implemented with farmers.

## **Drivers for creating a scorecard**

### *Complementary to FEP delivery process*

It is our experience, having so far delivered 1000 FEPs to our farmers, that there are challenges in engaging farmers in specific actions to address nitrogen loss risk on farm when using a complex model that produces a single whole farm level metric.

In contrast, the Scorecard which reports on nitrogen loss risk at a management practice level helps focus the conversation between a farmer and farm plan advisor on the things that are within a farmers control.

### *Cost effective approach*

Our previous Nitrogen Programme had a high cost of delivery, requiring a team of up to 30 experienced nutrient advisors to process nutrient budgets through Overseer<sup>®</sup> for three months of the year. While the programme has been effective at raising farmer awareness to the risks around nitrogen loss on farm, the focus has now evolved beyond awareness to focus on making on farm change to reduce nitrogen loss risk.

With the formation of Overseer Ltd and the deployment of Overseer FM<sup>®</sup>, an annual subscription-based software, continuing to use Overseer<sup>®</sup> in an exclusive capacity to deliver our nitrogen programme would have significantly increased the cost in the order of two million dollars per annum<sup>1</sup>.

In addition, the ability of Overseer Ltd to retain and commercialise farmer data entered into Overseer FM<sup>®</sup> meant Fonterra could no longer mandate its use, rather deferring the decision to use OverseerFM<sup>®</sup> to each individual farmer where they could consider the best decision for their farm business<sup>2</sup>. With this change, we therefore recognised that there will be some farmers who won't subscribe to use Overseer FM<sup>®</sup> and therefore the creation of the Nitrogen Risk Scorecard provides Fonterra with a tool to continue supporting those farmers with reporting on their specific management practices nitrogen loss risk.

### *Potential use in regulation*

The use of a single whole farm metric within regulation, in some instances as a pass or fail method to managing compliance, in our opinion creates a heavy administrative burden on the farmer, the industry (to provide experienced modellers) and the regulator to monitor compliance. We felt there was an opportunity to develop a tool that had the ability to simplify the implementation process and decrease the costs and complexity of managing nitrogen in a regulated catchment.

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<sup>1</sup> Costs are both direct cost to Fonterra and indirect i.e. costs to Fonterra shareholders

<sup>2</sup> Noting that in some regions the choice to subscribe to Overseer<sup>®</sup> FM is not at the farmers discretion, rather it is mandated through regulation.

## How the Scorecard Works

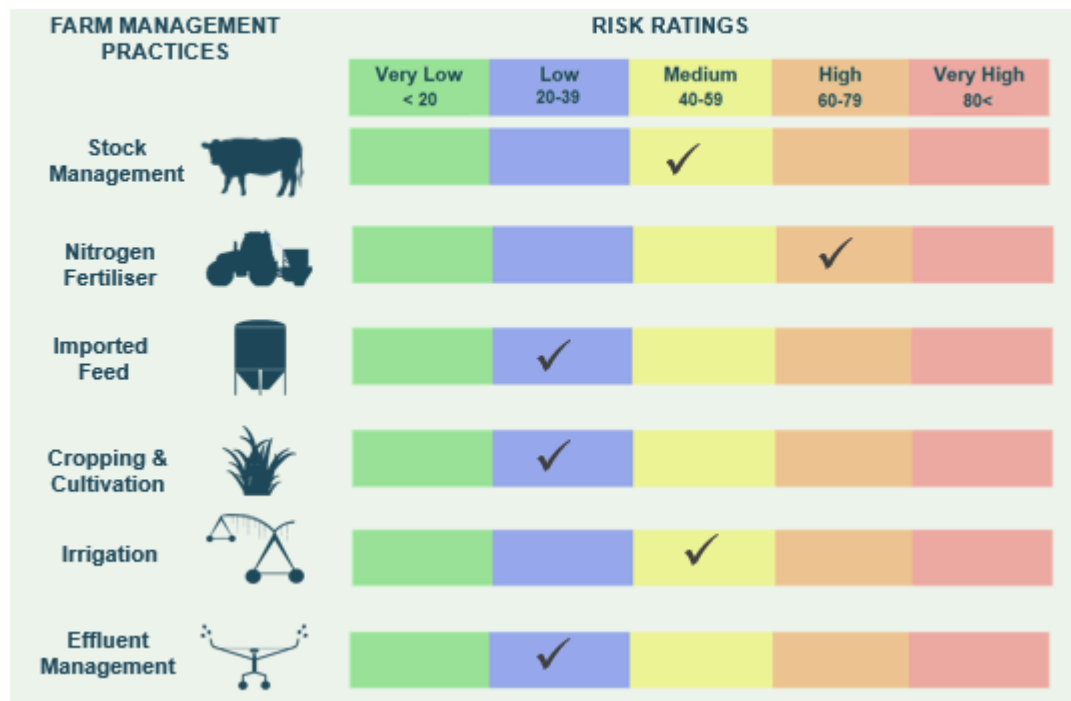
The Nitrogen Risk Scorecard uses annually collected farmer data relating to on-farm practices and applies a level of risk to those practices against a set of benchmark parameters. The data collection is sufficiently detailed to ensure all key risk factors can be robustly assessed. The key output from the Scorecard is an assessment of risk across six farm management practices that are the key drivers of farm nitrogen loss levels.

There are five simple risk ratings that can be applied to each factor; Very low, Low, Medium, High and Very High. The level of risk for each of the six farm management factors is determined by a score, with a score of 20 or less equating to very low risk ranging to a score of 80 or more equating to very high risk.

Risk rating scores are calculated by assessing individual practices (sub factors) relating to each of the six farm management practices. A points system is used to allocate points to each practice. Points are attributed to the key driver of risk for each management practice (e.g. stocking rate is the key driver for the Stock Management risk factor as is total tonnes of nitrogen applied for the Nitrogen Fertiliser risk factor).

Other specific practices that will increase or decrease the risk are then used to moderate the score for the overall farm management practice. Practices that would increase the risk of nitrogen loss attract additional points, while others that reduce N loss risk carry negative points.

### HOW THE SCORECARD WORKS



**Figure 1:** Table showing the six farm management practices assessed in the Scorecard and the points scale used to determine the level of risk.

In addition to the risk assessment for the six farm management practices, the Scorecard will include an environmental overlay. The environmental overlay will provide key climate and geo-physical data on the farm such as soil type and rainfall data. This information will not moderate either the aggregated score or any individual risk scores but would rather offer a further lens to which the level of risk presented in Scorecard can be interpreted. Future options for the environmental overlay could include the proximity to a sensitive receiving environment.

Also, the Scorecard calculates and reports the farms nitrogen ‘simple surplus’. Purchased surplus for the purposes of the Scorecard being: nitrogen imported through fertiliser and feed minus nitrogen leaving the property in productive outputs, reported as kg N/ha. This is a metric that has been widely used in other countries to understand the efficiency of resource conversion into productive outputs.

### Data behind the Scorecard

Fonterra collects annual farmer data through our Farm Dairy Records (FDR). The data collected is sufficiently detailed to ensure all key risks can be robustly assessed. (Note that while Fonterra uses our FDRs to collect the data required for the Scorecard, the data could be collected through any templated data collection approach that aligned with the Scorecard data fields.)

### Management practices assessed within the Scorecard

#### Nitrogen Fertilisers

The main driver for risk in this section is the amount of imported nitrogen fertiliser. To determine the overall risk for this section points are assigned to the key driver of risk, the total imported fertiliser. The scale for the key driver ranges from 0 to 200 representing no risk at 0 through to very high above 80. The main driver is the starting score or points for this management practice which will be moderated by the remaining risk practices.

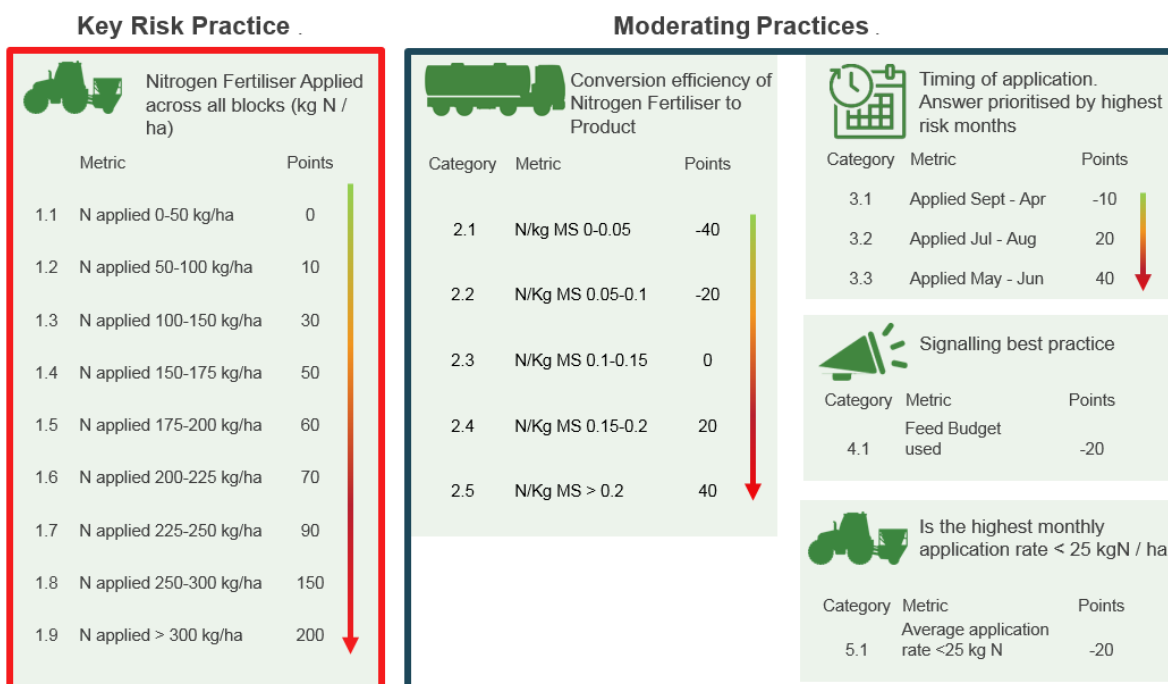


Figure 2: Slide showing the practices assessed under the nitrogen fertiliser section of the scorecard.

The nitrogen use efficiency of nitrogen fertiliser to product is calculated by dividing the total amount of milk solids produced by the total kg's of nitrogen applied via fertiliser.

To assess the timing of application the Scorecard groups each of the farms fertiliser applications into one of the 3 periods of the year, each of which carry a different level of risk and reports the worst result i.e. if a single fertiliser application above 20 kg/ha is made in the months of May -June then the result for this sub factor will be 40 points or “High Risk”. It is acknowledged with this approach there are situations where a farmer is applying the majority of their fertiliser in the spring/summer period, but they apply a small single application in a medium or high-risk period. To ensure that this single relatively small fertiliser application doesn't distort the overall risk for this section a trigger for any single application outside of the lowest risk months has been set at a minimum application rate of 20kg /ha.

The moderating practice of using a feed budget recognises the good farming practice of using a feed budget or wedge to help plan strategic fertiliser applications as opposed to routine or blanket nitrogen use.

The highest monthly application rate is calculated using the total amount of nitrogen applied to a block in any given month by summing all monthly fertiliser applications entered the FDR's. A look-up table is used to determine the nitrogen content of each fertiliser product applied. Total nitrogen is then divided across the block(s) it was applied to, to derive the average amount applied per hectare. If the average of all fertiliser applications across all months are 25kg/ha or less this would be considered to reduce the overall nitrogen fertiliser risk.

### Stock Management

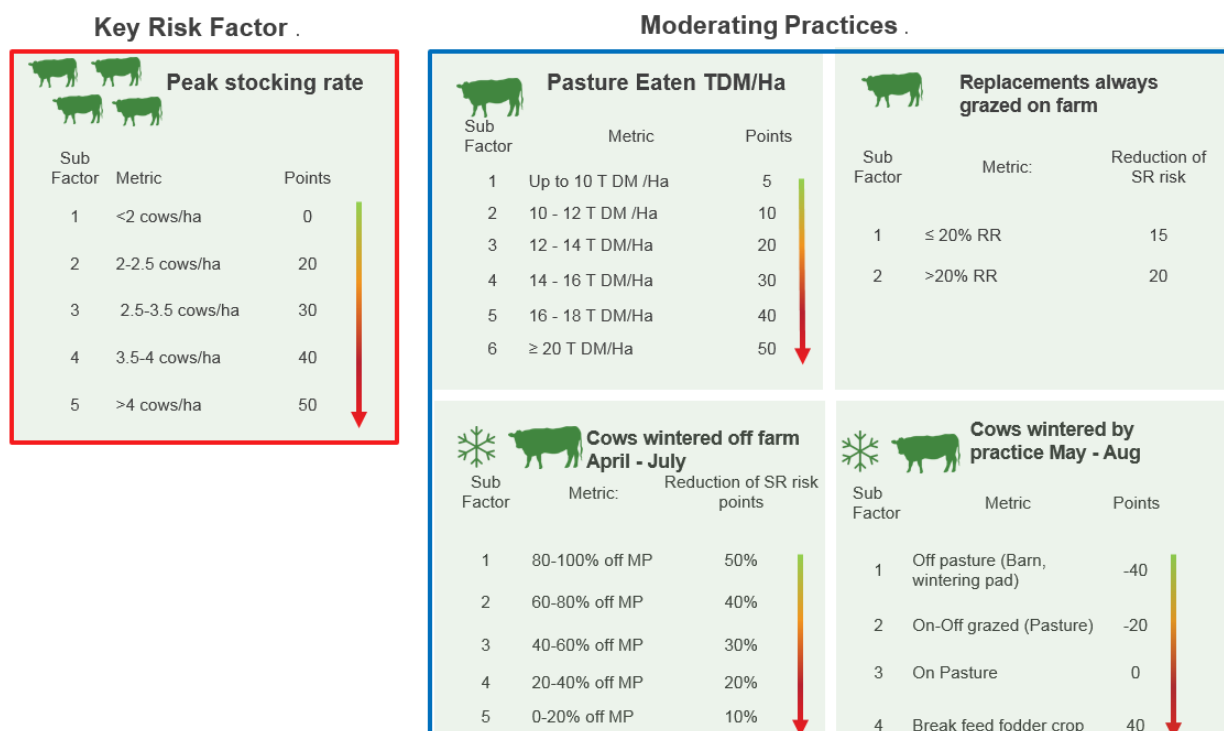


Figure 3: Slide showing the practices assessed under the stock management section of the scorecard.

Stocking rate is the key nitrogen loss driver for the Stock Management practice in the Scorecard. The higher the stocking rate the greater the underlying nitrogen loss risk. The Scorecard moderates this risk by assessing the total amount of dry matter eaten as it is acknowledged that stocking rate alone does not account for the difference in breed, age of animals and productive potential. The higher the amount of dry matter eaten the higher the amount of nitrogen ingested by the animal with excess nitrogen in the diet being returned to pasture as urinary N and N in excreta. In addition, the Scorecard further moderates this risk by how the herd is managed over the winter months, if animals are grazed off farm, the replacement rate and if replacements are grazed on farm.

The Scorecard calculates the total number of hours over the winter months and how many of these hours the animals spend on off-pasture facilities where effluent is captured. Points are applied pro-rata in situations where there is a split between different wintering options.

Wintering animals off the farm reduces number of animals depositing nitrogen back onto soil via excreta (mainly from urine patches), in turn reducing the overall nitrogen loss risk on the milking platform. The practice by which the animals are wintered has a major impact on the overall risk profile of the farming system. A farm system that practices 'on off' grazing, therefore reducing the amount of time cows spend on pasture, will reduce the overall nitrogen risk loss for the farm. The winter months are May-August and have a total of 2,952 hours. The Scorecard uses data from several different sections within the FDR's, such as cropping, winter standoff/housing, monthly animal numbers to calculate the total hours the animals spend in each of these activities/practices over the winter.

The points scale for the moderating winter practices range from -40 to 40 at the highest risk end. It is possible for a farms points to fall anywhere along this continuum. The negative points range represents the mitigating factor of having animals off pasture or crops on a structure with a contained effluent system.

The overall risk is determined by allocating points on a pro-rata basis from the percentage of the time (total hours) animals spent on:

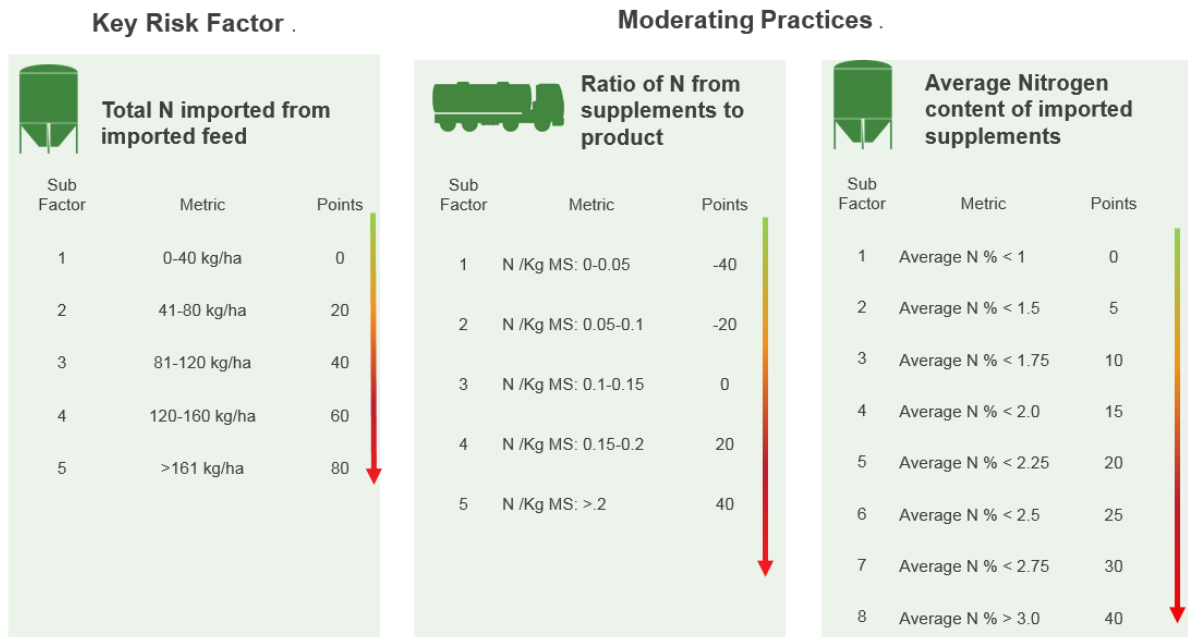
- Structures – wintering pads / standoff pad
- Grazing on crops
- Pasture (This is calculated as the time NOT spent on structures OR on crops)

### ***Imported Feed***

In this section, the Scorecard calculates the total amount of imported nitrogen from supplements and assesses this against the parameters in the table below. The average percentage nitrogen content of all imported supplements is also assessed giving the farmer an indication as to the potential increased risk through increasing urinary nitrogen as a result of their imported supplement choice.

These two parameters allow a farmer to understand how much nitrogen is entering their farm and where on the risk scale their supplements sit in terms of nitrogen content. This information allows the farmer to investigate if there is an opportunity to utilise a lower nitrogen content feed.

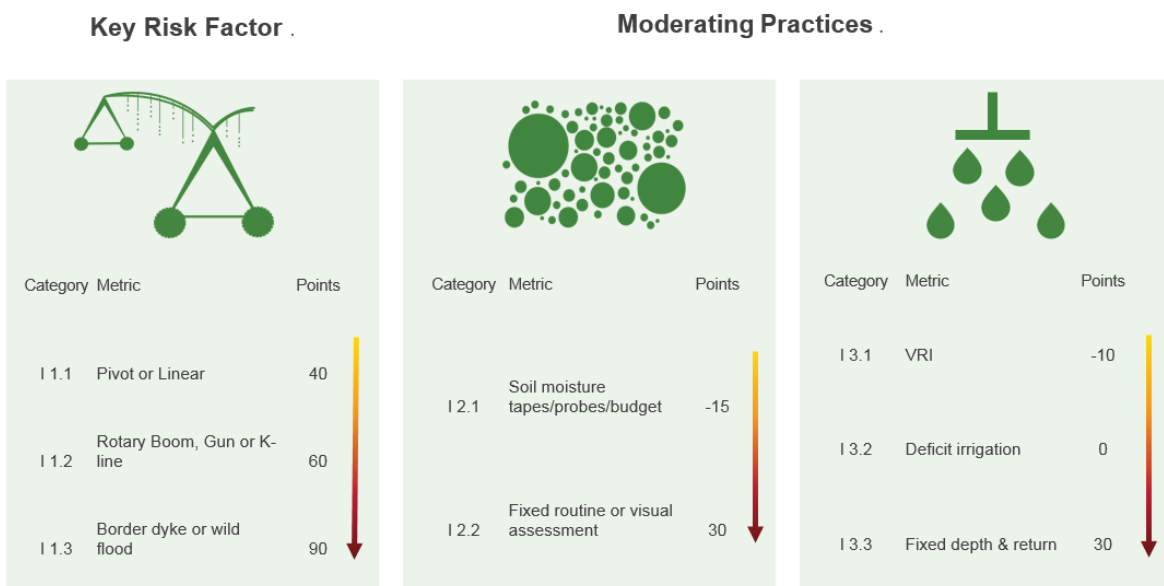
Lastly the conversion efficiency of the nitrogen from supplements into products is considered also.



**Figure 4:** Slide showing the practices assessed under the imported feed section of the Scorecard.

**Irrigation**

This section assigns a level of risk to a farms irrigation system and the management of the system e.g. their ability to monitor when to start and stop irrigating as well as to know how much water to apply at each event. The base risk is set by irrigator type and is then moderated by the method of scheduling and management of applications. This section is designed so that only a pivot/linear system with soil moisture monitoring and VRI can achieve very low risk. All other systems, dependant of the management, will range from medium to high risk. Points for each of the sections below are allocated on a pro rata basis calculated by the percentage of area under each irrigation method in use on the farm.



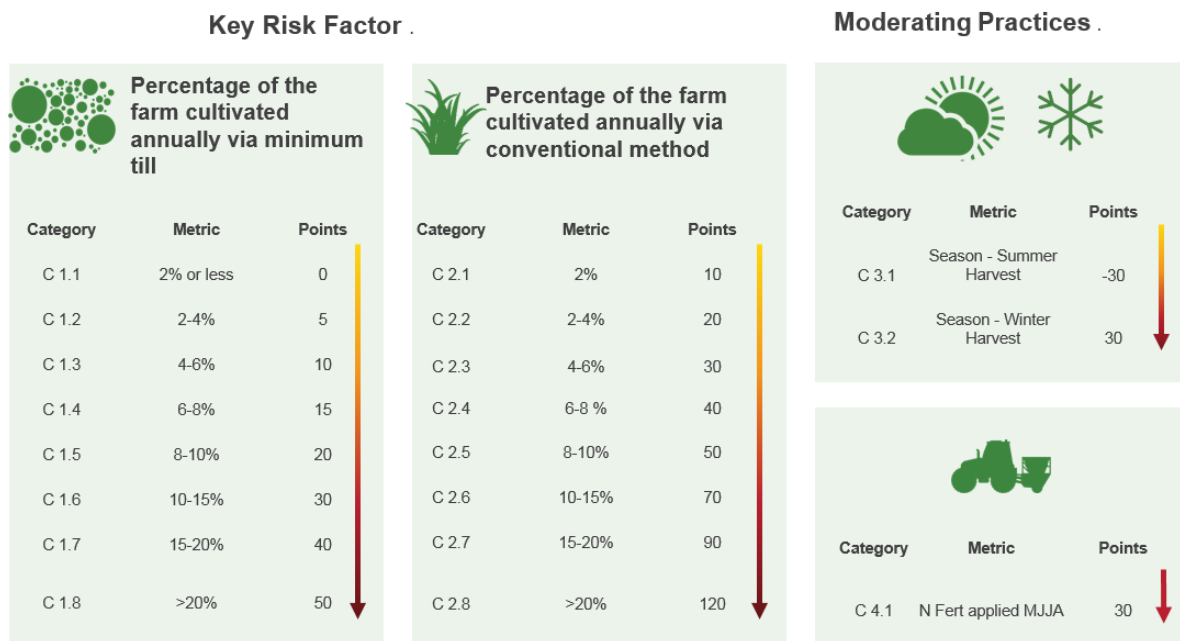
**Figure 5:** Slide showing the practices assessed under the irrigation section of the scorecard.

### ***Cropping and Cultivation***

Cropping/cultivation can impact on nitrogen leaching due to the release of mineral nitrogen after cultivation. The release of mineral nitrogen when not up taken by a crop can lead to leaching. In the short-term the cultivation method may be significant. Full cultivation can leave the land fallow for a longer period than no-till and full cultivation stimulates faster soil organic matter decomposition and mineral nitrogen release than no-till.

This section evaluates the risk posed by total area of a farm cultivated in conjunction with the method/type of cultivation used. Farms with routine pasture renewal using minimum tillage techniques should come out as a low or very low risk, but bigger areas, winter crops, conventional cultivation will end up higher risk.

The harvest season also plays a significant role, crops harvested in winter pose a higher risk to leaching both due to how they are harvested, e.g. grazed in situ and if they are left fallow through the winter period with high rainfall. The method of harvest is not considered under the Cropping and Cultivation section as it has been included in the Stock Management - wintering practices section to inform the level of risk from grazing crops in winter.

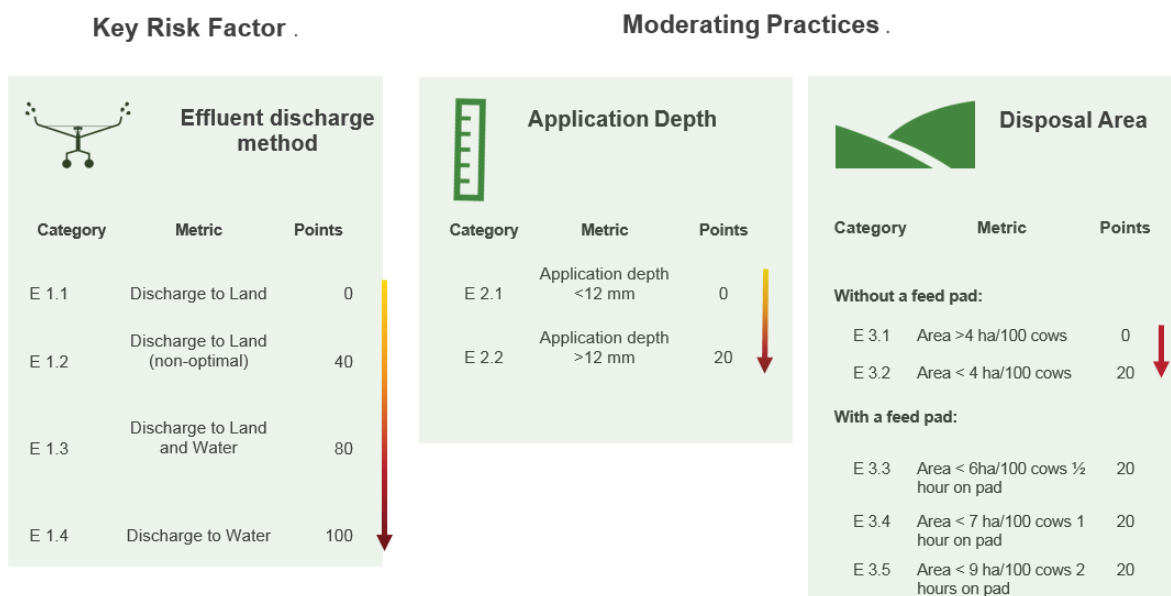


**Figure 6:** Slide showing the practices assessed under the cropping and cultivation section of the scorecard.

### ***Effluent Management***

Within the Scorecard, discharging to water carries the maximum very high-risk due to the fact these types of systems are often discharging high levels of nutrient directly to water. Often these are legacy systems that haven't undergone infrastructural upgrades as the farm has grown, they also discharge other contaminants such as E. coli. These systems are closely followed in risk by a mixed system (both discharge to land and water). Non-optimal discharge to land is where the system either doesn't have capacity to store effluent or the farmer has described their decisions around when to irrigate as being based on factors other than soil moisture content.





**Figure 7:** Slide showing the practices assessed under the effluent management section of the scorecard.

There are 3 potential options within this section. Discharging to land, discharge to water or a system that utilises both water and land. Discharging treated effluent to land with the sufficient storage to store effluent during wet conditions is lowest risk through to discharge to water at the highest risk. Ensuring the effluent disposal area is sufficiently sized for the farm system is important from both an environmental compliance and animal health perspective.

The nitrogen content of effluent fluctuates depending on several factors such as diet, the time cows spend on the yard during milking, time spent on a feed pad/housing, the amount of time the effluent is stored in a pond, the pond characteristics (depth, surface area) and if the system has solids removal.

Due to this the Scorecard uses a pragmatic approach to assess the level of risk associated with the effluent disposal area, evaluating it based on the number of cows per ha of disposal area. While this is an older, rule of thumb approach it serves to identify those systems where the size is at the marginal level and further assessment may be required.

## Conclusion

The Scorecard is not a complex farm system model quantifying a total amount of nitrogen loss, rather it's a tool that provides a simplified objective assessment as to the level of nitrogen loss risk arising from farm management practices that the farmer can influence or control. The primary purpose for developing the Scorecard is to be a supplementary tool to support the development of robust nutrient actions during the FEP delivery process. It is a strategic focus for Fonterra for all farmer shareholders to have an FEP by 2025, and the Scorecard is a practical cost-effective approach to ensure that we can assess the nitrogen loss risk of all our farmers on an annual basis.

The way in which data is reported within the Scorecard is intuitively understood by farmers without the necessity to be interpreted and translated by a nutrient management advisor. A

guiding principal in designing the report is that it should provide sufficient detail and context to form the basis for a discussion between farmers and our Sustainable Dairying Advisors, or any other farm plan advisor, as to what risks exist and what might be appropriate actions that can be taken to manage those risks.

The addition of an aggregate risk score also allows for further benchmarking and trend analysis over time which, should the Scorecard approach be adopted in a more formal regulatory capacity allows for reporting against a reference point. Relevant peer groups for benchmarking can be determined by a number of factors including farm systems type, catchment, climate and soils which are useful to help inform farmers about their relative performance.

It is our opinion that a method of risk analysis that reports on factors understood by, and within the control of farmers, is more likely to lead to enduring change than our previous focus on a modelled whole farm leaching number.